# The WTO and Economic Development

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**Introduction**
**Ben Zissimos**

## Motivation

What is the role that the World Trade Organization (WTO) plays in facilitating economic development? The intent expressed in the Marrakesh Agreement that established the WTO in 1995 is clear enough: "The Parties to the Agreement [recognize] that there is need for positive efforts designed to ensure that developing countries, and especially the least developed among them, secure a share in the growth in international trade commensurate with the needs of their economic development" (General Agreement on Tariffs and Trade, or GATT, 1994).

The intention that the WTO should be supportive of economic development is self-evident. However, the fact that the WTO's current round of world trade talks, aimed at implementing the 'Doha Development Agenda,' has taken far longer than planned and achieved far less than projected, has called into question the WTO's credentials in this regard.[1] This outcome has created an opportunity to reflect on what it is reasonable to expect from the WTO in supporting economic development, and how this expectation might be realized, given the WTO's institutional purpose and design.

This book brings together a collection of perspectives on different aspects of the purpose and institutional design of the WTO, and how these relate to economic development, from a group of leading scholars in the economics of international trade. The role that the WTO and its progenitor, the GATT, have played to date in facilitating economic development, and the role the WTO can reasonably be expected to play in the future, is the unifying theme.

To set the frame on this collection, in this section titled 'Motivation', I review the historical evolution of ideas regarding the relationship between trade liberalization and development, and how this interacted with the evolution of the GATT and later the WTO. This review makes an original contribution to the literature by providing a fresh perspective on how the ideas and GATT/WTO institutional approach concerning development evolved, and how this evolution can be understood in terms of the literature on international trade agreements. In turn, this motivation provides a unifying framework that I use in the section titled 'This Book' to interpret the contributions to this volume. Finally, in the section titled 'Basic Insights', I will synthesize the new insights that emerge.

The review that I will undertake below deliberately omits many of the fine institutional details of the GATT and WTO in order to highlight the main features of the evolution of ideas and policies. Throughout the review, I aim to include useful references so that further details can be obtained where desired.

The primary purpose of the WTO has always been to ensure that international trade flows as freely as possible. Yet the WTO's institutional framework allows for the possibility that freely flowing international trade may not be as beneficial for developing countries as for those that are advanced. Hence, the WTO's institutional framework embodies special and differential treatment (SDT) of developing countries, which forms the cornerstone of the WTO's approach to facilitating economic development.

SDT is effectively a set of exemptions from Most Favored Nation (MFN) treatment, which is the principle that any terms agreed between two parties to a trade agreement will automatically be extended to all others and is a central pillar of the GATT/WTO. As Whalley (1999) explains, SDT has two components: an access component, whereby developing countries are granted access to developed country markets; and a 'right to protect' component, whereby they do not have to reciprocate market access concessions that the developed countries make.

The intellectual underpinnings of SDT were: (i) that under the Gold Standard poor countries would tend to suffer from balance of payments problems that could be remedied through protection; (ii) the Prebisch-Singer thesis that developing countries would face secular decline in their terms of trade, which could be remedied by preferential access to developed country markets; and (iii) by the logic of infant industry protection, whereby fledgling industries need an initial period of protection to grow in a secure domestic market, before eventually competing abroad. These underpinnings supported the policy initiative of 'import substitution industrialization' (ISI), the aim of which was to achieve industrialization by substituting domestic production for imports of manufactures known to be in local demand.

Ironically, there was no SDT during the 1950s-60s when the research community was broadly sympathetic to the idea that development could be achieved through ISI. But ISI gained momentum among developing country policymakers through that time period, and SDT measures were formally adopted mainly in the Tokyo Round of 1973-79.[2] This happened right around the time that the research community was beginning to argue that development should be supported by outward-looking trade regimes to enhance economic efficiency.

Little, Scitovsky and Scott (1970) were particularly influential in turning the tide toward outward oriented development strategies.[3] On behalf of the Organization for Economic Cooperation and Development, they assessed the effects of trade policies on the economic growth and efficiency of seven countries where industrialization was under way. These were Argentina, Brazil, India, Mexico, Pakistan, the Philippines, and Taiwan. Their overarching conclusion was that they found ISI to be severely wanting. They argued that, ultimately, ISI itself limits the scope for growth through exports. The logic follows from the Lerner symmetry theorem, which demonstrates that a tariff on imports in trade equilibrium can be equivalent to a tax on exports.[4] Their conclusion was also based on the development successes of the so-called Asian Tigers, like Taiwan, whose development strategies had been outward oriented.

As a result of this history, there is an awkward mismatch between what mainstream economics would prescribe, an outward oriented development strategy, and the protectionism that is allowed for under SDT to this day. This mismatch can be seen through the lens of the 'terms-of-trade theory,' which is the oldest and most established economic theory of trade agreements, both theoretically and empirically (Mayer 1981, Bagwell and Staiger 1999, 2002, 2011). According to this theory, a trade agreement enables countries to escape from a terms-of-trade driven prisoner's dilemma, whereby they have a collective incentive to liberalize trade to maximize efficiency globally, but each has an individual incentive to adopt protection in order to improve their own terms of trade. Therefore, the benefits to a trade agreement are based on the exchange of balanced concessions, and developing countries can only expect to gain market access abroad if they concede it at home. By allowing developing countries to concede less, SDT holds back what they can expect to gain from participation in the multilateral trade rounds of the GATT and WTO.

According to the terms-of-trade theory, developing countries have historically been hurt by high protection of agriculture in developed countries because, under SDT, in past trade rounds developing countries have not offered concessions of their own for industrial goods.[5] A key implication of this theory is that, if developing countries do not make any tariff concessions, while developed countries do make reciprocal and non-discriminatory tariff cuts, the terms of trade will adjust so that trade flows will not change at all for developing countries. Consequently, developing countries cannot gain from any market access concessions that only developed countries make. This, again, is an implication of the Lerner symmetry theorem (Bagwell and Staiger 2014). Under this view, developing countries should eschew SDT to enable developed country trade liberalization to support their development.

The same kind of recommendation arises from the most established alternative to the terms-of-trade theory of trade agreements, known as the 'commitment theory' (Staiger and Tabellini 1987, Maggi and Rodriguez-Clare 1998). This theory holds that the purpose of a trade agreement is to enable governments to tie their hands against protectionist interests in their own countries. The imperative for developing country governments to escape from such domestic commitment problems has become greater from the 1980s onwards for two reasons. First, supply chains have become more internationalized (Baldwin 2016) and, second, with the fall of the Berlin Wall in 1989, developing countries have become more market - as opposed to planning - oriented (Ostry 2002). Both of these innovations have given developing countries a greater interest in international trade, the flip side of which is a greater interest in resisting domestic protectionist pressures. Motivated by this, in the Uruguay Round, developing countries committed to take on unprecedented obligations to reduce trade barriers.[6]

The WTO was formed as an outcome of the Uruguay Round, 1986-94. Any country that wished to become a member of the WTO, including any developing country, was required to sign onto all elements of the Uruguay Round agreement via a 'single undertaking'. In line with the single undertaking, new contracting parties that joined the GATT during the Uruguay Round were required to join under significantly stricter accession rules than those joining previously. Since developed countries were already contracting parties to the GATT, the new contracting parties overwhelmingly tended to be developing countries. Using the rationale put forward by Maggi and Rodriguez-Clare (1998), Tang and Wei (2009) show econometrically that WTO accession after the Uruguay Round has a commitment value strong enough to have a positive impact on growth. Indeed, they find that the effects are particularly large in countries with weak governance, where external policy commitments have a more important role to play.

Taking the implications of the established theories of trade agreements together, a basic recommendation would be that, while trade agreements under the WTO have a role to play in economic development, developing countries should eschew SDT all together. However, there are two main alternative perspectives that could provide potential roles for SDT in economic development. The first comes from the trade-and-development literature, which recognizes a role for government involvement in the process of industrialization. The second comes from the commitment-based literature on trade agreements, which attempts to rationalize the use of SDT to phase in trade agreement obligations that developing countries chose to take on in the Uruguay Round. Let us now consider each of these in turn.

Regarding the first alternative perspective, from the trade-and-development literature, here again Little et al (1970) are a useful reference point. While they argue strongly against ISI, they contend that government promotion of industrial exports can play an important role in development strategy based on the approach and successes of the Asian Tigers. What made the arguments that Little et al advanced distinctive at the time was their advocacy of a shift away from government attempts to take a planning approach to development, and towards a greater reliance on the price mechanism. For example, they advocated subsidizing firm entry into industrial activity where external benefits were thought to exist.[7]

The GATT Agreement on Safeguards and Countervailing Measures (ASCM), allowed developing countries to use subsidies to promote industrial firm entry along the lines envisaged by Little et al. The GATT ASCM was an outcome of the Tokyo Round, which prohibited the use of subsidies that were conditional on export performance, referred to as 'export subsidies'. It also prohibited subsidies contingent on the use of domestic goods over imported goods, referred to as 'local content subsidies'. The reasoning was that these types of subsidy were the most likely to have adverse effects on the trade flows of other contracting parties. Other types of subsidy were not prohibited outright, but could be subject to countervailing duties (CVDs) or a 'nullification and impairment complaint' if other contracting parties thought that they were compromising benefits expected from an earlier agreement. Developing countries secured exemption from the ASCM in the Tokyo Round, as part of the formal introduction of SDT.

Developing countries' exemption from ASCM ended when they agreed to comply with the terms of the WTO ASCM upon creation of the WTO, with an allowance for compliance to be phased in over a period of five years (GATT 1994, Annex 1A). So providing that subsidies are not made conditional on exporting, or on the use of domestic content, there is still some scope to use them under the WTO to promote entry along the lines envisaged by Little et al.[8]

The established theories of trade agreements do not identify an explicit role for government promotion of industrialization or export sectors. When the trade agreements literature considers SDT, it tends to be in its traditional role of import protection rather than to support the development of industrial sectors. Yet researchers have recently questioned the Lerner-symmetry-theorem based result outlined above, that developing country trade flows will not change at all if they do not make concessions of their own under SDT.

Econometric research has found evidence (though not conclusive) that developing country exports have increased significantly for trade agreements involving SDT (Rose 2004, Subramanian and Wei 2007, Gil-Pareja, Llorca-Vivero, and Martínez-Serrano 2014). However, it is not yet clear what the basis is for this increase. Has the surge in exports due to SDT facilitated the internalization of externalities that could underpin an export-led growth strategy? Or has it merely allowed exporters to collect rents as the terms of trade adjust? Ornelas (2016) provides a detailed discussion of this literature, outlining its main findings and also its limitations.

Regarding the second alternative perspective, with developing countries taking on tariff commitments voluntarily in the Uruguay Round, the emphasis in SDT changed. It shifted away from obtaining outright exemptions from tariff commitments, and towards developing countries being granted phase-in periods to meet the commitments that they took on. Conconi and Perroni (2012, 2015) have developed a theory to rationalize this new role for SDT. They show that a reciprocal trade agreement, in which a large developed country lowers its tariffs conditional on a small developing country doing the same, creates a 'carrot and stick' mechanism that helps the small country government to overcome its commitment problem. Moreover, if capacity in the small-country import-competing sector can only be reduced gradually, the agreement may need to allow the small country to delay the implementation of its trade liberalization commitments.[9]

We have already observed that developing countries took on unprecedented obligations to reduce trade barriers in the Uruguay Round. In addition, the Uruguay Round addressed areas not covered by previous rounds, and this extended coverage has created 'new issues' regarding the WTO's institutional structure and how this might relate to economic development. Ostry (2002) has described the outcome of the Uruguay Round as a 'grand bargain' between developed and developing countries. In this bargain, developed countries committed to open their markets to agriculture and labor-intensive manufacturing goods, especially textiles and clothing. These would generally be regarded as standard ‘market access’ commitments, which simply involve developed countries lowering tariffs and hence reducing local price distortions. Some of the commitments that the developing countries took on, which will be detailed below, would not be regarded as standard market access commitments, and it is for this reason that the ‘new issues’ have arisen.

As part of the grand bargain of the Uruguay Round, developing countries agreed to the inclusion into the trading system of trade in services (GATS), intellectual property (TRIPS) and (albeit to a lesser extent than originally demanded) investment (TRIMS). The outcome also included “the creation of the WTO, with the strongest dispute settlement system (DSS) in the history of international law” (Ostry 2002). These new features have created four different types of issue for developing counties in the way that they interact with others over international trade and trade policy.

First, since GATS focuses on trade in services, the relevant barriers to trade are measures such as laws, regulations, and administrative actions that impede cross-border flows. These are referred to as ‘behind-the-border’ measures. This contrasts markedly with the GATT, which focused on goods trade, where relevant barriers to trade are applied at the border, such as trade taxes and quotas, and are therefore called ‘border measures’. The measures associated with services are considerably less visible than those associated with goods, and so transparency became more of a concern in fulfilling negotiated commitments. Consequently, countries must now publish all relevant laws, regulations and administrative procedures. Implicit in this shift embodied in the GATS is a move away from GATT ‘negative regulation’ - what governments *must not* do - to ‘positive regulation’ - what governments *must* do. Two types of concern have arisen from this outcome: implementation is likely to be costly, amounting to as much as a year’s development budget for the least developed countries; and there is a sense that the implementation of regulation is being imposed on developing countries by developed countries, so risks being inappropriate and even ‘imperialistic’ (Finger and Schuler 2000).

Second, while GATS behind-the-border measures might reasonably be characterized as enhancing market access like GATT border measures do, TRIPS commitments are not market access commitments. Instead, TRIPS commitments set down minimum standards for the regulation by national governments of many forms of intellectual property, as applied to nationals of other WTO member nations. Consequently, their implementation would not be expected to reduce local-price distortions in developing countries in the way that traditional market access commitments would.

Bagwell and Staiger (2014) discuss this issue in detail. They argue that SDT has resulted in the WTO now facing a ‘latecomer problem’ with integrating its developing country members. That is, because developing countries have come to the trade negotiation table relatively late, they still have many distortions created by trade policies, while developed countries have already eliminated their domestic distortions in previous GATT rounds. The potential solution for developing countries, which Bagwell and Staiger (2014) describe as “setting a place at the table”, is to try to identify new areas where they can offer market access to developed countries. This would in turn create the opportunity for developed countries to respond with new reciprocal market access concessions themselves. But because the TRIPS agreement does not entail market access commitments, its inclusion in the Uruguay Round may actually have exacerbated the latecomer problem. Specifically, because TRIPS does not involve developing countries coming up with market access concessions that can be exchanged with developed countries, it cannot be used as a way to encourage developed countries to liberalize markets beneficial to developing countries, such as agriculture.

Third, TRIPS has been bitterly opposed by developing countries because it is seen as now-advanced countries ‘pulling up the development ladder,’ making it harder for developing countries to follow. In the past, most now-advanced countries have made use of an absence of intellectual property protection within their own economies to learn to innovate by first imitating (but not compensating) foreigners. With TRIPS making this approach illegal, currently many developing countries believe that the imitation route to industrial development is now closed off to them.

Saggi (2016) undertakes a balanced and comprehensive discussion of this issue, weighing the point just made against its counterarguments. One counter is that, with the dramatic growth of a number of middle income countries over the last few years, developing countries now account for half of the world economy. This is a large enough scale to affect incentives to innovate across all countries, including those in middle income developing countries themselves, and so an international regime to defend intellectual property rights is warranted. A second counter is that since developing countries now have stronger IPR regimes, this will provide greater incentives for developed countries to invest in developing country markets through foreign direct investment (FDI). This should in turn promote the transfer of technology to developing countries, providing a more direct route through which they will be able to start innovating.

The empirical evidence on TRIPS is limited to date but, such as it is, seems to show small effects both bad and good. Prices of patented products have risen in developing countries because the imitation channel has been closed off, but the price rises have been smaller than feared. On the other hand, while the pace of technology transfer through FDI has increased, there is as yet no evidence that this has had a positive impact on the pace of indigenous innovation in the developing world.[10]

Fourth, the new DSS could be good for developing countries because it reinforces the operation of the world trading system as 'rules based', but it can only be beneficial to developing countries if they can access it. In principle, even the smallest developing countries can hold the largest and most powerful to account for the concessions they have signed up to. But the absolute marginal cost of access to each small developing country of managing a dispute will in general be higher than to a developed country because the former tend to maintain smaller missions to the WTO Secretariat in Geneva. A developing country mission will therefore become over-stretched by a dispute more quickly, given their existing workload.

In recognition of the higher marginal costs of managing a dispute faced by developing countries, SDT makes available to them additional privileged procedures. Moreover, in 2001, the Advisory Centre on WTO Law (ACWL) was established to make available advice and subsidies to poorer countries, to help them with the costs of mounting a WTO dispute. Developing countries may choose a faster procedure, request longer time-limits, or request legal assistance. Some of these provisions are applied very frequently, while others have not yet had any practical relevance (Bown 2009).

Given that SDT helps developing countries to access the DSS, the main overarching issue raised by the system for developing countries is that it is 'self-enforcing'. That is, the only way for a country to enforce a violation of an agreement against it is to withdraw equivalent concessions that it has made in the agreement. This means that the reciprocal exchange of concessions on an MFN basis is at the core of the functioning of the dispute settlement system, and indeed the entire GATT/WTO based system of trade agreements. But, as Bown (2009) explains in detail, because SDT extends concessions to developing countries on a preferential and hence non-reciprocal basis, in the limit they may have nothing to withdraw in order to hold those violating an agreement to account. This provides yet another reason why, to be able to take full advantage of the DSS, developing countries should consider eschewing SDT.[11]

**This Book**

As discussed in the previous section, the historical evolution of ideas regarding the relationship between trade liberalization and development has seen a shift from endorsement of a planning-based approach towards a market-and-institutions based approach. Under the planning-based approach, economic development is an exercise in 'conscious design', whereby the government is directly involved in a deliberate process of deciding which firms and industries to promote, using trade policy to further this process. The market-and-institutions based approach aims to set institutions and government policies including those relating to trade such that, in the language of North and Thomas (1973), "individuals capture the social returns to their actions as private returns, so that development emerges spontaneously through the efforts of individuals." The market-and-institutions based approach has come to be the dominant paradigm in the literature on international trade agreements, and this is reflected in the contributions to this volume.

The chapters that follow are generally about getting institutions and prices right, leaving implicit the assumption that further government intervention is not necessarily required to promote the process of economic development. From a planning-based perspective, which is still prevalent in some quarters of the literature on international development, the contributions to this volume would be regarded as lacking in their disregard for the government's role in promoting a deliberate process of economic development.

In defense of our approach, it has proved remarkably difficult to find concrete evidence of which policies consistently promote economic development, leaving some to conclude that 'conscious design' based development is a fruitless exercise (Cohen and Easterly 2009). At the same time, the literature on misallocation and productivity has demonstrated that the removal of distortions, including those created by trade policies, as well as establishing institutions that support international trade, does play a demonstrable role in promoting productivity and hence economic development (Hall and Jones 1999, Waugh 2010).[12]

Past attempts to study the scope for the WTO to promote economic development in the Doha Round have tended to focus on which developed country sectors could be opened to the benefit of developing countries. The focus has been on agriculture, textiles, and other low-skilled manufactures, as well as services.[13] However, as we have seen, a key insight from the 'terms-of-trade' theory of trade agreements is that countries can only expect to gain from a trade agreement in proportion to the market access concessions that they themselves make. Accordingly, rather than focus on sectors where developing countries could benefit from being granted greater access, the first four chapters of this book aim to identify areas where developing countries have in the past, and could in the future, potentially offer concessions. Hence, the aim is to see how developing countries could create the greatest scope for themselves to gain from current and possible future trade rounds under the WTO.

Chapter 1 of this book, by Robert Staiger, sets out a comprehensive framework for formally incorporating non-tariff measures (NTMs) into a model for analyzing a multilateral trade agreement, taking account of the presence of tariffs as well. There appears to be broad recognition that the existence of NTMs is presenting difficulties for developing countries to gain reliable access to developed country markets. At the same time, there is recognition that developing countries set numerous NTMs of their own, and so there appears to be scope here for a mutually beneficial agreement between developed and developing countries that involves NTMs. The main issue with reaching such an agreement seems to be that NTMs have become increasingly complex and multifaceted, encompassing a dense web of rules and regulations across countries that are proving difficult to understand and disentangle systematically (UNCTAD 2013).

Chapter 1 first categorizes NTMs, taking the initial step of defining as NTMs all trade interventions that are not tariffs. It then breaks down NTMs into two sub-categories: 'border NTMs' such as import quotas and export restrictions; and 'behind-the-border NTMs' such as food safety standards and other standards aimed at protecting consumers.[14] Drawing on UNCTAD (2013), the chapter notes that while developing countries tend to impose border NTMs on imports from developed countries, developed countries tend to impose behind-the-border NTMs on imports from developing countries.

Although the framework developed in the chapter is general and allows for a broad spectrum of possibilities, the policy prescriptions turn out to be surprisingly clear-cut. With regard to border-NTMs, the chapter argues that some form of international cooperation may be needed to bring international trade flows up to efficient levels. A key question is whether the fact that NTMs do not necessarily generate any revenues prevents an agreement over border-NTMs from being subject to the same terms-of-trade motivation as tariffs. The concern is that tariff revenues apparently play a critical role in the terms-of-trade motivation for a trade agreement, while there may be no revenues with NTMs.

A key contribution of the chapter is to show that an agreement involving border-NTMs is indeed amenable to a terms-of-trade motivation. Since border-NTMs can exert a negative terms-of-trade externality on trade partners, by causing a reduction in demand for their exports, an agreement over border-NTMs has the same motivation of escaping from a terms-of-trade externality as in the tariff-based theory of trade agreements discussed earlier. This, the chapter points out, provides a rationale for the WTO's Trade Facilitation Agreement (TFA), reached at the 2013 Bali Ministerial Conference. The TFA focuses on trade facilitation, improving administrative procedures at the border.

Turning to behind-the-border measures, the chapter identifies a critical distinction between whether international prices are determined through a Walrasian process or instead involve an element of bilateral bargaining. International prices are determined through a Walrasian process when the production of each traded good takes place within a country. On the other hand, Antras and Staiger (2012) argue that offshoring may be seen as changing the nature of international price determination, from one governed by a standard Walrasian market-clearing mechanism to one that is described by a collection of bilateral bargains between foreign suppliers and domestic buyers. In that case, the rise in offshoring will require fundamental changes in the WTO's approach to trade liberalization if that institution is to remain effective.

In the case of behind-the-border NTMs under Walrasian international price determination, import tariffs and export taxes are the only policies that are distorted in the Nash equilibrium. All other (NTM) policies are set at their efficient, Pigouvian, levels conditional on (inefficiently low) Nash trade volumes. Hence the chapter shows that the only job for an international trade agreement is to liberalize tariffs and hence expand trade volumes to efficient levels, just as in an agreement without NTMs.

If on the other hand international prices are determined partly through bilateral bargaining, then not only do domestic policies such as a domestic consumption tax have a Pigouvian role, but they take on a terms-of-trade role as well. This means that to attain efficiency, in addition to a tariff component, an agreement must involve 'deep integration' that addresses behind-the-border measures such as consumption taxes as well.

This insight provides a possible rationale for why, as trade has become more supply-chain based in recent years, countries have increasingly pursued deep integration through preferential trade agreements (PTAs) in preference to shallow integration through multilateral trade rounds. It also suggests that developing countries have a stake in developed countries agreeing to adopt further behind-the-border NTMs, and could encourage this by offering concessions over border NTMs in exchange.

Chapter 2, by Chad Bown, adopts a more traditional focus on tariffs. The motivation is compelling, arguing that there are 3.5 billion people in the world who have yet to benefit from an agreement to lower tariffs under the GATT/WTO, the overwhelming majority of whom are in developing countries. This chapter uses the terms-of-trade theory to identify, in the data, scope for further efficiency gains through trade liberalization facilitated by the WTO. It does so by testing a key implication of the terms-of-trade theory, focusing on tariff bindings. Tariff bindings are levels above which countries are not permitted to raise tariffs, except under extenuating circumstances. In practical terms, agreements reached in GATT/WTO negotiations are over bindings rather than tariffs themselves. The implication focused on in the chapter is that, through WTO negotiations, members are requested to take on lower tariff binding commitments in products for which they have higher market power, and thus where their tariffs (if left unchecked) would result in larger terms-of-trade externality losses for trade partners.

Chapter 2 assesses this implication for three groups of countries: recent WTO accession countries, because they approximate countries who have yet to join; WTO members with unbound tariffs; WTO members with bound tariffs but substantial tariff overhang. (Tariff overhang is the gap between the tariff binding that a country has agreed to and the tariff that it actually applies.) The chapter uses established theoretical and econometric methodologies to investigate a new dataset that incorporates detailed evidence on a number of developing countries. We know from the prior literature that the terms-of-trade theory of trade agreements has provided motivation for tariff agreements between developed countries. The main contribution of this chapter is to assess the extent to which the same motivation holds for developing countries.

The results for recently acceding countries suggest that future accessions could be motivated by the terms-of-trade theory, yielding further efficiency gains through trade liberalization. The same is not found to be true of countries whose tariffs are unbound. This second group are concentrated in Sub-Saharan Africa, and tend to be poorer. For these countries, the general finding is that there is no evidence that market power considerations are driving applied tariff rates for unbound products. This finding is consistent with the idea that unbound tariffs in the WTO system allow countries flexibility to raise their applied rates in response to shocks, and poor countries put a high premium on such flexibility in raising tariff revenues because they lack domestic fiscal alternatives.

The approach to studying countries with substantial tariff overhang follows Nicita, Olarreaga and Silva (2018). This approach makes two predictions. First, as per the key implication noted above, when applied tariffs are constrained by WTO binding commitments there is a negative relationship between importer market power and the applied tariff. Second, when applied tariffs are unconstrained by WTO binding commitments, there is a positive relationship between importer market power and the applied tariff.

It is the second of these predictions that Chapter 2 investigates in detail for countries with substantial tariff overhang. The findings are that products for countries, and in particular developing countries, that have taken on WTO bindings but for which substantial tariff overhang remains have applied MFN import tariffs that continue to reflect importer market power considerations. So this may constitute an area where additional WTO-facilitated negotiations for applied MFN tariff reductions would be consistent with the motivation provided by the terms-of-trade theory of trade agreements.

Chapter 3, by Rodney Ludema, Anna Maria Mayda, and Jonathon McClure, studies the evolution of the so-called 'MFN free rider problem', an implication of the terms-of-trade theory. Ludema and Mayda (2009, 2013) show that an exporting country's benefit from an MFN tariff concession by another country is proportional to exporter concentration. An exporting country's willingness to pay for an MFN tariff concession on the product it exports with tariff concessions of its own depends on how much its refusal to offer concessions would reduce the MFN tariff concession. The smaller the exporter, the less its refusal would mitigate the tariff cut and thus the less costly it would be for the exporter to refuse to make a concession. The fact that any tariff concession that others make must be extended to all on an MFN basis then means that smaller exporters have an incentive to free ride on other countries' tariff concessions. Ludema and Mayda have termed this phenomenon the 'MFN free rider problem'. The MFN free rider problem is most severe when there is a relatively large number of small countries exporting a product, i.e. exporter concentration is low, so that each country has a low willingness to pay for an MFN tariff reduction with tariff concessions of its own.

Ludema and Mayda (2009, 2013) show that an exporter's maximum willingness to pay for a tariff cut is proportional to the square of its export share. Summing over all exporters, the collective willingness to pay of all MFN exporters is proportional to the Herfindahl-Hirschman index (HHI) of exporter concentration. The higher is the HHI, the less severe is the MFN free rider problem.

Chapter 3 focuses on the period since 1993. This covers the period since the Uruguay Round was completed in 1994 and the World Trade Organisation (WTO) was formed in 1995. The evolution of the MFN free rider problem is analysed in two steps. First, the chapter analyzes how much of the trade liberalization that has taken place since 1947 is attributable to the GATT. Alternative channels could be unilateral trade liberalization and through the formation of preferential trade agreements (PTAs). Particularly useful, given the focus of this book, is that the chapter decomposes the changes according to whether countries are developed or developing.

The results show that, through negotiations under the GATT up to the conclusion of the Uruguay Round, developing countries were able to internalize 78% of the terms-of-trade effects of their tariff reductions while developed countries were only able to internalize 70%. The difference is due to the fact that each developed country tends to account for a larger share of the goods that it exports, reflected in a higher HHI, motivating developed countries to offer larger tariff concessions. For developing countries, each country is responsible for a lower share of the good that it exports, resulting in a lower HHI, so that they are more inclined to free ride on MFN.

With regard to specific sectors, a particularly interesting finding is that while developing countries tend to export manufactures such as footwear and textiles, which have relatively high potential for negotiated liberalization, this potential goes unrealized. This is because these products are produced by a relatively large number of small countries, so the HHI is low and the free rider problem more acute for these products.

In addition, Chapter 3 examines the prospects for future multilateral trade liberalization by decomposing changes in exporter concentration into three components: the creation of PTAs; the WTO accession of new countries; the change in trade patterns due to emerging economies' high growth rates. The results show that the increase in PTAs over the last twenty years has increased exporter concentration. When countries form a PTA, they extend MFN treatment to fewer countries than they did before. Theoretically this could increase or decrease the HHI of the remaining exporters to those countries, but Chapter 3 shows that in the data the HHI has increased. So surprisingly, the chapter identifies a new way in which PTAs create 'building blocks' in the path to multilateral trade liberalization. Similarly, the accession of new members has also increased the HHIs of existing members.[15] This is because, before acceding, the new members were observers and so already received MFN treatment, but because they were observers they were not able to participate in negotiations. Thus, the accession of new members to the WTO increases exporter concentration by adding new participants to the negotiations.

However, crucially, through the growth of trade with emerging economies such as China, the MFN free rider effect is found to have gotten worse. For some countries like Brazil and India, the total HHI of industrial exporters with whom they negotiate has decreased between 1993 and 2012 because the increase in exports of industrial goods by China has eroded the export market shares of the existing exporters such as the US and European countries. This may be one reason why Brazil and India have apparently become more reluctant to make tariff reductions during the Doha Round. In other words, this effect may be a contributor to the 'latecomer problem' discussed by Bagwell and Staiger (2014). Yet the overarching finding is that there has been an average increase in exporter concentration consistent with the trade liberalization, however modest, that has been realized through the Doha round.

While the discussion so far has focused on developing country GATT/WTO members, Chapter 4 by Xuepeng Liu considers a puzzle concerning so-called non-member participants (NMPs). NMPs consist of three groups: colonies and overseas territories of GATT members; newly independent states; and provisional members. NMPs are relevant here because they tend overwhelmingly to be developing countries.

Recognition that NMPs may be important in understanding the benefits of the GATT emerged with the inception of the econometric literature on the GATT/WTO. This literature was launched by a controversial paper by Rose (2004) that apparently found "little evidence that countries joining or belonging to the GATT/WTO have different trade patterns than outsiders." Rose described his finding as an "interesting mystery". This has also been referred to in the literature as the GATT/WTO 'ineffectiveness puzzle'.

On the face of it, this puzzle was resolved by Tomz, Goldstein and Rivers (2007) when they took another look at the way Rose classifies countries into GATT 'insiders' and 'outsiders'. Rose classifies NMPs as outsiders when in fact they often formally adopt many of the rights and obligations of members. By more reasonably classifying these countries as insiders, Tomz et al find that insiders trade more than outsiders.

Perplexingly, in resolving the ineffectiveness puzzle, Tomz et al create a new one. Their preferred results imply that two formal GATT members trade 61 percent more than the baseline case of neither country being a formal member nor an NMP, while two NMPs trade 140 percent more than the baseline. It is difficult to understand why the NMPs should trade even more than formal members. Chapter 4 is directed at understanding this finding, which Liu refers to as the 'NMP puzzle'.

Chapter 4 addresses the NMP puzzle in two ways. The first is to incorporate zero bilateral trade flows in the dataset, something that Tomz et al do not do. So while Tomz et al are able to account for the effect of GATT participation on the intensive margin, they fail to take account of its effect on the extensive margin. Chapter 4 shows that full GATT membership was more effective in stimulating new trading relationships, possibly because only full members could initiate negotiations. While this approach addresses the NMP puzzle overall, the puzzle still remains at the intensive margin when the zeros are introduced.

The second way that the chapter addresses the NMP puzzle is to adopt a Poisson Quasi-Maximum Likelihood Estimation (PQML) approach in the regressions. This addresses a bias to estimates introduced by the standard gravity equation approach, known from the prior literature, that arises when taking the logarithm of trade flows.

The main finding of the chapter is as follows. Under the PQML approach, with both positive and zero trade, two formal GATT members trade 60% more than the baseline case of neither being a formal member nor an NMP, while two NMPs trade 10% less than the baseline case. While there is no necessary reason to expect NMPs to trade less than the baseline case, overall this finding is more in line with what we would expect in that NMPs trade less than members. In sum, the main contribution of the chapter is to show that the 'NMP puzzle' can be addressed by undertaking two relatively simple modifications to the original gravity equation approach of Rose (2004) and Tomz et al (2007).

The next three chapters of the book develop new theoretical and econometric approaches to better understand key aspects of trade liberalization under the GATT/WTO, with applications that can help us understand the implications of SDT. The first develops a new model of how nations can achieve cooperation in eliminating prohibitive trade barriers, which is useful because SDT has been used in the past to support autarky in some sectors. The chapter after that studies export subsidies in China, and asks whether these have been responsible for China's remarkable growth in exporting. This will shed light on whether government promotion of industrial development through SDT can form a useful part of a development strategy. The third of these chapters develops a framework for thinking about how to optimally set trade policy in such a way as to facilitate the movement of productive resources between sectors when this is costly, thus providing a different rationale for SDT.

In Chapter 5, David DeRemer develops a model for analyzing a trade agreement when autarky is the (unique) outcome of non-cooperation over trade policy. While the canonical model of trade agreements with perfect competition and political economy (Bagwell and Staiger 1999, 2002) has proved to be powerful and flexible in explaining many aspects of trade liberalization under the GATT/WTO, it cannot motivate a trade agreement of the kind that DeRemer considers. Specifically, in the canonical model, if each government has a unilateral preference for autarky then they must have a joint preference for autarky as well. This limits the scope for studying situations where developing countries have adopted autarkic trade policies for specific sectors through SDT, but where there may nevertheless be scope to open these sectors as part of a trade agreement.

The chapter adopts a familiar 'Brander-Spencer' type model in which to explore the scope for a trade agreement when autarky is the non-cooperative outcome. The basic setting is one of two countries, with one firm in each producing the same homogeneous product. Strategic interaction in production between the firms is captured via Cournot competition. The government in each country sets a specific tariff on imports coming from the other country. There is a standard rent-shifting motive for setting tariffs familiar from Brander and Spencer (1981).

Under this set-up, each government has a dominant strategy to set its tariff at a certain positive level determined by underlying parameters, and tariffs are strategically independent. The main parameter of interest in the basic set-up is the weight that each government places on the profits made by its nation's firm. The first main result identifies an interval for the weight in which, while Nash equilibrium tariffs are prohibitive, free trade is globally optimal. Consequently, governments and each nation as a whole can benefit from a trade agreement. This is the main idea of the chapter and the rest is devoted to exploring other conditions under which this basic result holds.

The extensions considered show that cooperation over trade liberalization is more likely for lower levels of trade costs, sufficiently large cross-industry differences in productivity, weaker levels of intranational competition, and intermediate ranges of firm heterogeneity.

An extension of this framework could be used to highlight the 'latecomer problem' identified by Bagwell and Staiger (2014) in a particularly stark way. That is, while developed countries liberalized a particular sector through past GATT rounds, some developing countries may have remained autarkic in that sector. As the chapter notes, this seems to have been particularly true for the production of buses and trucks, where many developing countries' markets are dominated exclusively by inefficient domestic goods produced behind high tariff walls even to this day. Fully understanding this problem may be the first step to finding a way to an appropriate solution.

Chapter 6, by Fabrice Defever and Alejandro Riaño, looks specifically at the export promotion policies implemented by China, and how these have promoted the transition of China from autarky in the 1970s to the world's largest exporting economy today. Previously we noted that the literature on international trade and development admits a potential role for the promotion of industrialization as part of a development strategy, to the extent that this internalizes externalities associated with industrial development. The literature's recognition of this role was originally based on successful government interventions in development of the Asian Tigers, and this success appears to be ongoing with the 'rise of China'.

The point of departure for this chapter is a set of stylized facts on firm exporting behavior that have been established in the economics literature for the world's major trading economies. The first aim of the chapter is to see the extent to which Chinese exporting firms conform to these stylized facts. The stylized facts are as follows: relatively few firms engage in exporting; exporting firms tend to be more productive and hence larger; most firms that do export sell only a small fraction of their output abroad. As the chapter notes, it is particularly interesting to compare the characteristics of Chinese exporters against these stylized facts, partly because export growth has been so rapid in China, and partly because the approach China has taken has been somewhat heterodox, based on the "distinctive traits of a centrally-planned economy".

Key features of China's approach to promoting exports have been: the formation of free trade zones (FTZs); the use of duty drawback schemes in the form of processing trade zones; and the provision of tax concessions and subsidies based on export share requirements. Since all of these policies are likely to distort economic incentives, the question is whether the standard stylized facts still prevail in this type of environment.

The chapter reveals that, on the face of it, the characteristics of Chinese exporters fit the stylized facts listed above. The most striking difference, the chapter notes, is that a third of firms export almost all of their output. These are referred to as 'pure exporters'. Moreover, pure exporters are found to be less productive than 'regular exporters', a large share of whose output serves the domestic market. This goes against a pervasive feature found elsewhere, that a firm's productivity and its export share are positively correlated. On this basis, the chapter characterizes China as having a 'dual export sector'.

The second aim of the chapter is to assess whether the export promoting policies that China has adopted have given rise to the dual nature of the export sector. The chapter uses a detailed dataset to characterize, along a number of dimensions, the sense in which Chinese export promotion policies have created a clear incentive to export, where otherwise the firms might not have.

The overall conclusion is that China's export promotion policies have been responsible for creating its dual export sector, and have been instrumental in China becoming the world's largest exporter. Now that these policies are being challenged under the WTO ACSM, the chapter speculates that perhaps the dual nature of China's export sector will recede. Yet the results seem to imply that export subsidies have played an important role in China's industrial development. Understanding China's experience in this regard may be helpful for anticipating future outcomes for a large number of other developing economies that use export subsidies. But the fact that the WTO ASCM outlaws such policies raises an open question of how industrialization might be promoted in future in ways that are consistent with WTO rules.

Chapter 7, by Eric Bond, considers whether an efficient trade agreement should allow for gradual trade liberalization to mitigate adjustment costs. Recent research has shown that the adjustment costs of moving productive resources between sectors in response to trade liberalization are significantly higher than previously thought. These costs are likely to be particularly high for developing countries, where adjustment is likely to involve geographical relocation between rural and urban settings. For example, Dix-Carneiro (2014) finds that in response to the Brazilian trade liberalization episode of

1988-94, labor migration costs could be as high as 42 percent of the gains from trade, and that adjustment can take 5 years or longer. The chapter pays particular attention to whether there should be an allowance for adjustment to be longer in developing countries, providing a potential role for SDT.

Recent agreements demonstrate the relevance of these issues. For example, developed countries were given 5 years to implement the tariff schedules negotiated in the Uruguay Round, but developing countries were allowed longer phase-in periods in some sectors, notably textiles and agriculture.

The analytical approach taken in Chapter 7 is to examine the optimal liberalization path between two large countries, where workers face adjustment costs of moving between sectors. The respective governments would like to be able to provide compensation to workers in their import-competing sectors, but do not have a lump-sum tax instrument to redistribute in a non-distorting way. The government's desire to compensate workers for trade liberalization in the import-competing sector results in tariff reductions being spread over the entire adjustment period until wage rates are equalized between sectors.

Having set up the analytical framework, the chapter is able to address several issues to do with gradual trade liberalization to mitigate adjustment costs. These include whether developing countries should be encouraged to front-load tariff reductions, so that the majority of reductions are achieved at the beginning of the adjustment period, or back-load them to largely occur at the end.

The results show that if tariffs are the only policy instruments available, then developing countries should be allowed longer phase-in periods if their marginal costs of adjustment are higher than in developed countries. Longer phase-in periods are also justified if initial employment levels are further from free trade levels, which will be true for developing countries if their initial tariffs are higher. Hence, the analysis shows that there may be a normative justification for SDT of developing countries.

Surprisingly, these results can break down when governments in developed countries have access to more policy instruments than developing countries. Then, under an optimal agreement developing countries should actually liberalize more rapidly than developed countries. The reason is that, to achieve efficiency, tariffs must be used more intensively by developing countries to encourage the movement of labor out of import-competing sectors when alternative instruments are unavailable.

The final two chapters of the book address the most important 'new issues' that arose from the grand bargain between developed and developing countries in the Uruguay Round. These centered mainly on the TRIPS agreement and the DSS, which the two final chapters consider respectively.

Chapter 8, by Eric Bond and Kamal Saggi, contrasts the roles of price controls and compulsory licensing (CL) to improve consumer access to patented foreign products in developing countries. While the TRIPS agreement created a storm of controversy, the eye of the storm was over the implication that, as a result of the agreement, it became more difficult for poor people in developing countries to access medicine at affordable prices. The TRIPS agreement extended the reach of the monopoly power granted to pharmaceutical companies by the patents that they held, with the overall expectation that this would increase the prices of pharmaceutical drugs. It comes as no surprise that governments across the world use price controls and other such regulations to combat the monopoly power of firms selling patented pharmaceuticals. A second instrument that governments can use to manage the monopoly power of firms granted through patents is CL.

While the issue of affordability of patented pharmaceuticals takes on a special urgency in the context of poor developing countries, it is also relevant within the developed world. Under the terms of the TRIPS agreement, if a patent holder refuses to grant access to its product on 'reasonable' commercial terms then a government may grant a CL to a different firm to produce the product. This may even be granted to a firm in a third country, to allow for the possibility that the domestic country lacks the capacity to produce pharmaceuticals locally.

In the model, a developing country sets the level of the price control while the patent-holder chooses between direct entry and the voluntarily licensing (VL) of its technology to a local firm. The model assumes a trade-off: the licensee has a lower fixed cost relative to the patent holder, but the licensee's product is of inferior quality. The chapter compares two scenarios: one where the developing country attempts to improve consumer access via the use of a price control and another where it resorts to CL if the patent-holder refuses to grant a VL locally.

The analysis shows that the option to use CL ensures that at least a lower quality version of the patented good is available locally if the patent-holder decides not to issue a VL in the developing country. However, the possibility of CL also makes it less likely that the patent-holder chooses to sell in the developing country. The logic is as follows. The threat of CL reduces the patent-holder's profits under VL by lowering the fee that the licensee in the developing country is willing to pay, knowing that a CL would eventually be granted. Similarly, since the royalty payments under CL provide the patent-holder a return from the developing country market when it chooses to stay out, entry there becomes less attractive as well. When CL replaces entry, it can lower Southern welfare because it delays consumer access to the patented good.

The main lesson of the chapter is that the social value of CL is context dependent. If the fixed cost of entry is high relative to the size of the developing country market, CL plays a socially useful role that can be to the advantage of both the developing country and the patent-holder. The reason is that the developing country obtains access to the pharmaceutical product while the patent-holder receives royalties from a market in which it would not have entered in the absence of CL. On the other hand, when fixed costs are at an intermediate level such that the patent-holder prefers to wait for the CL to be issued rather than entering itself, the developing country is made worse off by the fact that CL is an option. Finally, when fixed costs are so small that the patent-holder chooses to enter regardless of whether the developing country has the option to issue a CL or not, the threat of CL does not affect market outcomes and welfare. This context dependency seems to be a feature of outcomes under the TRIPS agreement more broadly, making it difficult to assess the extent to which it is beneficial or harmful overall.

The ninth and final chapter, by Mostafa Beshkar and Mahdi Majbouri, tests empirically the outcomes of disputes, focusing on whether or not they lead to litigation, taking explicit account of whether or not the dispute involves developed and/or developing countries. The chapter focuses on the fact that developing and developed countries show divergent behavior in the dispute settlement process. More than half of all initiated disputes are resolved without litigation, i.e. without the establishment of a dispute panel. This is likely to reflect the parties' desire to avoid the costs of litigation. Of those cases that do go to litigation, they are more likely to involve developed countries, probably because their marginal costs of going to litigation tend to be lower for them.

A surprising pattern uncovered in Chapter 9 is that, in a dispute between a developed and a developing country, litigation is more likely if the developed country is the defending party. As detailed in the chapter, 62 percent of disputes in which a developed country presses charges against a developing country are settled without establishing a dispute panel. In contrast, only 44 percent of disputes are settled without establishing a dispute panel if a developing country mounts a dispute against a developed country.

The chapter investigates this pattern as follows. It first develops a signalling model of 'direct breach' of a trade agreement, and a signalling model of 'indirect breach'. As the name suggests, direct breach is where the complainant claims that a term of an agreement has been breached. Indirect breach occurs where there is a disagreement over a policy that is not explicitly limited by an agreement but where its use may nullify or impair the benefits to a party that were intended under the agreement. Based on these models, the chapter derives two propositions. Proposition 1 states that the equilibrium settlement rate is increasing in the litigation costs of either party. Proposition 2 states that the equilibrium settlement rate is more sensitive to changes in the defendant's costs than to changes in the complainant's costs.

In the empirical section, these two theoretical propositions are then translated into two testable hypotheses. Hypothesis 1 is that the settlement rate is positively correlated with the measures of litigation costs. Hypothesis 2 is that the settlement rate is more sensitive to changes in the litigation costs of the defending party than to changes in the litigation costs of the complaining party. A third testable hypothesis is introduced in the empirical section which says that the settlement rate is negatively correlated with the trade volume between the disputing parties in the disputed sector prior to violation.

Support is found in the data for all three of these hypotheses prior to 2001. After 2001 the difference in settlement behaviour between developed and developing countries disappears. This is interesting and important because, as noted previously, it was in 2001 that the ACWL was established to provide subsidized expertise to poorer countries to help them with the costs of mounting or defending a WTO dispute. The disappearance in the difference of behaviour suggests that the subsidized legal assistance made available by the ACWL has been effective in addressing the potential denial of developing country access to the dispute settlement system as a result of their relatively low incomes.

**Basic Insights**

Classical economics provides a useful frame for the insights of this book. Among the most important points made by Smith (1776) was that economic prosperity rests on free international trade because this facilitates an efficient allocation of resources. To the extent that the process of economic development can be seen as synonymous with a nation's pursuit of economic prosperity, the GATT/WTO need do nothing more to promote economic development than to facilitate international trade. This perspective chimes well with the literature on misallocation and productivity, which has shown that the removal of distortions, including those created by trade policies, has been instrumental in increasing productivity and hence economic development. This perspective also chimes well with the view through the lens of the terms-of-trade theory of trade agreements, that to benefit from a multilateral trade agreement, each country must come to the table ready to make concessions of their own. This couches the gains from a trade agreement in terms of enhancing economic efficiency by removing domestic distortions, which is a critical part of exploiting the gains from specialization and trade through comparative advantage.

It had traditionally been thought that the case for developing countries exploiting the gains from trade was essentially a unilateral one, especially because they were thought not to have sufficient power on world markets to affect their own terms of trade. Yet the econometric evidence presented in this book (and elsewhere) suggests that even many developing countries' trade policies have an effect on international prices. So they too need the kinds of agreements facilitated by the GATT/WTO to be able to fully exploit these gains.

One set of insights that emerges from the contributions to this book is that there are still a number of areas where concessions could be made in future trade agreements under the GATT/WTO. Developed countries, who have largely exhausted the scope for further liberalization over industrial tariffs, could come to the table ready to make substantial concessions over behind-the-border NTMs. At the same time, developing countries have the opportunity not just to make concessions over tariff measures, but also over non-tariff border measures as well. Crucially, we have come to understand that possible agreements involving NTMs could follow the same basic terms-of-trade based logic as the tariff-only based agreements of the past, and this in itself offers motivation for future agreements to be made.

Equally important to understanding where future concessions could be made is the question of why possible gains may have gone unrealized in the Doha Round. The 'latecomer problem' has emerged in this book as a useful way to think about this issue. A key finding in the data was that the 'rise of China' has discouraged key emerging economies Brazil and India from coming to the table offering concessions in agriculture. This finding corroborates the suspicions of many that Brazil and India's reluctance to offer concessions in agriculture contributed to the disappointing outcomes of the Doha Round. Also exacerbating the latecomer problem is the fact that commitments taken on by developing countries as part of the TRIPS agreement cannot be regarded as standard market access concessions that could be exchanged for developed country concessions in agriculture.

These insights help to reconcile disagreements in the literature as to why the Doha Round proved to be so disappointing. Some argue that, after encouraging progress had been made in developing country trade liberalization during the Uruguay Round, the narrative surrounding the Doha Round has been one of developing country backsliding based on SDT (Ornelas 2016). Others suggest that the broadening of the policy space into new areas such as TRIPS has created a perceptibly more coercive, imperialistic policy environment of 'what countries must do', and that it was this that created reluctance among developing countries to come to the table (Rodrik 2011).[16] The insight we gain from this book is that both can be seen in terms of the latecomer problem. In part the findings presented here offer hope for the future: there is scope to resolve the latecomer problem by identifying market access concessions based on new policy instruments, particularly NTMs. In part the findings are more cautionary: if the rise of China is making the MFN free rider problem worse, the continued industrial development of Asia may further entrench the latecomer problem.

Regarding the new issues concerning the TRIPS agreement and the DSS, there appear to be two insights. The implications of the TRIPS agreement itself seems to be that its effects, both positive and negative, have been smaller than expected. However, it is early days in terms of the timespan that the agreement has had to make a meaningful impact, and there appears to be scope over the coming years for the effects to become larger in either direction. Regarding the DSS, the findings were quite encouraging in that assistance made available to developing countries through the WTO ACWL appears to have helped them to access the system on a more equal footing with developed countries. So even if the weakness of the Doha Round outcomes is an indication of slowing momentum behind multilateral trade rounds, having an effective DSS means that members, especially developing country members, should be able to access effectively the gains from agreements that have already been reached.

While the insights of this book endorse the consensus that developing countries should embrace trade liberalization as part of their development strategies, they also support a nuanced perspective that SDT may nevertheless have a role to play in supporting economic development. They are in line with the view that China's export subsidies have helped to promote the development of its industrial sectors. While the specific policies that China has used are now illegal under the WTO's ACSM, the question remains as to whether developing countries might legitimately want to exploit legal SDT measures to promote industrialization. In addition, there does appear to be a normative basis for using SDT measures to phase in trade liberalization commitments. The key set of questions that remain on this issue concern how, and indeed whether, SDT measures can be made robust against protectionist interests.

**References**

Antras, P., and R.W. Staiger. 2012. Offshoring and the Role of Trade Agreements. *American Economic Review* 102(7): 3140-3183.

Bagwell, K., and R.W. Staiger. 1999. An Economic Theory of the GATT. *American Economic Review* 89: 215-248.

Bagwell, K., and R.W. Staiger. 2002. *The Economics of the World Trading System*. MIT Press, Cambridge (Mass), US.

Bagwell, K., and R.W. Staiger. 2011. What Do Trade Negotiators Negotiate About? Empirical Evidence from the World Trade Organization" *American Economic Review* 101(4): 1238-127.

Bagwell, K., and R.W. Staiger. 2014. Can the Doha Round be a Development Round? Setting a Place at the Table. Published in R.C. Feenstra and A.M. Taylor (eds.), *Globalization in an Age of Crisis: Multilateral Economic Cooperation in the Twenty-First Century*, NBER, University of Chicago Press, Chicago, US.

Baldwin, R. 2016. *The Great Convergence: Information Technology and the New Globalization*. Harvard University Press, Cambridge (Mass), US.

Bown, C.P. 2009. *Self-Enforcing Trade: Developing Countries and WTO Dispute Settlement.* Brookings Institution Press, Washington, DC.

Brander, J.A. and B. Spencer. 1981. Tariffs and the Extraction of Foreign Monopoly Rent Under Potential Entry. *Canadian Journal of Economics* 14: 371-384.

Brown, D.K., A.V. Deardorff, and R.M. Stern. 2003. Developing Countries' Stake in the Doha Round. University of Michigan Gerald R. Ford School of Public Policy Discussion Paper No. 495.

Cohen, J., and W. Easterly. 2009. Introduction: Thinking Big versus Thinking Small. Ch.1 in Cohen, J., and W. Easterly (eds.) *What Works in Development?* Brookings Institution Press, Washington, D.C.

Conconi, P., and C. Perroni. 2012. Conditional versus Unconditional Trade Concessions for Developing Countries. *Canadian Journal of Economics* 45, 613-631.

Conconi, P., and C. Perroni. 2015. Special and Differential Treatment of Developing Countries in the WTO. *World Trade Review* 14, 67-86.

Corden, M. 1994. *Trade Policy and Economic Welfare* (2nd edition). Clarendon Press, Oxford, UK.

Dix-Carneiro, R. 2014. Trade Liberalization and Labor Market Dynamics. *Econometrica* 82(3): 825-885.

Easterly, W. 2013. *The Tyranny of Experts: Economists, Dictators, and the Forgotten Rights of the Poor.* Basic Books, New York.

Finger, J. M. and P. Schuler. 2000. Implementation of Uruguay Round Commitments: The Development Challenge. *The World Economy*, 23(4): 511–525.

General Agreement on Tariffs and Trade (GATT). 1994. Marrakesh Agreement Establishing the World Trade Organization. Geneva. Available online at: https://www.wto.org/english/docs_e/legal_e/04-wto_e.htm.

Gil-Pareja, S., R. Llorca-Vivero, and J.A. Martínez-Serrano. 2014. Do Nonreciprocal Preferential Trade Agreements Increase Beneficiaries' Exports? *Journal of Development Economics*, 107, 291-304.

Hall, R.E., and C.I. Jones. 1999. Why Do Some Countries Produce So Much More Output Per Worker Than Others? *Quarterly Journal of Economics*, 114(1): 83-116.

Hertel, T.W., and L.A. Winters. 2006. *Poverty and the WTO: Impacts of the Doha Development Agenda*. World Bank and Palgrave Macmillan, Washington, D.C.

Lester, S. 2016. Is the Doha Round Over? The WTO's Negotiating Agenda for 2016 and Beyond. *Free Trade Bulletin*, 64: February 11, 2016: 4 pages. Available online at: https://object.cato.org/sites/cato.org/files/pubs/pdf/ftb64.pdf

Little, I.M.D., T. Scitovsky, and M. Scott. 1970. *Industry and Trade in some Developing Countries: A Comparative Study*, London: Oxford University Press, for the Organization of Economic Cooperation and Development.

Ludema, R., and A.M. Mayda. 2009. Do countries free ride on MFN? *Journal of International Economics* 77(2): pp. 137-150.

Ludema, R., and A.M. Mayda. 2013. Do terms-of-trade effects matter for trade agreements? Theory and Evidence from WTO Countries. *Quarterly Journal of Economics* 128(4): 1837- 1893.

Maggi, G., and A. Rodriguez-Clare. 1998. The value of trade agreements in the presence of political pressures. *Journal of Political Economy* 106: 574-601

Mayer, W. 1981. Theoretical Considerations on Negotiated Tariff Adjustments. *Oxford Economic Papers* 33(1): 135-153.

Nicita, A., M. Olarreaga, and P. Silva. 2018. Cooperation in WTO's Tariff Waters. *Journal of Political Economy*. 126(3): 1302-1338.

North, D.C., and R.P. Thomas. 1973. *The Rise of the Western World*. Cambridge University Press, Cambridge, UK.

Ornelas, E. 2016. Special and Differential Treatment for Developing Countries. Chapter 7 in K. Bagwell & R. W. Staiger (eds.), *Handbook of Commercial Policy*, Elsevier/North Holland, Volume 1B: 369-432.

Ostry, S. 2002. The Uruguay Round North-South Grand Bargain: Implications for Future Negotiations. Published in *The Political Economy of International Trade Law: Essays in Honor of Robert E. Hudec*, edited by D.L.M. Kennedy and J.D. Southwick. Cambridge University Press, Cambridge, U.K.

Restucia, D., and R. Rogerson. 2013. Misallocation and Productivity. *Review of Economic Dynamics*, 16: 1-10. (Introduction to special issue on Misallocation and Productivity.)

Rodrik, D. 2007. *One Economics, Many Recipes: Globalization, Institutions, and Economic Growth*. Princeton University Press, Princeton, New Jersey, US.

Rodrik, D. 2011. *The Globalization Paradox: Why Global Markets, States, and Democracy Can't Coexist*. Oxford University Press, Oxford.

Rose, A. 2004. Do We Really Know That the WTO Increases Trade? *American Economic Review* 94(1): 98-114.

Saggi, K. 2016. Trade, Intellectual Property Rights, and the World Trade Organization. Chapter 8 in K. Bagwell & R. W. Staiger (eds.), *Handbook of Commercial Policy*, Elsevier/North Holland, Volume 1B: 433-512.

Smith, A. 1776. *An Enquiry into the Nature and Causes of the Wealth of Nations*. Strahan and Cadell, London, UK.

Srinivasan, T.N. 1999. Developing Countries in the World Trading System: From GATT, 1947, to the Third Ministerial Meeting of the WTO, 1999. *World Economy*, 22(8): 1047-1064.

Staiger, R.W. and G. Tabellini. 1987. Discretionary trade policy and excessive protectionism. *American Economic Review* 77(5): 823-837.

Subramanian, A., and S.-J. Wei. 2007. The WTO Promotes Trade Strongly but Unevenly. *Journal of International Economics* 72: 151-175.

Tang, M.-K., and S.-J. Wei. 2009. The Value of Making Commitments Externally: Evidence from WTO Accessions. *Journal of International Economics* 78: 216-229.

Tomz, M., J.L. Goldstein, and D. Rivers. 2007. Do We Really Know That the WTO Increases Trade? Comment. *American Economic Review* 97(5): 2005-2018.

UNCTAD. 2007. *Elimination of TRIMS: The Experience of Selected Developing Countries*. UNCTAD Current Studies on FDI and Development. United Nations. New York and Geneva.

UNCTAD. 2013. *Non-Tariff Measures to Trade: Economic Policy Issues for Developing Countries*. Developing Countries in International Trade Studies, United Nations, New York and Geneva.

Waugh, M.E. 2010. International Trade and Income Differences. *American Economic Review*, 100(5): 2093-2124.

Whalley, J. 1999. Special and Differential Treatment in the Millennium Round. *World Economy*, 22(8): 1065-1093.

Wolf, M. 2004. *Why Globalization Works*. Yale University Press, New Haven.

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[1] The Doha Round has not formally been concluded at the time of writing, but there is a growing consensus that it effectively ended with the Ministerial Conference that took place in Nairobi in December 2015. See Lester (2016) for a discussion of the accomplishments of the 'Nairobi Ministerial', the Doha Round overall, how this relates to the outcomes that were planned, and what should be the focus of WTO negotiations in future.

[2] Formal recognition among GATT parties that allowances might be made for developing countries' less favourable experiences with trade can be traced to 1957. At the Twelfth Session of the contracting parties to the GATT, they decided to appoint a Panel of Experts to report on trends in international trade: "in particular the failure of the trade of less developed countries to develop as rapidly as that of industrialized countries …". This lead to 'GATT Part IV' being introduced in 1965, adding three Articles (36, 37, and 38) that recognize the development needs of developing countries and state the principle of non-reciprocity. Article 18 was the GATT's first attempt in 1954 to accommodate developing country initiatives for infant industry protection, but only on a reciprocal basis: any countries using this were expected to offer compensation or face retaliation (GATT 1994 Analytical Index, Part IV, and Whalley 1999). Also see Srinivasan (1999).

[3] See Corden (1994) and Wolf (2004) on Little et al (1970).

[4] In addition they argued that ISI tended to be highly distortionary. For example, while industrial finished products were protected, imported capital goods and other imports were encouraged, so much so that industrialization became excessively capital intensive and value added in some instances turned negative.

[5] Some agricultural liberalization has now been agreed at the Nairobi Ministerial Conference of the Doha Round. See Lester (2016) for details.

[6] While the obligations that developing countries as a group agreed to take on in the Uruguay Round were significantly greater than before, and have widely been described as unprecedented, it is important to keep their commitments in perspective. As will be discussed later in this Introduction, and in Chapter 2 of this book, a number of developing countries did not take on any commitments in the Uruguay Round, and a number did so for only a limited number of products. While a number of countries did take on notional commitments for some products, the levels at which they capped, or 'bound', their tariffs were so far above the rates at which their tariffs were applied, that these commitments had no effect on the openness of their economies.

[7] See, for example, the various references to Little et al (1970) in Corden (1994).

[8] Under ASCM, subsidies may be judged to be 'actionable' if they cause adverse effects of 'injury' and 'serious prejudice' in addition to nullification-and-impairment (Article V). But unlike prohibited subsidies, for which a dispute settlement panel would recommend 'withdraw without delay' (Article 4.7), countries can achieve compliance for actionable subsidies by removing their adverse effects (Article 7.8).

[9] For an in-depth discussion of this perspective, see Ornelas (2016). Whalley (1999) discusses the change in approach to SDT adopted in the Uruguay Round.

[10] See Saggi (2016) for a comprehensive and nuanced discussion, both of the theoretical issues raised about TRIPS, and the empirical studies of the effects of TRIPS.

[11] TRIMS has attracted less attention than the other new features of the WTO (such as GATS and TRIPS), both in practice and in research. See UNCTAD (2007) for a useful discussion.

[12] See Restuccia and Richardson (2013) for a review of the literature on misallocation and productivity. See Easterly (2013, part 2) for a discussion of the two views of development, as planning-based (what he refers to as 'conscious design') vs market-and-institutions based (what he refers to as 'spontaneous solutions'), that argues in favour of a market-and-institutions based approach. See Rodrik (2007) for a view that both recognizes the idea that markets and institutions must be organized to align individual incentives towards development, but at the same time sees a fairly extensive role for government to internalize externalities in support of development.

[13] See for example Brown, Deardorff and Stern (2003), and Hertel and Winters (2006).

[14] These are more formally referred to as 'sanitary and phytosanitary (SPS) measures, and technical barriers to trade (TBTs) respectively.

[15] The terminology of GATT 'contracting party' and 'member' is used interchangeably, for consistency with the fact that the terminology of 'member' is used with reference to the WTO.

[16] Rodrik (2011) refers to the new approach to trade negotiations that developed from the Uruguay Round onwards as 'hyperglobalization'.

# Non-Tariff Measures and the WTO*

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**Abstract**

In this paper I sketch out the rough contours of the challenge faced by the WTO in dealing with non-tariff measures (NTMs) as seen from the economic theories of trade agreements. The key questions for the WTO – the answers to which largely dictate the choice between shallow and deep approaches to integration – appear to be two: (1) Is it the terms-of-trade problem or the commitment problem that WTO member governments seek to solve with their WTO membership?; and (2) Is it market clearing or offshoring/bilateral bargaining that is now the most prominent mechanism for the determination of international prices? I suggest that evidence on the first question points to the terms-of-trade theory and hence toward shallow integration, but that answering the second question may be the key to identifying the best way forward on NTMs for the WTO. Along the way I provide a terms-of-trade interpretation of the WTO's Trade Facilitation Agreement.

JEL: D62, F13, F55, H21 and H23. Keywords: terms of trade, commitment, border measures, behind-the-border measures, trade facilitation, offshoring, bilateral bargaining.

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## 1. Introduction

In this paper I consider how the World Trade Organization (WTO) might best approach the issue of non-tariff measures (NTMs). The General Agreement on Tariffs and Trade (GATT) adopted a particular minimalist approach to handling NTMs. That approach evolved over time, and with the creation of the WTO, GATT's successor organization, the handling of NTMs has evolved further still, with the latest example of this evolution provided by the recently concluded negotiations over the Trade Facilitation Agreement emerging from the Doha Round. Was there an economic logic to GATT's approach? Do the changes in the treatment of NTMs ushered in with the creation of the WTO mark an improvement from the perspective of the economic theory of trade agreements? Is the GATT/WTO approach to the treatment of NTMs adequate for the world economy of today? I survey and extend the economic theory of trade agreements to provide answers to these questions, and I use the theory to characterize the central issues with which the WTO must contend in regard to NTMs.

The issue of NTMs may have particular relevance for developing countries. As I describe further below, a central question faced by the WTO regarding NTMs is whether a continued evolution away from a primary focus on border measures ("shallow integration") to greater emphasis on behind-the-border measures ("deep integration") is warranted. While the use of policy measures that could be classified as NTMs is widespread across all countries (see, for example, UNCTAD, 2013), the NTMs typically employed in developing countries tend to take the form of border measures (e.g., quantitative restrictions), while in developed countries behind-the-border measures (e.g., technical regulations) receive greater emphasis. Hence, the NTMs that are most important for developing country exporters in their attempts to export into developed-country markets are those NTMs that are at the heart of the shallow/deep integration question.

Moreover, the issue of NTMs and the WTO's approach to this issue is at the center of rising concerns about the clash between international trade agreements and national sovereignty. While the WTO and deeper forms of integration are not mutually inconsistent, an important question is this: Can the WTO continue to emphasize a shallow-integration approach and deliver internationally efficient policy outcomes while avoiding unnecessary intrusions into national sovereignty?; or instead does achieving internationally efficient policies require that the WTO evolve further toward deep integration, with the increasing erosion of the national sovereignty of WTO members that this implies?

The subsequent sections of the paper sketch out the rough contours of the challenge faced by the WTO in dealing with NTMs from the perspective of the economic theories of trade agreements. I conclude that, when it comes to handling NTMs, the key questions for the WTO appear to be two: (1) Is it the terms-of-trade problem or the commitment problem (or both, or neither) that WTO member governments seek to solve with their WTO membership?; and (2) Is it market clearing or offshoring/bilateral bargaining that is now the most prominent mechanism for the determination of international prices? As I describe below, answers to these questions help to indicate whether shallow or rather deep integration with regard to NTMs is warranted.

Regarding the first question, the empirical evidence as surveyed by Bagwell and Staiger (2010) and most recently by Bagwell, Bown and Staiger (2016) offers support for the terms-of-trade theory as identifying the main purpose of the GATT/WTO, though more evidence on this important question is needed. Regarding the second question, there is as yet no systematic body of evidence that would help provide an answer. But as I argue below, it seems likely that answering this second question will be a key input to identifying the best way forward on NTMs for the WTO.

The rest of the paper proceeds as follows. The next section considers the definition of non-tariff measures. Section 3 then describes the evolving approach to NTMs in existing trade agreements. In section 4 I describe what the various economic theories of trade agreements have to say about the treatment of NTMs, and along the way I provide a novel terms-of-trade interpretation of the WTO's Trade Facilitation Agreement. Finally, section 5 concludes with a summary of the challenge faced by the WTO regarding the treatment of NTMs as that challenge is suggested by the material in the preceding sections.

## 2. Non-Tariff Measures

In this section I consider the definition of non-tariff measures, and thereby frame the scope of my discussion for the remainder of the paper. After describing in broad terms the available evidence on the landscape of non-tariff measures in practice, I then turn briefly to discuss the quantification of trade effects associated with non-tariff measures.

### 2.1. Defining Non-Tariff Measures

What are "non-tariff measures" (NTMs)? As the term suggests, NTMs may include any policy measures other than tariffs that can impact trade flows. At a broad level NTMs can usefully be divided into three categories.

A first category of NTMs are those imposed on imports. This category includes import quotas, import prohibitions, import licensing, and customs procedures and administration fees, as well as the non-tariff features associated with various forms of administered protection (e.g., price undertakings resulting from antidumping actions). A second category of NTMs are those imposed on exports. These include export taxes, export subsidies, export quotas, export prohibitions, and voluntary export restraints. These first two categories encompass NTMs that are applied at the border, either to imports or to exports. A third and final category of NTMs are those imposed internally in the domestic economy. Such behind-the-border measures include domestic legislation covering health/technical/product/labor/environmental standards, internal taxes or charges, and domestic subsidies.

It is difficult to obtain a comprehensive picture of the catalog of possible NTMs, but an impressive collection of studies compiled by the OECD (OECD, 2005) provides a view of the range, complexity and diversity of NTMs in practice. One study contained in this collection sets out to assess the relative importance for the post-Uruguay Round landscape of the various kinds of behind-the-border measures and NTMs (or equivalently, NTBs – non-tariff barriers) imposed on imports as these measures are perceived by foreign exporters and recorded in various survey results. Summarizing the survey findings, the study reports:

> "The ten and seven surveys that report technical measures and customs rules and procedures, respectively, rank these barriers high. They are always among the five most reported categories of barriers...Where internal taxes or charges and competition-related restrictions on market access are reported, these are also often among the top five. Although less often mentioned, restrictions for services in general rank high in three out of the five surveys that report them. The relatively consistent high ranking observed for these items does not hold in the case of other NTB categories, such as government procurement practices or subsidies, although they are reported by a substantial number of the surveys. Finally, although respondents in almost half of the 12 surveys mention problems related to intellectual

> property protection and finance measures and a smaller number report price control measures, import charges and other para-tariff measures, these categories of barriers are not among the most reported." (OECD 2005, p, 23)

Another study in the OECD collection focuses on NTMs that are of particular importance to developing countries, including technical barriers to trade (TBTs) and sanitary and phytosanitary (SPS) measures, and paints a more complicated, dynamic and somewhat mixed picture of the evidence in this regard:

> "The existing literature describes a few key findings and trends pertaining to developing countries. Most analysts observe that the utilization of certain types of NTBs affecting developing countries, such as quantitative restrictions, has decreased markedly in the post-Uruguay Round (UR) setting...The remaining post-Uruguay NTBs, according to frequency ratio analyses...appear to be more prevalent in developing-country than in developed country markets, although they have decreased over time. Michalopoulos (1999) notes that frequency ratios of quantity and price control measures tend to be higher in countries with lower levels of per capita income and lower degrees of openness. A seemingly greater prevalence of these NTBs in trade among developing countries is however difficult to demonstrate given that the literature focuses predominantly on barriers to developing-country trade in their major export markets, which are generally OECD markets... .
>
> "Although the literature takes a range of approaches to identifying measures of concern to developing countries, it frequently focuses on quantity control measures: nonautomatic import licensing, quotas and tariff rate quotas. These measures may also attract attention because their effects are by nature easier to quantify and analyze than most other types of NTBs. Researchers report that post-UR NTBs are far more frequent for processed goods than for primary commodities.
>
> "Laird (1999) finds that the primary NTBs affecting developing-country access to both OECD and non-OECD markets are essentially the same, primarily import licensing systems (including allocation of tariff quotas); variable levies and production and export subsidies (in the agricultural sector); import/export quotas (in textiles and clothing sector) and local content and export balancing requirements (automotive industry); export subsidies to develop non-traditional manufacturers

(administered as tax breaks or subsidized finance, as direct subsidies have almost disappeared under fiscal pressures); and state trading operations.

"Another perspective comes from research that identifies the prevalence of various types of NTBs differently, according to whether developing countries trade with developed countries or among themselves...The literature suggests that technical regulations, price control measures and certain other measures are very often subject to concerns about access to developed-country markets.

"...A more systematic account of developing countries' perceptions of non-tariff barriers comes from the notification process established under the auspices of NAMA [non-agricultural market access negotiations]... TBTs represent the NTB category with the highest incidence of notifications with 530 entries, or almost half of the total, followed by Customs and Administrative Procedures (380 entries) and SPS measures (137 entries). Quantitative restrictions, trade remedies, government participation in trade, charges on imports, as well as other barriers amount to less than 5% of total NTB entries." (OECD 2005, pp. 230-234).

Finally, two of the OECD studies focus specifically on export NTMs, in the form of export duties and export restrictions. Regarding export duties, a natural question is why these duties should be defined as non-tariff measures rather than as tariffs. This and related questions are addressed in one of the OECD studies in this way:

"The question also arises whether export duties should be considered a tariff or a nontariff measure. In the Doha Declaration of 2001, paragraph 16 on market access for nonagricultural products states that negotiations aim to reduce, or as appropriate eliminate, tariffs as well as non-tariff barriers. In discussions on the organisation of these negotiations, the definition of the scope of non-tariff barriers to be included has been a primary concern, while for tariffs (particularly reduction of import tariffs), the coverage and issues for discussion have been well defined. Export duties are sometimes equated with tariffs (and even called export tariffs), perhaps reflecting the fact that they are normally levied by customs in a manner similar to import tariffs. For example, the EU-Mexico free trade agreement (FTA) includes 'customs duties on exports' in the chapter on customs duties, rather than in the chapter on 'non-tariff measures'. However, the GATT and a number of regional

> trade agreements (RTAs) tend to consider export duties as non-tariff measures. The 'Indicative List of Notifiable Measures' annexed to the Decision on Notification Procedures adopted at the conclusion of the Uruguay Round puts 'export taxes' in the category of non-tariff measures. The NAFTA also puts 'export taxes' in the section 'Non-tariff Measures.' A well-known case book uses the term 'export taxes' in the chapter entitled 'Export Controls under the GATT and National Law' (Jackson et al., 1995).
>
> "A further question is the relationship between export duties and fees and formalities. Export duties are explicitly excluded from the application of Article VIII(a) of the GATT 1994, which deals with fees and formalities and prohibits fees and other charges rendered in connection with exportation (or importation) that exceed the costs of the service rendered. The article stipulates that fees and other charges shall not represent an indirect protection to domestic products or a taxation of imports or exports for fiscal purposes. It applies to all fees and formalities of whatever character, but it explicitly states that 'export duty' is excluded from the scope of application. Therefore, a distinction should be drawn between export duties and fees or charges, even though in specific cases the substance of the measures may be similar." (OECD 2005, p 179).

In short, we may think of NTMs as all of the measures that governments might take other than import tariffs which can impact trade flows. And as the quoted passages above make clear, NTMs comprise an extremely diverse set of policy measures, which can be individually as different from each other as they are collectively different from import tariffs.

This raises an important question: Why should non-tariff trade impacting measures be separated conceptually from import tariffs and lumped together as NTMs? For example, for the purpose of discussing trade-impacting measures, why not adopt an alternative categorization strategy, in which all trade-impacting measures are divided into tax and non-tax measures, or in which they are categorized in terms of border and non-border measures? In some sense, these alternative ways of categorizing trade-impacting measures would reflect a more natural and obvious intellectual coherence.

But in the context of the institutional features of the GATT/WTO, NTMs *are* usefully separated from import tariffs, because while both tariff and non-tariff measures may impact trade, import tariffs stand out as the central policy measure with which negotiated market access commitments are made– through negotiated tariff “bindings” – and in this way, tariffs have a special place relative to all non-tariff measures in the GATT/WTO. A fundamental question is whether the GATT/WTO’s asymmetric treatment of tariff versus non-tariff measures is warranted on economic grounds. As we will see, the answer to this question is complex, offering strong support for the GATT/WTO treatment of some NTMs but less support for others. And importantly, as I will describe below, the answer itself depends in part on the nature of trade, and so it may evolve as the nature of trade evolves.

### 2.2. Quantifying the Impact of NTMs on Trade

In light of the diversity of NTMs as described above, it should come as no surprise that quantifying the impact of NTMs on trade is a challenging exercise. For example, as the Executive Summary of the OECD study described above observes:

> “...Not only do these measures take often non-transparent forms, analysis also has to take into account whether and how they are linked to non-trade policy objectives. Some NTBs serve important regulatory purposes and are legitimate under WTO rules under clearly defined conditions even though they restrict trade. For example, import licences may be used to control the importation of products carrying potential health risks. Countries may ban imports of farm products for food safety reasons or impose labelling requirements in response to consumer demands for information. The issue here is whether governments, in pursuing legitimate goals, are restricting imports more than is necessary to achieve those goals. Under multilateral rules, the objective is not to remove these measures but to ensure that they are set at an appropriate level to achieve legitimate objectives with minimum impact on trade. However, because legitimacy claims are typically associated with the introduction of these measures, they are hard to assess.
>
> “All this makes the issues that arise in connection with determining the economic impact of NTBs very different from those surrounding the use of tariffs. As far as trade and the economic impact of NTBs are concerned, much depends on the specific circumstances of their application. To understand the effect of a specific measure requires a case-by-case examination.” (OECD, 2005, p. 13).

The validity of these concerns notwithstanding, various attempts using different methodologies and data have been undertaken to estimate the impact of NTMs on imports, including frequency/coverage measures, price comparison measures and quantity impact measures, as well as residuals of gravity-type equations (see Deardorff and Stern, 1997, for a review). The most ambitious attempt to date, in terms of both theoretical grounding and country/tariff line coverage, is contained in Kee et al (2009), who seek a consistent measure of the trade-restrictiveness of NTMs that can be compared to tariffs.[1] Kee et al motivate their approach as follows:

> "...trade policy can take many different forms: tariffs, quotas, non-automatic licensing, antidumping duties, technical regulations, monopolistic measures, subsidies, etc. How can one summarize in a single measure the trade restrictiveness of a 10% tariff, a 1000-ton quota, a complex non-automatic licensing procedure and a $1 million subsidy? Often the literature relies on outcome measures, e.g., import shares. The rationale is that import shares summarise the impact of all these trade policy instruments. The problem is that they also measure differences in tastes, macroeconomic shocks and other factors which should not be attributed to trade policy. Another approach that is often followed is to simply rely on tariff data or collected customs duties and assume that all other instruments are positively (and perfectly) correlated with tariffs. These are obviously unsatisfactory solutions. A more adequate approach...is to bring all types of trade policy instruments into a common metric." (Kee et al, 2009, p. 173).

The approach taken by Kee et al is to estimate ad-valorem equivalents of NTMs for each country at the tariff line level that can then be compared directly to (ad valorem) tariffs.

Despite all of these difficulties in measurement, most estimates of the trade impacts of NTMs suggest that they can be substantial. For example, Kee et al (2009) find that for a majority of tariff lines the ad valorem equivalent of the NTMs in their sample of 78 countries is higher than the actual tariff. And the mechanism by which NTMs impact trade can be subtle: for instance, Staiger and Wolak (1994) find that the mere filing of US antidumping claims can significantly reduce trade flows during the period of investigation of these claims, even though

[1] Recent papers that focus more narrowly on the trade effects of specific non-tariff measures include Martincus, Carballo and Graziano (2015) who estimate the effects of custom-related delays on Uruguay's firm-level exports, and Fontagne, Orefice, Piermartini and Rocha (forthcoming) who estimate the effects of SPS measures on the exports of French firms.

no antidumping duties are in place over the period of investigation and even if the investigation ends in a finding of no dumping and no duties are ever imposed.

## 3. The Evolving Approach to NTMs in Trade Agreements

In this section I describe briefly the evolving approach to NTMs taken first by GATT and then by the WTO. I also describe briefly the approaches to NTMs taken increasingly by countries when they create preferential trade agreements. In each case I first consider border (import and export) NTMs, and then turn to behind-the-border NTMs.

### 3.1. The GATT Approach

The GATT took a minimalist approach to NTMs in general. I begin by briefly describing GATT's approach to NTMs applied at the border, and then turn to describe in broad terms the GATT approach to behind-the-border NTMs.

#### 3.1.1. Border NTMs

The GATT approach to border NTMs differs on the import side and the export side. The approach can be loosely characterized as follows.

First, on the import side, GATT was designed to serve as a negotiating forum in which reciprocal, voluntary and nondiscriminatory (MFN) tariff bargaining among member governments would lead to tariff bindings that defined maximum allowable tariff levels. Of course, tariff bindings in themselves are not likely to be valued by governments. But it was anticipated that these bindings would imply meaningful increases in market access and trade volumes for foreign exporters, and for this reason would be valued by the participating governments.

However, as Hudec (1990) describes, the drafters of GATT were acutely aware that policies other than tariffs could easily substitute for tariffs and might become tempting in this role once a country bound its tariffs as a result of a negotiation. And the drafters understood that if left unchecked these NTMs could undermine the market-access value of a negotiated tariff binding and hence the foundation of the negotiating framework they sought to create. For this reason, while member governments did not negotiate directly over the level of NTMs in GATT as they did over tariffs, GATT contains numerous provisions – e.g., Articles V (freedom of transit), VIII (fees and formalities connected with importation and exportation), X (publication and administration of trade regulations) and XI (general elimination of quantitative restrictions) that are designed to induce "tariffication" of import-protective border measures and prevent the substitution of alternative forms of import protection for tariffs. This is the essence of GATT's approach to border NTMs on the import side.

On the export side, GATT was far more permissive (although the GATT rules on fees and formalities and prohibition on quantitative restrictions apply to both imports and exports), in part because it was not anticipated that GATT member governments would actively engage in negotiations over export-sector liberalization commitments (say, on export taxes or export subsidies), so the issues regarding NTMs that arise on the import side as described above do not arise symmetrically on the export side. In addition, at least with regard to developed countries (who were the major actors in GATT-sponsored negotiated liberalization), export taxes were less often used than import tariffs, and so they may have been seen as a less-pressing issue for the world trading system at the time of GATT's creation.[2] With regard to the particular issue of export subsidies, early GATT disciplines were very permissive though they have tightened over time. For example, originally, GATT contained only a loose reporting requirement regarding export subsidies (and granted the authority for affected importing countries to impose countervailing duties).

### 3.1.2. Behind-the-Border NTMs

The GATT approach to dealing with behind-the-border NTMs can also be described as a minimalist or "shallow integration" approach. The essence of this approach follows the logic described above for GATT's approach to border NTMs on the import side, though the tactics differ. In particular, as observed above, the drafters of GATT were well-aware that policies other than tariffs could easily substitute for tariffs and might become attractive if a country bound its tariffs as a result of a negotiation. But in the case of behind-the-border NTMs, issues of national sovereignty precluded the kind of approach to this issue that was taken with regard to border NTMs (e.g., the prohibition on quantitative restrictions). Hudec (1990) describes this problem as it was perceived by the drafters of GATT:

> "...The standard trade policy rules could deal with the common types of trade

[2] That said, Irwin et al (2008, pp. 69-70, 136) observe that in the negotiations leading up to the creation of GATT, the United States pushed for a prohibition on export taxes. While no such prohibition was ultimately included in GATT, this observation does indicate that export taxes were an important trade policy concern in the pre-GATT era to at least some of the major trading countries.

> policy measure governments usually employ to control trade. But trade can also be affected by other 'domestic' measures, such as product safety standards, having nothing to do with trade policy. It would have been next to impossible to catalogue all such possibilities in advance. Moreover, governments would never have agreed to circumscribe their freedom in all these other areas for the sake of a mere trade agreement." Hudec (1990, p. 24).

To address this problem, the GATT essentially took a two-pronged approach to behind-the-border NTMs. First, GATT requires that all domestic taxes, charges and regulations satisfy a basic nondiscrimination rule (national treatment). This rule in principle prevents the simplest and most direct method of substituting behind-the-border NTMs for tariffs, namely, discriminating in taxes and/or regulations against imported products.

But it was also recognized by the drafters of GATT that even nondiscriminatory domestic taxes and regulations could be a partial substitute for tariffs, and it was therefore thought that something more unusual might be needed to guard against the substitution of behind-the-border NTMs for import tariffs. Hudec (1990) continues in this regard:

> "The shortcomings of the standard legal commitments were recognized in a report by a group of trade experts at the London Monetary and Economic Conference of 1933. The group concluded that trade agreements should have another more general provision which would address itself to any other government action that produced an adverse effect on the balance of commercial opportunity..." Hudec (1990, p. 24).

As Hudec explains, these additional concerns eventually led to the inclusion of a second line of defense against the substitution of behind-the-border NTMs for import tariffs, which is contained in the so-called "nonviolation" nullification-or-impairment provision of GATT. According to the nonviolation clause, a GATT member is entitled to compensation from another GATT member if the two countries had originally negotiated an exchange of tariff bindings, and if one of the countries subsequently introduces a new measure – any new measure, even one on which there exist no GATT commitments – that erodes the market access value of its original tariff binding and that the other country could not reasonably have anticipated at the time of their original market access negotiation.

Hence, as with border NTMs, member governments did not negotiate directly over behind-the-border NTMs in GATT. But there are several provisions that are meant to protect the value of negotiated market access agreements against erosion by behind-the-border NTMs. This is the essence of GATT's approach to behind-the-border NTMs.

### 3.2. The WTO Approach

The approach to NTMs has evolved from the GATT to the WTO. As described above, GATT's approach to NTMs was minimalist, although as mentioned in the later GATT years some of the obligations regarding NTMs (e.g., export subsidies) became more stringent. With the creation of the WTO this trend was continued and extended in a number of important ways.

#### 3.2.1. Border NTMs

The WTO approach to border NTMs represents a significant tightening of obligations relative to GATT along a number of dimensions. For example, the WTO Safeguard Agreement prohibits the use of various forms of border NTMs administered on the export side (e.g., Orderly Marketing Arrangements (OMAs) and Voluntary Export Restraints (VERs)) that were considered "grey-area" measures under GATT and had become popular in the last decade of GATT before the creation of the WTO. The WTO Subsidies and Countervailing Measures (SCM) Agreement strengthens significantly the prohibition against export subsidies. And most recently in the context of the Doha Round, the conclusion of the negotiations of the Trade Facilitation Agreement (TFA) at the Bali Ministerial marks a similar tightening and clarification of the rules related to border NTMs contained in GATT Articles V, VIII and X.

#### 3.2.2. Behind-the-Border NTMs

The WTO approach to behind-the-border NTMs also represents a significant tightening of obligations relative to GATT along a number of dimensions. For example, the WTO Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary Measures (SPS) Agreements represent a significant strengthening of the nondiscrimination/national treatment obligations regarding certain kinds of domestic regulations.[3] In addition, the WTO SCM Agreement con-

[3] The WTO TBT Agreement can also be seen as complementing the ongoing international standardization process, as embodied for example in the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). I do not emphasize this standardization process in what follows, because my focus is on the international cooperation (e.g., prisoners' dilemma) problems that I will argue the

tains substantial commitments regarding domestic subsidies that were not included in GATT. In essence, while the overall approach of the WTO with respect to behind-the-border NTMs can still be characterized as one of shallow integration, there has been some evolution over the history of the GATT/WTO in the direction of "deep integration."

### 3.3. The PTA Approach

I close this section by simply noting that many recent preferential trade agreements (PTAs) include commitments on behind-the-border NTMs that are substantially more stringent than those contained in the GATT or the WTO. In particular, a growing number of PTAs go significantly beyond eliminating tariffs on a preferential basis, and focus instead on negotiating specific commitments on behind-the-border NTMs. A recent and comprehensive documentation of this development, including a discussion of the circumstances under which countries seem to prefer this kind of deep integration from their negotiated agreements rather than the shallow integration that characterizes traditional GATT market access agreements, is provided in WTO (2011), while Bagwell, Bown and Staiger (2016) survey the relevant economics literature. I will return to the issue of deep versus shallow integration in later sections.

## 4. The Economics of the Approach to NTMs in Trade Agreements

In this section I review the two major established economic theories of trade agreements, the terms-of-trade theory and the commitment theory, and consider what each theory has to say about the treatment of border NTMs and the treatment of behind-the-border NTMs in trade agreements. Motivated by the recent rise in "offshoring" of specialized inputs, I then consider a world in which international prices are determined by bilateral bargaining between buyers and sellers, and I show that a key result from the terms-of-trade theory with regard to the treatment of behind-the-border NTMs is reversed. I use these contrasting findings to interpret the implications of the rise in offshoring for the treatment of NTMs in trade agreements.

### 4.1. The Terms-of-Trade Theory

According to the terms-of-trade theory of trade agreements, governments are attracted to trade agreements as a means of escape from a terms-of-trade driven Prisoners' Dilemma (see Bagwell

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WTO is designed to solve rather than on the international coordination problems that the standardization process seeks to address.

and Staiger, 1999, 2002). The "problem" that arises in the absence of an agreement, and that a trade agreement can then exist to "fix," can be easily understood in intuitive terms as follows.

Suppose a government is unconstrained by a trade agreement, and chooses unilaterally the level of a tariff it will impose. This government will naturally consider the various costs and benefits of a slightly higher or lower tariff when coming to its decision on the preferred level of import protection, but there is one cost that the government will inevitably leave out of its calculation: the cost of its import protection that is borne by foreign exporters. And in ignoring this cost the unilateral trade policy choices of the government will then be too protective relative to internationally efficient choices. According to the terms-of-trade theory of trade agreements, the purpose of a trade agreement is to give foreign exporters a "voice" in the tariff choices of their trading partners, so that through negotiations they can make their trading partners responsive to this cost. And in accomplishing this, a trade agreement then naturally leads to lower tariffs and an expansion of market access and trade volumes.

#### 4.1.1. Border NTMs

The description of the basic prediction of the terms-of-trade theory that I have provided above is focused on tariffs as the instrument of protection. What does the terms-of-trade theory say about border NTMs? Regarding border NTMs on the export side, and in particular export subsidies, there is some tension between the terms-of-trade theory and the negotiated restrictions on export subsidies that are observed, especially as those commitments are structured in the WTO, in effect because negotiated restrictions on export subsidies would tend to reduce trade volumes and therefore work against the basic goal of trade agreements according to the terms-of-trade theory (see Bagwell and Staiger, 2001a, 2012a).[4] However, regarding border NTMs on the import side, the observed treatment in GATT and the WTO resonates strongly with the terms-of-trade theory. In particular, the logic of tariffication as emphasized by GATT and described above finds support in the terms-of-trade theory. For example, the prohibition of quantitative measures contained in GATT Article XI facilitates the implementation of nondiscriminatory (MFN) import protection, which the terms-of-trade theory supports (see Bagwell and Staiger, 1999). And the evolving GATT/WTO approach to issues of "trade facilitation" in relation to GATT Articles V, VIII and X can also be usefully interpreted from the perspective

[4] A comprehensive assessment of the treatment of export subsidies (and of border NTMs more generally) in the GATT and the WTO and an evaluation of this treatment from the perspective of the terms-of-trade theory is provided in Bagwell, Staiger and Sykes (2013).

of the terms-of-trade theory.

This last point is not well-appreciated in the literature. Therefore, below I sketch a simple model to illustrate the rationale for the TFA from the perspective of the terms-of-trade theory. I emphasize three related points. First, the terms-of-trade theory provides a simple framework for interpreting the purpose of an agreement on trade facilitation. Second, the terms-of-trade theory indicates that the inefficiencies associated with unilateral investments in trade facilitation arise only once tariffs are constrained through international agreement. And third, in principle these inefficiencies can be addressed by either shallow or deep integrations approaches.[5]

**A Model of Trade Facilitation** At the broadest level, the issue of trade facilitation encompasses any measure that impacts the cost of international trade, including both border measures and behind-the-border measures. In the context of the WTO TFA, however, the focus on trade facilitation is decidedly narrow, restricted to improving administrative procedures at the border. I capture this focus by considering a simple partial equilibrium setting, in which a home country imports a competitively produced good from the foreign country, and I let $I$ and $I^*$ denote respectively home and foreign investments in border management processes (e.g., IT) that determine the efficiency of import and export transactions. In particular, I assume that the per-unit (specific) trade cost for exports from foreign to home, $t$, can be represented by the function $t(I, I^*)$, where $t(0,0)$ is non-prohibitive and with $t(I, I^*)$ decreasing and convex in both its arguments and non-negative for all $I$ and $I^*$.

With the (specific) import tariff set by the home government denoted by $\tau$, and the (specific) export tax set by the foreign government denoted by $\tau^*$, the arbitrage relationship between the home-country price of this good ($P$) and the foreign-country price of the good ($P^*$) that must hold as long as strictly positive trade occurs is given by

$$P = P^* + t(I, I^*) + \tau + \tau^*. \tag{4.1}$$

I then define the *foreign world price* by

$$P^{w*} \equiv P^* + \tau^*,$$

[5] Bond (2006) also provides an analysis of agreements on trade facilitation from the perspective of a terms-of-trade model, thereby also demonstrating that the terms-of-trade theory can account for the purpose of a trade facilitation agreement. His focus is somewhat different than my focus here, however, and he does not consider the second and third points that I emphasize below.

and I define the *home world price* by

$$P^w \equiv P - \tau.$$

The foreign and home world prices $P^{w*}$ and $P^w$ are measures of the foreign- and home-country terms of trade – the foreign terms of trade improves when $P^{w*}$ rises, and the home terms of trade improves when $P^w$ falls – and through (4.1) they are related by

$$P^w - P^{w*} = t(I, I^*).$$

A drop in transport costs $t$ brings $P^w$ and $P^{w*}$ closer together, and when $t = 0$ the home and foreign world prices are equated.

To complete the model, I denote by $D(P)$ and $D^*(P^*)$ the home and foreign demands for the product under consideration, and I assume that each demand function is a decreasing function; and for simplicity I assume that the product is supplied only by the foreign country, and denote the foreign supply function by $S^*(P^*)$ which I assume is an increasing function. Using the pricing relationship (4.1), and denoting foreign export supply by $E^*(P^*) \equiv S^*(P^*) - D^*(P^*)$ and home import demand by $M(P) \equiv D(P)$, the market clearing condition may be written as

$$M(P^* + t(I, I^*) + \tau + \tau^*) = E^*(P^*)$$

yielding the market clearing foreign price $\hat{P}^*(t(I, I^*) + \tau + \tau^*)$, from which the market clearing home price and foreign and home world prices also follow:

$$\begin{aligned}
\hat{P}(t(I, I^*) + \tau + \tau^*) &\equiv \hat{P}^*(t(I, I^*) + \tau + \tau^*) + t(I, I^*) + \tau + \tau^* \\
\hat{P}^{w*}(t(I, I^*) + \tau, \tau^*) &\equiv \hat{P}^*(t(I, I^*) + \tau + \tau^*) + \tau^* \\
\hat{P}^w(t(I, I^*) + \tau^*, \tau) &\equiv \hat{P}(t(I, I^*) + \tau + \tau^*) - \tau.
\end{aligned}$$

As is standard, the world prices depend on the levels of both $\tau$ and $\tau^*$, but the home and foreign prices depend only on the sum $\tau + \tau^*$ (and on the trade facilitation investment levels $I$ and $I^*$).

With the market clearing price expressions above, the terms-of-trade impacts of policy choices can now be assessed. Regarding the terms-of-trade impacts of trade taxes, direct calculations yield (with a prime denoting the derivative of the function with respect to its argument):

$$\begin{aligned}
\frac{\partial \hat{P}^w}{\partial \tau} &= \frac{\partial \hat{P}^{w*}}{\partial \tau} = \frac{M'}{E^{*\prime} - M'} < 0 \\
\frac{\partial \hat{P}^{w*}}{\partial \tau^*} &= \frac{\partial \hat{P}^w}{\partial \tau^*} = \frac{E^{*\prime}}{E^{*\prime} - M'} > 0.
\end{aligned}$$

As expected, an increase in the home-country tariff improves the home terms of trade and worsens the foreign terms of trade, while an increase in the foreign-country tariff has the opposite impact, improving the foreign terms of trade and worsening the home terms of trade. These familiar terms-of-trade effects of tariff intervention provide the basis for the inefficient Prisoners' Dilemma situation that according to the terms-of-trade theory arises in the absence of a trade agreement.

The terms-of-trade impacts of investments in trade facilitation are more novel. For home-country investments in trade facilitation, these impacts are given by

$$\begin{aligned} \frac{\partial \hat{P}^w}{\partial t}\frac{\partial t}{\partial I} &= \frac{E^{*\prime}}{E^{*\prime}-M^\prime}\cdot\frac{\partial t}{\partial I} < 0 \\ \frac{\partial \hat{P}^{w*}}{\partial t}\frac{\partial t}{\partial I} &= \frac{M^\prime}{E^{*\prime}-M^\prime}\cdot\frac{\partial t}{\partial I} > 0, \end{aligned} \tag{4.2}$$

while for foreign-country investments in trade facilitation, these impacts are given by

$$\begin{aligned} \frac{\partial \hat{P}^{w*}}{\partial t}\frac{\partial t}{\partial I^*} &= \frac{M^\prime}{E^{*\prime}-M^\prime}\cdot\frac{\partial t}{\partial I^*} > 0 \\ \frac{\partial \hat{P}^{w}}{\partial t}\frac{\partial t}{\partial I^*} &= \frac{E^{*\prime}}{E^{*\prime}-M^\prime}\cdot\frac{\partial t}{\partial I^*} < 0. \end{aligned} \tag{4.3}$$

Evidently, home-country investments in trade facilitation improve the home-country terms of trade *while at the same time improving the terms of trade of the foreign country*, and similarly for foreign-country investments in trade facilitation. Such a "win-win" prospect for investments in trade facilitation makes it tempting to conjecture that the terms-of-trade theory cannot explain why countries would need an international agreement to encourage such investments.[6] As I will demonstrate below, however, this conjecture turns out to be false. Intuitively, the key is to note from the derivative expressions in (4.2) and (4.3) above that each country's investment in

[6] Indeed, the view that the rationale for international agreements regarding trade facilitation (such as the TFA) falls outside the purview of the terms-of-trade theory of trade agreements seems to have gained traction recently in policy circles. Although it appears in various writings, the clearest expression of this view of which I am aware is in Hoekman (2014, p. 5), who also emphasizes that investments in trade facilitation improve the terms of trade of both importing and exporting countries, and concludes:

> "The puzzle therefore is that a government can unilaterally take actions that will improve its terms of trade without in the process creating an adverse impact on its trading partners. While the foreign country will benefit from a trading partner's trade facilitation, it does not do so at the expense of the country concerned. There is therefore no prisoner's dilemma situation of the type that often drives cooperation on trade policy. The TFA cannot be motivated by the terms-of-trade rationale that has become the staple of the formal economic literature on trade agreements..."

trade facilitation imparts a positive terms-of-trade externality on the other country, providing a possible reason for under-investment in trade facilitation when countries are guided only by their unilateral interests (i.e., in the absence of an international agreement that covers trade facilitation).

I now define the welfare functions for the home and foreign country policy makers. I abstract from political economy motives, though the results I report below are easily generalized to include such motives. With no home-country production, home welfare is then given by the sum of consumer surplus plus tariff revenue minus the cost of home investment in trade facilitation. Letting $c$ denote the unit cost for the home country of investment in trade facilitation, with the total cost of home-country investment in trade facilitation then given by $c \cdot I$, and with $CS$ denoting home-country consumer surplus and using $\tau = P - P^w$, home welfare is given by

$$\begin{aligned} W &= CS(\hat{P}(t(I,I^*)+\tau+\tau^*)) \\ &\quad +[\hat{P}(t(I,I^*)+\tau+\tau^*) - \hat{P}^w(t(I,I^*)+\tau^*,\tau)] \cdot M(\hat{P}(t(I,I^*)+\tau+\tau^*)) - c \cdot I \\ &\equiv W(I, \hat{P}(t(I,I^*)+\tau+\tau^*), \hat{P}^w(t(I,I^*)+\tau^*,\tau)). \end{aligned}$$

Taking account of production in the foreign country and with $PS^*$ denoting foreign producer surplus and with $c^*$ denoting the unit cost for the foreign country of investment in trade facilitation, foreign welfare is similarly defined as the sum of consumer and producer surplus plus export tax revenue minus the cost of foreign investment in trade facilitation, or

$$\begin{aligned} W^* &= CS^*(\hat{P}^*(t(I,I^*)+\tau+\tau^*)) + PS^*(\hat{P}^*(t(I,I^*)+\tau+\tau^*)) \\ &\quad +[\hat{P}^{w*}(t(I,I^*)+\tau,\tau^*) - \hat{P}^*(t(I,I^*)+\tau+\tau^*)] \cdot E^*(\hat{P}^*(t(I,I^*)+\tau+\tau^*)) - c^* \cdot I^* \\ &\equiv W^*(I^*, \hat{P}^*(t(I,I^*)+\tau+\tau^*), \hat{P}^{w*}(t(I,I^*)+\tau,\tau^*)). \end{aligned}$$

Finally, the sum of home and foreign welfare, which I refer to as "world welfare" and denote by $W^w$, is given by

$$\begin{aligned} W^w &= CS(\hat{P}(t(I,I^*)+\tau+\tau^*)) + CS^*(\hat{P}^*(t(I,I^*)+\tau+\tau^*)) + PS^*(\hat{P}^*(t(I,I^*)+\tau+\tau^*)) \\ &\quad +[\hat{P}(t(I,I^*)+\tau+\tau^*) - \hat{P}^*(t(I,I^*)+\tau+\tau^*) - t(I,I^*)] \cdot E^*(\hat{P}^*(t(I,I^*)+\tau+\tau^*)) \\ &\quad -c \cdot I - c^* \cdot I^* \\ &\equiv W^w(I, I^*, \hat{P}(t(I,I^*)+\tau+\tau^*), \hat{P}^*(t(I,I^*)+\tau+\tau^*)). \end{aligned}$$

Notice that while home and foreign welfare each depend on their respective world prices and hence on the levels of both $\tau$ and $\tau^*$, world welfare is independent of world prices – because movements in these prices only serve to redistribute surplus between the home and foreign country – and hence world welfare depends only on the sum of home and foreign tariffs $\tau + \tau^*$ (in addition to trade facilitation investment levels $I$ and $I^*$).

**Efficient Policies** I define efficient policies as those that maximize world welfare (and thereby implicitly assume that lump sum transfers are available to distribute surplus across the two countries as desired). As noted just above, world welfare depends on the sum of the home and foreign tariffs, $\tau + \tau^*$, and on home and foreign investment levels in trade facilitation, $I$ and $I^*$. The first-order conditions that define the sum of efficient tariffs, $\partial W^w / \partial[\tau + \tau^*] = 0$, can be simplified to yield[7]

$$[\tau + \tau^*] \cdot \frac{\partial E^*}{\partial P^*} \frac{\partial \hat{P}^*}{\partial[\tau + \tau^*]} = 0$$

which immediately implies

$$\tau^e + \tau^{*e} = 0 \tag{4.4}$$

where a superscript "$e$" denotes efficient policies. Hence, as should come as no surprise in this perfectly competitive setting, there is no efficiency role for tariff intervention, and this is true independent of the setting of investment levels for trade facilitation (and hence independent of trade costs $t$).

Consider next the efficient level of home and foreign investment in trade facilitation, denoted by $I^e$ and $I^{*e}$ respectively. The first-order condition that defines $I^e$ can be manipulated to yield

$$\{[\tau + \tau^*] \cdot \frac{\partial E^*}{\partial P^*} \frac{\partial \hat{P}^*}{\partial[\tau + \tau^*]} - E^*\} \frac{\partial t}{\partial I} = c$$

which, evaluated at the efficient tariffs $\tau^e + \tau^{*e}$, simplifies to

$$M^e \cdot [-\frac{\partial t}{\partial I}] = c \tag{4.5}$$

where $M^e$ denotes home import volume evaluated at efficient policies. In words, the efficient level of home investment in trade facilitation $I^e$ equates the marginal benefit of the last unit of this investment undertaken by the home country (the marginal savings in total trade costs $M^e \cdot [-\frac{\partial t}{\partial I}]$) with the marginal cost to the home country of the last unit of this investment ($c$). The efficient level of foreign investment in trade facilitation, $I^{*e}$, is similarly characterized:

$$E^{*e} \cdot [-\frac{\partial t}{\partial I^*}] = c^* \tag{4.6}$$

with $E^{*e}$ denoting foreign export volume evaluated at efficient policies.

[7]Here and throughout I assume that second order conditions for the relevant maximization problems hold.

**Nash Policies** Next consider the Nash policies adopted by the two countries in the absence of a trade agreement. The first-order conditions for the home country that define its best-response levels of $\tau$ and $I$ are given by

$$\begin{aligned} \frac{\partial W}{\partial \tau} &= -M(\hat{P})\frac{\partial \hat{P}}{\partial \tau} + \tau \frac{\partial E^*}{\partial P^*}\frac{\partial \hat{P}^*}{\partial \tau} + M(\hat{P}) = 0 \\ \frac{\partial W}{\partial I} &= [-M(\hat{P})\frac{\partial \hat{P}}{\partial t} + \tau \frac{\partial E^*}{\partial P^*}\frac{\partial \hat{P}^*}{\partial t}]\frac{\partial t}{\partial I} - c = 0. \end{aligned} \tag{4.7}$$

Similarly, the first-order conditions for the foreign country that define its best-response levels of $\tau^*$ and $I^*$ are given by

$$\begin{aligned} \frac{\partial W^*}{\partial \tau^*} &= -E^*(\hat{P}^*)\frac{\partial \hat{P}^*}{\partial \tau^*} + \tau^* \frac{\partial M}{\partial P}\frac{\partial \hat{P}}{\partial \tau^*} + E^*(\hat{P}^*) = 0 \\ \frac{\partial W^*}{\partial I^*} &= [-E^*(\hat{P}^*)\frac{\partial \hat{P}^*}{\partial t^*} + \tau^* \frac{\partial M}{\partial P}\frac{\partial \hat{P}}{\partial t^*}]\frac{\partial t^*}{\partial I^*} - c^* = 0. \end{aligned} \tag{4.8}$$

The Nash policies, which I denote by $\tau^N$, $I^N$, $\tau^{*N}$ and $I^{*N}$, satisfy the four first-order conditions in (4.7) and (4.8) simultaneously.

Now notice from the pricing relationships above that $\frac{\partial \hat{P}}{\partial \tau} = \frac{\partial \hat{P}}{\partial t}$ and $\frac{\partial \hat{P}^*}{\partial \tau} = \frac{\partial \hat{P}^*}{\partial t}$ and that $\frac{\partial \hat{P}^*}{\partial \tau^*} = \frac{\partial \hat{P}^*}{\partial t^*}$ and $\frac{\partial \hat{P}}{\partial \tau^*} = \frac{\partial \hat{P}}{\partial t^*}$. Using this, substituting the top first-order condition in (4.7) into the bottom first-order condition in (4.7), and simplifying the top condition in (4.7) further, and performing the analogous steps for the first order conditions in (4.8), it follows that the Nash tariffs are characterized by

$$\tau^N = \frac{\hat{P}^{w*N}}{\eta^{E^{*N}}} \text{ and } \tau^{*N} = \frac{\hat{P}^{wN}}{\eta^{M^N}}, \tag{4.9}$$

while the Nash investment levels satisfy

$$M^N \cdot [-\frac{\partial t}{\partial I}] = c \text{ and } E^{*N} \cdot [-\frac{\partial t}{\partial I^*}] = c^*, \tag{4.10}$$

with $\eta^{E^{*N}}$ the elasticity of foreign export supply evaluated at Nash policies and $\eta^{M^N}$ the elasticity of home import demand (defined positively) evaluated at Nash policies, and where $\hat{P}^{w*N}$, $\hat{P}^{wN}$, $M^N$ and $E^{*N}$ denote their respective previously-defined magnitudes evaluated at Nash policies. The Nash tariffs in (4.9) represent the usual inverse-trade-elasticity formulae for the Johnson (1953-54) optimal tariff; the Nash investments in trade facilitation described by (4.10) equate the marginal benefit of investment with its marginal cost, just as described previously in the context of efficient policy choices.

**A Trade Facilitation Agreement** With the Nash and efficient policies characterized, I now offer an interpretation of the evolving GATT/WTO approach to issues of trade facilitation from the perspective of the terms-of-trade theory. An initial pair of observations come directly from a comparison of the conditions for Nash and efficient policies. First, as (4.4) and (4.9) make clear, Nash tariffs are too high relative to efficient tariffs: $\tau^N+\tau^{*N} = \frac{\hat{P}^{w*N}}{\eta^{E*N}} + \frac{\hat{P}^{wN}}{\eta^{MN}} > 0 = \tau^e+\tau^{*e}$. And second, as (4.5), (4.6) and (4.10) make clear, conditional on the Nash trade volume, the Nash investments in trade facilitation are *efficient* (i.e., they equate the marginal savings in total trade costs with the marginal cost of investment).

These initial observations reflect a hallmark prediction of the terms-of-trade theory of trade agreements that I will emphasize again in later sections: as the import tariff or export tax is the first-best policy for manipulating the terms of trade, and as terms-of-trade manipulation is the only problem for a trade agreement to fix, import tariffs and export taxes will be the only policies that are distorted in the Nash equilibrium, with all other policies set at their efficient levels conditional on (inefficiently low) Nash trade volumes. Hence, the job of a trade agreement is to liberalize tariffs and thereby expand trade volumes to efficient levels, without introducing inefficiencies in the other policy choices – once tariffs are constrained by the agreement – as a second-best means of terms-of-trade manipulation.

To interpret an agreement on trade facilitation through the lens of the terms-of-trade theory, it is then necessary to consider the incentive each country would have to distort unilaterally its investment in trade facilitation as a second-best means of terms-of-trade manipulation once its tariffs are bound below their best-response levels in a trade agreement and are therefore no longer set to optimally manipulate the terms of trade from a unilateral perspective. To this end, suppose countries begin from an efficient set of policies ($\bar{\tau}$, $\bar{\tau}^*$, $\bar{I}$ and $\bar{I}^*$) such that $\bar{\tau}+\bar{\tau}^* = \tau^e+\tau^{*e}$, $\bar{I} = I^e$ and $\bar{I}^* = I^{*e}$ and both countries are positioned below their best-response tariffs.[8] From this starting point, if it can be shown that $\frac{\partial W}{\partial I} < 0$ and $\frac{\partial W^*}{\partial I^*} < 0$ so that the home and foreign countries would each have a unilateral incentive to back away from efficient levels of investment in trade facilitation, then it may be concluded that if left unconstrained on this dimension the home and foreign country would under-invest in trade facilitation relative to the efficient level, indicating that some form of international cooperation on trade facilitation

[8] It is possible to be on the efficiency frontier and yet have one country strictly above its tariff reaction curve (because as I have noted, only the sum of the tariffs matters for efficiency, not the individual tariff levels), but it is standard to restrict attention to points on the efficiency frontier where both countries are strictly below their tariff reaction curves (see the discussion, for example, in Bagwell and Staiger, 2005).

would be needed to bring investments in trade facilitation up to their efficient levels.

Beginning from the efficient policies outlined above, we have

$$\frac{\partial W}{\partial I} = [-M^e \frac{\partial \hat{P}}{\partial t} + \bar{\tau} \frac{\partial E^*}{\partial P^*} \frac{\partial \hat{P}^*}{\partial t}] \frac{\partial t}{\partial I} - c \tag{4.11}$$

where all magnitudes in (4.11) are evaluated at these efficient policies. But it follows from the top condition in (4.7) that

$$\frac{\partial W}{\partial \tau} = -M^e \frac{\partial \hat{P}}{\partial \tau} + \bar{\tau} \frac{\partial E^*}{\partial P^*} \frac{\partial \hat{P}^*}{\partial \tau} + M^e > 0 \tag{4.12}$$

when all magnitudes in (4.12) are evaluated at these efficient policies. Manipulating (4.12) and substituting into (4.11) then implies

$$\frac{\partial W}{\partial I} = [-M^e \frac{\partial \hat{P}}{\partial t} + \bar{\tau} \frac{\partial E^*}{\partial P^*} \frac{\partial \hat{P}^*}{\partial t}] \frac{\partial t}{\partial I} - c < M^e \cdot [-\frac{\partial t}{\partial I}] - c = 0, \tag{4.13}$$

where the last equality follows from (4.5) which implies that $[-\frac{\partial t}{\partial I}] = \frac{c}{M^e}$ when evaluated at efficient policies. Using the top condition in (4.8), analogous steps lead to

$$\frac{\partial W^*}{\partial I^*} = [-E^*(\hat{P}^*) \frac{\partial \hat{P}^*}{\partial t^*} + \tau^* \frac{\partial M}{\partial P} \frac{\partial \hat{P}}{\partial t^*}] \frac{\partial t^*}{\partial I^*} - c^* < E^{*e} \cdot [-\frac{\partial t}{\partial I^*}] - c^* = 0, \tag{4.14}$$

where the last equality follows from (4.6) which implies that $[-\frac{\partial t}{\partial I^*}] = \frac{c^*}{E^{*e}}$ when evaluated at efficient policies.

Hence, according to (4.13) and (4.14), beginning from a position on the efficiency frontier as described above and if left unconstrained in their investment decisions, the home and foreign country would choose to under-invest in trade facilitation relative to the efficient level. This implies that, according to the terms-of-trade theory of trade agreements, some form of international cooperation on trade facilitation would be needed to bring investments in trade facilitation up to their efficient levels.

Finally, while I will develop closely related points further in the context of later sections, it is worth observing here that the terms-of-trade theory points to two interesting and potentially viable forms of international cooperation on trade facilitation: a "shallow" form of cooperation in which integration is accomplished with negotiated tariff bindings combined with "tariffication" rules to prevent the erosion of implied market access commitments through the use of border NTMs, reminiscent of GATT's reliance on negotiated tariff bindings plus associated rules such as GATT Articles V, VIII, X and XI as described above; and a "deeper" form of cooperation in which integration is accomplished with direct negotiations over tariff bindings *and* specific border NTMs. The first approach places minimal restrictions on border NTMs and hence raises fewer issues of national sovereignty than the second, but in placing constraints on specific border NTMs directly the second approach may be more straightforward to implement.[9] An interpretation of the WTO's TFA according to the terms-of-trade theory is that the TFA represents an evolution of approaches on border NTMs in the GATT/WTO from shallow to deeper forms of integration over border measures.[10] As with the terms-of-trade theory more generally, an interesting implication of this interpretation is that TFA commitments should reflect the presence of market power, with truly small countries essentially left unconstrained to make unilateral investment decisions in trade facilitation.[11]

#### 4.1.2. Behind-the-Border NTMs

Some of the terms-of-trade theory's most interesting and provocative predictions regarding the treatment of NTMs are associated with behind-the-border NTMs. To illustrate the implications of the terms-of-trade theory for the treatment of behind-the-border NTMs in trade agreements, I now present a variant of the basic model of Staiger and Sykes (2011), and confirm the findings of that paper (which in turn confirms the original findings of Bagwell and Staiger, 2001b and extends those findings to a setting with product standards): in the noncooperative Nash equilibrium from which countries would begin in the absence of a trade agreement, tariffs are set inefficiently high but behind-the-border NTMs are set at efficient levels. After establishing these findings, I then offer an interpretation of their implications for the treatment of behind-the-border NTMs in trade agreements.

[9] For a formal analysis of the implications of international agreements for national sovereignty with a particular emphasis on trade agreements and the GATT/WTO, see Bagwell and Staiger (forthcoming).

[10] As I later discuss, the degree of the GATT/WTO's evolution toward deeper forms of integration on behind-the-border NTMs has been much less significant than it has been for border NTMs as embodied especially in the recently negotiated TFA. A possible reason is that the sovereignty issues that arise with the TFA are minor compared to those that would arise with deep integration over behind-the-border NTMs.

[11] In this regard, it is also interesting to note that the negotiations leading to the WTO's TFA seemed to feature a distinctly more multilateral structure than that typical of GATT/WTO bargains over tariffs; in the latter, a more decentralized approach is often emphasized featuring bilateral bargaining in the presence of norms such as reciprocity and the principal supplier rule. It is not clear from the terms-of-trade perspective I have described here why the TFA negotiations featured such a different approach, though one possibility might be that the extreme nature of the free-rider potential associated with investments in trade facilitation as compared to tariff cuts on particular goods (it would be difficult to design improvements in ports or customs procedures that would selectively benefit some foreign exporters but not others) made the more decentralized bargaining approach infeasible in the context of the TFA. In any case, I thank Chad Bown for bringing this issue to my attention, and I view it as an interesting open question for future research.

**The Basic Model** Following Staiger and Sykes (2011), I consider a simple partial equilibrium two-country model of trade between a domestic and a foreign country. Throughout I denote foreign-country variables with a '*'. For simplicity I assume that the good under consideration is produced in both countries but only demanded in the domestic country, where its demand can be represented by the demand curve $D(P)$, with $P$ the consumer price of the good in the domestic market. I assume that $D$ is decreasing in $P$, with "choke price" $\alpha$ (possibly infinite) such that $D(\alpha) = 0$.[12]

To provide a possible rationale for government intervention with domestic policies, I assume that consumption of the good under consideration generates a negative externality. This externality is not internalized by individual consumers, and therefore it does not impact demand for the product; and I assume as well that it does not effect production. Hence I am considering an "eye sore" pollutant whose impact is simply to detract from aggregate national welfare in the domestic country (and I assume the externality does not cross borders).

The domestic government has the capability to impose a regulatory standard which specifies a (maximum) level of pollution generated per unit of the good consumed, and in principle the standard may discriminate between domestically produced and imported units of the good. I denote by $r$ the standard imposed on domestically produced units of the good, with $\theta(r)$ the associated per-unit pollution level generated by consumption of domestically produced units under the standard $r$. And analogously, I denote by $\rho$ the standard imposed on imported units of the good, with $\theta^*(\rho)$ the associated per-unit pollution level generated by consumption of imported units under the standard $\rho$. I assume that $\theta$ and $\theta^*$ are decreasing and convex in their respective arguments.

Meeting a regulatory standard of course has a cost. I assume that to meet the standard $r$, domestic producers must incur the per-unit compliance cost $\phi(r)$; and similarly, I assume that to meet the standard $\rho$, foreign producers must incur the per-unit compliance cost $\phi^*(\rho)$. And I assume that $\phi$ and $\phi^*$ are increasing and convex in their respective arguments. For simplicity, I take domestic and foreign supply to be linear in the price faced by producers. In particular, for any regulatory standards $r$ and $\rho$, I assume that domestic and foreign supply are given respectively by $S = q - \phi(r)$ for $q \geq \phi(r)$, and $S^* = q^* - \phi^*(\rho)$ for $q^* \geq \phi^*(\rho)$, where $q$ and $q^*$

[12] Staiger and Sykes (2011) adopt a linear demand assumption, and the more general demand function that I work with here is the main difference between the model of Staiger and Sykes and the model I develop in this section. As I will establish later in the paper, allowing for generalized demands is important once I introduce offshoring.

are the respective domestic and foreign producer prices.

The domestic government also has at its disposal an import tariff $\tau$ and a consumption tax $t$ (both expressed in specific terms), in addition to the regulatory standards that I have just described. For simplicity and to keep focused on the main points, I assume that the foreign government is passive in this industry.[13] Assuming that all taxes are set at non-prohibitive levels, the domestic consumer and producer price must satisfy

$$P = q + t, \tag{4.15}$$

while the domestic and foreign producer prices must satisfy

$$q = q^{*} + \tau. \tag{4.16}$$

Note that all units of the product sell in the domestic country at the same price $P$ regardless of the standard to which they are produced. This feature derives from my assumption that individual consumers do not differentiate across units of the good on the basis of how much pollution it generates when they consume it, and so their willingness to pay for the good is independent of the good's pollution-generating characteristics.

I also define the price at which the good is available for sale in international markets once it clears customs in the exporting country – which hereafter I call the "world" price – as:

$$q^{w} \equiv q^{*} = q - \tau. \tag{4.17}$$

Given my assumption that the foreign government has no export policy, the world price is simply the foreign exporter price in this setting, as (4.17) reflects. However, more generally the world price will differ from the foreign exporter price as a result of foreign export tax policies (see, for example, the analysis in Staiger and Sykes, 2011). To reflect this distinction and avoid confusion, I will continue where appropriate to use the notation $q^{w}$ for the world price and the notation $q^{*}$ for the foreign price, even though in this setting they happen to be one and the same.

I am now ready to use the model to determine equilibrium prices. Equilibrium in this market is determined by the market-clearing condition that the volume of domestic imports must equal

[13] Staiger and Sykes (2011) allow the foreign government to choose an export tax for the industry. They show that all of the results that I emphasize in this section go through with a policy-active foreign government of this kind. As none of the results depend on whether or not the foreign government is policy active, I simplify here by abstracting from foreign government policies altogether.

the volume of foreign exports:

$$D - S = S^*. \tag{4.18}$$

Employing the expressions for demands and supplies as well as the pricing relationships in (4.15)-(4.17), the market clearing condition (4.18) implicitly determines the market-clearing world price – which I denote by $\tilde{q}^w(\tau, t, r, \rho)$ – as a function of the tax and regulatory policies:

$$D(\tilde{q}^w + \tau + t) = 2\tilde{q}^w + \tau - \phi(r) - \phi^*(\rho). \tag{4.19}$$

With (4.15)-(4.17) I may also derive expressions for the market-clearing levels of each of the other prices as functions of the tax and regulatory policies:

$$\begin{aligned} \tilde{P}(\tau, t, r, \rho) &= \tilde{q}^w(\tau, t, r, \rho) + \tau + t, \\ \tilde{q}(\tau, t, r, \rho) &= \tilde{q}^w(\tau, t, r, \rho) + \tau, \text{ and} \\ \tilde{q}^*(\tau, t, r, \rho) &= \tilde{q}^w(\tau, t, r, \rho). \end{aligned} \tag{4.20}$$

It will also be useful to record how the equilibrium world price is impacted by policies. Implicit differentiation of (4.19) yields

$$\begin{aligned} \frac{\partial \tilde{q}^w}{\partial \tau} &= \frac{-[D'(\tilde{P}) - 1]}{[D'(\tilde{P}) - 2]} < 0, \\ \frac{\partial \tilde{q}^w}{\partial t} &= \frac{-D'(\tilde{P})}{[D'(\tilde{P}) - 2]} < 0, \\ \frac{\partial \tilde{q}^w}{\partial r} &= \frac{-\phi'(r)}{[D'(\tilde{P}) - 2]} > 0, \\ \frac{\partial \tilde{q}^w}{\partial \rho} &= \frac{-\phi^{*\prime}(\rho)}{[D'(\tilde{P}) - 2]} > 0. \end{aligned} \tag{4.21}$$

And using (4.20), the following derivative properties are direct (and as is clear from (4.20), all other price derivatives are the same as those for $\tilde{q}^w$ as reported above):

$$\begin{aligned} \frac{\partial \tilde{P}}{\partial \tau} &= \frac{-1}{[D'(\tilde{P}) - 2]} > 0, \\ \frac{\partial \tilde{P}}{\partial t} &= \frac{-2}{[D'(\tilde{P}) - 2]} > 0, \\ \frac{\partial \tilde{q}}{\partial \tau} &= \frac{-1}{[D'(\tilde{P}) - 2]} > 0. \end{aligned} \tag{4.22}$$

I next define the market-clearing foreign producer price of the "raw" *un*regulated good – prior to bringing it into compliance with the prevailing regulatory standard – as a function of the tax and regulatory policies, and the associated world price of the foreign-produced unregulated good. These are given by

$$\begin{aligned} \tilde{q}_0^*(\tau, t, r, \rho) &\equiv \tilde{q}^*(\tau, t, r, \rho) - \phi^*(\rho), \text{ and} \\ \tilde{q}_0^w(\tau, t, r, \rho) &\equiv \tilde{q}^w(\tau, t, r, \rho) - \phi^*(\rho). \end{aligned} \tag{4.23}$$

Following Staiger and Sykes (2011), I will refer to $\tilde{q}_0^w$ rather than $\tilde{q}^w$ as the terms of trade, although for any $\rho$ there is a one-to-one mapping between the two notions of world price as the bottom line of (4.23) indicates. Note that $\tilde{q}_0^*$ also happens to be the market-clearing volume of foreign exports (production, $S^*$): this will simplify some of the calculations below, but it does not drive any of the results. The following derivative properties are direct (and as (4.23) makes clear, all other price derivatives are the same as those for $\tilde{q}^*$ and $\tilde{q}^w$ respectively as reported above):

$$\begin{aligned} \frac{\partial \tilde{q}_0^*}{\partial \rho} &= \frac{\phi^{*\prime}(\rho) \cdot [1 - D'(\tilde{P})]}{[D'(\tilde{P}) - 2]} < 0, \\ \frac{\partial \tilde{q}_0^w}{\partial \rho} &= \frac{\phi^{*\prime}(\rho) \cdot [1 - D'(\tilde{P})]}{[D'(\tilde{P}) - 2]} < 0. \end{aligned}$$

I can now write down expressions for domestic and foreign welfare. Domestic country welfare is given by first calculating the usual partial equilibrium measure of consumer surplus plus producer surplus plus tax revenue, and then subtracting off from this measure the disutility of the consumption-generated pollution. Domestic consumer ($CS$) and producer ($PS$) surplus are defined as

$$CS = \int_{\tilde{P}}^{\alpha} D(P)dP \equiv CS(\tilde{P}), \text{ and } PS = \int_{\phi(r)}^{\tilde{q}} [q - \phi(r)]dq \equiv PS(r, \tilde{q}).$$

Using the pricing relationships above and the definition of $\tilde{q}_0^w$, the tax revenue collected by the domestic government ($TR$) can be written as

$$TR = [\tilde{P} - \tilde{q}] \cdot D(\tilde{P}) + [\tilde{q} - \tilde{q}_0^w - \phi^*(\rho)] \cdot [D(\tilde{P}) - (\tilde{q} - \phi(r))] \equiv TR(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^w).$$

And the utility cost of domestic pollution ($Z$) is given by

$$Z = \theta(r) \cdot [\tilde{q} - \phi(r)] + \theta^*(\rho) \cdot [D(\tilde{P}) - (\tilde{q} - \phi(r))] \equiv Z(r, \rho, \tilde{P}, \tilde{q}).$$

With these definitions, I may write domestic welfare as

$$W = CS(\tilde{P}) + PS(r, \tilde{q}) + TR(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^w) - Z(r, \rho, \tilde{P}, \tilde{q}) \equiv W(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^w). \tag{4.24}$$

Note that (4.24) expresses domestic welfare as a function of prices (in addition to non-tax regulations). As Bagwell and Staiger (1999, 2001b) have emphasized and as I confirm below, writing government objectives as functions of prices rather than tax policies directly can help to illuminate the basic structure of the terms-of-trade theory of trade agreements.

Using the definition of $TR(r, \rho, \tilde{P}, \tilde{q}, \tilde{q}_0^w)$, notice that (4.24) implies $W_{\tilde{q}_0^w} = -[D(\tilde{P}) - (\tilde{q} - \phi(r))] < 0$ (where here and throughout I use a subscripted variable to denote a partial derivative with respect to the variable). This captures the welfare reduction suffered by the domestic country when its terms of trade deteriorate (i.e., when $\tilde{q}_0^w$ rises) holding all regulatory standards and domestic local prices fixed; and it is simply the income effect of a small terms-of-trade deterioration for the domestic country, which amounts to the domestic import volume.

I turn next to foreign welfare. The fact that the foreign government is passive in the industry under consideration, combined with the absence of foreign demand for the product in this industry and the absence of foreign pollution, makes the foreign welfare measure very simple. Specifically, foreign welfare is given by foreign producer surplus. Using the pricing relationships above and the definition of $\tilde{q}_0^*$, foreign producer surplus ($PS^*$) can be defined as

$$PS^* = \int_{\phi^*(\rho)}^{\tilde{q}_0^* + \phi^*(\rho)} [q^* - \phi^*(\rho)] dq^* = \int_0^{\tilde{q}_0^*} q^* dq^* \equiv PS^*(\tilde{q}_0^*).$$

Hence, foreign welfare may be expressed as

$$W^* = PS^*(\tilde{q}_0^*) \equiv W^*(\tilde{q}_0^*). \tag{4.25}$$

Notice from $W^*(\tilde{q}_0^*)$ that foreign welfare does not depend directly on the standard $\rho$ to which foreign producers must comply (though it does depend on $\rho$ indirectly through the impact of $\rho$ on $\tilde{q}_0^*$). As Staiger and Sykes (2011) explain, this feature derives from the fact that the production of the unregulated good has been modeled as an increasing cost (upward-sloping supply) industry, while for a given standard level $\rho$ the per-unit cost of coming into compliance with the standard is then assumed to be constant (and equal to $\phi^*(\rho)$) regardless of how many units of the unregulated good must be altered to meet the standard. For this reason, foreign producer surplus is impacted by the standard level $\rho$ only to the extent that $\rho$ impacts the market-clearing foreign supply decisions for the unregulated good (through $\tilde{q}_0^*$).[14]

[14] If there were a separate increasing-cost industry in the foreign country that took unregulated goods as inputs and provided a service which transformed these goods to achieve compliance for a given regulatory standard, then there would be an additional foreign-producer-surplus consequence of the domestic regulatory choice $\rho$, but

**Efficient Policies** With my variant of the basic Staiger and Sykes (2011) model described, I first characterize the jointly efficient policy choices (i.e., the policies that maximize $W+W^*$).[15] I will subsequently compare these policies to the noncooperative policy choices that the domestic government would make absent any international agreement, and in this way will identify and characterize the problem that a trade agreement must solve if it is to move governments from inefficient non-cooperative ("Nash") choices to the efficiency frontier.[16]

Recalling that the domestic government has at its disposal four policy instruments (and the foreign government has none), the first-order conditions that must hold at the choices of these policies that maximize the sum of domestic and foreign welfare are given by[17]

$$\begin{aligned} W_{\tilde{P}}\frac{d\tilde{P}}{d\tau}+W_{\tilde{q}}\frac{d\tilde{q}}{d\tau}+W_{\tilde{q}_0^w}\frac{d_{\tilde{q}_0^w}}{d\tau}+W^*_{\tilde{q}_0^*}\frac{d\tilde{q}_0^*}{d\tau} &= 0, \\ W_{\tilde{P}}\frac{d\tilde{P}}{dt}+W_{\tilde{q}}\frac{d\tilde{q}}{dt}+W_{\tilde{q}_0^w}\frac{d_{\tilde{q}_0^w}}{dt}+W^*_{\tilde{q}_0^*}\frac{d\tilde{q}_0^*}{dt} &= 0, \\ W_r+W_{\tilde{P}}\frac{d\tilde{P}}{dr}+W_{\tilde{q}}\frac{d\tilde{q}}{dr}+W_{\tilde{q}_0^w}\frac{d_{\tilde{q}_0^w}}{dr}+W^*_{\tilde{q}_0^*}\frac{d\tilde{q}_0^*}{dr} &= 0, \text{ and} \\ W_\rho+W_{\tilde{P}}\frac{d\tilde{P}}{d\rho}+W_{\tilde{q}}\frac{d\tilde{q}}{d\rho}+W_{\tilde{q}_0^w}\frac{d_{\tilde{q}_0^w}}{d\rho}+W^*_{\tilde{q}_0^*}\frac{d\tilde{q}_0^*}{d\rho} &= 0. \end{aligned} \tag{4.26}$$

But as previously noted and as (4.20) and (4.23) confirm, the foreign country's lack of available policy instrument in this industry implies that $\tilde{q}_0^w=\tilde{q}_0^*$. Moreover, observe that

$$[W_{\tilde{q}_0^w}+W^*_{\tilde{q}_0^*}]=-[D(\tilde{P})-(\tilde{q}-\phi(r))]+\tilde{q}_0^w=0,$$

where the second equality follows from market clearing. Hence I may write the first-order

again the impact would travel through market-clearing prices, in this case the price of the service performed. As long as this new price is introduced into the measure of welfare in the appropriate way, the added complication would not alter the basic findings I present below.

[15] As before, by focusing on the policy choices that maximize this joint welfare measure, I am thereby assuming implicitly that lump sum transfers are available to distribute surplus across the two countries as desired.

[16] I will sometimes refer to the noncooperative policy choices of the domestic country as "Nash" policies even though the foreign country has no policies of its own and so there is no strategic interaction between the countries, because all of the findings that I emphasize here would go through also when the foreign country is allowed to have policies as well and such strategic interaction between countries is present (see note 13).

[17] I assume throughout that policy choices correspond to interior solutions of the relevant maximization problems. It is easily confirmed that the second-order conditions associated with the maximization problems considered here and throughout this section are satisfied under the convexity assumptions for $\theta$, $\theta^*$, $\phi$ and $\phi^*$.

conditions for efficiency in (4.26) as

$$\begin{aligned} W_{\tilde{P}} \frac{d\tilde{P}}{d\tau} + W_{\tilde{q}} \frac{d\tilde{q}}{d\tau} &= 0, \\ W_{\tilde{P}} \frac{d\tilde{P}}{dt} + W_{\tilde{q}} \frac{d\tilde{q}}{dt} &= 0, \\ W_r + W_{\tilde{P}} \frac{d\tilde{P}}{dr} + W_{\tilde{q}} \frac{d\tilde{q}}{dr} &= 0, \text{ and} \\ W_\rho + W_{\tilde{P}} \frac{d\tilde{P}}{d\rho} + W_{\tilde{q}} \frac{d\tilde{q}}{d\rho} &= 0. \end{aligned} \tag{4.27}$$

Using the expressions in (4.19)-(4.25) to evaluate the first-order conditions for efficiency contained in (4.27), and letting the efficient policy choices be denoted by $\tau^E$, $t^E$, $r^E$ and $\rho^E$, it follows that

$$\begin{aligned} \tau^E &= [\theta^*(\rho^E) - \theta(r^E)], \\ t^E &= \theta(r^E), \\ -\theta'(r^E) &= \phi'(r^E), \text{ and} \\ -\theta^{*\prime}(\rho^E) &= \phi^{*\prime}(\rho^E), \end{aligned} \tag{4.28}$$

where here I have used primes to denote derivatives.

There are a number of notable features of the efficient policies as described by (4.28). First, notice that $t^E = \theta$, and so the efficient domestic consumption tax is set at a Pigouvian level that reflects the externality associated with consumption of a unit of the *domestically produced* good, even if this externality differs from the externality associated with consumption of a unit of the imported good. As the top expression of (4.28) indicates, the efficient way to respond to any difference in the externality generated by consumption of the domestically produced and imported goods is via the *tariff*: $\tau^E$ is positive (a net tax on imports) if consumption of a unit of the imported good generates more pollution than a unit of the domestically produced good; and $\tau^E$ is negative (a net subsidy to imports) if consumption of a unit of the imported good generates less pollution than a unit of the domestically produced good. This feature admits a natural interpretation once it is observed that a tariff can be equivalently thought of as a (discriminatory) domestic tax on the consumption of the imported good: thus, these two policies together represent the usual Pigouvian intervention to address the (possibly distinct levels of) consumption externality associated with consumption of the domestically produced and imported good.

Second, notice that $r^E$, the efficient standard on domestically produced goods, equates the marginal per unit benefit of pollution reduction that is associated with a slightly tighter standard $(-\theta'(\cdot))$ with the marginal per unit cost of domestic compliance with the tighter standard $(\phi'(\cdot))$. A similar observation holds for $\rho^E$, the efficient standard on imported goods: this standard must equate the marginal per unit benefit of pollution reduction that comes with a slightly tighter standard $(-\theta^{*\prime}(\cdot))$ with the marginal per unit cost of foreign compliance with the tighter standard $(\phi^{*\prime}(\cdot))$. In general, the efficient regulatory standards for domestic and imported goods, and the efficient level of the externality produced by each type of good, will not be the same.[18]

This raises a third and related point: it is interesting to consider the efficient policies for a symmetric benchmark case in which both domestic and foreign producers face the same compliance cost for any (common) standard level (i.e., the functions $\phi$ and $\phi^*$ are identical), and consumption of both the domestically produced and imported good generate the same per unit level of pollution for any (common) standard level (i.e., the functions $\theta$ and $\theta^*$ are identical). In this case, due to symmetry in the compliance cost functions $\phi$ and $\phi^*$, (4.28) implies $\rho^E = r^E$. And given that $\rho^E = r^E$, symmetry in the pollution functions $\theta$ and $\theta^*$ then implies by the first condition in (4.28) that $\tau^E = 0$. Hence, in the symmetric benchmark case, the efficient policies are given by

$$\begin{aligned} \tau^E &= 0, \\ t^E &= \theta(r^E), \\ -\theta'(r^E) &= \phi'(r^E), \text{ and} \\ \rho^E &= r^E. \end{aligned} \tag{4.29}$$

As (4.29) indicates, efficient policy intervention in the case of identical technologies across countries takes the intuitive form of free trade, a nondiscriminatory regulatory standard that equates the marginal benefit of pollution reduction to the marginal compliance cost, and a Pigouvian consumption tax set at the level of the consumption externality.

**Noncooperative Policies** I next characterize the noncooperative (Nash) policy choices of the domestic country (recall that the foreign country is assumed passive in this industry).

[18] This observation is also made in Staiger and Sykes (2011), where a discussion of its implications for the desirability of the GATT "national treatment" clause is included as well. See also Gulati and Roy (2008).

Using the domestic welfare expression given in (4.24), the noncooperative policy choices are the choices of $\tau$, $t$, $r$ and $\rho$ that satisfy the following four first-order conditions:

$$\begin{aligned}
W_{\tilde{P}}\frac{d\tilde{P}}{d\tau}+W_{\tilde{q}}\frac{d\tilde{q}}{d\tau}+W_{\tilde{q}_0^w}\frac{d\tilde{q}_0^w}{d\tau} &= 0, \\
W_{\tilde{P}}\frac{d\tilde{P}}{dt}+W_{\tilde{q}}\frac{d\tilde{q}}{dt}+W_{\tilde{q}_0^w}\frac{d\tilde{q}_0^w}{dt} &= 0, \\
W_r+W_{\tilde{P}}\frac{d\tilde{P}}{dr}+W_{\tilde{q}}\frac{d\tilde{q}}{dr}+W_{\tilde{q}_0^w}\frac{d\tilde{q}_0^w}{dr} &= 0, \text{ and} \\
W_\rho+W_{\tilde{P}}\frac{d\tilde{P}}{d\rho}+W_{\tilde{q}}\frac{d\tilde{q}}{d\rho}+W_{\tilde{q}_0^w}\frac{d\tilde{q}_0^w}{d\rho} &= 0.
\end{aligned} \tag{4.30}$$

Using the expressions in (4.19)-(4.25) to evaluate the first-order conditions contained in (4.30), and denoting the noncooperative volume of foreign export supply by $S^{*N}$ and the noncooperative policy choices by $\tau^N$, $t^N$, $r^N$, $\rho^N$ and $\tau^{*N}$, the following expressions for the Nash policy levels may be derived:

$$\begin{aligned}
\tau^N &= [\theta^*(\rho^N)-\theta(r^N)]+S^{*N}, \\
t^N &= \theta(r^N), \\
-\theta'(r^N) &= \phi'(r^N), \text{ and} \\
-\theta^{*\prime}(\rho^N) &= \phi^{*\prime}(\rho^N).
\end{aligned} \tag{4.31}$$

And finally, in the symmetric benchmark case of identical technologies, Nash policies reduce to

$$\begin{aligned}
\tau^N &= S^{*N}, \\
t^N &= \theta(r^N), \\
-\theta'(r^N) &= \phi'(r^N), \text{ and} \\
-\theta^{*\prime}(\rho^N) &= \phi^{*\prime}(\rho^N).
\end{aligned} \tag{4.32}$$

**The Problem for a Trade Agreement to Solve** I now turn to a comparison of the efficient policies and the noncooperative policies as characterized above, in order to identify and understand the problem that a trade agreement must solve if it is to move governments from inefficient Nash choices to the efficiency frontier. This comparison turns out to be illuminating, and in the context of the present model and the terms-of-trade theory more generally (see Bagwell and Staiger, 2001b), it leads to a striking result.

Specifically, a comparison of the bottom two conditions in (4.28) and (4.31) reveals that the Nash standards choices satisfy the same conditions as the efficient standards choices, and indeed the Nash standards correspond to the efficient standards: $r^N = r^E$ and $\rho^N = \rho^E$. And with $r^N = r^E$, it also follows from a comparison of the middle conditions in (4.28) and (4.31) that the Nash consumption tax corresponds to the efficient consumption tax: $t^N = t^E$. Hence, all behind-the-border NTMs are left undistorted from their internationally efficient levels in the noncooperative Nash equilibrium.

Given that $r^N = r^E$ and $\rho^N = \rho^E$, it is then also apparent from a comparison of the first condition in (4.28) with the first condition in (4.31) that $\tau^N > \tau^E$.[19] And it is easily shown that the difference between Nash and efficient tariffs is driven by the home country's incentive to manipulate the terms of trade ($\tilde{q}_0^w$) with its unilateral tariff choice.[20] Finally, the same statements apply in the case of identical technologies. This can be seen by comparing the efficient policies for the symmetric benchmark case in (4.29) to the Nash policies in the symmetric benchmark case given in (4.32).

The inefficiencies of noncooperative policies in this model can thus be traced to a single source: the Nash tariff is too high, and the Nash trade volume is correspondingly too low, because the domestic country seeks to manipulate its terms of trade with its tariff. In fact, this interpretation of the problem for a trade agreement to solve can be confirmed at a more general level by following Bagwell and Staiger (1999, 2001b) and defining *politically optimal* policies as those policies that would hypothetically be chosen by governments unilaterally if they did not value the terms-of-trade implications of their policy choices.[21]

In particular, with the foreign government passive by assumption in the model I have developed here, to define politically optimal tariffs in the present setting I need only suppose hypothetically that the domestic government acts as if $W_{\tilde{q}_0^w} \equiv 0$ when choosing its politically optimal policies. I can then ask whether politically optimal policies so-defined are efficient

[19] This follows from my focus on non-prohibitive intervention, which ensures that the Nash export volume $S^{*N}$ is strictly positive.

[20] To see this, notice that the elasticity of foreign export supply in this model can be written as $\frac{\partial S^*}{\partial \tilde{q}^w}\frac{\tilde{q}^w}{S^*} = \frac{\tilde{q}^w}{S^*}$. Dividing $\tau^N$ by $\tilde{q}^w$ to convert the specific import tariff of the domestic country into its ad-valorem equivalent yields $\frac{\tau^N}{\tilde{q}^w} = \frac{[\theta^*(\rho^N)-\theta(r^N)]}{\tilde{q}^w} + \frac{S^*}{\tilde{q}^w}$. Evidently, the second term in this expression is the inverse of the foreign export supply elasticity, which is the Johnson (1953-54) "optimal" terms-of-trade-manipulating ad-valorem tariff.

[21] The terminology used by Bagwell and Staiger (1999, 2001b) reflects the fact that they work with government objective functions that allow for general political economy motives. I have abstracted from political economy motives here, but it is convenient nevertheless to adopt their terminology (and it can be shown that the results I emphasize here extend to a setting with political economy motives, as Staiger and Sykes, 2011 also observe).

when evaluated in light of the governments' actual objectives, and thereby explore whether the Nash inefficiencies identified above can in fact be given the terms-of-trade interpretation I have just outlined. But comparing (4.30) when $W_{\tilde{q}_0^w} \equiv 0$ – which yields the first-order conditions that define the politically optimal policies in this setting – with the conditions for efficiency in (4.27), it is immediate that politically optimal policies are indeed efficient. Hence, if governments could be induced to make policy choices free from motives reflecting terms-of-trade manipulation, there would be nothing left for a trade agreement to do.

As a consequence, the fundamental inefficiency for a trade agreement to correct in this setting – and therefore the problem that gives rise to the need for a trade agreement to exist in this setting – is the unilateral incentive for the domestic government to manipulate the terms of trade $\tilde{q}_0^w$ with its tariff choice. But as (4.23) makes clear, the domestic country can alter $\tilde{q}_0^w$ with *any* of its policies, both tariffs and behind-the-border NTMs. Why, then, are all behind-the-border NTMs left undistorted from their internationally efficient levels in the noncooperative Nash equilibrium, with all of the distortions contained in the level of the tariff? The simple reason is that the tariff is the first-best instrument for manipulating the terms of trade in this setting, and hence with the domestic country's Nash tariff set to achieve this purpose, there is no need for it to distort any other policy choices to engage in terms-of-trade manipulation.[22]

This leads to an important point: according to the terms-of-trade theory, even in the context of a complex policy environment there is no need for member governments of a trade agreement to negotiate directly over the levels of their behind-the-border NTMs. Rather, according to the terms-of-trade theory, the central task of a trade agreement is simply to reduce tariffs and raise trade volumes without *introducing* distortions into the unilateral choices of domestic regulatory and tax policies as a result of the negotiated constraints on tariffs.

For my purposes here, the important implication of this point is what it means for the approach to negotiations in a world where governments have a myriad of policies at their disposal: in principle, negotiations over tariffs alone, in combination with an effective "market access preservation rule" that prevents governments from subsequently manipulating their domestic policy choices to undercut the market access implications of their tariff commitments, can bring governments to the efficiency frontier. The key feature of such a market access preservation rule, which in practice as discussed further in Bagwell and Staiger (2001b) and Staiger

[22] With this interpretation it can also be seen that the international efficiency of the behind-the-border NTMs in the noncooperative Nash equilibrium does not hinge on the nature (e.g., complete) of the set of behind-the-border instruments that are available to a government.

and Sykes (2011) has its closest conceptual analogue in GATT's non-violation clause, is that in principle by securing market access against erosion from future unilateral changes in domestic policies such a rule also secures the terms of trade $\tilde{q}_0^w$ against such changes.[23]

To illustrate this point, consider its application to the setting I have analyzed here, where there are no political economy considerations. Efficiency can in this case be achieved in the presence of a market access preservation rule by a simple commitment to free trade from the domestic country and no negotiated commitments on its behind-the-border NTMs.[24] To see that this must be true, note that efficiency will be achieved under the free-trade agreement if only the domestic government does not alter its domestic tax and regulatory policies from their Nash levels; and note as well that the market-access preservation rule, by preserving $\tilde{q}_0^w$, must also preserve $\tilde{q}_0^*$ given that $\tilde{q}_0^w = \tilde{q}_0^*$ and hence must preserve the level of foreign welfare $W^*(\tilde{q}_0^*)$.[25] But then, with the elimination of tariffs and beginning from the Nash domestic tax and regulatory policies, the efficiency of this starting point ensures that it is impossible for the domestic government to find alternative domestic tax and regulatory policies to the Nash policies which would satisfy the market-access preservation rule (and thereby preserve the level of foreign welfare) and yet make itself better off.

Evidently, the terms-of-trade theory of trade agreements provides strong support for shallow integration as the most direct means to solve the policy inefficiencies that would arise absent a trade agreement. At a conceptual level, this resonates with the GATT approach to behind-the-border NTMs described earlier, where negotiators emphasize tariff reductions as a means to expand market access, and where various GATT provisions serve to protect the value of negotiated market access agreements against erosion by behind-the-border NTMs.[26]

[23] The importance of the non-violation clause in practice is difficult to assess, because it can shape GATT/WTO policy outcomes through both on-equilibrium and off-equilibrium impacts. Staiger and Sykes (2017) consider the implications of the observed (on-equilibrium-path) performance of the non-violation clause in GATT/WTO disputes for the implied importance of the clause in shaping GATT/WTO policy outcomes.

[24] See Bagwell and Staiger (2001b) and Staiger and Sykes (2011) for a demonstration that the same desirable properties of a market access preservation rule of the kind described in the text extends to the case of governments with political economy motives. Bagwell and Staiger (2006) establish related themes in the context of domestic subsidies.

[25] In a more general setting where the foreign government also had a trade tax instrument at its disposal so that a distinction between $\tilde{q}_0^*$ and $\tilde{q}_0^w$ could arise as a result of this foreign trade tax, the same conclusion would hold, because changes in domestic-country policies which hold $\tilde{q}_0^w$ fixed would also hold $\tilde{q}_0^*$ fixed given the (unchanged) level of the foreign trade tax (see Staiger and Sykes, 2011).

[26] This is not to imply that this support is without caveats. For example, important qualifications to some of the results I emphasize here have been shown to arise in the presence of private information (see Bagwell, Bown and Staiger, 2016, for a recent review of the relevant literature).

### 4.2. The Commitment Theory

Thus far I have described an "international externality" theory of trade agreements that emphasizes the control of the beggar-my-neighbor motives associated with terms-of-trade manipulation. A distinct though possibly complementary theory of trade agreements turns the focus away from international policy externalities that one government imposes on another, and posits instead that the purpose of a trade agreement is to tie the hands of its member governments in their interactions with private agents in the economy, and thereby to offer an external commitment device.[27]

With a few exceptions, two of which I discuss briefly below, most research adopting the commitment approach to trade agreements has focused on tariffs, and specifically on the possibility that governments might benefit from a trade agreement that could help them commit to a policy of free trade. As a result, the implications of the commitment approach for the treatment of NTMs in trade agreements is less well understood than for the terms-of-trade theory. Nevertheless, a basic feature of the commitment approach to trade agreements is worth emphasizing here: unlike the terms-of-trade theory, which offers a robust reason to expect that trade agreements ought to be trade *liberalizing*, there is no presumption one way or the other under the commitment theory as to whether trade agreements should increase or reduce trade. Hence a basic anchor of the terms-of-trade theory that resonates broadly with observed trade agreements and provides structure for understanding the treatment of NTMs is absent from the commitment theory.

A simple way to see this is to note that government commitment problems typically arise when governments are forced to use policy instruments that are "second best" for the task to which they are put. A tariff, which as is well known is equivalent to a combination production subsidy and consumption tax, will almost always be a second-best instrument for any goal (aside from terms-of-trade manipulation), because it distorts two margins, a production margin and a consumption margin. Consider, then, a developing country government that would like to offer a production subsidy to firms that invest in a new import-competing industry (i.e., it would like to distort the production margin), but cannot feasibly raise the funds for the production subsidy by independent means and so employs an import tariff in the industry instead (which

[27]The commitment role for trade agreements has been formalized in a large number of papers. In addition to the papers I discuss below, see Carmichael (1987), Staiger and Tabellini (1987), Matsuyama (1990) and Maggi and Rodriguez-Clare (1998, 2007), to name a few.

distorts both the production margin and the consumption margin).

In this case, the commitment problem faced by the government could be described as follows: announcing the import tariff in order to stimulate firm entry and import-competing production will not be credible for the government, because if firm entry were to occur and investments in production processes made, it would be optimal for the government to then renege on the promise of a tariff in order to avoid the consumption distortion that would be associated with the tariff. But anticipating this, domestic firms will not enter the import-competing industry in the first place, and the government will therefore be unable to carry out its desired plan on account of a credibility ("time consistency") problem. In principle, a trade agreement could help supply the needed credibility for the government, by credibly threatening to punish the government if it reneges on its import-tariff plan. But notice that in this case the purpose of a trade agreement would be to enable higher tariffs, not lower. In general, as noted above, there is no presumption either way as to the trade effects of trade agreements in a world where governments use trade agreements as commitment devices.

Still, commitment theories may offer important insights into features of the treatment of NTMs in real-world trade agreements that the terms-of-trade theory fails to explain. I next briefly describe two papers that provide insights into the trade-agreement treatment of border and behind-the-border NTMs, respectively.

#### 4.2.1. Border NTMs

I first discuss the implications of the commitment theory of trade agreements for the treatment of border NTMs in trade agreements, focusing specifically on export subsidies. A paper that uses the commitment theory to offer an explanation for features of the observed treatment of export subsidies in the GATT/WTO is Potipiti (2012).

In particular, Potipiti (2012) employs the commitment theory to offer an explanation of the asymmetric treatment of tariffs and export subsidies in the WTO where, as described previously, tariffs are the subject of negotiated limits while export subsidies are banned outright. To focus on the distinct non-terms-of-trade elements, commitment theories of trade agreements typically adopt a small-country assumption, a convention that Potipiti follows. In Potipiti's model, the anticipation of protection generates inefficient investment ex ante for which the government is not compensated in its (ex-post) political relationship with the industry, along the lines of Maggi and Rodriguez-Clare (1998). A government can join an agreement that bans tariffs and/or an agreement that bans export subsidies, and doing so will eliminate this anticipation and generate a social welfare gain. On the down side, commitment to such an agreement means that the government must forfeit the political contributions it would otherwise collect for the protection it offers. In Potipiti's model, the government therefore commits to a trade agreement on a particular policy (import tariff and/or export subsidy) if the social welfare gain from liberalizing that policy is greater than the government's valuation of the associated loss in political contributions.

The asymmetry in treatment across import tariffs and export subsidies in Potipiti's (2012) model stems from an underlying asymmetry in growth prospects of the two sectors. As Potipiti demonstrates, in an environment where trade and transportation costs are decreasing over time, export sectors grow and import-competing sectors decline. Therefore, in export sectors, export subsidies attract new entrants and investment that erodes the protection rent associated with the export subsidies: the political contributions that the government receives from providing export subsidies is therefore small, and Potipiti establishes conditions under which the government would opt to ban export subsidies for the social welfare gain as a result. On the other hand, in declining import-competing sectors, the return on capital drops and capital is therefore sunk and cannot exit. As Potipiti argues, this sunk capital allows protection to raise the rate of return in these sectors at least somewhat without attracting entry: here the rent from protection is not eroded by new entrants and the government can extract large political contributions for offering protection. Potipiti shows that under the same conditions that lead the government to ban export subsidies, it will opt for the political rents and not ban import tariffs.

Hence, as Potipiti (2012) demonstrates, the asymmetric treatment of export subsidies and import tariffs in the WTO, which is difficult to explain from the perspective of the terms-of-trade theory, may be understood from the perspective of the commitment theory as reflecting underlying differences in the rent-generating capacity of protection in export and import-competing sectors.

#### 4.2.2. Behind-the-Border NTMs

Turning to the treatment of behind-the-border NTMs in trade agreements, Brou and Ruta (2013) adopt a small-country political economy setting similar to Potipiti (2012) and more specifically Maggi and Rodriguez-Clare (1998), but they introduce domestic production subsidies as well as import tariffs to study what they term the "policy substitution problem."[28] Taxation is assumed to be distortionary, so that a tariff is not dominated by a production subsidy for achieving production goals: rather, as Brou and Ruta show, in the setting that they study optimal intervention will typically include a mix of tariffs and production subsidies.

In the model of Brou and Ruta (2013), the fundamental reason for signing a trade agreement that commits a government to free trade is the same as that in Maggi and Rodriguez-Clare (1998) and in Potipiti (2012). But the novel twist in the model of Brou and Ruta is that a commitment to free trade by itself will induce the government to simply turn more intensively to production subsidies in its political relationship with the import-competing lobbies – the policy substitution problem – and the resulting distortions are welfare-reducing (and recall that the country is assumed to be small, so there is no terms-of-trade reason for the government to distort its domestic subsidy once its tariff is constrained and no sense in which a "market access preservation rule" could fix this problem). As Brou and Ruta show, relative to an agreement that simply commits the government to free trade, the government is better off under an agreement that also imposes explicit rules on the use of domestic subsidies, because only under such a more complete trade agreement can policy credibility with respect to special interests be achieved.

As Brou and Ruta (2013) demonstrate, their model is capable of providing a commitment-theory based explanation of some of the important features for handling domestic subsidies that are contained in the WTO SCM agreement and that the terms-of-trade theory has difficulty explaining. And in particular, the findings of Brou and Ruta can provide a rationale for the need to pursue deep integration with regard to behind-the-border NTMs.[29]

[28] Limao and Tovar (2011) also study the role of trade agreements as commitment devices when governments have both tariffs and behind-the-border NTMs at their disposal, but their focus is on the possibility that international commitments to lower tariffs will impact the use of behind-the-border NTMs, and on whether tariff agreements can still be attractive to governments when these impacts are present. Unlike Brou and Ruta (2013), Limao and Tovar do not consider the possibility that international commitments might be extended to cover behind-the-border NTMs, and the way in which this extension might best be designed.

[29] DeRemer (2011) provides an alternative "international externality" rationale for deep integration, and in particular for the evolution of GATT/WTO subsidy rules in this direction. Working in a setting characterized by monopolistic competition, trade taxes and trade costs where entry is fixed but for an entry subsidy from the government, DeRemer argues that the kinds of market-access assurance rules incorporated in GATT do not prevent international policy externalities from being transmitted in this setting and so cannot enable countries to achieve efficient policies with shallow integration.

### 4.3. The Offshoring Theory

It is well-documented that modern trade flows are dominated by trade in intermediate inputs, many of which appear to be highly specialized to their intended use, and that this has not always been so (see, for example, the discussion in Antras and Staiger, 2012a). This rise in the prominence of "offshoring" raises the question whether the traditional approach to trade liberalization as embodied in the rules and norms of the GATT/WTO, crafted at a time when the nature of trade was quite different than it is today, is still appropriate in the world of today.

Recently, Antras and Staiger (2012a, 2012b) ask this question and suggest a provocative answer: if offshoring can be seen as changing the nature of international price determination from one governed by a standard market-clearing mechanism to one that is described by a collection of bilateral bargains between foreign suppliers and domestic buyers, then the rise in offshoring will require fundamental changes in the WTO's approach to trade liberalization if that institution is to remain effective. In the next two sections I discuss the implications of offshoring for the treatment of border and behind-the-border NTMs in trade agreements.

#### 4.3.1. Border NTMs

Whether offshoring has strong implications for the treatment of border NTMs (such as export subsidies) that would differ from those of the terms-of-trade theory is not known at this time. However, as I demonstrate in the next section, some striking implications of offshoring for the treatment of NTMs in trade agreements come in the context of behind-the-border measures. In light of these implications, exploring the treatment of border NTMs in the presence of offshoring seems like a promising area of further research.

#### 4.3.2. Behind-the-Border NTMs

To illustrate the implications of offshoring for the treatment of behind-the-border NTMs in trade agreements, I now introduce further changes to the variant of the model of Staiger and Sykes (2011) developed in section 4.1.2 above. Specifically, I now assume that individual pairs of foreign exporters and domestic importers bargain over the international price at which the traded good is exchanged between them, along the lines of Antras and Staiger (2012a, 2012b). As in Antras and Staiger, the model I describe here is meant to highlight and capture in a simple way the growing importance of the relationship-specific nature of trade between importers and their specialized suppliers.

Antras and Staiger (2012a) work in a setting in which the supply of a specialized input is offshored, providing a natural environment for the study of relationship-specific trade. Here, in order to make minimal changes to the framework of Staiger and Sykes (2011) within which the findings presented in earlier sections were derived, I follow Antras and Staiger (2012b) and do not introduce trade in inputs but instead simply assume that a domestic importer imports a specialized good from abroad for sale on the domestic market, and that the international price at which this good is exchanged is determined through bilateral bargaining between the domestic importer and the foreign exporter/supplier. In this setting, I show that now both the tariff *and* behind-the-border NTMs are set inefficiently in the Nash equilibrium (confirming related findings by Antras and Staiger). I then offer an interpretation of the implications of these findings for the treatment of behind-the-border NTMs in trade agreements when offshoring is present.[30]

In particular, I continue to assume that domestic demand ($D(P)$) and domestic supply ($S = q - \phi(r)$) are exactly as in the model of section 4.1.2 above, and I continue to make the same assumptions about the available policies (i.e., the domestic country has $\tau$, $t$, $r$ and $\rho$ at its disposal while the foreign country is passive in this industry). But now I assume that there is a single domestic importer who acts like a monopolist in the domestic market facing a "competitive fringe" of domestic suppliers. As for the foreign exporters faced by the monopoly importer, there are now two interesting possibilities that might be considered.

A first possibility is that the monopoly importer faces a competitive foreign export supply, given by $S^* = q^* - \phi^*(\rho)$ just as before in the model of section 4.1.2. In this case, there is domestic market power, but otherwise nothing has changed from the earlier setup. It can be confirmed (along the lines of Bagwell and Staiger, 2002, Ch. 9, Bagwell and Staiger, 2012b and Antras and Staiger, 2012b) that all of the results from section 4.1 continue to apply in this market-power-augmented setup.

A second possibility is that the monopoly importer faces a single foreign exporter. It is this possibility that I focus on here. Specifically, I adopt an incomplete contracts setting (along the lines of Antras and Staiger, 2012a), and I assume that to successfully make sales in the domestic market, the foreign exporter must first invest in production and then (Nash) bargain over the

[30] As Antras and Staiger (2012b) emphasize, the key feature of the economy needed for results of the kind I describe below is that international prices are determined by bilateral bargaining rather than by market clearing mechanisms, and the rise of offshoring is just one plausible way in which the former method of price determination may have become increasingly prominent in recent decades.

price – the *international* price – at which it sells its production to the domestic importer. I take the good under consideration to be specialized for the domestic market and worthless if not sold there, and I assume that the importer has no alternative source of supply: hence the outside option of both the importer and the exporter is zero. For simplicity, I also now assume that the unit cost of foreign production is $1 + \phi^*(\rho)$. The decisions of this importer-exporter pair imply an import quantity $x^*$ that together with the domestic competitive-fringe supply response then determines total supply in the domestic market.

I now describe the structure of the bilateral importer-exporter relationship in detail. I assume that all government policies are fixed in advance of the start of the following sequence of events:

**stage 1.** The foreign exporter decides on the amount $x^*$ to be produced (at marginal cost of $1 + \phi^*(\rho)$).

**stage 2.** The foreign exporter and the domestic importer (symmetric Nash) bargain over the price at which the good will change hands. Failure to reach agreement leaves both partners with their zero outside option.

**stage 3.** The domestic importer imports the quantity $x^*$ from the foreign exporter, payments agreed in *stage* 2 are settled, and the domestic importer sells $x^*$ on the domestic market at the domestic market clearing price (with taxes collected at the time of importation and sale on the domestic market).

To analyze the outcome of this 3-stage game, I consider first the determination of the domestic producer price $q$ given a level of imports $x^*$. With the supply of the domestic competitive fringe given by $q - \phi(r)$, domestic demand given by $D(P)$, and the relationship between the domestic consumer price $P$ and the domestic producer price $q$ given by $P = q + t$, domestic market clearing determines the domestic producer price according to

$$x^* + q - \phi(r) = D(q + t), \tag{4.33}$$

which implicitly defines $\tilde{q}(x^*, r, t)$. The following derivative properties may be obtained from total differentiation of (4.33):

$$\begin{aligned}\frac{\partial \tilde{q}}{\partial x^*} &= \frac{1}{D'(\tilde{q}(x^*,r,t)+t)-1} < 0, \\ \frac{\partial \tilde{q}}{\partial t} &= \frac{-D'(\tilde{q}(x^*,r,t)+t)}{D'(\tilde{q}(x^*,r,t)+t)-1} < 0, \\ \frac{\partial \tilde{q}}{\partial r} &= \frac{-\phi'(r)}{D'(\tilde{q}(x^*,r,t)+t)-1} > 0.\end{aligned} \tag{4.34}$$

Consider now the subgame perfect equilibrium of the 3-stage game outlined above. First, if the domestic importer and foreign exporter reach agreement in stage 2, the importer can offer the quantity $x^*$ for sale on the domestic market and make revenues net of trade taxes equal to $[\tilde{q}(x^*,r,t)-\tau]\cdot x^*$, whereas disagreement in stage 2 results in both the importer and the exporter receiving their outside option of zero. Hence, given the quantity $x^*$ it follows that in the symmetric Nash bargain of stage 2 the domestic importer and the foreign exporter split the bargaining surplus and each receives $\frac{1}{2}[\tilde{q}(x^*,r,t)-\tau]\cdot x^*$. For the domestic importer, its share of the bargaining surplus is also its profits, and I record these profits (conditional on $x^*$) for future use:

$$\pi = \frac{1}{2}[\tilde{q}(x^*,r,t)-\tau]\cdot x^*. \tag{4.35}$$

Now consider the foreign exporter's output choice in stage 1. Recalling that the unit cost of production for the foreign exporter is $1+\phi^*(\rho)$, the foreign exporter chooses $x^*$ to maximize its profits, which are given by

$$\pi^* = \left(\frac{1}{2}[\tilde{q}(x^*,r,t)-\tau]-[1+\phi^*(\rho)]\right)\cdot x^*. \tag{4.36}$$

Using (4.36) and (4.34), the chosen $\hat{x}^*(r,\rho,t,\tau)$ is therefore implicitly defined by the first order condition

$$\frac{1}{2}[\tilde{q}(x^*,r,t)-\tau+\frac{x^*}{D'(\tilde{q}(x^*,r,t)+t)-1}]-[1+\phi^*(\rho)]=0. \tag{4.37}$$

It is direct to confirm that the second-order condition implies $2(D'-1)^2-\hat{x}^*\cdot D''>0$, which is satisfied provided that demand is not too convex (i.e., $D''$ not too large and positive). In fact, for simplicity I impose the stronger assumption that demand is neither too convex nor too concave (i.e., $|D''|$ not too large), thereby ensuring that the impact on $\hat{x}^*$ of each policy takes the intuitive sign, as I now record:

$$\begin{aligned}
\frac{\partial \hat{x}^*}{\partial r} &= \phi'[\frac{(D'-1)^2 - \hat{x}^* \cdot D''}{2(D'-1)^2 - \hat{x}^* \cdot D''}] > 0, \qquad (4.38)\\
\frac{\partial \hat{x}^*}{\partial \rho} &= \frac{2\phi^{*\prime} \cdot (D'-1)^3}{2(D'-1)^2 - \hat{x}^* \cdot D''} < 0,\\
\frac{\partial \hat{x}^*}{\partial t} &= \frac{D' \cdot (D'-1)^2 - \hat{x}^* \cdot D''}{2(D'-1)^2 - \hat{x}^* \cdot D''} < 0,\\
\frac{\partial \hat{x}^*}{\partial \tau} &= \frac{(D'-1)^3}{2(D'-1)^2 - \hat{x}^* \cdot D''} < 0.
\end{aligned}$$

Using $\hat{x}^*(r, \rho, t, \tau)$ as implicitly defined by (4.37), I can now express the equilibrium domestic producer price as a function of government policies:

$$\hat{q}(r, \rho, t, \tau) = \tilde{q}(\hat{x}^*(r, \rho, t, \tau), r, t).$$

For future use, I record the following derivatives whose signs are intuitive and again follow from my assumption that $|D''|$ is not too large:

$$\begin{aligned}
\frac{\partial \hat{q}}{\partial r} &= -\phi'[\frac{(D'-1)}{2(D'-1)^2 - \hat{x}^* \cdot D''}] > 0, \qquad (4.39)\\
\frac{\partial \hat{q}}{\partial \rho} &= \frac{2\phi^{*\prime} \cdot (D'-1)^2}{2(D'-1)^2 - \hat{x}^* \cdot D''} > 0,\\
\frac{\partial \hat{q}}{\partial t} &= -[\frac{D' \cdot (D'-1) - \hat{x}^* \cdot D''}{2(D'-1)^2 - \hat{x}^* \cdot D''}] < 0,\\
\frac{\partial \hat{q}}{\partial \tau} &= \frac{(D'-1)^2}{2(D'-1)^2 - \hat{x}^* \cdot D''} > 0.
\end{aligned}$$

And finally, using (4.35) and (4.36), the home and foreign profits may be written as functions of government policies:

$$\pi(r, \rho, t, \tau) = \frac{1}{2}[\hat{q}(r, \rho, t, \tau) - \tau] \cdot \hat{x}^*(r, \rho, t, \tau),$$

$$\pi^*(r, \rho, t, \tau) = \left(\frac{1}{2}[\hat{q}(r, \rho, t, \tau) - \tau] - [1 + \phi^*(\rho)]\right) \cdot \hat{x}^*(r, \rho, t, \tau).$$

The *international ("world") price* of the product under consideration (i.e., the untaxed price negotiated in stage 2 for the exchange between the foreign exporter and the domestic importer), which I now denote by $\hat{q}^w$, is given by $\hat{q}^w = \pi^*/\hat{x}^* + (1 + \phi^*(\rho))$, which can in turn be written as

$$\hat{q}^w = \frac{1}{2}[\hat{q}(r, \rho, t, \tau) - \tau] \equiv \hat{q}^w(r, \rho, t, \tau). \qquad (4.40)$$

The remaining equilibrium prices may then be defined as follows:

$$\begin{aligned}\hat{P}(r,\rho,t,\tau) &= \hat{q}(r,\rho,t,\tau)+t,\\ \hat{q}^*(r,\rho,t,\tau) &= \hat{q}^w(r,\rho,t,\tau)=\frac{1}{2}[\hat{q}(r,\rho,t,\tau)-\tau],\end{aligned}$$

where observe that the absence of a foreign trade tax instrument again ensures $\hat{q}^* = \hat{q}^w$ as in the model of section 4.1.2. And analogously to before, I now define the "raw" prices of the foreign export good by

$$\begin{aligned}\hat{q}_0^*(r,\rho,t,\tau) &\equiv \hat{q}^*(r,\rho,t,\tau)-\phi^*(\rho), \text{ and} \\ \hat{q}_0^w(r,\rho,t,\tau) &\equiv \hat{q}^w(r,\rho,t,\tau)-\phi^*(\rho).\end{aligned} \tag{4.41}$$

Welfare in the domestic country is again given by the usual partial equilibrium measure of consumer surplus plus producer surplus – and now also domestic profits – plus tax revenue, and then subtracting off the disutility of the consumption-generated pollution. Domestic consumer surplus ($CS$) and producer surplus ($PS$), are given by

$$CS=\int_{\hat{P}}^{\alpha} D(P)dP \equiv CS(\hat{P}(r,\rho,t,\tau)), \text{ and } PS=\int_{\phi(r)}^{\hat{q}}[q-\phi(r)]dq \equiv PS(r,\hat{q}(r,\rho,t,\tau)),$$

while tax revenue is given by

$$TR = t\cdot D(\hat{P}(r,\rho,t,\tau))+\tau\cdot\hat{x}^*(r,\rho,t,\tau)\equiv TR(r,\rho,t,\tau).$$

Finally, the utility cost of domestic pollution ($Z$) is given by

$$Z=\theta(r)\cdot[\hat{q}(r,\rho,t,\tau)-\phi(r)]+\theta^*(\rho)\cdot\hat{x}^*(r,\rho,t,\tau)\equiv Z(r,\rho,t,\tau).$$

With these definitions, domestic welfare $W$ may now be expressed as[31]

$$\begin{aligned}&CS(\hat{P}(r,\rho,t,\tau))+PS(r,\hat{q}(r,\rho,t,\tau))+\pi(r,\rho,t,\tau)+TR(r,\rho,t,\tau)-Z(r,\rho,t,\tau) \\ \equiv\ & W(r,\rho,t,\tau).\end{aligned} \tag{4.42}$$

Turning now to foreign welfare, recall that the absence of foreign demand for the product under consideration and of foreign pollution, together with the assumed policy passivity of the foreign government, makes the foreign welfare measure very simple: foreign welfare is given by the profits of the foreign exporter. Hence

$$W^*=\pi^*(r,\rho,t,\tau)\equiv W^*(r,\rho,t,\tau). \tag{4.43}$$

[31] I do not express welfare in terms of non-tax policies and prices as I did in section 4.1.2, because as I will show below the terms-of-trade structure that such a representation of welfare was useful for illuminating does not apply in the offshoring environment that I consider here.

**Efficient Policies** With the "offshoring" variant of the model of section 4.1.2 described, I now turn to characterize the jointly efficient policy choices in this environment. As before, after characterizing and interpreting the efficient policy choices I will subsequently compare these policies to the noncooperative policy choices that the domestic government would make absent any international agreement, and thereby shed light on the problem that a trade agreement must solve in this environment if it is to move governments from inefficient Nash choices to the efficiency frontier.

Recalling once more that the domestic government has at its disposal four policy instruments (and the foreign government has none), there are four first-order conditions that must hold at the choices of these policies that maximize the sum of domestic and foreign welfare as given in (4.42) and (4.43) respectively. Using the derivatives in (4.38) and (4.39) and solving these four equations for the efficient levels of the four policies yields

$$\begin{aligned} \tau^E &= \frac{\hat{x}^{*E}}{D'(\hat{P}^E)-1} - [1+\phi^*(\rho^E)] + [\theta^*(\rho^E) - \theta(r^E)], \\ t^E &= \theta(r^E), \\ -\theta'(r^E) &= \phi'(r^E), \text{ and} \\ -\theta^{*\prime}(\rho^E) &= \phi^{*\prime}(\rho^E), \end{aligned} \tag{4.44}$$

where I use $\hat{x}^{*E}$ and $\hat{P}^E$ to denote the equilibrium magnitudes of these variables evaluated at efficient policies. And in the symmetric benchmark setting in which the functions $\phi$ and $\phi^*$ are identical and the functions $\theta$ and $\theta^*$ are identical, (4.44) reduces to

$$\begin{aligned} \tau^E &= \frac{\hat{x}^{*E}}{D'(\hat{P}^E)-1} - [1+\phi^*(\rho^E)], \\ t^E &= \theta(r^E), \\ -\theta'(r^E) &= \phi'(r^E), \text{ and} \\ \rho^E &= r^E. \end{aligned} \tag{4.45}$$

Comparing the efficient policies in (4.44) and (4.45) with those of section 4.1.2 as contained in (4.28) and (4.29) where the international price is determined by market clearing, it is apparent that the only difference in efficient policies when international prices are determined by bilateral bargaining is in the efficient setting of the tariff. In particular, as the first line of (4.44) indicates, in addition to serving a Pigouvian role ($[\theta^*(\rho^E) - \theta(r^E)]$) as in (4.28) before, the efficient tariff now also offsets the market power wielded by the foreign exporter when it chooses its export volume (a subsidy to imports in the amount $\frac{\hat{x}^{*E}}{D'(\hat{P}^E)-1}$) and corrects the "holdup" problem associated with the foreign exporter's ex-ante investment decision (a subsidy to imports in the amount $-[1+\phi^*(\rho^E)]$). Facing the efficient tariff $\tau^E$, the foreign export volume is then determined by (4.37) to satisfy $\hat{q}^E = [1+\phi^*(\rho^E)] + [\theta^*(\rho^E) - \theta(r^E)]$: in words, the efficient tariff level induces a level of foreign exports $\hat{x}^{*E}$ such that the marginal cost of the last unit produced by the competitive fringe of domestic suppliers ( $\hat{q}^E$) is equal to the cost of foreign supply ($[1+\phi^*(\rho^E)]$) adjusted for any difference in per-unit pollution level generated by consumption of the foreign and domestically produced good $[\theta^*(\rho^E) - \theta(r^E)]$.

Aside from the differences in the levels of the efficient tariff, the efficient levels of intervention for the other instruments as depicted in (4.44) and (4.45) are all unchanged relative to (4.28) and (4.29) by the presence of bilateral bargaining between the domestic importer and the foreign exporter/supplier. In particular, as before, the efficient domestic consumption tax is set at a Pigouvian level that reflects the externality associated with consumption of a unit of the domestically produced good. And as before, the efficient standards applied to domestic and imported goods must equate the marginal per unit benefit of pollution reduction that comes with a slightly tighter standard with the marginal per unit cost of compliance with the tighter standard.

**Noncooperative Policies** Next I turn to characterize the noncooperative (Nash) policy choices of the domestic country (recall again that the foreign country is assumed passive in this industry). Using the domestic welfare expression given in (4.42) and the derivatives in (4.38) and (4.39), the noncooperative choices of $\tau$, $t$, $r$ and $\rho$ must satisfy the four first-order conditions for maximization of $W$. Denoting by $\hat{x}^{*N}$ and $\hat{P}^N$ the equilibrium magnitudes of these variables evaluated at non-cooperative (Nash) policies, these first-order conditions can be manipulated to yield

$$\begin{aligned}
\tau^N &= -\frac{\pi^N}{\hat{x}^{*N}} - \frac{\hat{x}^{*N}}{D'(\hat{P}^N)-1} + [\theta^*(\rho^N) - \theta(r^N)], \qquad (4.46)\\
t^N &= \theta(r^N) + \frac{\hat{x}^{*N}\cdot D''(\hat{P}^N)}{2D'(\hat{P}^N)\cdot(D'(\hat{P}^N)-1)^2},\\
-\theta'(r^N) &= \phi'(r^N), \text{ and}\\
-\theta^{*\prime}(\rho^N) &= \phi^{*\prime}(\rho^N).
\end{aligned}$$

And in the symmetric benchmark setting (4.46) reduces to

$$\begin{aligned}
\tau^N &= -\frac{\pi^N}{\hat{x}^{*N}} - \frac{\hat{x}^{*N}}{D'(\hat{P}^N) - 1}, \\
t^N &= \theta(r^N) + \frac{\hat{x}^{*N} \cdot D''(\hat{P}^N)}{2D'(\hat{P}^N) \cdot (D'(\hat{P}^N) - 1)^2}, \\
-\theta'(r^N) &= \phi'(r^N), \text{ and} \\
\rho^N &= r^N.
\end{aligned} \tag{4.47}$$

Comparing (4.46) and (4.47) to their analogues (4.31) and (4.32) in section 4.1.2, it is apparent that the conditions determining the Nash regulatory policies are the same. But the conditions determining the Nash tariff and domestic consumption tax are now different.

Referring to the general case of (4.46), the level of the Nash tariff now reflects three forces. First, $\tau^N$ is lower when the importer's profit per unit imported ($\frac{\pi^N}{\hat{x}^{*N}}$) is higher, because with $\frac{\partial \hat{x}^*}{\partial \tau} < 0$ by (4.38) a marginally higher tariff is then more costly to the domestic country in terms of reduced domestic profits. Second, $\tau^N$ is higher when the market power wielded by the foreign exporter ($-\frac{\hat{x}^{*N}}{D'(\hat{P}^N)-1}$) is higher, because more of the incidence of the tariff can then be imposed on the foreign country and extracted as tariff revenue. And finally, $\tau^N$ serves the now-familiar Pigouvian role ($[\theta^*(\rho^N) - \theta(r^N)]$).

Turning to the Nash domestic consumption tax, its level is now determined by two forces: first, its Pigouvian role ($\theta(r^N)$); and second, an add-on term ($\frac{\hat{x}^{*N} \cdot D''(\hat{P}^N)}{2D'(\hat{P}^N) \cdot (D'(\hat{P}^N)-1)^2}$) whose sign is opposite the sign of $D''$. This second term can be understood intuitively as follows.

First, note from (4.37) that the domestic country can alter its tariff and domestic consumption tax in a manner that leaves the equilibrium trade volume $\hat{x}^*$ unaffected. Using (4.37), the precise adjustment in $\tau$ that must accompany a small increase in $t$ to hold $\hat{x}^*$ fixed is given by

$$\frac{d\tau}{dt}|_{d\hat{x}^*=0} = -[\frac{D' \cdot (D'-1)^2 - \hat{x}^* \cdot D''}{(D'-1)^3}] < 0,$$

where the inequality follows under my maintained assumption that the magnitude of $D''$ is not too large. Next observe that these tax adjustments impact foreign profits according to

$$\frac{d\pi^*(r, \rho, t, \tau(t)|_{d\hat{x}^*=0})}{dt} = -\frac{(\hat{x}^*)^2 \cdot D''}{2(D'-1)^3},$$

whose sign is the same as the sign of $D''$. And finally, it is direct to confirm that, beginning from the efficient domestic consumption tax $t^E = \theta(r^E)$, the impact of these tax adjustments on domestic welfare is given by

$$\frac{dW(r,\rho,t,\tau(t)|_{d\hat{x}^*=0})}{dt}|_{t^E=\theta(r^E)} = \frac{(\hat{x}^*)^2\cdot D''}{2(D'-1)^3},$$

which takes a sign opposite to the sign of $D''$. Evidently, when $D''$ is positive (negative) and beginning from $t^E$, the domestic country can reduce foreign profits and convert this foreign loss into its own welfare gain by reducing (increasing) the domestic consumption tax from its efficient level and adjusting the tariff so as to preserve the equilibrium volume of foreign exports $\hat{x}^*$. And as (4.46) indicates, what eventually stops this adjustment in $t$ away from its efficient level is the cost of the domestic demand distortion (as reflected in the magnitude of $D'(\hat{P})$) that is induced by the changes in $t$.

Finally, notice from (4.40) and (4.41) that foreign profits may be written as $\pi^* = [\hat{q}_0^w - 1]\cdot\hat{x}^*$, and so the maneuver I have described just above – wherein the domestic country uses adjustments in $t$ and $\tau$ to hold $\hat{x}^*$ fixed while reducing $\pi^*$ for domestic benefit – amounts to a maneuver to manipulate the terms of trade in its favor (i.e., to reduce $\hat{q}_0^w$). However, while this points to terms-of-trade manipulation as again the root of the problem that leads to inefficiencies in the noncooperative Nash equilibrium, it should nevertheless be clear that the policies used to manipulate the terms of trade in the presence of offshoring are more complex than would be expected according to the terms-of-trade theory.[32]

**The Problem for a Trade Agreement to Solve** I now turn to a comparison of the efficient policies characterized in section 4.3.2 with the noncooperative policies characterized in section 4.3.2, in order to identify and understand the problem that a trade agreement must solve in this "offshoring" environment if it is to move governments from inefficient Nash choices to the efficiency frontier. This comparison again turns out to be illuminating, and in the context of the present model (as in Antras and Staiger, 2012a, 2012b), it leads to a striking result.

Consider first the tariff. It can be shown that $\tau^N > \tau^E$: the Nash tariff is again inefficiently high. Simply put, it is not in the unilateral interests of the domestic country to offer import subsidies so as to counter the inefficiencies associated with foreign market power and the holdup problem, as international efficiency concerns would dictate. On the contrary, as (4.46) indicates,

[32] In fact, Antras and Staiger (2012a) establish formally that when political economy motivations are absent (as is the case here), the problem for a trade agreement to fix in the presence of offshoring can be given a terms-of-trade interpretation. However, they also show that this interpretation no longer applies once political economy motives are introduced.

the domestic country has a unilateral incentive to tax imports and shift some of the incidence of this tax on to the foreign exporter, an incentive that is kept in check only by the trade volume reductions that come with the higher tariff. This finding is analogous to that derived in the context of the terms-of-trade theory in section 4.1.2

Now consider the domestic consumption tax. Recalling that according to the terms-of-trade theory the domestic consumption tax is not distorted in the Nash equilibrium from its efficient level, we now have a striking finding: in the presence of offshoring, where international prices are determined by bilateral bargaining rather than market clearing conditions, the Nash level of the domestic consumption tax is distorted from its internationally efficient level. That is, as a comparison of (4.44) and (4.46) reveals, $t^N$ is greater than or less than its efficient Pigouvian level as $D''$ is negative or positive.[33] Hence, behind-the-border NTMs can no longer be presumed to be set at efficient levels in the noncooperative Nash equilibrium in the presence of offshoring.

Recalling now that it was the terms-of-trade theory's prediction of efficient Nash choices for behind-the-border NTMs that I interpreted as lending support to the kind of shallow integration that characterizes the GATT approach, the result just above indicates that the rise of offshoring, by changing the nature of international price determination, undercuts this support, and it points instead to the possibility that deep integration must now be achieved for effective trade agreements. In this way, the rise in offshoring may necessitate fundamental changes in the WTO's approach to behind-the-border NTMs.[34]

Interestingly, at least in the model considered here, the inefficiency of noncooperative behind-the-border NTMs in the presence of offshoring is contained to domestic tax policies, and does not spread to domestic non-tax regulations. This can be seen by noting from the bottom two lines in (4.44) and (4.46) that the Nash standards choices continue to satisfy the same conditions as the efficient standards choices, and indeed the Nash standards correspond to the efficient standards: $r^N = r^E$ and $\rho^N = \rho^E$. Hence, at least in this model and where product level consumption taxes are available, the presence of offshoring and the implications for international price determination that offshoring implies lead to inefficient noncooperative

[33] The role of my generalization of the model of Staiger and Sykes (2011) to non-linear demands can now be appreciated, since with linear demands $D'' = 0$ and the inefficiency identified here would not arise. The role of the curvature of demand plays an analogous role in the model of offshoring I develop here to the role of the curvature of the final-good production function in Antras and Staiger (2012a).

[34] See Antras and Staiger (2012a) for a discussion of this point as well as additional ways in which offshoring may change the role for trade agreements, and of the possibility that the recent proliferation of PTAs may in part be an institutional response to offshoring triggered by the WTO's inability to facilitate deep integration for its member governments.

choices for domestic tax instruments, but not for domestic non-tax policies.

A finding that is somewhat related to this last point is reported by Staiger and Sykes (2011) in the context of the terms-of-trade theory. They show that when the tariff is constrained in a trade agreement and when domestic taxes and non-tax regulations are constrained to satisfy a "national treatment" restriction, the domestic consumption tax will be distorted but the non-tax regulations will not.[35] However, as Staiger and Sykes observe, for a variety of reasons the ability of governments to impose product-specific consumption taxes appears to be quite limited in practice. Hence, it is important to note that this last point depends on the availability of such taxes. In the next section, I show that when a (product-specific) consumption tax is unavailable to the domestic government, the inefficiency of noncooperative Nash behind-the-border NTMs spreads to non-tax regulatory policies.

**Consumption Tax Unavailable** Thus far I have adopted the view that product-specific consumption taxes are available to the domestic government. As might be expected, the ability to impose product-specific consumption taxes at the same level of detail as the tariff and product standards is important for the formal results above, and in particular for the result that in the presence of offshoring, among all of the possible behind-the-border NTMs, only domestic tax instruments are distorted in the noncooperative Nash equilibrium.

In practice, however, governments are not typically observed to impose detailed and distinct product-specific consumption taxes across a wide swath of products (gasoline is an obvious exception). Rather, the norm in practice tends to be uniform sales (or value-added) taxes at various levels of government. Motivated by this observation, I now illustrate briefly how the "offshoring" results reported above must be altered if the domestic government does not have a (product-specific) consumption tax at its disposal.[36] For simplicity, and because it will not impact the point that I emphasize here, I also assume that consumption of the domestically produced good no longer has an externality associated with it, and that there is no regulatory policy imposed on the (clean) domestic production. That is, I now assume $t \equiv 0$, $r \equiv 0$ and $\theta \equiv 0$, so that I may concentrate on the domestic-country policies $\tau$ and $\rho$. In this context, I repeat my comparison of efficient and noncooperative policies to assess the efficiency properties

[35] Non-tax regulatory policies are not considered in Antras and Staiger (2012a, 2012b), so there is no analogous result reported in those papers.

[36] No changes would result in the (non-consumption-tax) findings I report from the terms-of-trade theory if the consumption tax is assumed unavailable to the domestic government (see note 22).

of the non-tax behind-the-border regulatory policy $\rho$ in the noncooperative Nash equilibrium.

Proceeding as above, it is direct to demonstrate that when $t \equiv 0$, $r \equiv 0$ and $\theta \equiv 0$, the efficient domestic tariff and regulatory policies (recall once more that the foreign government is passive) satisfy

$$\begin{aligned} \tau^E &= \frac{\hat{x}^{*E}}{D'(\hat{P}^E) - 1} - [1 + \phi^*(\rho^E)] + \theta^*(\rho^E), \quad \text{and} \\ -\theta^{*\prime}(\rho^E) &= \phi^{*\prime}(\rho^E). \end{aligned} \tag{4.48}$$

The interpretation of (4.48) is analogous to that of (4.44) as described in section 4.3.2. And proceeding as before, it can be shown that the noncooperative Nash policies are now described by

$$\begin{aligned} \tau^N &= -\frac{\pi^N}{\hat{x}^{*N}} - \frac{\hat{x}^{*N}}{D'(\hat{P}^N) - 1} + \theta^*(\rho^N) + \frac{(\hat{x}^{*N})^2 \cdot D''}{(D'-1)^3}, \quad \text{and} \\ -\theta^{*\prime}(\rho^N) &= \phi^{*\prime}(\rho^N)[1 - \frac{(D'-1)^2}{2(D'-1)^2 - \hat{x}^{*N} \cdot D''}]. \end{aligned} \tag{4.49}$$

Notice that relative to (4.46), (4.49) implies that the Nash tariff is adjusted by an add-on term $(\frac{(\hat{x}^{*N})^2 \cdot D''}{(D'-1)^3})$ whose sign is opposite the sign of $D''$: this compensates for the lack of an available domestic consumption tax $t$. But the important difference to note is revealed by comparing the second lines of (4.48) and (4.49): it is direct to confirm that this comparison implies $-\theta^{*\prime}(\rho^N) < -\theta^{*\prime}(\rho^E)$, which in turn indicates that $\rho^N > \rho^E$. In words, in the presence of offshoring and when product-level domestic consumption taxes are unavailable to the domestic government, the noncooperative level of the domestic regulation applied to foreign exports is set higher than would be efficient. Hence, in this limited-domestic-tax-instrument setting, offshoring and the bilateral bargaining over international prices that is associated with it results in inefficiencies in the noncooperative Nash equilibrium that extend beyond border measures (tariffs) to apply as well to behind-the-border non-tax regulatory policies.

## 5. Conclusion

In this paper I have attempted to sketch out the rough contours of the challenge faced by the WTO in dealing the NTMs. As I have described, the GATT adopted a particular and minimalist "shallow-integration" approach to handling NTMs. That approach evolved over time, and with the creation of the WTO, the handling of NTMs evolved further still. I have considered the economic logic to GATT's shallow-integration approach from the perspective of three theories of trade agreements: the terms-of-trade theory, the commitment theory, and the offshoring theory. I have shown that subject to certain caveats GATT's approach resonates well with the terms-of-trade theory of trade agreements. Along the way I have provided a terms-of-trade interpretation of the WTO's Trade Facilitation Agreement. Some of the changes in the treatment of NTMs toward a deeper form of integration that were ushered in with the creation of the WTO are less supported by the terms-of-trade theory, but may find some support in the commitment theory of trade agreements. Finally, I have asked: Is the GATT/WTO approach to the treatment of NTMs adequate for the world economy of today? Viewed through the lens of the offshoring theory of trade agreements, I have suggested that the answer to this question may be "No" if the rise in offshoring can be taken to imply that the predominate mechanism for international price determination has changed.

From this perspective I have suggested that when it comes to handling NTMs, and specifically the choice between shallow and deep approaches to integration, the key questions for the WTO appear to be two: (1) Is it the terms-of-trade problem or the commitment problem (or both, or neither) that WTO member governments seek to solve with their WTO membership?; and (2) Is it market clearing or offshoring/bilateral bargaining that is now the most prominent mechanism for the determination of international prices?

Regarding the first question, empirical evidence seems to support the terms-of-trade theory as identifying the main purpose of the GATT/WTO (see Bagwell, Bown and Staiger, 2016, for a recent review of this evidence), but more evidence on this important question is needed. Regarding the second question, I am not aware of any systematic evidence that would help provide an answer.[37] But it seems likely that answering this second question will be a key step in identifying the best way forward on NTMs for the WTO.

Finally, as I noted in the Introduction, the appropriate handling of NTMs in trade agreements may have particular importance for developing countries in light of evidence that the most prevalent form of NTMs faced by developing country exporters in their attempts to export into developed-country markets are behind-the-border measures. These are the NTMs that are at the heart of the shallow/deep integration question, and in this sense developing countries may have the biggest stake in getting the answer to this question right. In this light, extend-

[37] That said, some indirect evidence that hints at the growing relevance of the offshoring/bilateral bargaining perspective is provided in Antras and Staiger (2012a).

ing the simple frameworks I have outlined above to better reflect the particular experience of developing countries seems an especially important goal of future research.

## References


Antras P, Staiger RW. 2012a. Offshoring and the role of trade agreements. *American Economic Review* 102(7): 3140-3183

Antras P, Staiger RW. 2012b. Trade Agreements and the Nature of International Price Determination. *American Economic Review Papers and Proceedings 102(3),* May: 470-6

Bagwell, K, C Bown, Staiger RW. 2016. Is the WTO Passe? *Journal of Economic Literature* 54(4): 1125-1231

Bagwell K, Staiger RW, Sykes AO. 2013. Border Instruments. In H Horn and PC Mavroidis (eds) *Legal and Economic Principles of World Trade Law.* American Law Institute and Cambridge University Press

Bagwell K, Staiger RW. 1999. An economic theory of GATT. *American Economic Review* 89: 215-48

Bagwell K, Staiger RW. 2001a. Strategic trade, competitive industries and agricultural trade disputes. *Economics and Politics* 13: 113-28

Bagwell K, Staiger RW. 2001b. Domestic policies, national sovereignty and international economic institutions. *The Quarterly Journal of Economics* 116: 519-62

Bagwell K, Staiger RW. 2002. *The Economics of the World Trading System.* Cambridge, MA: The MIT Press

Bagwell K, Staiger RW. 2005. Multilateral trade negotiations, bilateral opportunism and the rules of GATT/WTO. *Journal of International Economics* 67: 268-294.

Bagwell K, Staiger RW. 2006. Will international rules on subsidies disrupt the world trading system? *American Economic Review* 96(3): 877-95

Bagwell K, Staiger RW. 2010. The World Trade Organization: Theory and Practice. *Annual Review of Economics*

Bagwell K, Staiger RW. 2011. What do trade negotiators negotiate about? Empirical evidence from the World Trade Organization. *American Economic Review* 101: 1238-73

Bagwell K, Staiger RW. 2012a. The economics of trade agreements in the linear cournot delocation model. *Journal of International Economics* 88(1): 32-46

Bagwell K, Staiger RW. 2012b Profit shifting and trade agreements in imperfectly competitive markets. *International Economic Review* 53(4): 1067-1104

Bagwell, K, Staiger RW. Forthcoming. National Sovereignty in an Interdependent World. *World Trade Evolution: Growth, Productivity and Employment*, Routledge

Bond, Eric W. 2006. Transportation Infrastructure Investments and Trade Liberalization. *The Japanese Economic Review* 57(4): 483-500.

Brou D, Ruta M. 2013. A Commitment Theory of Subsidy Agreements. *BE Journal of Economic Analysis & Policy* 13(1): 239-270

Carmichael C. 1987. The control of export credit subsidies and its welfare consequences. *Journal of International Economics* 23: 1-19

Deardorff AV, Stern RM. 1997. Measurement of Non-tariff Barriers. Economics Department Working Paper, No. 179

DeRemer DR. 2011. The Evolution of International Subsidy Rules. mimeo, Columbia University. November

Fontagne L, Orefice G, Piermartini R, Rocha N. Forthcoming. Product standards and margins of trade: firm-level evidence. *Journal of International Economics*

Gulati S, Roy D. 2008. National Treatment and the Optimal Regulation of Environmental Externalities. *Canadian Journal of Economics* 41: 1445-71

Hoekman B. 2014. The Bali Trade Facilitation Agreement and Rulemaking in the WTO: Milestone, Mistake or Mirage? European University Institute Working Paper RSCAS 2014/102

Hudec RE. 1990. *The GATT Legal System and World Trade Diplomacy.* Second Edition, Salem: Butterworth Legal Publishers

Irwin D, Mavroidis PC, Sykes AO. 2008. *The Genesis of the GATT* (Cambridge University Press)

Jackson JH, Davey WJ, Sykes AO. 1995. *Legal Problems of International Economic Relations, Cases, Materials, and Text.* Third Edition

Johnson HG. 1953-54. Optimum tariffs and retaliation. *Review of Economic Studies* 21: 142-53

Kee HL, Nicita A, Olarreaga M. 2009. Estimating Trade Restrictiveness Indices. *The Economic Journal* 119

Laird S. 1999. Millennium Round Market Access Negotiations in Goods and Services. Paper prepared for a meeting of the International Economics Study Group, Birmingham, 14-16 September

Limao N, Tovar P. 2011. Policy choice: Theory and evidence from commitment via international trade agreements. *Journal of International Economics* 85 (2)

Maggi G, Rodriguez-Clare A. 1998. The value of trade agreements in the presence of political pressures. *Journal of Political Economy* 106: 574-601

Maggi G, Rodriguez-Clare A. 2007. A political-economy theory of trade agreements. *American Economic Review* 97: 1374-1406

Martincus CV, Carballo J, Graziano A. 2015. Customs. *Journal of International Economics* 96(1): 119-37

Matsuyama K. 1990. Perfect equilibria in a trade liberalization game. *American Economic Review* 80: 480-92

Michalopoulos C. 1999. *Trade Policy and Market Access Issues for Developing Countries: Implications for the Millennium Round*. World Bank Washington DC

OECD. 2005. *Looking Beyond Tariffs: The Role of Non-Tariff Barriers in World Trade.* OECD Trade Policy Studies

Potipiti,T. 2012. Import Tariffs and Export Subsidies in the WTO: A Small Country Approach. Unpublished mimeo. Chulalongkorn University

Staiger RW, Sykes AO. 2011. International trade, National Treatment and Domestic Regulation. *Journal of Legal Studies* 40(2)

Staiger RW, Sykes AO. 2017. How important can the non-violation clause be for the GATT/WTO? *American Economic Journal: Microeconomics* 9(2): 149-187

Staiger RW, Tabellini G. 1987. Discretionary trade policy and excessive protection. *American Economic Review* 77: 823-37

Staiger RW, Wolak F. 1994. Measuring Industry Specific Protection: Antidumping in the United States. *Brookings Papers on Economic Activity: Microeconomics.* Volume 1

Sykes AO, 2005. The economics of WTO rules on subsidies and countervailing measures. In *The World Trade Organization: Legal, Economic and Political Analysis. Vol. II*, eds. Appleton A, Macrory P, Plummer M. Springer-Verlag

UNCTAD. 2013. *Non-Tariff Measures to Trade: Economic and Policy Issues for Developing Countries*. Developing Countries in International Trade Studies, United Nations Publication ISSN 1817-1214, New York and Geneva.

WTO. 2011. *World Trade Report 2011.* Geneva

# What's left for the WTO?*

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**Abstract**

Suppose that when addressing the question of "what's left for the WTO?," negotiators relied on the terms-of-trade theory of trade agreements to identify tariff negotiating priorities. This chapter uses the lens of the terms-of-trade theory to investigate three specific areas in which it is frequently alleged that applied tariffs are "too high," the implication being that there are still tariff reductions out there for an agreement like the WTO to facilitate. These three areas include applied tariffs for countries that are not members of the WTO, applied tariffs for WTO members that are unbound, and applied tariffs for WTO members set in the presence of large amounts of tariff binding overhang. As it turns out, these three areas are almost exclusively found to be the trade policies that developing countries themselves impose. I build upon recent developments in the empirical literature to present tentative evidence - some direct, some indirect - that sheds light on each of these three areas. I then draw insights from these results to highlight open and additional policy questions for additional research.

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# 1 Introduction

While the WTO may seem ubiquitous, in reality there have been substantial segments of the international trading system that remain seemingly untouched by its reaches. This chapter utilizes the lens of the terms-of-trade theory of trade agreements and insights from recent empirical developments to investigate three of these areas in particular. First, as of 2013, roughly three dozen countries remained WTO nonmembers. The people living in these countries do not enjoy the basic rights and obligations of the multilateral system for 100 percent of the products that they might trade. Second, another 25 countries have now been full WTO members for more than 20 years and yet their governments have not taken on even the minimal legal commitment of binding the upper limit of their import tariffs for more than two thirds of manufactured products. Third, even for the WTO members that have legally bound their tariffs, another 45 countries have committed to binding rates that convey limited economic meaning. On average, the binding commitments are more than 15 percentage points above these countries' applied MFN tariff rates; put differently, these countries could immediately and permanently raise their applied MFN tariffs by an average of 400 percent with only minimal notification to other WTO members and with no required compensation. Combined, more than 3.5 billion people live under one of these three sets of conditions in what are predominantly developing countries.

I highlight and choose to investigate these three areas given the crossroads at which the WTO found itself, even before the more recent challenges threatening the system.[1] On one hand, trade negotiators seemed to have moved beyond the WTO. The Doha Round was a failure; albeit, its weaknesses may be at least partially laid at the feet of those who established the Doha negotiating agenda in 2001.[2] Many have argued the agenda and approach to be fundamentally ill-fitted to deliver any sort of successful outcome along the lines of what the previous institutional and reciprocal negotiating frameworks that the GATT had repeatedly delivered over eight previous Rounds and more than 50 years of negotiations (Bagwell and Staiger, 2014).[3]

Perhaps more threatening to the stasis that plagued the WTO, however, was that many important WTO members had already turned their negotiating efforts away from the multilateral system and toward something else. This included moving away from the GATT/WTO's historical, "shallow"-integration approach of negotiating over tariffs and market access in favor of the "deeper" integration and direct negotiation over behind-the-border policy instruments through the "mega-regional" negotiations of the Trans-Pacific Partnership (TPP) and Transatlantic Trade and Investment Partnership (T-TIP), as well as a potential Regional Comprehensive Economic Partner-

[1] The United States presented a number of challenges to the WTO by holding up the appointment of WTO Appellate Body members and through the Trump administration's 2018 imposition of tariffs on steel and aluminum under the allegation that they are a threat to American national security (The Economist, 2018.)

[2] The only negotiated tariff reduction taking place under the WTO in the intervening period was for the 201 products arising through the plurilateral, Information Technology Agreement that involved a critical mass of more than 20 WTO members in 2015. Similar negotiations to cut tariffs plurilaterally under an Environmental Goods Agreement have stalled. I will not investigate those products or negotiations here.

[3] Other explorations behind the stalled Doha Round and its ineffectiveness include Martin and Mattoo (2011) and Jones (2010). For a behind-the-scenes perspective of many of the personalities involved, see Blustein (2009).

ship (RCEP) or Free Trade Area of the Asia-Pacific (FTAAP)(Bagwell, Bown and Staiger, 2016).[4] Shifting away from the WTO and toward these mega-regional efforts was at least initially led by both historical champions of the multilateral system, such as the United States, European Union, and Japan, as well as other recent and chief beneficiaries, such as China.[5]

On the other hand, the economics literature has made improved strides toward understanding some of the core microeconomic and institutional underpinnings behind what has facilitated the GATT/WTO's relatively successful achievement of reaching and sustaining levels of import tariffs that were historically low, even despite massive macroeconomic shocks to the system (Bown, 2011a). In particular, the terms-of-trade literature of trade agreements, most closely associated with the theoretical developments introduced by Bagwell and Staiger (1999, 2002), as well as the inaugural empirical work of Broda, Limão and Weinstein (2008), has ushered in a number of recent theoretical and empirical advancements. In Section 2, I survey key aspects of this literature that had significantly helped clarify determinants of trade policy under the multilateral system. Many of these insights interpret the WTO as coordinating policies for countries seeking to address the prisoner's dilemma outcome of terms-of-trade externalities.

One of the primary insights from the theory is that, in order for the GATT/WTO to work at getting significant areas of the global economy to internalize such externalities, it has focused on shallow integration and the reduction of border barriers (tariffs), relied on fundamental principles such as reciprocity, most-favored nation (MFN) treatment and national treatment, and secured market access commitments implied by tariff reductions through a legal system of tariff bindings that is backed up by third party dispute settlement. The research that I review in Section 2 sheds light on some of the successes of this approach at getting countries to internalize what would otherwise be terms-of-trade *externalities* - i.e., applying tariffs that exert market power and drive down the exporter-received price for sales into the import market. But second, the literature has also begun to reveal specific places where the impact of the historical approach has proven incomplete, and potential explanations behind why failures have arisen. My approach is to extend this analysis of the WTO with a particular focus on three areas of tariffs that are particularly critical to the interests of developing countries.

In Section 3, I begin this chapter's empirical contribution by introducing the applied tariffs for the 36 countries and 500 million people that were not yet a part of the WTO system as of 2013. I choose this as my launching point not only because this is where the WTO has had the least impact to date, but also because this is one of the least studied areas of international trade policy. As such, much of my effort here is expositional - i.e., a contributing reason why so little has been studied for these countries is due to a combination of data limitations (some of which I am able to overcome) but also because these particular countries have many other economic

[4]Krishna (2014) also provides a skeptical view of the proliferation of preferential trade agreements and its implications for the multilateral trading system. See also Maggi (2014).

[5]Even though the United States negotiated a successful TPP agreement, Donald Trump pulled the country out of the TPP agreement on his third day in office. It has since been renegotiated by the remaining 11 member countries as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership, or CPTPP.

and social problems to address in the global community that may outweigh the importance of international trade agreements. Nevertheless, this section also provides me the opportunity to compare the applied tariffs and political-economic characteristics of WTO non-member countries with a group of nearly 30 other countries that recently acceded to the WTO. Furthermore, I am able to utilize newly available data and newly constructed measures of importer market power by taking advantage of newly available foreign export supply estimates provided by Nicita, Olarreaga and Silva (2018). I then reassess - and largely confirm - prior evidence in the terms-of-trade literature on the tariff-setting behavior for a subsample of these recent accession countries, and the role of market power in affecting the changes to their trade policies upon accession to the WTO.

I then turn to a more formal empirical investigation of two areas in which the applied tariffs of WTO members are sometimes alleged to be too high. Section 4 focuses on the applied tariffs for the products that are "unbound" in the WTO system. I examine a set of 25 countries (and more than 700 million people), mostly concentrated in Sub-Saharan Africa, that are longstanding WTO members that have nevertheless not yet taken on the legal commitment to bind the upper limit of their tariffs at any level for more than two thirds of their manufactured import products. Nevertheless, while there may be non-terms-of-trade motivated arguments for the WTO to encourage these countries to bind the tariffs of these unbound products, I fail to find evidence that the applied tariffs for these unbound products are positively related to the importing country's ability to exert market power.

There is, however, evidence linking import market power influences and applied MFN tariffs for countries that have legally bound their tariffs under the WTO and yet which retain considerable discretion as to the *level* at which they would be applied due to the existence of "tariff overhang." In Section 5, I illustrate the 45 countries (and more than 2.4 billion people) where substantial tariff overhang still remains in the WTO system, and I provide some evidence identifying this area as potentially one in which the terms-of-trade theory could motivate the WTO as a useful forum to facilitate additional tariff liberalization.

Finally, in Section 6, I conclude by integrating this evidence alongside related work that highlights the difficulties confronting negotiators seeking to utilize the WTO system to facilitate additional tariff liberalization. As such, I also highlight priority areas and some remaining unanswered questions for policy-related research.

Before delving into the formal theoretical and empirical analysis, it is worth acknowledging two additional points. First, my focus on tariffs and the terms-of-trade theory is limited by design so as to keep the empirical analysis manageable, but it is admittedly incomplete.[6] Second, the

[6]In addition to the terms-of-trade theory described in more detail below, there are other prominent theories of trade agreements that I will not integrate into my formal analysis but which also deserve mention. The first alternative approach to trade agreements is the commitment theory (Maggi and Rodriguez-Clare 1998, 2007; Staiger and Tabellini, 1987; Limão and Tovar, 2011) in which governments may seek an external agreement to tie their own hands vis-a-vis their private sectors. Other recent alternative theories include consideration of potential other international externalities aside from the terms-of-trade externality, e.g., that may arise through firm delocation (Ossa 2011, 2012). A third theory is motivated by the rise of offshoring (Blanchard 2007, 2010; Antràs and Staiger 2012a,b). Bagwell, Bown and Staiger (2016) provide a more extensive survey of theoretical and empirical advances in these areas as well as the terms-of-trade literature. Bown and Crowley (2016) survey the empirical landscape of

role of the WTO in the multilateral trading system goes well beyond it serving as a forum for reciprocal tariff cutting. Put differently, even if the evidence were to indicate that the WTO's tariff-liberalization function were now somehow complete - which even the evidence that I review and provide below suggests is not yet the case - the WTO *institution* makes other substantive contributions to the system that are not provided by any other entity. These include it providing fora for the peaceful resolution of bilateral trade disputes between countries over its commitments and obligations (Maggi and Staiger 2011, 2015; Bown 2009, Bown and Reynolds 2015, 2017) and for transparency and the dissemination of information - e.g., the Trade Policy Review Mechanism and other reporting requirements - regarding how governments make changes to their trade policies in ways that affect trading partners' market access (Maggi, 1999).

# 2 The Terms-of-Trade Approach to Trade Agreements

My analysis of "where to look" for evidence that the WTO's tariff liberalization performance-to-date may be incomplete is guided by the terms-of-trade theory of trade agreements and a number of recent pieces of empirical evidence. This section provides a brief description of the core insights of the terms-of-trade theory of trade agreements and recent empirical research that searches for evidence of this theory inside and outside of the GATT/WTO system. Its main purpose is to survey the state of the art of the existing research literature in this area in order to establish expectations for my formal empirical analysis that follows. I begin with the theory of the terms-of-trade motivations for trade agreements, before I turn to evidence on how this affects trade policy determination for countries outside of the GATT/WTO, for countries that change their tariffs in order to enter the WTO through accession, and for countries that have been more longstanding participants of the GATT/WTO regarding their applied and binding tariffs.

## 2.1 The terms-of-trade theory of trade agreements

Here I review the basics of the terms-of-trade theory of trade agreements introduced in Bagwell and Staiger (1999). In a noncooperative setting characterizing the absence of a trade agreement, two large countries each have a unilateral incentive to impose import tariffs at Nash levels that are too high, relative to the jointly efficient outcome. Each Nash tariff is too high because it shifts some of the cost of the tariff - by reducing the price received by the trading partner's exporters of the product - onto the trading partner via a terms-of-trade externality. The result of each country setting its tariff at an excessively high level is the classic, terms-of-trade driven prisoner's dilemma outcome. Bagwell and Staiger then compare this outcome with an outcome whereby they suppose that each government was not motivated by terms-of-trade considerations in its objective function when setting its tariff, but that each government was only (potentially) concerned with the domestic price effects of its tariff choice. In this way, their model allows for the consideration of

tariffs and other trade policy instruments in historical perspective and in more detail.

political-economy influences; e.g., a government may be interested in using its tariff to redistribute income from one group in the domestic economy to another.[7]

The Bagwell and Staiger (1999) approach generates a number of insights that have subsequently had implications for empirical analysis.[8] First, a trade agreement like the GATT/WTO can be used to coordinate tariff reductions for the governments of two large countries, neither of which would have a unilateral incentive to reduce tariffs because it would suffer losses in economic welfare flowing through a self-imposed worsening of its terms of trade. They interpret the GATT principle of reciprocity as providing a framework for the mutual reduction of import tariffs that serves to expand trade volumes from inefficient levels of market access when under Nash tariffs to jointly efficient levels. Reciprocity allows for the mutual reduction in tariffs that serves to *neutralize* the impact on each country's terms-of-trade so that neither country experiences a negative price effect of its own tariff liberalization.

A second important insight, and one that often goes overlooked, is that the *only* role for the GATT/WTO in this framework is to reduce tariffs to a level that eliminates the international (terms-of-trade) externality impact of each government's tariff choice. I.e., in the trade agreement equilibrium, the "politically optimal" trade agreement tariffs that the government imposes may still be *positive*. In this case, once the terms-of-trade externality has been neutralized, the jointly efficient equilibrium tariffs arising under the trade agreement may still be positive and the GATT/WTO under the terms-of-trade theory will have nothing left "to do" in terms of facilitating additional tariff liberalization.

The key implication of the theory is that when empiricists begin to examine the tariff data, the existence of positive tariffs is not, by itself, evidence that job performance of the WTO is incomplete. Under a strict interpretation of the terms-of-trade theory, the WTO only has work to be done if any non-zero tariff is positive because the country is exercising its import market power - i.e., if, for some reason, the country is a member of the agreement but the terms-of-trade component to its tariff has not been fully exorcised. Put differently, if the non-zero tariff is positive for political or redistributive purposes (in light of the government's preferences), and all of the import market power exertion motives have been extinguished (e.g., either through reciprocal bargaining under GATT rounds or through WTO accession negotiations), then the terms-of-trade motive for the WTO would indicate that its tariff-reducing job is done.

From the perspective of this basic theory, I use the next two subsections to review recent developments in the empirical literature on trade agreements. A number of recent contributions provide evidence supporting key elements of this basic theory. However, the evidence is also beginning to shed light on particular areas where, within the international trading system, the GATT/WTO has failed to deliver evidence consistent with the baseline theory, thus identifying potential limits as to

[7] In this way it allows for political-economy influences of many different classes of models, including Grossman and Helpman (1994).

[8] Some of the terms-of-trade externality analysis in the context of trade policy was provided by Johnson (1953-54). Bagwell and Staiger (2002) provides a book-length treatment that considers a number of alternative applications of the model to trade agreements under different settings, including consideration of some forms of nonpecuniary exernalities and domestic policy instruments.

what the GATT/WTO and the terms-of-trade approach might be able to achieve.

## 2.2 The first wave of evidence on applied and bound tariffs for countries outside and inside the WTO

In light of the main predictions of the terms-of-trade theory described above, what is the empirical evidence? As this recent and evolving literature covers a number of different trade policy environments, samples of countries, and historical moments in time, I also use Table 1 to briefly summarize.

When contemplating whether the terms-of-trade externality is a serious problem that countries seek to solve by establishing a trade agreement like the GATT/WTO, a first question to consider is what are the determinants of tariffs that countries set when they are not constrained by such agreements? Is there evidence that tariffs are influenced by import market power, or is the variation in import tariffs driven simply by domestic political economy influences?

Broda, Limão and Weinstein (2008) were the first to provide an empirical approach to directly examine whether the tariffs set by a number of countries outside of the WTO - and thus countries unencumbered by (multilateral) trade agreement constraints - were influenced by market power motives. Their benchmark analysis focused on the applied tariffs set by 15 countries listed in Table 1 during the 1993-2000 period when they were not GATT Contracting Parties or (at the time) members of the WTO. They first construct estimates of foreign export supply elasticities facing those importing countries, and they then provide strong evidence that governments impose higher import tariffs in products where they are found to have market power, as captured by the inverse of the foreign export supply elasticity that their consumers face, just as is predicted by the canonical optimal tariff formula. Their first round of evidence was thus consistent with the potential terms-of-trade motive for the GATT/WTO - i.e., in the absence of such agreements, governments set import tariffs that reflect their market power and a result is that some of the externality costs of those higher tariffs are imposed on trading partners through reductions in those partners' exporter-received prices.

To further support their analysis, Broda, Limão and Weinstein (2008) also examine the relationship between these measures of a country's import market power and a number of different trade policy instruments utilized by the United States. The US is different from the 15 countries in their baseline sample in that it is a country *within* the GATT/WTO and one that the theory would predict trading partners would have been motivated to seek the terms-of-trade component of its tariffs extinguished. Indeed, Broda, Limão and Weinstein (2008) find no statistical evidence of market power affecting US applied MFN import tariffs; this is consistent with an interpretation of decades of GATT/WTO tariff reduction negotiations having eliminated the terms-of-trade cost-shifting component from the applied US tariff. Furthermore, they do find evidence that market power considerations affect US trade policies in two other places: first, the US application of non-tariff measures - or the policies less constrained by GATT/WTO negotiations and rules;[9] and

[9] As I describe in more detail below, Bown and Crowley (2013a) provide a separate empirical analysis of a particular

second, the US's statutory (or "column 2") tariffs, which are the tariffs that the United States applied to a number of countries that were not members of the WTO and with which the US did not have normal trading relations.

Given that countries outside of the GATT/WTO agreement may impose import tariffs in a way that reflects their market power, is there other evidence that such market power is neutralized (or at least reduced) when they eventually join the WTO? Bagwell and Staiger (2011) examine this question by empirically examining the determinants of the tariff cuts made by a group of 16 countries that acceded to the WTO between 1995 and 2005, five of which (including China) overlapped with the Broda, Limão and Weinstein sample of non-GATT countries. Unlike countries that had long been members of the GATT/WTO but whose tariff levels may have gradually been brought to more globally efficient levels over time, the Bagwell-Staiger framework investigates whether these new members brought their tariffs down from unbound (Nash-like) levels to bound (politically optimal and efficient) levels in one shot upon accession and in accordance with the terms-of-trade theory's core predictions.[10] The Bagwell-Staiger evidence is broadly consistent with the theory; i.e., there is a strong positive relationship between the magnitude of tariff cuts negotiated under the WTO and the pre-negotiation volume of imports. Furthermore, for the five countries with which they have overlap with the Broda-Limão-Weinstein sample, their evidence also holds when specifically controlling for the import market power as measured by Broda-Limão-Weinstein estimated trade elasticities.

While these first two papers present evidence that is consistent with the terms-of-trade theory, the bulk of that evidence admittedly derives from countries either outside of the GATT/WTO (Broda, Limão and Weinstein) or that only recently acceded to the WTO (Bagwell and Staiger). What about the trade policymaking behavior of the major economies that are both "inside" the GATT/WTO system and are the ones that have driven the GATT/WTO through sixty years of reciprocal tariff cutting under multilateral negotiating rounds? Furthermore, with the exception of the Broda-Limão-Weinstein evidence for the United States, and the Bagwell-Staiger evidence for China, most of the countries in these samples were not major trading economies in the international system. This has the potential to raise concerns about the external validity for the terms-of-trade theory of trade agreements if, for some reason, these countries did not exhibit behavior consistent with that of the major players.

Ludema and Mayda (2013) provide one approach to address these concerns by examining the applied MFN tariffs under the WTO at the conclusion of the GATT's Uruguay Round of negotiations for a larger sample of 26 countries, including most of the major economies.[11] In particular, they explore whether variation in these countries' applied MFN tariffs is related to variation in

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class of non-tariff barriers for the United States. That study covered a different time period and assessed the terms-of-trade implications of a slightly different theoretical model (Bagwell and Staiger, 1990), but it also provides evidence consistent with the terms-of-trade theory.

[10] To clarify, Bagwell and Staiger (2011) compare a country's unbound (applied MFN) tariff rates before the country's WTO accession with its legally binding tariff commitment post-WTO accession, and not its post-accession applied MFN rate.

[11] See also Ludema and Mayda (2009) for an alternative approach focused exclusively on the United States.

these countries' import market power and their trading partners' (exporters') industrial concentration. They find that the concentration of trading partner exporter interests at the product level, as measured by the Herfindahl-Hirschman Index (HHI), helps explain applied MFN tariff variation - i.e., products with a combined situation of (i) foreign export suppliers that are less concentrated and (ii) an importer with more market power tend to have higher tariffs even after GATT/WTO negotiations.

The Ludema-Mayda evidence is that there is variation in the extent to which the terms-of-trade component of a country's tariff may be negotiated away under the WTO and that can be linked to the free rider problem arising from the GATT/WTO's MFN rule. First, this empirical result is intuitive in that it may help to explain the relatively high applied tariffs remaining under the WTO in sectors such as agriculture, textiles, and footwear that continue to persist because the exporting interests behind these products are diffuse. A limitation of the historical framework for conducting negotiations may have arisen because negotiations were voluntary and the tariff liberalization outcome would be extended to all members under the MFN rule of nondiscrimination. However, because the existence of MFN implied that countries could free ride in the negotiations, sometimes a critical mass of exporting interests may not have bothered to show up at the negotiating table in the first place. Second, an important insight arising from this research is the recognition that not all terms-of-trade effects may be fully neutralized even upon a country's entry into the WTO, a point to which I return below. I.e., Ludema-Mayda's results identify one potential area in which there may be more tariff-liberalizing work (for terms-of-trade neutralizing reasons) to be "done"; nevertheless in discovering it, they also identify how the historical GATT/WTO approach of relying on voluntary negotiations and MFN may have contributed to the process by which tariff liberalization (for terms-of-trade neutralizing reasons) remains incomplete.[12]

Finally, given the evidence that the terms-of-trade effects matter for trade policy determination, and that the GATT/WTO system may be working to at least partially neutralize such externalities through negotiations, how economically important is the job that the WTO has done for the major economies of the system? One way to address this issue is to ask how large Nash tariffs - i.e., the combination of best-response tariffs that countries would use - would be in a trade war, and what the economic costs of eliminating trade policy cooperation would be. Using a quantitative approach, Ossa (2014) constructs counterfactual estimates for the size of Nash tariffs in a model featuring seven regions (including the US, EU, Japan, China, India, Brazil, and rest of the world) and finds the median to be 58.1 percent across countries and industries.[13] The quantitative model

[12] Bown and Crowley (2013a) provide additional evidence that terms-of-trade motives continue to affect trade policy decisions for WTO members, albeit in a different trade policy setting. They provide evidence consistent with the Bagwell and Staiger (1990) repeated game model of trade agreements by focusing on the US use of antidumping and safeguards over 1997-2006. They find for a country like the US (with applied tariffs virtually at their binding level), the flexibility of antidumping and safeguards can be seen as allowing the government to raise import protection levels in response to trade volume shocks arising for terms-of-trade motivations.

[13] This is notably higher than the estimates of the tariffs applied at the height of the Great Depression in the 1930s, after the US imposition of the Smoot-Hawley tariff in 1930 and international retaliatory response. See Bown and Irwin (2017) for a discussion of the range of tariffs more likely to have been in effect just prior to the GATT's starting point in 1947, which they put at around 22 percent.

suggests substantial gains from the imposition of the tariffs that are in place, relative to the levels of welfare that would arise were countries to resort to imposing their Nash tariffs under a trade war.

### 2.3 Additional evidence on applied tariffs, bindings, and tariff overhang for countries inside the WTO

The next framework that I explore is the recent theoretical and empirical contribution of Nicita, Olarreaga and Silva (2018), which examines the relationship between a WTO member's applied tariffs and the role of import market power, contingent on whether those tariffs are constrained by WTO tariff binding legal commitments. First, they develop a theoretical model that allows for the political influence of not only import-competing sectors but also exporting sectors. In an environment in which export policies are constrained - as under the WTO, where export subsidies are illegal - they provide a theory that predicts an exporting country government will negotiate larger tariff reductions exactly where that importing country has the most market power. Their model predicts that in the instances in which applied tariffs are at their WTO binding rates, and countries are cooperating under the WTO, there will actually be a *negative* relationship between the importer's market power and its negotiated tariff. The intuition is that in these instances, not only does the trade agreement get the country to cooperatively reduce its tariff (so as to neutralize the terms-of-trade externality) but in equilibrium the negotiation "overshoots" and the tariff ends up even lower so as to compensate the politically organized exporters in the trading partner. Furthermore, the theoretical prediction of the positive relationship between applied tariffs and market power also arises in their model, but it only arises for applied tariffs that are well below tariff binding rates - i.e., applied tariffs in the presence of sufficiently large amounts of tariff binding "overhang."

The second major contribution of Nicita, Olarreaga and Silva (2018) is empirical. First, they construct estimates of "foreign" export supply elasticities for 100 WTO member economies at the 6-digit Harmonized System (HS06) level, resulting in a database of hundreds of thousands of importing country-product-specific elasticities. (I will draw heavily on these elasticities in the formal empirical analysis that I introduce below.) Second, they utilize these estimated elasticities to empirically investigate their model's theoretical predictions for applied tariffs imposed between 2000 and 2009. They find evidence that the inverse foreign export supply elasticity has a *negative* relationship with applied MFN tariffs when there is zero tariff overhang - i.e., when countries are "cooperating" in that applied rates are set at binding levels - and they find a *positive* relationship between the importer's market power and the applied tariff when tariff overhang levels are positive. I further investigate empirically below this second result; i.e., for "tariff overhang" products, are there un-checked terms-of-trade externalities that countries are imposing through their applied tariffs that the WTO could potentially be used as a negotiating forum to eliminate?

In related work, Behskar, Bond and Rho (2015) provide a terms-of-trade based theory exploring the question of where a country might set its tariff binding in relationship to its applied tariff under a trade agreement. Their theoretical model predicts that governments will seek to retain flexibility and thus bind their tariffs significantly above the applied rates where the importer has little market power. They conduct an empirical examination of product-level tariff data for a sample of 108 WTO member economies over the period 1995-2007; they also partially rely on the inverse foreign export supply elasticities generated by Nicita, Olarreaga, and Silva (2018) as the measure of import market power in their sensitivity analysis. First, they find that newly acceding WTO members bind a larger share of their product lines than the historical GATT members under the WTO. Second, their various measures of import market power are negatively related to the level of the bindings that countries take on, as well as the size of the tariff binding overhang.[14]

A final stream of recent research that I briefly highlight explores additional economic implications of countries failing to constrain their applied tariffs by leaving sufficient tariff overhang between the applied rates and their tariff bindings.[15] Handley and Limão (2015) develop a dynamic, heterogeneous firms model with sunk costs of exporting and show that investment and entry into export markets is reduced when trade policy is uncertain. Furthermore, they show how a credible commitment implied by a trade agreement (e.g., reducing tariff bindings) can increase trade even if applied trade barriers are already low.[16] Handley (2014) provides an application of some of the key elements of this theory to the context of WTO tariff bindings and the case of Australia, finding that growth of exporter-product varieties would have been 7 percent lower between 1993 and 2001 without the binding commitments that Australia took on upon its WTO entry. While the Handley results suggest gains (to the exports) of a trading partner, one would expect that the *reciprocal* reduction of uncertainty - i.e., two countries jointly eliminating uncertainty by simultaneously binding their applied tariffs at low levels - could lead to analogous joint gains that accrue under the distinct exercise of two countries simultaneously lowering those applied rates under a terms-of-trade neutralizing trade agreement in the first place.[17]

[14] To clarify, Beshkar, Bond and Rho (2015) focus on the determinants of the level tariff bindings (taking applied rates as given) whereas Nicita, Olarreaga and Silva (2018) focus on the determinants of the level of *applied* tariffs (taking binding rates as given). Nicita, Olarreaga and Silva do not investigate the impact of import market power on either the level of tariff *bindings* or the *amount of overhang*between the binding and the applied tariff; an IV for the amount of overhang is interacted with the measure of importer market power.

[15] Separately, there is some empirical evidence related to the commitment theory of trade agreements, however, it is much less developed in the literature. Examples include Tang and Wei (2009) which finds some evidence of a positive impact of WTO accession on economic growth. Bown and Crowley (2014) find evidence for some developing countries that WTO entry has committed them to change how they implement increases to their levels of import protection (in response to macroeconomic shocks) by switching to different (and WTO-sanctioned) trade policy instruments, and this is both different from how they operated before the WTO and it is similar to the commitments and trade policy use of higher income WTO members. See also Staiger and Tabellini (1999) for evidence on the role of the GATT in allowing the United States to make trade policy commitments during the Tokyo Round of negotiations.

[16] Handley and Limão (2015) provide a structural approach to estimate the model and apply it to Portuguese firm-level data. Their policy environment does not entail the binding of tariffs under the WTO, instead they examine the 1986 Portuguese trade agreement accession to the European Economic Community which reduced trade policy uncertainty by locking in zero import tariffs from European trading partners. Francois and Martin (2004) provide an alternative theoretical approach examining the role of tariff bindings in reducing the uncertainty associated with market access. Limão and Maggi (2015) provide a more general theory examining when trade agreements can provide gains through the reduction of trade-policy uncertainty. Conditional on the level of income risk aversion in a country, gains from reducing trade policy uncertainty are more likely to arise for economies that are more open and specialized and that have lower export supply elasticities.

[17] See also Handley and Limão (2017) for an examination of the resolution of trade policy uncertainty facing Chinese

## 3 WTO Non-Members (and recently acceded members)

This section focuses attention on WTO non-member countries in the international trading system as of 2013. One ultimate question of interest - to which I will admittedly only be able to provide very indirect evidence - is whether such countries apply import tariffs that reflect market power motives and whether those would be neutralized should those countries accede to the WTO. First, I introduce the WTO non-members and their political economic characteristics. Then I examine a comparison group of countries that recently acceded to the WTO. I then investigate empirically the implications of the terms-of-trade theory of trade agreements for that second group of countries by applying the Nicita, Olarreaga and Silva (2018) foreign export supply elasticities to the basic estimation approach introduced by Bagwell and Staiger (2011).

### 3.1 Introduction and political-economic characteristics

As Figure 1 illustrates, the non-members of the WTO are found throughout the world; nevertheless, they are disproportionately concentrated in the Middle East and North Africa, East Africa, and Central Asia. Table 2 provides summary data for key economic characteristics of these countries, as well as comparable data for a separate list of important comparison countries that recently acceded to the WTO - i.e., between 1998 and 2014.[18] For ease of exposition, I rank the countries in each group by Gross National Income (GNI) per capita, and I split them roughly into three categories based on GNI per capita - I refer to the three groups as low income, lower-middle income, and middle and higher income.[19] For countries that are not yet members of the WTO, I also provide information on whether they have formally been granted "observer" status by the WTO.[20]

Table 2 reveals a number of stylized facts about the WTO non-members. First, they are disproportionately poor countries - at least 28 of the 38 countries have GNI per capita in 2013 that was less than the world average of $10,683. Second, there is a wide range in the size of the populations of these countries. Some are tiny (and relatively wealthy) city-states or islands, with less than a million people. Others are poorer and larger countries in Africa - the largest is Ethiopia at 94 million people. Combined, 490 million people lived in these WTO non-member countries, or 6.9 percent of the total world population.

Most of the WTO non-member countries had imports that were greater than exports in 2013.

firms resulting from accession to the WTO in 2001 and the reduction of uncertainty surrounding US applied tariffs that had persisted during the 1990s through the annual Senate debate on whether to renew China's MFN treatment. They find that the effect of the WTO on reducing the threat of a trade war explains 22 percent of China's export growth to the US, and that the reduction in policy uncertainty lowered U.S. prices and increased consumers' income by the welfare equivalent of an 8 percentage point tariff decrease.

[18] I utilize data on accessions starting only in 1998 (instead of, for example, 1996) because some of the initial wave of WTO accession countries in 1996 and 1997 were countries that may have simply waited to begin the domestic legal process to formally ratify WTO membership until after the major WTO members had done so, i.e., recalling the US experience at failing to ratify the ITO in the 1940s, which led to the GATT.

[19] Note that these three country groupings do not correspond to the World Bank's official categories.

[20] Governments with WTO observer status are not members but they are granted limited WTO rights, such as access to certain WTO meetings, but they are also expected to uphold other obligations, such as making some (minimal) contributions to the WTO's operating budget.

The exceptions are mostly made up of major energy (oil and/or natural gas) producers/exporters - e.g., Algeria, Azerbaijan, Equatorial Guinea, Iran, Iraq, Kazakhstan, Libya, and Turkmenistan. For the rest of the countries with imports substantially larger than exports, this is potentially notable for two reasons. First, the expectation might be that their imports would be limited because their import policies are legally unaffected and undisciplined by the WTO system. Second, many of the non-members are relatively poor and are therefore likely (at least in principle) to be beneficiaries of unilateral preference programs offered by WTO member countries. Ceteris paribus, their firms may face lower-than-MFN tariffs for their sales to those markets which would tend to encourage their exports. Nevertheless, at least at a first glance, the data does not suggest this to be the case.

Finally, I mention briefly some other geo-political factors that are likely contributors to the question of why these countries are not (yet) members of the WTO. First, fourteen of these countries can be characterized as states in Fragile and Conflict Affected Situations (FCS) (World Bank, 2014) - these are areas affected by civil war or other forms of violence and strife. Second, while Russia finally acceded to the WTO in 2012 and a handful of former Soviet Republics became members earlier, five of the former Soviet Republics (Azerbaijan, Belarus, Kazakhstan, Turkmenistan and Uzbekistan) have not yet gained entry.

Next compare the WTO non-members with the list on the right-hand-side of Table 2, which includes the countries that acceded to the WTO between 1998 and 2014. The recently acceded countries are also disproportionately poor and include a range of small and large countries by population. The recent accession list also includes countries with geopolitical constraints, such as Russia and other former Republics of the Soviet Union (Armenia, Georgia, Kyrgyz Republic, Moldova, Tajikistan, and Ukraine, as well as Estonia, Latvia and Lithuania that have since also acceded to the European Union), and also FCS countries such as Nepal and Yemen. Overall, I conclude that these sets of WTO non-member and recent WTO accession countries have a number of similarities.

### 3.2 Establishing a benchmark: The experience of recently acceded WTO members

What might accession to the WTO for non-member countries mean? To provide context, in this section I benchmark these non-member countries' applied tariffs against the tariffs of a set of recently acceded WTO member countries. Table 3 introduces the most recently available information on the applied tariffs for these WTO non-member countries. The table documents the mean of their applied rates, as well as their minimum and maximum rates, and the standard deviation of applied tariffs across import products. The average tariff of these countries ranges from a high of 35.1 percent (Bahamas) to a flat import tariff of 2.5 percent applied to every imported product (Timor-Leste). Some of these countries do have tariffs that peak at rates higher than 100 percent.

Table 3 also provides important summary statistics for the tariffs of the recently acceded WTO members, as a point of comparison. For these recently acceded countries, I present four pieces of information: (i) the tariffs they applied five years prior to the their WTO membership, (ii) the share of imported products over which the country agreed to bind its tariffs upon accession to the WTO, (iii) the average tariff binding rate that the country committed not to exceed when joining the WTO, and (iv) the MFN tariff rate that the country applied to all other WTO members in 2013.

First, Table 3 indicates that even the poorest recently acceded countries have bound almost 100 percent of their tariffs at some level. As I will observe in Section 4.1, this is very different from many developing countries at similar levels of income per capita that joined the WTO upon its inception in 1995 or which had previously been a Contracting Party to the GATT 1947, and which did not similarly bind all of their products' tariffs. (I investigate and address this issue for such countries separately below.)

Second, for a number of recent WTO accession countries, they were not forced to make substantial cuts (on average) to their applied tariffs upon entry into the agreement. Indeed, for more than half of the 27 recently acceded WTO members listed in Table 3, their average binding commitment under the WTO is actually higher than the average tariff the country applied five years prior to WTO entry, meaning that the country could (on average) increase its applied tariffs upon entry into the WTO and still be in compliance with its obligations. Major exceptions include a number of large economies such as China, Saudi Arabia, Taiwan (China), and Ukraine. However, a notable characteristic of all of the recently acceded WTO members is the relatively limited amount of average tariff overhang between binding rates and applied MFN tariffs in 2013. With the exception of Vanuatu (30.6 percentage points), no newly acceded member has an average level of tariff overhang exceeding 13.8 percent in 2013 (Nepal) - as Section 5.1 reveals, this is also substantially different from countries that acceded to the WTO upon its entry into force in 1995; i.e., there are 45 WTO members with more than 15 percentage points of average tariff overhang in 2013.

Figure 2 illustrates the industry-level variation for these tariff data summarized by Table 3. The three panels represent the average tariffs by sector for three groupings of countries - low-income countries, lower-middle-income countries, and middle- and higher-income countries. For each sector, there are two sets of bars - the first set reflects the average tariffs for the recently acceded WTO members, and the second set reflects the average tariffs for the WTO non-members. Finally, for WTO members, for each sector there are three pieces of information - the grey bar reflects the average MFN applied rate in 2013, the white bar reflects the tariff binding overhang (or water) above the applied rate, and the black star reflects the average applied tariff that was in place five years *prior to* the country's WTO accession. For the WTO non-member countries, the black bar represents the average tariff in the sector that the countries in that income group applied in 2013.

First compare the black stars with the black bars - i.e., compare the average applied tariffs for the recent accession countries five years prior to their WTO membership with the average applied tariffs of the non-members. Overall, Figure 2 suggests the patterns are quite similar (conditional on income group) across industries; on average at least, the "future" WTO accession countries apply import tariffs that are similar to the applied tariff starting point of the recent accession countries before they gained WTO entry. And while there is variation across sectors and income groups, if anything, the evidence would suggest that WTO non-members apply rates that are slightly higher than the applied rates of the recently acceded countries five years prior to their joining the WTO.

Second, focus attention on the applied tariff *changes* for the countries that recently acceded to the WTO - i.e., the difference between the star (applied tariff level 5 years prior to WTO accession) and the grey bar (applied tariff level in effect in 2013). The pattern across industries and country groupings is that applied rates tend to fall on average upon joining the WTO. In levels, the average changes are largest for the lower-middle-income group of countries in the middle panel - this reflects the fact that both more tariff cutting is likely expected of them (relative to low income countries) and they are starting from higher tariff levels (relative to higher income countries).

Third, consider the differences in tariff binding overhang that results upon entry into the WTO. On average in 2013, there is more tariff overhang remaining upon WTO accession for low-income countries in comparison to higher income countries.

While Table 3 and Figure 2 illustrate a suggestive path forward for WTO non-member countries - if what is expected of them roughly corresponds to what has been the impact of WTO accession on the tariffs of recently acceded members - I have not yet provided any evidence that this is linked to the terms-of-trade theory of trade agreements. In the next section I consider the potential implications of WTO accession for non-members through the lens of this theory and drawing from evidence arising from the experience of recent accession countries.

### 3.3 Empirical evidence from tariff bindings for recent WTO accession countries

The first empirical question is whether it is likely that accession to the WTO by these non-members would neutralize any terms-of-trade externalities that their applied tariffs impose on trading partners.

Because I do not have the ability to test this counterfactual, instead I examine whether there is evidence from the group of recently acceded WTO member countries to suggest that terms-of-trade externalities of their import tariffs were reduced when they joined the WTO. The alternative - i.e., that there is no relationship between their post-WTO accession tariffs and market power influences - would suggest that these countries joined the WTO with something else in mind, and thus some other approach aside from the terms-of-trade theory would be required to motivate why they find the WTO valuable.

In order to specifically investigate this question, I broadly follow the Bagwell and Staiger (2011) estimation approach described earlier. In particular, I examine whether there is a relationship between the binding rate that country $c$ adopts for HS06 product $g$ after WTO accession, ($\tau_{gc}^{WTO-binding}$), and two theoretically-motivated determinants: (i) the pre-accession applied tariff rate ($\tau_{gc}^{pre-WTO}$), and (ii) the inverse of the foreign export supply elasticity ($1/\omega_{gc}^{*}$). I thus estimate models of the form

$$ln(1+\tau_{gc}^{WTO-binding}) = \alpha_g + \alpha_c + \beta_0 ln(1/\omega_{gc}^{*}) + \beta_1 ln(1+\tau_{gc}^{pre-WTO}) + \epsilon_{gc} \qquad (1)$$

where $\alpha_c$ is importing country fixed effect, $\alpha_g$ is the HS06 product fixed effect, and $\epsilon_{gc}$ is the iid error term. The Bagwell-Staiger theory clearly predicts $\beta_1 > 0$ and $\beta_0 < 0$, or that the post-WTO binding rate will be positively related to $\tau_{gc}^{pre-WTO}$ and negatively related to the measure of the importer's market power $(1/\omega_{gc}^{*})$.

My estimation exercise serves to complement the original Bagwell-Staiger approach in a number of ways. First, I utilize a slightly different sample of countries (see Table 1 for the list), though notably my additional countries include a number of relatively large (by population) importers - such as Russia, Saudi Arabia, and Ukraine - that acceded to the WTO only after the Bagwell-Staiger sample period. Second, here I rely heavily on the export supply elasticities provided by Nicita, Olarreaga and Silva (2018) that were not available at the time of the original study. Third, I utilize fixed effects to address other potential determinants of tariffs.[21]

Before turning to the estimates, I also explain here the general approach that I take throughout to address potential data limitations.[22] For example, one potential concern is that the elasticities are themselves estimates, and some of the estimated values are extreme.[23] First, I winsorize the data set of the elasticities by setting the extreme values to be the values at the 10th and 90th percentiles of the distribution. Second, in the baseline specifications to each of the regressions, I will take the log of the inverse of foreign export supply elasticity, and I will utilize as a robustness check either an indicator for "high elasticity" products (defined as those above the median of the distribution) or the *level* of inverse of the foreign export supply elasticity. Third, I will also use as my measure of import tariffs $ln(1+\tau)$, though I frequently report as a robustness check a measure of the tariff that is simply the level of the tariff, $\tau$.

Table 4 provides evidence of the expected strong negative relationship between the inverse foreign export supply elasticity and the WTO tariff binding commitment taken upon accession for this sample of 12 countries that recently acceded to the WTO. I.e., ceteris paribus, newly acceding members are requested (through WTO negotiations) to take on lower tariff binding commitments in products for which they have higher market power and thus where their tariffs (if left unchecked) would result in larger terms-of-trade externality losses for trading partners. Note that I also find a strong positive relationship between the pre-WTO applied tariff and the WTO tariff binding commitment, in line with the theoretical prediction. In column (2), I show the robustness of the results by replacing the log of the inverse foreign export supply elasticity with an indicator that takes on the value of one if the elasticity is "high" (above the median value) and zero otherwise, and again the estimated size of the coefficient is negative. Specification (3) substitutes the levels of the tariffs and the elasticities for the log levels that are used in the baseline specification and elsewhere in the table. In column (4), I add importing country fixed effects. Columns (5) and (6) split the sample in two depending on whether the importing country was large (by population)

[21]Finally, my estimation exercise here and below relies only on OLS. Unlike the prior literature, I do not implement instrumental variables estimation; thus the estimates reported here should not be interpreted as identifying magnitudes associated with causal effects.

[22]The Appendix provides a full description of the data and its sources.

[23]For a discussion of a variety of potential approaches to adopt to assess the robustness of results, see Broda, Limão, and Weinstein (2008) and Nicita, Olarreaga and Silva (2018).

- i.e., China, Russia, Saudi Arabia, and Ukraine - or small. While both sets of estimates on the elasticity are negative, as predicted by the theory, the estimate on the elasticity is no longer significant for the small (by population) country subsample. Nevertheless, even this nonresult is somewhat reassuring, given that I would expect the results to be more likely to break down in the small country subsample.

Overall this section suggests evidence consistent with the terms-of-trade theory of trade agreements and that the pre-existing WTO membership has negotiated tariff binding commitments for newly acceding WTO non-members that serves to reduce the negative (terms-of-trade) externality impact of their tariffs on trading partners. Again, to the extent that there are similarities between the WTO *non-members'* applied tariffs and the tariff-setting behavior of these recently acceded WTO members before their WTO accession, any future WTO accession by the non-members could also be expected to have them take on lower tariff binding commitments where they would otherwise have more import market power.

# 4 WTO members with unbound tariffs

This section begins my examination of the tariffs that WTO members apply, and in particular whether there is scope for the WTO to "provide" a forum for additional terms-of-trade-motivated applied tariff reductions for these countries. Put differently, my approach for the next two sections is to examine different areas in the WTO system where speculation has been that applied tariffs remain "too high," and I ask whether the level of applied tariffs in each area continues to remain influenced by measures of import market power. Evidence of such a relationship would be consistent with identification of additional tariff-reduction work for countries to utilize the WTO to potentially pursue under the terms-of-trade theory of trade agreements. However, an alternative may be that, while applied tariffs in one or more areas may appear "too high" (or otherwise unconstrained by the WTO); nevertheless, the applied tariffs are not related to product-level measures of the importing country's market power. If this is the case, there may be little scope to engage the WTO in a terms-of-trade neutralizing attempt to get the country to reduce its tariffs further.

This section begins by focusing on the issue area of unbound tariffs. These are the products for which countries have not taken on the legal commitment to set any upper limit for their MFN applied import tariffs. I first introduce where it is that unbound tariffs are most prevalent in the WTO system, and then in Section 4.2 I investigate whether there is evidence linking import market power motives and applied tariff levels in the areas where tariffs are unbound.

## 4.1 The countries and the unbound products - descriptive

Table 5 introduces the WTO member countries with the largest share of products for which their applied import tariffs are unbound. Given that a condition of WTO entry for all countries was the expectation that they would agree to bind all tariffs for their agricultural products, I rank the countries in the table by the share of their *non-agricultural* tariff lines that are bound. The left half of the table lists the 25 WTO member countries ("Group A") that will serve as the main sample for the regression analysis that I describe in the next section; these are countries that have bound fewer than one third of their non-agricultural import products. Cameroon has committed to a legally binding upper limit on the smallest share of imported products at 1.7 percent, followed by Tanzania and Gambia.

An examination of the 25 WTO members with less than 33 percent of bound non-agricultural products suggests a number of common characteristics. First, they are disproportionately poor, as only one (Macao SAR, China) has GNI per capita in 2013 greater than the world average of \$10,683. Second, with only a handful of exceptions (Bangladesh, Macao SAR (China), Cuba, Sri Lanka, Suriname), Figure 1 reveals that the vast majority of unbound tariffs are geographically located in Sub-Saharan Africa. Third, while there is also a range of large and small (by population) countries with substantial unbound tariffs, in total the numbers add up: more than 700 million people - or 10% of the world's population - live in WTO member countries that have bound fewer than one third of their non-agricultural tariffs at any level. Finally, the last column on the left half of Table 5 does suggest relatively little variation in average applied tariffs across these countries - with the exception of Macao SAR, China and Mauritius, the average applied MFN tariff (over all products) for the other 23 WTO member countries ranges between 10 and 20 percent. A major element of this is due to the fact that many of these countries are part of the ECOWAS (Economic Community of West African States), which has been developing a customs union arrangement and thus a common external tariff against non-participants, including the MFN tariff that each would apply against imports arising from all other (non-participant) WTO members.

The right side of Table 5 provides similar summary statistics for WTO member countries that have bound between 33 percent and 95 percent of their non-agricultural product tariff lines. These 14 countries ("Group B") will be used in robustness checks in the formal regression analysis in the next section, but a cursory examination of their economic characteristics suggests that they are much more diverse. At the extremes, some countries on the list are very poor (Central African Republic) and others very rich (Singapore), and with populations that are very small (Brunei and Iceland) or very large (India). The 2013 average applied MFN tariff also ranges substantially from free trade (Hong Kong SAR, China) to 18 percent (Central African Republic). Finally, a country like Turkey in particular is also notable in that - while it may have bound relatively few (only 35 percent) of its non-agricultural products legally at the WTO, it has constrained its applied MFN tariffs through other trade agreement means, i.e., by forming a customs union arrangement with the European Union covering most of its non-agricultural products, with the exception of steel and textiles.

Before moving on, the last note that I make about Table 5 concerns those countries that are *not* found in the table. I.e., the rest of the WTO membership (more than 100 WTO members) that are not listed in the table have bound 95 percent or more of their non-agricultural products. I have already illustrated the tariff data for some of these countries - i.e., the recently acceded WTO members - in Table 3.

Finally, consider Figure 3 which illustrates the average MFN applied tariffs by sector for the 25 WTO members with less than 33 percent of their non-agricultural products that are bound. Much of the cross-industry pattern is similar to what is commonly observed in other settings for low–income countries (see again Figure 2, for the comparable tariffs for low-income WTO non-members and recently acceded members) - e.g., relatively higher applied tariffs in sectors such as footwear, textiles, hides and skins, and lower applied tariffs for fuel, chemicals and machinery.

### 4.2 Empirical evidence for unbound tariffs

To my knowledge, there is no theoretical or empirical work exploring the finer question of why a WTO member would choose to bind some products and yet leave other products unbound. Nevertheless, in this section I use the following model to examine empirically the question of whether measures of importer market power are related to applied tariffs for these *unbound* products

$$ln(1 + \tau_{gc}^{WTO-applied}) = \alpha_g + \alpha_c + \gamma_0 ln(1/\omega_{gc}^*) + \epsilon_{gc}. \tag{2}$$

If importing countries continue to exert market power over their applied MFN import tariffs ($\tau_{gc}^{WTO-applied}$) for these unbound products, the theoretical expectation is that $\gamma_0$ would be positive.

Table 6 presents the results. The general finding is that there is no evidence that market power considerations are driving applied tariff rates for unbound products when the model is estimated on the 25 countries ("Group A") that have committed to bind their tariffs for less than 33 percent of their non-agricultural products. The first column is the baseline specification which indicates no statistically significant relationship between the log of the inverse of the foreign export supply elasticity $ln(1/\omega_{gc}^*)$ and the applied MFN tariff rate, given by $ln(1+\tau_{gc}^{WTO-applied})$. In fact, when I introduce importing country fixed effects in column (2), there is actually a negative and statistically significant relationship between the measures of import market power and applied MFN tariffs. While, to my knowledge, no one has previously investigated this particular area of unbound tariffs for WTO member countries, these results have some similarities to the pattern of results found by Beshkar-Bond-Rho (described earlier) that examine binding tariff levels for 108 WTO members. They find tariff binding levels are negatively related to market power, especially in the presence of substantial amounts of tariff overhang (what they refer to as "weak bindings"). Their theoretical model interprets this negative relationship between import market power and tariff binding levels (in the presence of tariff overhang) as allowing countries flexibility to raise their applied rates in response to shocks. While speculative, a similar motivation could also be at work explaining the applied tariffs for products that are unbound in the WTO system.

Indeed, the last two columns of Table 6 provide additional evidence of this negative relationship between importer market power and applied MFN tariffs for unbound products by altering the sample of unbound products on which the model is estimated. In column (4), I also include in the sample the unbound products for the 14 WTO member countries (in "Group B") of Table 5 that had (overall) between 33 percent and 95 percent of their non-agricultural products bound.

In column (5) I estimate the model on only the subsample of data from those 14 WTO member countries. In both cases, the estimate of $\gamma_0$ is negative and statistically significant.

To conclude this section, I am unable to find evidence to suggest that the applied MFN tariff levels for unbound products under the WTO are positively associated with importer market power considerations. Under the basic terms-of-trade theory of trade agreements, if countries with unbound tariffs are not applying them to exert market power and impose externalities on trading partners, this suggests little role for the WTO to facilitate applied tariff reductions in this area. While there may be other theories that would motivate welfare improvements arising from countries voluntarily binding these tariffs through the external commitment of a trade agreement - e.g., the trade policy and uncertainty literature associated with Handley and Limão (2015, 2017), Handley (2014), or Limão and Maggi (2015) - in this instance, the motivation may not arise from the basic terms-of-trade theory itself.

# 5 WTO members with bound tariffs but substantial tariff overhang

A second contentious area within the WTO system involves countries that, while having taken on the legal commitments to bind their tariffs at some upper limit, have set the upper limit so high relative to the applied MFN tariff that the binding level is economically meaningless. The difference between the legally binding commitment and the applied tariff is, again, defined as the amount of tariff overhang. In this section I examine whether applied import tariffs are positively associated with importer market power considerations for products which are characterized by substantial tariff *overhang.*

My approach in this section follows the theoretical insights and empirical framework introduced by Nicita, Olarreaga and Silva (2018) described above. To summarize, they study the applied tariffs for roughly 100 WTO member countries and provide two key empirical results. First, when applied tariffs are constrained by WTO binding commitments - e.g., in the extreme, suppose that the applied rate is equal to the binding commitment, so there is zero tariff overhang - then there is a negative relationship between importer market power and the applied tariff. Second, when applied tariffs are unconstrained by WTO binding commitments - e.g., in the extreme, suppose that there is substantial tariff overhang because tariff bindings have *not* been negotiated down close to applied levels - then there is a positive relationship between importer market power and the applied tariff. It is this second result in particular that I investigate in more detail.

## 5.1 The countries and the products with overhang - descriptive

First I need to identify the set of WTO member countries with bound tariffs but with significant amounts of tariff overhang remaining between their tariff binding commitments and their applied rates. Table 7 provides the list of WTO member countries that each have at least 15 percentage points of average tariff overhang. First, it is interesting to note that almost all of the countries in

Table 7 acceded to the WTO at the time of its inception in 1995. As is apparent from the data in Table 3 for countries that acceded to the WTO sometime later - i.e., in 1998 or after - they were only allowed to enter the WTO with much less tariff overhang in place.

Second, it is important to clarify that none of the countries listed in Table 7 overlap with the "Group A" countries (of Table 5) that had bound less than 33 percent of their non-agricultural products - i.e., these two lists are mutually exclusive. However, a handful of countries do appear in both Table 7 and on the "Group B" list of countries in Table 5, i.e., those with less than 95 percent of their non-agricultural products being bound.[24] While these countries' *unbound* products were included as part of the robustness checks provided in columns (4) and (5) of Table 6, here I only consider the countries' *bound* products. Therefore, because the unbound products are dropped from the analysis here, the country-product pairs included in the robustness check regressions of Table 6 and those presented next are mutually exclusive.

The countries in Table 7 share some similarities, but also a number of notable differences, with the WTO non-members and recently acceded members (see again Tables 2 and 3) and the list of WTO members with substantial unbound tariffs (see again Table 5) discussed thus far. Like the earlier lists, the countries with substantial tariff overhang are also developing countries - e.g., nearly three quarters of the 45 countries have a 2013 GNI per capita at or below the world average. Nevertheless, these developing countries with substantial tariff overhang on average do have higher GNI per capita than the developing countries that are WTO non-members, WTO members that recently acceded, or WTO members with substantial unbound products.

Next, to the extent that the countries with substantial unbound products were geographically concentrated in Sub-Saharan Africa, the countries with substantial tariff overhang tend to be geographically concentrated in Latin America (see again Figure 1). Nevertheless, there are important exceptions, including countries with substantial overhang arising in South and East Asia and North Africa. Furthermore, while relatively large population countries such as Egypt, Philippines, Brazil, Mexico, Indonesia, and India are notably on the list of countries with substantial tariff overhang, this list also contains a number of countries with tiny populations - e.g., eleven of the 45 have less than one million people - including a number of small island economies of the Caribbean. Nevertheless, the combined population of these 45 countries is over 2.4 billion people, or more than one third of the global population.

Figure 4 illustrates the average MFN applied tariffs and tariff bindings by sector for these 45 WTO members that average more than 15 percentage points of tariff overhang. The average applied tariffs exhibit cross-industry patterns similar to the other settings for developing countries - e.g., relatively higher applied tariffs in sectors such as footwear, textiles, hides and skins, and lower applied tariffs for fuel, chemicals and machinery. There are significant differentials for the binding levels across sectors, however. Tariff binding levels average over 60 percent in animals, vegetables, and foodstuffs, whereas they are closer to 40 percent for all other (non-agricultural) sectors.

[24]These countries are Israel, Turkey, Central African Republic, Philippines, Bahrain, India and Tunisia.

## 5.2 Empirical evidence for bound tariffs with substantial overhang

In this section I follow a modified version of Nicita, Olarreaga, and Silva (2018) to examine empirically the question of whether measures of importer market power are related to applied tariffs for the countries identified in Table 7 as having substantial tariff overhang, or an average of more than 15 percentage points between their tariff bindings and their applied MFN tariffs. In the estimation, I also condition on the country-product pairs that have 15 percentage points or more of tariff overhang as well.[25] The basic model that I estimate is again simply

$$ln(1 + \tau_{gc}^{WTO-applied}) = \alpha_g + \alpha_c + \gamma_0 ln(1/\omega_{gc}^*) + \epsilon_{gc}, \tag{3}$$

where if importing countries continue to exert market power over their applied import tariffs ($\tau_{gc}^{WTO-applied}$) for this subset of bound products over which there is substantial tariff overhang, I expect $\gamma_0$ to be positive. The main difference from the approach described in the last section is not the model, it is simply the subsample of countries and products (those with bound tariffs and tariff overhang) over which the model is estimated.

Table 8 presents the results. The general finding confirms the Nicita, Olarreaga and Silva evidence for this particular subsample of countries that market power considerations are positively related to applied MFN tariff rates in 2013 for these products.

The first column of Table 8 is the baseline specification which indicates a positive and statistically significant relationship between the log of the inverse of the foreign export supply elasticity, given by $\ln(1/\omega_{gc}^*)$, and the measure of the applied MFN tariff rate, given by $\ln(1 + \tau_{gc}^{WTO-applied})$. In column (2) I introduce importing country fixed effects, and in column (3) I utilize the high inverse elasticity indicator variable in lieu of the continuous measure. The results are robust to these different specifications.

The next three columns of Table 8 examine subsamples of these data. Column (4) focuses on where tariff overhang is the greatest by changing the threshold from 15 percentage points to 25 percentage points, thereby reducing the sample almost in half.[26] The size of the estimated impact of market power is even larger in the subsample of countries and products where tariff overhang is largest. Columns (5) and (6) split the original baseline sample in two depending on whether or not the products fall into agriculture. Interestingly, the potential influence of market power is not found in the agricultural product subsample of the data in column (6), though admittedly this is a much smaller sample of observations.

Finally, and as a last "consistency check" with expectations, the very last column of Table 8 presents estimates from the same model on a completely different subsample of data - i.e., the twelve

[25] That is, I drop from the sample all products within these 45 countries that have bound tariffs but applied MFN tariffs that are within 15 percentage points (or less) of the binding rate. Because I am therefore conditioning on a sample of countries and products that *only* have tariff overhang, I do not need to include interaction terms a la Nicita, Olarreaga and Silva (2018) so as to thereby separate out the potential negative relationship between measures of import market power in the absence of such overhang (i.e, when the applied MFN tariff is equal to the binding rate).

[26] For the countries involved in this subsample, see again Table 7, and the bottom two thirds of the listed countries, beginning with Peru (26.1 percent).

countries that recently acceded to the WTO that were part of the formal econometric analysis of tariff bindings presented in Table 4. Not surprisingly, the relationship in column (7) between the inverse foreign export supply elasticity and applied import tariffs for these twelve countries is not only not positive, but it is negative and statistically significant. Recall from Table 3 that upon entry to the WTO, countries like China, Russia and Ukraine not only took on nearly universal tariff binding coverage, but they bound their tariffs at relatively low levels compared to their applied rates. I.e., average tariff overhang for the countries and products in the column (7) sample is only 3.6 percentage points, and less than 5 percent of observations in that sample have 15 percentage points or more of tariff overhang.[27] The applied tariffs for the recently acceded WTO members thus have a very different empirical relationship with measures of import market power than the applied tariffs for the WTO members that have been around since the agreements' inception and which continue to have large amounts of tariff overhang.

The evidence from this section suggests that products for countries that have taken on WTO bindings but for which substantial tariff overhang remains have applied MFN import tariffs that continue to reflect import market power considerations. As such, this may constitute an area where additional WTO-facilitated negotiations for applied MFN tariff reductions would be consistent with the insights of the terms-of-trade theory of trade agreements.

## 6 Conclusions and Policy Implications

This chapter uses the lens provided by the terms-of-trade theory of trade agreements, as well as recent empirical and data advances arising in the literature, to assess whether there may be a market power neutralization motive for the WTO to facilitate additional tariff reductions in three distinct areas: (i) applied tariffs for WTO non-members, (ii) applied tariffs for members where they are unbound, and (iii) applied tariffs for members where there is substantial tariff overhang.

An open policy question is how could the WTO be redeployed to address these areas where additional terms-of-trade motivated liberalization might take place? While I have provided a mix of direct and indirect evidence for where there remains a positive relationship between import market power and applied import tariffs, nevertheless, I have refrained from assessing why it is that "high" applied import tariffs (that reflect terms-of-trade motives) have yet to be extinguished even by WTO negotiations, as well as whether institutional impediments might be overcome that would allow for their negotiated reduction.

A first promising line of research involves the Bagwell, Staiger, and Yurukoglu (2015) examination of the *historical* process of reciprocal trade negotiations that took place product-by-product under the early GATT Rounds. There may be lessons to be learned from the details of such experiences for any additional liberalization remaining to be undertaken today.

Nevertheless, one additional possible starting point arises out of the results that I have developed

[27] While not presented in the Table, I can also confirm another relationship identified by Nicita, Olarreaga, and Silva (2018) for this particular sample of countries - that when applied rates are equal to binding rates (so "cooperation" is the strongest), the relationship between market power and the applied MFN tariff is still negative.

here in Section 5.2. WTO members that retain substantial amounts of tariff overhang and have applied MFN tariffs that continue to reflect market power influences could potentially be grouped with one another to identify reciprocal liberalization matches in the spirit suggested by the Bagwell and Staiger (1999) theory. While obviously these regression results are only suggestive of where negotiators could potentially look in greater detail, the countries in this sample include Argentina, Brazil, India, Indonesia, and Mexico - all members of the Group of 20 (G20) and potential future leaders with a vested interest in sustaining the multilateral trading system.[28] On the other hand, the last set of results of Section 5.2 presents no evidence that, on average, applied MFN tariffs and market power remain positively related for the set of recently acceded WTO members that includes China and Russia. Such evidence would tend to suggest that the recent WTO accession countries may not be great candidates to lead a new set of reciprocal tariff liberalization negotiations.

Furthermore, I have already noted one particularly important strand of research in the terms-of-trade literature that identifies variation in the concentration of export interests across countries as presenting an additional bottleneck that may mitigate the effectiveness of the GATT/WTO's reciprocal, shallow-integration approach to tariff cutting (Ludema and Mayda, 2013). The Ludema-Mayda evidence was based on a 26 country sample that included a number of high-income countries and it does suggest that not all of the terms-of-trade motives may have (as yet) been exorcised for the high-income economy applied MFN tariffs. While this would imply that such countries could also plausibly be part of future reciprocal bargains still to be struck, the difficulty for the WTO and trade negotiators may rest in how to make those matches and strike those bargains. Put differently, the second insight from the Ludema-Mayda evidence is that the real world of trade negotiations is certainly even more complicated than simply getting two large importing countries together to reciprocally reduce their import tariffs. The potential asymmetry of exporters in a many-country world, or the concentration (or lack thereof) of exporting interests for a particular product, may make implementation of the GATT/WTO's historical "principal supplier rule" approach to pairing negotiating interests difficult. To what extent might third party intermediaries (such as an institution like the WTO) be needed to organize *triangular* liberalization efforts, say, if bilateral trade liberalization opportunities between partners are unlikely due to trade imbalances or other asymmetries? More research is certainly required to further investigate all of these questions.

An additional and potentially related concern requiring additional exploration is that the importing countries that continue to impose positive tariffs reflecting their market power incentives may also not face significantly large "foreign" tariffs on their exported products to generate the trade-off necessary for the neutralization of the terms-of-trade cut under the traditional, reciprocal approach. This may be because the importing country receives preferential tariff treatment from trading partners for its exports, either through unilateral preferences such as GSP, or through *reciprocal* preferential trade agreements. Alternatively, "intermediate" (but not "latecomer" non-

[28]However, this is complicated by the fact that many of the countries on this list - e.g., Mexico, Colombia, Peru, and Chile - are actively involved in the formation of preferential tariff agreements with major high-income economies. These agreements may serve as an alternative to neutralizing the terms-of-trade motives associated with certain applied *bilateral* tariffs (vis-a-vis major trading partners at least) if not their applied MFN tariffs.

member) countries to the system may find that they already receive MFN treatment of very low applied tariffs from the major markets of other WTO members for their exports. While the WTO system has seemingly been able to overcome this hurdle when it comes to neutralizing the terms-of-trade motives behind recently acceded WTO member countries (Bagwell and Staiger 2011, see also the results in Section 3.3), it appears that it may have been much less successful in doing so when it allowed in the initial tranche of acceding members in 1995, when it did not require these countries especially to take on particularly stringent tariff binding commitments (see the results of Section 5 and Nicita, Olarreaga and Silva 2018).

There are other complications to the historical GATT/WTO approach to reciprocal liberalization that the theoretical literature has begun to identify and explore that may also serve as impediments for future liberalization. These include trade in products where prices are determined by bilateral bargaining and not market-clearing conditions (e.g., Antràs and Staiger 2012a,b) and environments characterized by cross-border ownership and foreign direct investment (Blanchard 2007, 2010). While these particular impediments may be more suited to the relatively complex trade in parts and tasks that is commonly associated with high-income countries, nevertheless, as Johnson and Noguera (2017) document, the importance of such trade is increasing almost everywhere over time.

Finally, I conclude by pointing out that even once countries are inside of the WTO and the terms-of-trade incentives may have been extinguished from their applied MFN tariffs, significant institutionally-provided flexibilities exist so that trade policy is not truly and permanently locked in at levels that may turn out to be too low in the face of political-economic shocks. Bown and Crowley (2013a), for example, provide evidence consistent with the Bagwell and Staiger (1990) theoretical, repeated-game framework of trade agreements that interprets some use of antidumping and safeguards as governments managing the terms-of-trade pressure - even once they have bound their applied MFN tariffs at low levels - associated with trade volume shocks.[29] Thus while the WTO may still have some work to do, so as to more completely exorcise the terms-of-trade incentives from its members' applied MFN tariffs, even after potential completion of those efforts, some trade policy flexibility (and influence of terms-of-trade motives affecting the use of such flexibility) may likely remain.

[29] For evidence that macroeconomic shocks - real exchange rate shocks, real GDP and unemployment shocks - also trigger new import protection under such temporary trade barrier policies permitted under the WTO, see Bown and Crowley (2013b,2014) for cross-country studies on high-income and emerging economies, respectively, in the spirit of the Bagwell and Staiger (2003) theoretical framework. Vandenbussche and Zanardi (2008) describe motivations for the rise of antidumping laws - the most commonly invoked temporary trade barrier policy - across the WTO membership over time, Bown (2011b) provides a recent empirical account of use of the policies across countries over time.

## References


Antràs, Pol and Robert W. Staiger. 2012a. "Trade agreements and the nature of price determination." *American Economic Review: Papers and Proceedings* 102(3): 470-6.

Antràs, Pol and Robert W. Staiger. 2012b. "Offshoring and the role of trade agreements." *American Economic Review* 102(7): 3140-3183

Bagwell, Kyle, Chad P. Bown and Robert W. Staiger. 2016. "Is the WTO Passé?" *Journal of Economic Literature* 54(4): 1125-1231.

Bagwell, Kyle and Robert W. Staiger. 1990. "A Theory of Managed Trade." *American Economic Review* 80(4): 779-95.

Bagwell, Kyle and Robert W. Staiger. 1999. "An Economic Theory of GATT." *American Economic Review* 89(1): 215-48.

Bagwell, Kyle and Robert W. Staiger. 2002. *The Economics of the World Trading System.* Cambridge, MA: The MIT Press.

Bagwell, Kyle and Robert W. Staiger. 2003. "Protection and the Business Cycle." *Advances in Economic Analysis & Policy* 3(1): Article 3 (available at http://www.bepress.com/bejeap/advances/vol3/iss1/art3/)

Bagwell, Kyle and Robert W. Staiger. 2011. "What do trade negotiators negotiate about? Empirical evidence from the World Trade Organization." *American Economic Review* 101(4): 1238-73.

Bagwell, Kyle and Robert W. Staiger. 2014. "Can the Doha Round be a Development Round? Setting a Place at the Table." In *Globalization in an Age of Crisis: Multilateral Economic Cooperation in the Twenty-First Century*, edited by Robert C. Feenstra and Alan M. Taylor, 91-124. Chicago, IL: University of Chicago Press for the NBER.

Bagwell, Kyle, Robert W. Staiger, and Ali Yurukoglu. 2015. "Multilateral Trade Bargaining: A First Look at the GATT Bargaining Records." *NBER Working Paper No. 21488,* August.

Beshkar, Mostafa, Eric W. Bond, and Youngwoo Rho. 2015. "Tariff binding and overhang: theory and evidence." *Journal of International Economics* 97(1): 1-13.

Blanchard, Emily J. 2007. "Foreign direct investment, endogenous tariffs, and preferential trade agreements." *BE Journal of Economic Analysis & Policy* 7.

Blanchard, Emily J. 2010. "Reevaluating the role of trade agreements: Does investment globalization make the WTO obsolete?" *Journal of International Economics* 82(1): 63-72.

Blustein, Paul. 2009. *Misadventures of the Most-Favored Nations: Clashing Egos, Inflated Ambitions, and the Great Shambles of the World Trade System.* New York: Public Affairs.

Bown, Chad P. 2009. *Self-Enforcing Trade: Developing Countries and WTO Dispute Settlement.* Washington, DC: Brookings Institution Press.

Bown, Chad P., Ed. 2011a. *The Great Recession and Import Protection: The Role of Temporary Trade Barriers.* London, UK: CEPR and World Bank.

Bown, Chad P. 2011b. "Taking Stock of Antidumping, Safeguards and Countervailing Duties, 1990-2009." *The World Economy* 34(12): 1955-1998.

Bown, Chad P. and Meredith A. Crowley. 2013a. "Self-Enforcing Trade Agreements: Evidence from Time-Varying Trade Policy." *American Economic Review* 103(2): 1071-1090.

Bown, Chad P. and Meredith A. Crowley. 2013b. "Import Protection, Business Cycles, and Exchange Rates: Evidence From the Great Recession." *Journal of International Economics* 90(1): 50-64.

Bown, Chad P. and Meredith A. Crowley. 2014. "Emerging Economies, Trade Policy, and Macroeconomic Shocks." *Journal of Development Economics* 111: 261-273.

Bown, Chad P. and Meredith A. Crowley. 2016. "The Empirical Landscape of Trade Policy." In *The Handbook of Commercial Policy*, edited by Kyle Bagwell and Robert W. Staiger, 3-108. Amsterdam, NL: Elsevier.

Bown, Chad P. and Douglas A. Irwin. 2017. "The GATT's Starting Point: Tariff Levels circa 1947." In *Assessing the World Trade Organization: Fit for Purpose?*, edited by Manfred Elsig, Bernard Hoekman, and Joost Pauwelyn, 45-74. Cambridge, UK: Cambridge University Press.

Bown, Chad P. and Kara M. Reynolds. 2015. "Trade Flows and Trade Disputes." *Review of International Organizations* 10(2): 145-177.

Bown, Chad P. and Kara M. Reynolds. 2017. "Trade Agreements and Enforcement: Evidence from WTO Dispute Settlement." *American Economic Journal: Economic Policy* 9(4): 64-100.

Broda, Christian, Nuno Limão, and David E. Weinstein. 2008. "Optimal tariffs and market power: the evidence." *American Economic Review* 98(5): 2032-65.

The Economist. 2018. "The Looming Global Trade War." March 8.

Francois, Joseph F. and William J. Martin. 2004. "Commercial policy variability, bindings, and market access." *European Economic Review* 48(3): 665-679.

Grossman, Gene M. and Elhanan Helpman. 1994. "Protection for sale." *American Economic Review* 84(4): 833-50.

Handley, Kyle. 2014. "Exporting under trade policy uncertainty: Theory and evidence." *Journal of International Economics* 94(1): 50-66.

Handley, Kyle and Nuno Limão. 2017. "Policy Uncertainty, Trade and Welfare: Theory and Evidence for China and the U.S." *American Economic Review* 107(9): 2731-2783.

Handley, Kyle and Nuno Limão. 2015. "Trade and Investment under Policy Uncertainty: Theory and Firm Evidence." *American Economic Journal: Economic Policy* 7(4): 189-222.

Johnson, Harry G. 1953-4. "Optimum Tariffs and Retaliation." *Review of Economic Studies* 21(2): 142-53.

Johnson, Robert C. and Guillermo Noguera. 2017. "A Portrait of Trade in Value Added over Four Decades." *Review of Economics and Statistics* 99(5): 896-911.

Jones, Kent. 2010. *The Doha Blues: Institutional Crisis and Reform in the WTO.* Oxford, UK: Oxford University Press.

Krishna, Pravin. 2014. "Preferential Trade Agreements and the World Trade System: A Multilateralist View." In *Globalization in an Age of Crisis: Multilateral Economic Cooperation in the Twenty-First Century*, edited by Robert C. Feenstra and Alan M. Taylor, 131-160. Chicago, IL: University of Chicago Press for the NBER.

Limão, Nuno and Giovanni Maggi. 2015. "Uncertainty and Trade Agreements." *American Economic Journal: Microeconomics* 7(4): 1-42.

Limão, Nuno and Patricia Tovar. 2011. "Policy Choice: Theory and Evidence from Commitment via International Trade Agreements." *Journal of International Economics* 85(2): 186-205.

Ludema, Rodney D. and Anna Maria Mayda. 2009. "Do Countries Free Ride on MFN?" *Journal of International Economics* 77(2): 137-50.

Ludema, Rodney D. and Anna Maria Mayda. 2013. "Do Terms-of Trade Effects Matter for Trade Agreements? Theory and Evidence from WTO Countries." *Quarterly Journal of Economics* 128(4): 1837-93.

Maggi, Giovanni. 1999. "The Role of Multilateral Institutions in International Trade Cooperation." *American Economic Review* 89(1): 190-214.

Maggi, Giovanni. 2014. "International trade agreements." In *Handbook of International Economics,* edited by Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff, Volume 4: 317-90. Amsterdam, NL: Elsevier.

Maggi, Giovanni and Andres Rodriguez-Clare. 1998. "The value of trade agreements in the presence of political pressures." *Journal of Political Economy* 106(3): 574-601.

Maggi, Giovanni and Andres Rodriguez-Clare. 2007. "A political-economy theory of trade agreements." *American Economic Review* 97(4): 1374-1406.

Maggi, Giovanni and Robert W. Staiger. 2011. "The Role of Dispute Settlement Procedures in International Trade Agreements." *Quarterly Journal of Economics* 126(1): 475-515.

Maggi, Giovanni and Robert W. Staiger. 2015. “Optimal Design of Trade Agreements in the Presence of Renegotiation.” *American Economic Journal: Microeconomics* 7(1): 109-43.

Martin, William J. and Aaditya Mattoo, Eds. 2011. *Unfinished Business? The WTO's Doha Agenda.* London, UK: CEPR and the World Bank.

Nicita, Alessandro, Marcelo Olarreaga, and Peri Silva. 2018. “Cooperation in WTO's Tariff Waters?” *Journal of Political Economy* 126(3): 1302-1338.

Ossa, Ralph. 2011. “A ‘new-trade’ theory of GATT/WTO negotiations.” *Journal of Political Economy* 119(1): 122-52.

Ossa, Ralph. 2012. “Profits in the “new trade” approach to trade negotiations.” *American Economic Review: Papers and Proceedings* 102(2): 466-69.

Ossa, Ralph. 2014. “Trade Wars and Trade Talks with Data.” *American Economic Review* 104(12): 4104-46.

Staiger, Robert W. and Guido Tabellini. 1987. “Discretionary Trade Policy and Excessive Protection.” *American Economic Review* 77(5): 823-37.

Staiger, Robert W. and Guido Tabellini. 1999. “Do GATT Rules Help Governments Make Domestic Commitments?” *Economics and Politics* 11(2): 109-144.

Tang, Man-Keung and Shang-Jin Wei. 2009. “The value of making commitments externally: Evidence from WTO accessions.” *Journal of International Economics* 78(2): 216-229.

Vandenbussche, Hylke and Maurizio Zanardi. 2008. “What explains the proliferation of antidumping laws?” *Economic Policy* 23(1): 93–138.

World Bank. 2014. “Harmonized List of Fragile Situations FY14.” Washington, DC: The World Bank.

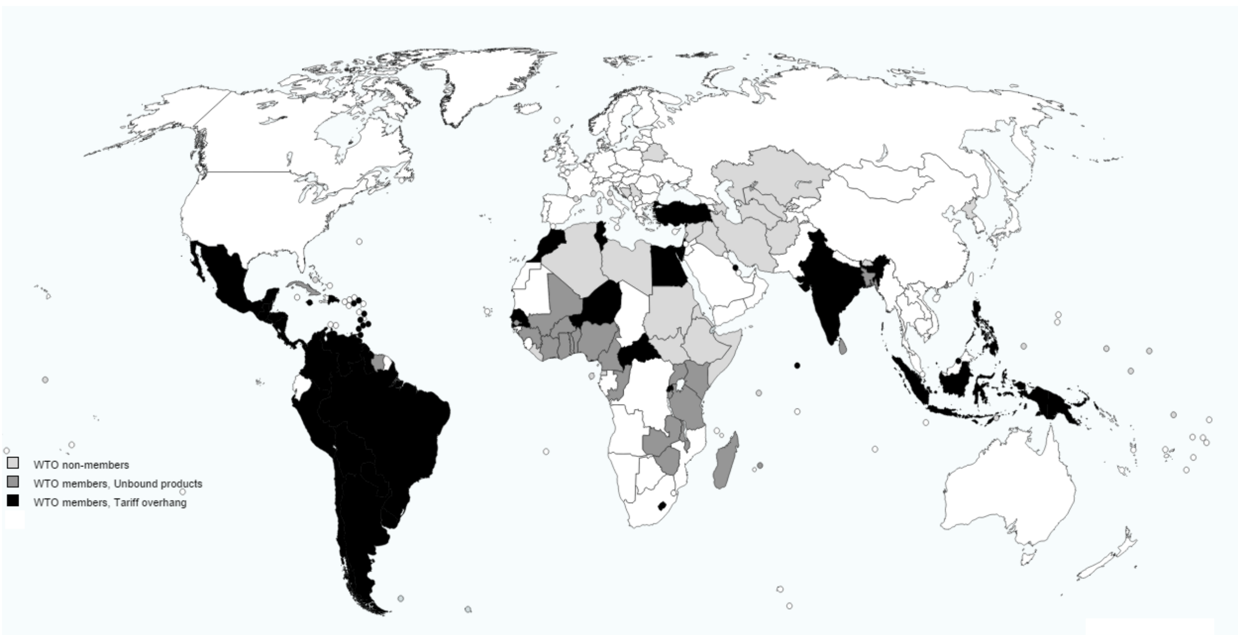
**Data Appendix**

The sources of the applied MFN tariff data for WTO members, the tariff binding data for WTO members, and the applied tariff data for WTO non-members are a combination of WTO IDB, CTS and UNCTAD TRAINS. Some of the tariff data is more disaggregated than the HS06 level, in which case I first construct means at the HS06 level before further employing it.

The data on the inverse export supply elasticities at the HS06 level for 108 WTO member countries is from Nicita, Olarreaga and Silva (2018).

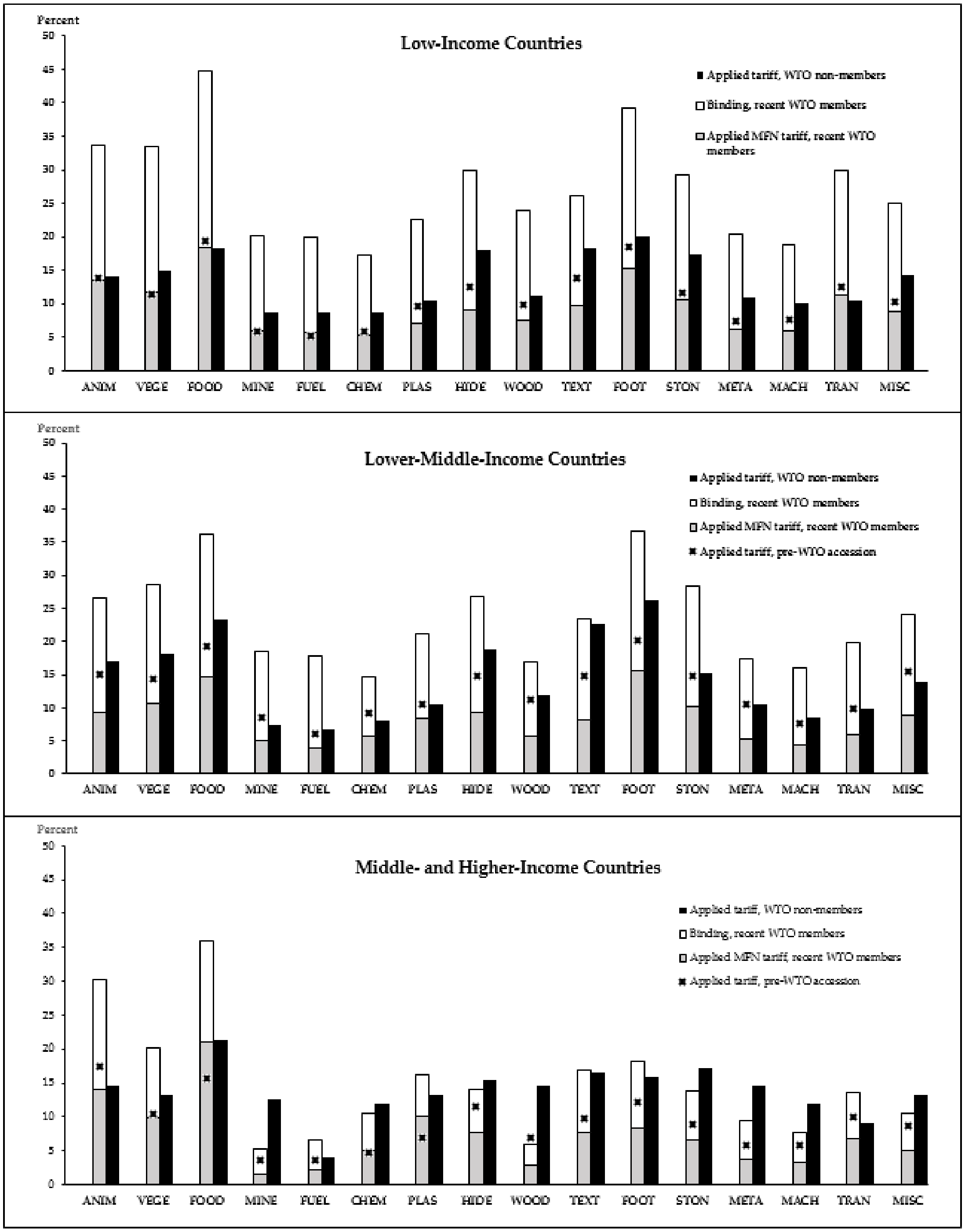
The sources of the data on the economic characteristics of countries is primarily the World Bank's World Development Indicators - for some countries with missing data, estimates were utilized from CIA's World Factbook.

Figure 1: WTO Non-Members, Members with Substantial Unbound Products, and Members with Substantial Tariff Overhang in 2013



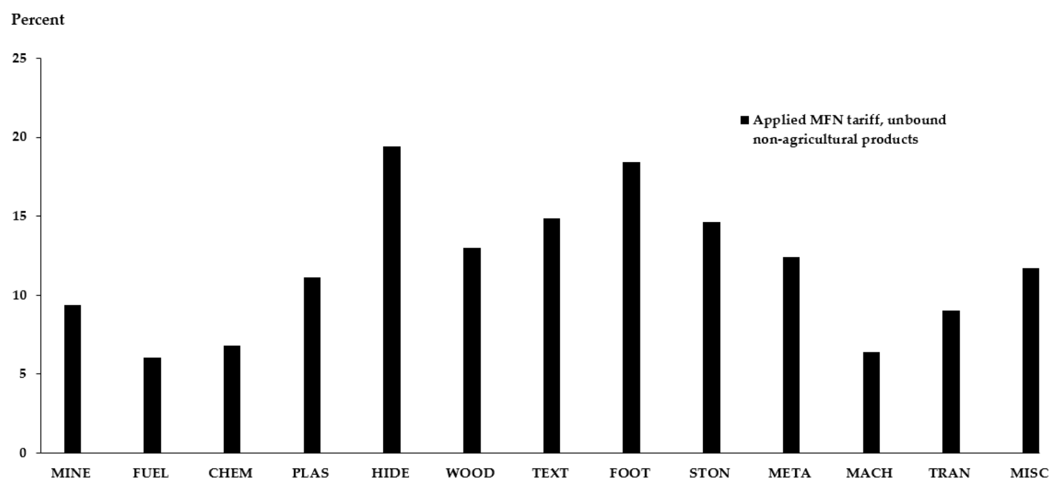

Source: Constructed by the author. For the list of WTO non-members, see Table 2. WTO members with substantial unbound products defined as countries with fewer than one third of non-agricultural products with tariff bindings; for list, see Table 5. WTO members with substantial tariff overhang defined as countries with more than one third of non-agricultural products with tariff bindings but with average tariff overhang of 15 percentage points or more; for list, see Table 7.

Figure 2: Average Tariffs for WTO Non-Members versus Recently Acceded WTO Members, by Industry and Country Group



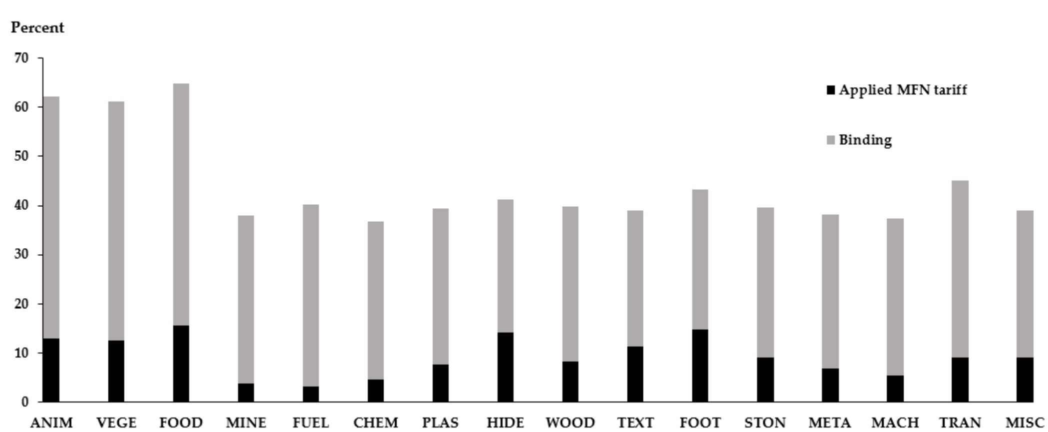

Source: Constructed by the author from tariff data at the HS-06 level from the WTO IDB, CTS and UNCTAD TRAINS. Constructed from available data and country groupings provided in Table 3.

Figure 3: Average Applied MFN Tariffs for WTO Members with Substantial Unbound Tariffs in 2013, by Industry




Source: Constructed by the author from tariff data at the HS-06 level from the WTO IDB, CTS and UNCTAD TRAINS. Constructed from the data for the 25 WTO member countries in Table 5 ("Group A") with less than 33 percent of non-agricultural tariffs that are bound.

Figure 4: Average Applied MFN Tariffs and Tariff Bindings for WTO Members with Substantial Tariff Overhang in 2013, by Industry




Source: Constructed by the author from tariff data at the HS-06 level from the WTO IDB, CTS and UNCTAD TRAINS. Constructed from the data for the 45 WTO member countries in Table 7 with 15 percentage points or more of average tariff overhang.

Table 1: Selected Empirical Studies of Trade Agreements, Import Tariffs and Market Power

| Paper | Trade policy environment | Countries |
|---|---|---|
| Broda, Limo and Weinstein (2008) | Applied tariffs set by 15 non-GATT/WTO countries, as a cross section (at some point over 1993-2000) | Algeria, Belarus, Bolivia, China, Czech Republic, Ecuador, Latvia, Lebanon, Lithuania, Oman, Paraguay, Russia, Saudi Arabia, Taiwan (China), Ukraine |
| | Applied tariffs, statutory tariffs, and non-tariff measures set by one major GATT/WTO member | United States |
| Bagwell and Staiger (2011) | WTO tariff binding levels upon accession for 16 new members that joined over 1995-2005 | Albania, Armenia, Cambodia, China, Ecuador, Estonia, Georgia, Jordan, Kyrgyz Republic, Latvia, Lithuania, Macedonia, Moldova, Nepal, Oman, Panama |
| Ludema and Mayda (2013) | Applied MFN tariffs for 26 WTO members at the conclusion of the Uruguay Round | Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Ecuador, European Union, Hungary, Iceland, India, Indonesia, Japan, South Korea, Madagascar, Malaysia, Mauritius, Mexico, Morocco, New Zealand, Norway, Peru, Romania, Thailand, United States |
| Ossa (2014) | Quantification of Nash, unilaterally optimal, and cooperative tariffs for 7 countries and rest of the world | Brazil, China, European Union, India, Japan, United States and rest of the world |
| Nicita, Olarreaga and Silva (2018) | Applied MFN tariffs for 100 WTO members with and without binding overhang, 2000-2009 | 100 countries |
| Beshkar, Bond and Rho (2015) | Binding levels and tariff overhang for 108 WTO members, 1995-2007 | 108 countries |
| Bown and Crowley (2013) | Antidumping and safeguard tariffs for a WTO member with applied tariffs at the binding level, 1997-2006 | United States |
| | The current chapter applies the Nicita, Olarreaga, and Silva (2018) export supply elasticities to... | |
| Section 3 | WTO tariff binding levels for 12 countries upon WTO accession (countries acceded 1998-2012) | Albania, Armenia, Cabo Verde, China, Georgia, Jordan, Kyrgyz Republic, Moldova, Nepal, Oman, Russia, Saudi Arabia, Ukraine |
| Section 4 | Applied tariffs for unbound products of 25 WTO members that have bound fewer than one third of nonagricultural products, 2013 | 25 countries listed in Table 5 |
| Section 5 | Applied tariffs for bound products of 45 WTO members with an average of 15 percentage points or more of tariff overhang, 2013 | 45 countries listed in Table 7 |

Table 2: Economic Characteristics of WTO Non-Members and Recently Acceded WTO Members, 2013

| WTO Non-member Country | WTO Observer Status | GNI per capita (2013 US$) | Population (millions) | Imports (billions, 2013 US$) | Exports (billions, 2013 US$) |
|---|---|---|---|---|---|
| **Low-income countries** | | | | | |
| Liberia | Observer | 410 | 4.3 | 1.6 | 0.6 |
| Ethiopia | Observer | 470 | 94.1 | 13.8 | 5.9 |
| Eritrea | No | 490 | 6.3 | 0.6 | 0.4 |
| Afghanistan | Observer | 690 | 30.6 | 10.0 | 1.3 |
| Comoros | Observer | 840 | 0.7 | 0.4 | 0.1 |
| South Sudan | No | 950 | 11.3 | 5.1 | 2.1 |
| Sao Tomé and Principe | Observer | 1,470 | 0.2 | 0.1 | <0.1 |
| Sudan | Observer | 1,550 | 38.0 | 10.7 | 6.4 |
| Uzbekistan | Observer | 1,880 | 30.2 | 18.0 | 15.7 |
| Syria* | Observer | NA | 22.8 | 7.6 | 1.9 |
| North Korea* | No | NA | 24.9 | 4.8 | 4.0 |
| Somalia* | No | NA | 10.5 | 0.8 | 0.6 |
| **Lower-middle-income countries** | | | | | |
| Bhutan | Observer | 2,330 | 0.8 | 1.1 | 0.7 |
| Kiribati | No | 2,620 | 0.1 | 0.2 | <0.1 |
| Micronesia* | No | 3,280 | 0.1 | 0.3 | 0.1 |
| Timor-Leste* | No | 3,940 | 1.2 | 1.6 | 0.2 |
| Marshall Islands* | No | 4,310 | 0.1 | 0.1 | <0.1 |
| Bosnia and Herzegovina | Observer | 4,780 | 3.8 | 9.5 | 5.7 |
| Algeria | Observer | 5,330 | 39.2 | 63.6 | 69.7 |
| Iran* | Observer | 5,780 | 77.4 | 60.1 | 93.0 |
| Tuvalu* | No | 5,840 | 0.0 | 0.2 | <0.1 |
| Serbia | Observer | 6,050 | 7.2 | 23.6 | 18.6 |
| Nauru | No | NA | <0.1 | 0.1 | 0.1 |
| **Middle- and higher-income countries** | | | | | |
| Iraq | Observer | 6,720 | 33.4 | 75.0 | 77.9 |
| Belarus | Observer | 6,730 | 9.5 | 45.9 | 43.9 |
| Turkmenistan | No | 6,880 | 5.2 | 15.6 | 25.8 |
| Azerbaijan | Observer | 7,350 | 9.4 | 19.8 | 35.8 |
| Lebanon | Observer | 9,870 | 4.5 | 33.8 | 27.7 |
| Palau | No | 10,970 | <0.1 | 0.2 | 0.2 |
| Kazakhstan | Observer | 11,550 | 17.0 | 61.9 | 88.7 |
| Seychelles | No | 13,210 | 0.1 | 1.3 | 1.1 |
| Equatorial Guinea | Observer | 14,320 | 0.8 | 10.7 | 13.8 |
| Bahamas | Observer | 21,570 | 0.4 | 4.7 | 3.5 |
| Andorra* | Observer | NA | 0.1 | 1.5 | <0.1 |
| Holy See (Vatican City) | Observer | NA | <0.1 | NA | NA |
| Libya* | Observer | NA | 6.2 | 26.8 | 34.9 |
| Monaco* | No | NA | <0.1 | 1.2 | 1.1 |
| San Marino* | No | NA | <0.1 | 2.1 | 2.6 |
| Subtotal (Non-members) | | | 490.4 | 534.3 | 583.9 |
| World | | 10,683 | 7,125.1 | 22,719.6 | 23,442.6 |
| Share of world | | | 6.9% | 2.4% | 2.5% |

| Recent WTO Accession Country | WTO Accession Year | GNI per capita (2013 US$) | Population (millions) | Imports (billions, 2013 US$) | Exports (billions, 2013 US$) |
|---|---|---|---|---|---|
| **Low-income countries** | | | | | |
| Nepal | 2004 | 730 | 27.8 | 7.2 | 2.1 |
| Cambodia | 2004 | 950 | 15.1 | 11.2 | 10.0 |
| Tajikistan | 2013 | 990 | 8.2 | 5.8 | 1.6 |
| Kyrgyz Republic | 1998 | 1,210 | 5.7 | 6.9 | 3.4 |
| Yemen* | 2014 | 1,330 | 24.4 | 11.0 | 8.1 |
| Laos | 2013 | 1,450 | 6.8 | 5.2 | 4.2 |
| Vietnam | 2007 | 1,740 | 89.7 | 136.8 | 143.8 |
| **Lower-middle-income countries** | | | | | |
| Moldova | 2001 | 2,470 | 3.6 | 6.5 | 3.5 |
| Vanuatu | 2012 | 3,130 | 0.3 | 0.4 | 0.4 |
| Georgia | 2000 | 3,560 | 4.5 | 9.3 | 7.2 |
| Cabo Verde | 2008 | 3,620 | 0.5 | 0.9 | 0.6 |
| Armenia | 2003 | 3,800 | 3.0 | 5.0 | 2.8 |
| Ukraine | 2008 | 3,960 | 45.5 | 98.3 | 83.2 |
| Samoa | 2012 | 3,970 | 0.2 | 0.4 | 0.2 |
| Tonga | 2007 | 4,490 | 0.1 | 0.3 | 0.1 |
| Albania | 2000 | 4,510 | 2.9 | 6.8 | 4.5 |
| Macedonia | 2003 | 4,870 | 2.1 | 7.4 | 5.5 |
| Jordan | 2000 | 4,950 | 6.5 | 24.0 | 14.3 |
| **Middle- and higher-income countries** | | | | | |
| China | 2001 | 6,560 | 1,357.4 | 2,203.6 | 2,440.5 |
| Montenegro | 2012 | 7,250 | 0.6 | 2.7 | 1.8 |
| Seychelles | 2015 | 13,210 | 0.1 | 1.3 | 1.1 |
| Croatia** | 2000 | 13,420 | 4.3 | 24.6 | 24.9 |
| Russia | 2012 | 13,850 | 143.5 | 471.6 | 594.8 |
| Lithuania** | 2001 | 14,900 | 3.0 | 33.9 | 33.2 |
| Latvia** | 1999 | 15,290 | 2.0 | 17.8 | 16.8 |
| Estonia** | 1999 | 17,780 | 1.3 | 21.2 | 21.4 |
| Oman | 2000 | 25,150 | 3.6 | 27.8 | 48.5 |
| Saudi Arabia | 2005 | 26,260 | 28.8 | 229.3 | 387.6 |
| Taiwan, China* | 2002 | NA | 23.4 | 267.4 | 304.6 |
| Subtotal (Recent accession) | | | 1,814.7 | 3,644.8 | 4,170.8 |
| World | | 10,683 | 7,125.1 | 22,719.6 | 23,442.6 |
| Share of world | | | 25.5% | 16.0% | 17.8% |
| Share of world (not including China) | | | 6.4% | 6.3% | 7.4% |

Sources: World Bank's World Development Indicators, *data unavailable so supplemented with estimates from the CIA's The World Fact Book. GNI=Gross national income, NA=not available. Income classifications *not* based on official World Bank categories. ** indicates country also acceded to the European Union during this period and adopted the EU's common external tariff.

Table 3: Tariff Characteristics of WTO Non-Members and Recently Acceded WTO Members, 2013

| WTO Non-member Country | WTO Observer Status | MFN applied tariff rate, 2013: Simple average | Min. | Max. | St. Dev. |
|---|---|---|---|---|---|
| **Low-income countries** | | | | | |
| Liberia | Observer | 10.0 | 0.0 | 50.0 | 6.9 |
| Ethiopia | Observer | 17.3 | 0.0 | 35.0 | 11.8 |
| Eritrea | No | 7.9 | 0.0 | 25.0 | 8.5 |
| Afghanistan | Observer | 5.9 | 0.0 | 40.0 | 3.9 |
| Comoros | Observer | 15.3 | 0.0 | 20.0 | 7.8 |
| Sao Tomé and Principe | Observer | 10.2 | 0.0 | 20.0 | 4.1 |
| Sudan | Observer | 21.2 | 0.0 | 40.0 | 15.8 |
| Uzbekistan | Observer | 15.1 | 0.0 | 30.0 | 10.9 |
| Syria | Observer | 16.5 | 0.0 | 80.0 | 23.2 |
| **Lower-middle-income countries** | | | | | |
| Bhutan | Observer | 21.9 | 0.0 | 100.0 | 13.7 |
| Timor-Leste | No | 2.5 | 2.5 | 2.5 | 0.0 |
| Bosnia and Herzegovina | Observer | 6.5 | 0.0 | 824.4 | 13.4 |
| Algeria | Observer | 18.6 | 0.0 | 30.0 | 10.3 |
| Iran | Observer | 26.6 | 3.0 | 400.0 | 28.7 |
| Tuvalu | No | 7.7 | 0.0 | 35.0 | 9.8 |
| Serbia | Observer | 7.4 | 0.0 | 30.0 | 7.3 |
| **Middle- and higher-income countries** | | | | | |
| Belarus | Observer | 8.8 | 0.0 | 100.0 | 6.6 |
| Turkmenistan | No | 5.1 | 0.0 | 150.0 | 15.4 |
| Azerbaijan | Observer | 9.7 | 0.0 | 1478.8 | 26.0 |
| Lebanon | Observer | 6.3 | 0.0 | 334.0 | 13.7 |
| Palau | No | 4.2 | 0.0 | 1370.1 | 29.1 |
| Kazakhstan | Observer | 8.7 | 0.0 | 100.0 | 6.6 |
| Equatorial Guinea | Observer | 17.9 | 0.0 | 30.0 | 9.5 |
| Bahamas | Observer | 35.1 | 0.0 | 75.0 | 16.2 |
| Libya | Observer | 21.3 | 0.0 | 3000.0 | 113.8 |

| Recent WTO Accession Country | WTO Accession Year | MFN applied tariff rate (simple avg.), pre-WTO‡ | MFN applied tariff rate (simple avg.), 2013 | WTO binding tariff rate (simple avg.) | WTO binding coverage (%) |
|---|---|---|---|---|---|
| **Low-income countries** | | | | | |
| Nepal* | 2004 | 12.3 | 12.2 | 26.0 | 99.4 |
| Cambodia | 2004 | 16.4 | 10.9 | 19.1 | 100.0 |
| Tajikistan | 2013 | 7.6 | 7.6 | 7.9 | 100.0 |
| Kyrgyz Republic* | 1998 | 0.0 | 4.5 | 7.4 | 99.9 |
| Laos | 2013 | 9.7 | 9.7 | 18.8 | 100.0 |
| Vietnam | 2007 | 16.4 | 9.4 | 11.4 | 100.0 |
| **Lower-middle-income countries** | | | | | |
| Moldova* | 2001 | 6.0 | 8.8 | 6.7 | 100.0 |
| Vanuatu | 2012 | 14.0 | 9.1 | 39.7 | 100.0 |
| Georgia* | 2000 | 10.6 | 1.4 | 7.2 | 100.0 |
| Cabo Verde* | 2008 | 10.4 | 10.3 | 15.8 | 100.0 |
| Armenia* | 2003 | 3.0 | 3.6 | 8.5 | 100.0 |
| Ukraine* | 2008 | 7.0 | 4.5 | 5.8 | 100.0 |
| Samoa | 2012 | 11.0 | 11.3 | 21.1 | 100.0 |
| Tonga | 2007 | 11.7 | 11.7 | 17.6 | 100.0 |
| Albania* | 2000 | 15.9 | 3.8 | 7.0 | 100.0 |
| Macedonia | 2003 | 14.4 | 6.5 | 6.9 | 100.0 |
| Jordan | 2000 | 22.1 | 9.5 | 16.2 | 100.0 |
| **Middle- and higher-income countries** | | | | | |
| China* | 2001 | 23.7 | 9.6 | 10.0 | 100.0 |
| Montenegro | 2012 | 4.6 | 4.2 | 5.1 | 100.0 |
| Croatia** | 2000 | 10.6 | 4.6 | 4.1 | 100.0 |
| Russia* | 2012 | 9.0 | 8.8 | 7.3 | 100.0 |
| Lithuania** | 2001 | 3.6 | 4.6 | 4.1 | 100.0 |
| Latvia** | 1999 | 4.3 | 4.6 | 4.1 | 100.0 |
| Estonia** | 1999 | 0.1 | 4.6 | 4.1 | 100.0 |
| Oman* | 2000 | 4.7 | 4.5 | 13.6 | 100.0 |
| Saudi Arabia* | 2005 | 11.9 | 4.7 | 10.7 | 100.0 |
| Taiwan, China | 2002 | 7.8 | 5.6 | 5.7 | 100.0 |

Sources: Compiled by the author from WTO IDB and CTS and UNCTAD TRAINS made available via WITS. ‡ pre-accession data taken from 5 years prior to WTO accession. **Acceded to the European Union during this period and thus adopted the EU's common external tariff. Yemen and Seychelles not included because they acceded in 2014 and 2015, respectively. *Countries utilized in the econometric exercise of Table 4.

Table 4: Market Power and Post-WTO Accession Import Tariff Bindings for Recently Acceded Countries

Regression equation: $ln(1+\tau_{gc}^{WTO-binding}) = \alpha_g + \alpha_c + \beta_0 ln(1/\omega^*_{gc}) + \beta_1 ln(1+\tau_{gc}^{pre-WTO}) + \epsilon_{gc}$

| | Baseline (1) | High inv. elasticity indicator (2) | Level inverse elasticity (3) | Add importer FE (4) | Large countries only (5) | Small countries only (6) |
|---|---|---|---|---|---|---|
| Log inverse elasticity: $\ln(1/\omega^*_{gc})$ | -2.39*** | | | -0.66** | -1.40*** | -0.62 |
| | (0.30) | | | (0.29) | (0.41) | (0.65) |
| Indicator for high inverse elasticity | | -0.06*** | | | | |
| | | (0.01) | | | | |
| Inverse elasticity: $(1/\omega^*_{gc})$ | | | -1.49*** | | | |
| | | | (0.19) | | | |
| Log pre-accession tariff: $\ln(1+\tau_{gc}^{pre-WTO})$ | 0.26*** | 0.26*** | | 0.31*** | 0.35*** | 0.27*** |
| | (0.01) | (0.01) | | (0.01) | (0.01) | (0.01) |
| Pre-accession tariff: $\tau_{gc}^{pre-WTO}$ | | | 0.24*** | | | |
| | | | (0.03) | | | |
| Product level (HS06) fixed effects | Y | Y | Y | Y | Y | Y |
| Importing country fixed effects | N | N | N | Y | Y | Y |
| Observations | 26,417 | 26,417 | 26,417 | 26,417 | 13,659 | 12,758 |
| $R^2$ | 0.48 | 0.48 | 0.43 | 0.62 | 0.68 | 0.66 |

Notes: Robust standard errors in parentheses, ***, **, * indicates statistically significant at the 1, 5, or 10 percent levels, respectively. Estimates for the constant term suppressed. Pre-WTO accession tariffs for HS-06 digit product $g$ taken five years prior to accession date for 12 countries ($c$): Albania, Armenia, Cabo Verde, China, Georgia, Jordan, Kyrgyz Republic, Moldova, Nepal, Oman, Russia, Saudi Arabia, and Ukraine. Large countries in column (5) defined as China, Russia, Saudi Arabia and Ukraine.

Table 5: Economic and Tariff Characteristics of WTO Members with Substantial Unbound Tariffs, 2013

**Countries with WTO binding coverage that is less than 33 percent of all non-agricultural products (Group A)**

| **WTO Member Country** | **WTO Accession Year** | **GNI per capita (2013 US$)** | **Population (millions)** | **Binding coverage, non-ag (%)** | **MFN applied (simple avg.), 2013** |
|---|---|---|---|---|---|
| Cameroon | 1995 | 1,290 | 22.3 | 1.7 | 18.0 |
| Tanzania | 1995 | 840 | 49.3 | 1.8 | 12.8 |
| Gambia | 1996 | 500 | 1.8 | 2.2 | 14.1 |
| Kenya | 1995 | 1,160 | 44.4 | 2.3 | 12.8 |
| Togo | 1995 | 530 | 6.8 | 2.4 | 11.9 |
| Ghana | 1995 | 1,770 | 25.9 | 2.8 | 12.9 |
| Uganda | 1995 | 600 | 37.6 | 4.3 | 12.7 |
| Bangladesh | 1995 | 1,010 | 156.6 | 4.4 | 14.0 |
| Congo | 1997 | 2,590 | 4.4 | 5.0 | 18.0 |
| Zambia | 1995 | 1,780 | 14.5 | 5.5 | 13.2 |
| Zimbabwe | 1995 | 860 | 14.1 | 5.7 | 13.2 |
| Mauritius | 1995 | 9,570 | 1.3 | 6.0 | 1.5 |
| Nigeria | 1995 | 2,690 | 173.6 | 8.4 | 11.7 |
| Burundi | 1995 | 260 | 10.2 | 12.1 | 12.8 |
| Macao SAR, China | 1995 | 71,270 | 0.6 | 12.7 | 0.0 |
| Suriname | 1995 | 9,370 | 0.5 | 13.3 | 10.4 |
| Malawi | 1995 | 270 | 16.4 | 20.8 | 12.7 |
| Madagascar | 1995 | 440 | 22.9 | 21.2 | 11.7 |
| Cuba | 1995 | NA | 11.3 | 21.2 | 10.3 |
| Cote d'Ivoire | 1995 | 1,450 | 20.3 | 23.7 | 11.9 |
| Sri Lanka | 1995 | 3,180 | 20.5 | 28.2 | 10.5 |
| Guinea | 1995 | 460 | 11.7 | 30.9 | 11.9 |
| Burkina Faso | 1995 | 660 | 16.9 | 31.3 | 11.9 |
| Benin | 1996 | 790 | 10.3 | 31.4 | 11.9 |
| Mali | 1995 | 690 | 15.3 | 32.0 | 11.9 |
| Subtotal (Group A) | | | 709.5 | | |
| World | | 10,683 | 7,125.1 | | |
| Share of world | | | 10.0% | | |

**Countries with WTO binding coverage that is between 33 and 95 percent of all non-agricultural products (Group B)**

| **WTO Member Country** | **WTO Accession Year** | **GNI per capita 2013 US$)** | **Population (millions)** | **Binding coverage, non-ag (%)** | **MFN applied (simple avg.), 2013** |
|---|---|---|---|---|---|
| Turkey | 1995 | 10,980 | 74.9 | 35.0 | 10.8 |
| Hong Kong SAR, China | 1995 | 38,520 | 7.2 | 35.2 | 0.0 |
| Tunisia | 1995 | 4,210 | 10.9 | 52.7 | 15.5 |
| Central African Rep. | 1995 | 320 | 4.6 | 58.9 | 18.0 |
| Singapore | 1995 | 54,580 | 5.4 | 63.9 | 0.1 |
| Philippines | 1995 | 3,270 | 98.4 | 63.9 | 3.7 |
| Thailand | 1995 | 5,360 | 67.0 | 68.4 | 10.4 |
| Bahrain | 1995 | 21,330 | 1.3 | 71.1 | 5.4 |
| India | 1995 | 1,560 | 1,252.0 | 71.2 | 13.3 |
| Israel | 1995 | 33,930 | 8.1 | 72.4 | 3.4 |
| Malaysia | 1995 | 10,420 | 29.7 | 75.4 | 5.0 |
| Korea | 1995 | 25,870 | 50.2 | 93.5 | 12.2 |
| Brunei | 1995 | NA | 0.4 | 94.1 | 1.3 |
| Iceland | 1995 | 46,650 | 0.3 | 94.3 | 5.9 |
| Subtotal (Group B) | | | 1,610.5 | | |
| World | | 10,683 | 7,125.1 | | |
| Share of world | | | 22.6% | | |

Sources: World Bank's World Development Indicators, tariffs constructed by the author with data from WTO CTS, IDB and UNCTAD TRAINS.
Ranked by binding coverage of non-agricultural products. GNI=Gross national income, NA=not available.

Table 6: Market Power and WTO Members' Applied Tariffs for Unbound Products, 2013

| | | | | | |
|---|---|---|---|---|---|
| | Regression equation: $ln(1+\tau_{gc}^{WTO-applied}) = \alpha_g + \alpha_c + \gamma_0 ln(1/\omega_{gc}^*) + \epsilon_{gc}$ | | | | |
| | Baseline (1) | Add importer FE (2) | High inv. elasticity indicator (3) | Add 33% to 95% bound to sample (4) | Alternative unbound sample (5) |
| Log inverse elasticity: $\ln(1/\omega_{gc}^*)$ | 0.44 | -1.28*** | | -0.96*** | -2.43*** |
| | (0.63) | (0.45) | | (0.34) | (0.70) |
| Indicator for high inverse elasticity | | | -0.02 | | |
| | | | (0.02) | | |
| Product level (HS06) fixed effects | Y | Y | Y | Y | Y |
| Importing country fixed effects | N | Y | Y | Y | Y |
| Observations | 25,326 | 25,326 | 25,326 | 36,525 | 11,199 |
| $R^2$ | 0.44 | 0.71 | 0.71 | 0.69 | 0.70 |

Notes: Robust standard errors in parentheses, ***, **, * indicates statistically significant at the 1, 5, or 10 percent levels, respectively. Estimates for the constant term suppressed. Columns (1), (2) and (3) include only the 25 WTO member countries (Group A) with less than 33 percent of non-agricultural products bound, as listed in Table 5. Column (4) adds 14 countries (Group B of Table 5) that have bound between 33 and 95 percent of non-agricultural products. Column (5) estimates the model on only the 14 Group B countries that have bound between 33 and 95 percent of non-agricultural products.

Table 7: Economic and Tariff Characteristics of WTO Members with Substantial Tariff Overhang, 2013

| **WTO Member Country** | **WTO Accession Year** | **GNI per capita (2013 US)** | **Population (millions)** | **Tariff Overhang (simple avg.), 2013** | **Tariff Binding rate (simple avg.)** | **MFN applied rate (simple avg.), 2013** | **Binding Coverage (%)** |
|---|---|---|---|---|---|---|---|
| Panama | 1997 | 10,700 | 3.9 | 16.2 | 23.0 | 6.8 | 99.9 |
| Maldives | 1995 | 6,850 | 0.3 | 16.2 | 36.7 | 20.5 | 99.1 |
| Israel | 1995 | 33,930 | 8.1 | 17.2 | 20.7 | 3.4 | 72.4 |
| Turkey | 1995 | 10,980 | 74.9 | 17.5 | 28.3 | 10.8 | 35.0 |
| Brazil | 1995 | 12,550 | 200.4 | 17.9 | 31.4 | 13.5 | 100.0 |
| Senegal | 1995 | 1,050 | 14.1 | 18.1 | 30.0 | 11.9 | 100.0 |
| Central African Republic | 1995 | 320 | 4.6 | 18.1 | 36.1 | 18.0 | 58.9 |
| Argentina | 1995 | 14,590 | 41.4 | 18.5 | 31.9 | 13.4 | 100.0 |
| Chile | 1995 | 15,230 | 17.6 | 19.1 | 25.1 | 6.0 | 100.0 |
| Egypt | 1995 | 3,140 | 82.1 | 20.6 | 36.1 | 15.5 | 99.1 |
| Uruguay | 1995 | 15,640 | 3.4 | 21.1 | 31.6 | 10.5 | 100.0 |
| Philippines | 1995 | 3,270 | 98.4 | 21.9 | 25.6 | 3.7 | 63.9 |
| Brunei | 1995 | NA | 0.4 | 22.9 | 24.2 | 1.3 | 94.1 |
| Venezuela | 1995 | 11,730 | 30.4 | 23.2 | 36.5 | 13.3 | 100.0 |
| Paraguay | 1995 | 3,980 | 6.8 | 23.5 | 33.5 | 10.0 | 100.0 |
| Peru | 1995 | 6,270 | 30.4 | 26.1 | 29.4 | 3.4 | 100.0 |
| Honduras | 1995 | 2,120 | 8.1 | 26.4 | 32.1 | 5.7 | 100.0 |
| Morocco | 1995 | 3,030 | 33.0 | 27.0 | 41.2 | 14.3 | 100.0 |
| Dominican Republic | 1995 | 5,770 | 10.4 | 27.0 | 34.3 | 7.3 | 100.0 |
| Papua New Guinea | 1996 | 2,020 | 7.3 | 27.1 | 31.5 | 4.4 | 100.0 |
| Mexico | 1995 | 9,880 | 122.3 | 27.5 | 35.2 | 7.7 | 100.0 |
| Bolivia | 1995 | 2,550 | 10.7 | 28.3 | 40.0 | 11.6 | 100.0 |
| Bahrain | 1995 | 21,330 | 1.3 | 28.8 | 34.2 | 5.4 | 71.1 |
| Indonesia | 1995 | 3,760 | 249.9 | 29.9 | 37.1 | 7.2 | 96.0 |
| El Salvador | 1995 | 3,720 | 6.3 | 30.6 | 36.6 | 6.0 | 100.0 |
| Niger | 1996 | 410 | 17.8 | 33.0 | 44.9 | 11.9 | 96.1 |
| Nicaragua | 1995 | 1,750 | 6.1 | 35.3 | 41.1 | 5.7 | 100.0 |
| Colombia | 1995 | 7,610 | 48.3 | 35.6 | 42.3 | 6.8 | 100.0 |
| Guatemala | 1995 | 3,340 | 15.5 | 35.9 | 41.6 | 5.7 | 100.0 |
| India | 1995 | 1,560 | 1,252.0 | 36.2 | 49.6 | 13.3 | 71.2 |
| Costa Rica | 1995 | 9,450 | 4.9 | 37.2 | 42.7 | 5.6 | 100.0 |
| Jamaica | 1995 | 5,220 | 2.7 | 39.4 | 49.8 | 10.4 | 100.0 |
| Tunisia | 1995 | 4,210 | 10.9 | 43.0 | 58.5 | 15.5 | 52.7 |
| Trinidad and Tobago | 1995 | 15,640 | 1.3 | 45.3 | 55.8 | 10.5 | 100.0 |
| Guyana | 1995 | 3,750 | 0.8 | 45.4 | 56.6 | 11.2 | 100.0 |
| Grenada | 1996 | 7,490 | 0.1 | 46.3 | 56.7 | 10.4 | 100.0 |
| Belize | 1995 | 4,510 | 0.3 | 47.4 | 58.1 | 10.7 | 100.0 |
| Antigua and Barbuda | 1995 | 13,050 | 0.1 | 48.1 | 58.6 | 10.5 | 100.0 |
| Dominica | 1995 | 6,860 | 0.1 | 48.4 | 58.7 | 10.3 | 96.4 |
| Saint Lucia | 1995 | 7,060 | 0.2 | 51.8 | 62.1 | 10.3 | 100.0 |
| Saint Vincent and the Grenadines | 1995 | 6,540 | 0.1 | 52.5 | 62.7 | 10.2 | 100.0 |
| Barbados | 1995 | NA | 0.3 | 65.6 | 78.2 | 12.6 | 100.0 |
| St. Kitts and Nevis | 1996 | 13,760 | 0.1 | 65.7 | 76.0 | 10.3 | 100.0 |
| Lesotho | 1995 | 1,590 | 2.1 | 70.8 | 78.4 | 7.6 | 100.0 |
| Rwanda | 1996 | 630 | 11.8 | 76.6 | 89.4 | 12.8 | 100.0 |
| Subtotal | | | 2,442.0 | | | | |
| World | | 10,683 | 7,125.1 | | | | |
| Share of world | | | 34.3% | | | | |

Sources: World Bank's World Development Indicators, tariffs constructed by the author with data from WTO CTS, IDB and UNCTAD TRAINS. Members with average tariff overhang greater than 15 percentage points, ranked from lowest to highest. GNI=Gross national income, NA=not available.

Table 8: Market Power and WTO Members' Applied Tariffs for Bound Products with Substantial Tariff Overhang, 2013

| | Regression equation: $ln(1+\tau_{gc}^{WTO-applied}) = \alpha_g + \alpha_c + \gamma_0 ln(1/\omega_{gc}^{*}) + \epsilon_{gc}$ | | | | | | |
|---|---|---|---|---|---|---|---|
| | Baseline (1) | Add importer FE (2) | High inv. elasticity indicator (3) | Change to 25 p.p. subsample (4) | Non-Agr. only (5) | Agr. only (6) | Recent accessions only (7) |
| Log inverse elasticity: $\ln(1/\omega_{gc}^{*})$ | 1.74*** | 0.49** | | 1.37*** | 0.55** | 0.31 | -1.25*** |
| | (0.28) | (0.24) | | (0.32) | (0.25) | (0.66) | (0.38) |
| High inverse elasticity indicator | | | 0.03*** | | | | |
| | | | (0.01) | | | | |
| Product level (HS06) fixed effects | Y | Y | Y | Y | Y | Y | Y |
| Importing country fixed effects | N | Y | Y | Y | Y | Y | Y |
| Observations | 68,355 | 68,355 | 68,355 | 38,710 | 60,532 | 7,823 | 30,096 |
| $R^2$ | 0.33 | 0.58 | 0.58 | 0.65 | 0.59 | 0.57 | 0.48 |

Notes: Robust standard errors in parentheses, ***, **, * indicates statistically significant at the 1, 5, or 10 percent levels, respectively. Estimates for the constant term suppressed. With the exception of columns (4) and (7), model estimated on bound products for 45 countries (listed in Table 7) each with tariff overhang greater than 15 percentage points. Column (4) model estimated on bound products for 30 countries (listed in Table 7) with tariff overhang greater than 25 percentage points. Column (7) estimated on bound products for 12 recently acceded WTO countries listed in Table 3. With the exception of Nepal (13.8) and Oman (9.1), the other ten countries have average tariff overhang of 6 percentage points or less.

# Dragons, Giants, Elephants and Mice:

## Evolution of the MFN Free Rider Problem in the WTO Era[1]

by

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*Abstract*

In this paper, we examine the evolution of the MFN free rider problem from 1993 to 2012 by investigating changes in one of its main determinants, namely, the concentration of MFN exporters. We find evidence of an average increase in exporter concentration, which would suggest that negotiated tariffs for most countries would decrease if a new round of multilateral negotiations were completed. However, for a few key developing economies, India and Brazil in particular, the MFN free rider problem has gotten worse, offering a potential explanation for their apparent resistance to the Doha Round. We decompose changes in exporter concentration into three channels: the accession of new members to the WTO, the formation of new PTAs and the changes in trade flows. The main determinant of the average increase in exporter concentration is the formation of new PTAs, which provides empirical evidence of a "building-bloc" effect of PTAs working through terms-of-trade effects. The main countervailing effect causing decreases in exporter concentration is the export growth of emerging economies, most notably China.

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"To be blunt, there is hesitation to make indirect concessions to China, whether or not people are willing to name the dragon in the middle of the room." (Francois, 2008)

"For them, the elephant—or rather, the dragon—in the living room was China. Brazil, India, and other emerging economies were reluctant to further reduce industrial tariffs on an MFN basis because market opening towards OECD countries on this basis would also result in market opening towards China, whom they increasingly feared as a competitor." (Kleimann and Guinan, 2011).

## 1. Introduction

Today's World Trade Organization (WTO) oversees a vastly different trading system from the one it inherited twenty years ago, due in large part to three major trends: the accession of new members to the WTO, the rise of emerging economies, and the proliferation of preferential trade agreements (PTAs). The 2012 WTO had 157 members, 45 of which acceded since the WTO replaced the GATT in 1994.[2] Most notable among these new entrants are two of Asia's largest economies, the People's Republic of China (which acceded in 2001) and the Russian Federation (which acceded in 2012). The second trend is the rise of "emerging" economies, most notably Brazil, Russia, India, and China (BRIC). On average, emerging economies have grown far faster than the rest of the world. From 2004-2013, the average annual real GDP growth rates of Brazil, China, India, Indonesia, and Russia averaged 6.5%, while Germany, France, Japan, UK, and the US averaged only 1.2% over the same time span.[3] Along with this GDP growth has come impressive export growth, which has shaped the trade patterns of all countries. The share of U.S. imports coming from low-income countries, for example, grew from 15% in 2001 to 28% in 2007, with China accounting for 89 percent of this growth (Autor, Dorn, Hanson, 2013). Emerging countries have also become more assertive in negotiations. The third trend is the proliferation of preferential trade agreements (PTAs). Hundreds of PTAs have been signed since the WTO's creation, such that the majority of world

[2] WTO membership data for 1994 and 2012 are taken from WTO.org.
[3] IMF World Economic Outlook Databases.

trade now flows between PTA partners and thus is not subject to the WTO's key principle of nondiscrimination.[4] This has led some to question the continuing relevance of the WTO system.

Over the same twenty years, progress towards multilateral trade liberalization through WTO negotiations has ground to a halt. The Doha Round proved largely unsuccessful: the modest package of trade reforms approved at the Bali Ministerial Conference is the only tangible result of fourteen years of Doha Round negotiations (2001-2015). This leaves open many questions about the WTO's role as a forum for multilateral trade negotiations. Why were expectations for the Doha Round so high? Why has the divide between developed and developing members grown so wide? Were the trends described above factors in the Doha Round failure? And, most importantly, in light of these trends, what are the prospects for the WTO as a vehicle for trade liberalization going forward?

Much has already been written in answer to these questions. The ambition of the Doha Round has been linked to the timing of its launch in the wake of the September 11 attacks on the United States. Doha was seen by WTO members as a means of demonstrating their commitment to international cooperation and to combating terrorism by addressing what is arguably a root cause: poverty and underdevelopment (Blustein, 2009; Kleimann and Guinan, 2011). The subsequent stalemate has been linked to the rise of "emerging" markets, such as Brazil, India, and China, which challenged the traditional dominance of the 'Quad' (United States, European Union, Japan, and Canada) in the negotiations. Standoffs between these groups ensued over agriculture for several years of the Round. This gave way to standoffs over non-agricultural market access (NAMA)[5] as the mercurial growth of Chinese exports brought about a hesitance in other countries to make MFN tariff cuts (Francois, 2008). This hesitance was reinforced by the global economic downturn of the late 2000s, which reinforced countries' unwillingness to reduce tariffs and relinquish a tool of protectionism and revenue (Blustein, 2009).

Blame for the stalemate has been directed at both sides. Emerging countries have been blamed for using their developing-country status as a pretext for refusing to make or delay tariff cuts. Former U.S. Trade Representative Susan Schwab has referred to this as "elephants hiding

[4] Over 50% of trade flows occur between PTA partners (an increasing trend, see Carpenter and Lendle, 2010) but a comparatively small amount (16% in 2011) actually receives preferential treatment (WTO. "Changing Face of Trade Pacts Requires Coherence with WTO, Report Says." WTO, 20 July 2011.)
[5] See Fergusson (2011).

behind mice" (Schwab, 2011). Others place the blame on the United States for failing in its traditional leadership role. Jagdish Bhagwati refers to the U. S. as a "selfish hegemon" suffering from a "diminished giant syndrome" in the face of a rising China (Bhagwati, 2008), and has criticized its turn toward regionalism for undermining Doha (Bhagwati, 2011). Bagwell and Staiger (2011) fault both developing countries, for seeking special and differential treatment, and the United States, for misguided proposals on agriculture. Bagwell and Staiger (2014) argue that the stalemate occurred because developed countries have achieved most of the liberalization they want from each other in past rounds, particularly in manufactures, while developing countries have not come to the table ready to make sufficient concessions themselves.

This paper attempts to shed light on the past, present and future of the GATT/WTO system as a vehicle for multilateral trade liberalization by employing a unified framework, in which both the purpose of trade agreements and the limitations of multilateral negotiations derive from the same source: terms of trade externalities. The framework is built upon three main claims. The first is that governments acting unilaterally will tend to overuse tariffs and other trade restrictions, to the extent that they are able to shift the cost of protecting a domestic industry onto foreign producers by altering the terms of trade. The second, following the work of Bagwell and Staiger (2002), is that the GATT/WTO serves as a mechanism by which countries internalize the terms-of-trade externalities of their policies and thus move toward efficient policy choices. The third, following Ludema and Mayda (2009, 2013), is that terms-of-trade externalities may not be fully internalized if some countries "free ride" on the MFN tariff cuts of others, and the severity of this problem depends on the concentration of MFN exporters across countries and products.

The empirical evidence in favor of these claims has been mounting for some time. Broda, Limão and Weinstein (2008) provide evidence that the tariffs of non-WTO countries are set on the basis of cost-shifting motives, as are the statutory (non-negotiated) tariff rates of the United States. Bagwell and Staiger (2011) find that the pattern of GATT/WTO negotiated tariff cuts for accession countries is consistent with the internalization of terms-of-trade externalities. Bown and Crowley (2013) find that U.S. contingent protection responds to trade shocks in accordance with terms-of-trade-based cooperation. Ludema and Mayda (2009) find evidence of MFN free riding in the pattern of U.S. MFN tariffs. Finally, Ludema and Mayda (2013) study a sample of

30 WTO countries and find evidence from the MFN tariffs negotiated during the Uruguay round that countries partially internalized the terms-of-trade effects of their tariff reductions but were limited by MFN free riding.[6]

The novel contribution of this paper is to examine the evolution of the MFN free rider problem from 1993 to 2012 by investigating changes in MFN exporter concentration, measured as the Herfindahl-Hirschman Index (HHI) of WTO exporters receiving MFN treatment. We find evidence of an average increase in exporter concentration, which would suggest that negotiated MFN tariffs would decrease if the Doha round were completed. We also decompose changes in exporter concentration into the three trends noted above. First, we find that the main determinant of the average increase in exporter concentration between 1993 and 2012 has been the creation of new PTAs. When two WTO countries form a PTA, they extend MFN treatment to fewer countries than they did before. While this could theoretically increase or decrease the HHI of the remaining exporters to those countries, it has generally increased it in practice, thus reducing the MFN free rider problem. Thus we identify a new mechanism through which PTAs can be a "building bloc" of multilateral trade liberalization. Our paper shows that, far from contributing to the failure of the Doha round, the creation of new PTAs has actually increased the chances of its success.

Second, we show that accession of new members to the WTO has increased the HHIs of existing members. This is because, before acceding, the new members already received MFN treatment but, at the same time, were not able to participate in the negotiations – thus were not included in the (numerator of the) HHI. Thus accession of new members to the WTO increases the HHI of existing members by adding new potential participants to the negotiations.[7]

Third, we find that the rapid expansion of exports of emerging markets has generally decreased the concentration of exports across most countries and products, suggesting that the "dragon in the room" problem has merit. Our analysis shows that the HHI of exporters to several

[6] The analysis in Ludema and Mayda (2009, 2013) is based on applied rates since the theory in these papers holds for the rates that actually apply to trade flows at any point in time. However, the empirical results are robust to using bound rates as an alternative dependent variable.

[7] Most acceding countries already received MFN status before becoming members of the WTO, so their exports already had MFN access to the markets of existing members. But until they became members, existing members could not pressure them to make concessions in exchange. Thus before acceding, these countries were free riders by construction.

developing countries, like Brazil and India, has decreased between 1993 and 2012, mostly due to the growth of trade with other emerging economies like China. For these importing countries, the growth of China has eroded the market shares of their principal suppliers, which according to our model undermines the willingness of principal suppliers to reciprocate tariff reductions of the importing country. This reduces the incentive for the importing country to reduce tariffs. Hence, importing countries like Brazil and India have been reluctant to make tariff reductions due to the growth of China – consistent with the quotes at the beginning of the paper. This also explains why developing countries have not come to the table ready to make significant concessions, as noted by Bagwell and Staiger (2014).[8]

*Macro versus Micro Free Riding*. Before proceeding with the analysis, it is worth distinguishing between two ways in which free riding on MFN can affect WTO negotiations. The first we call "macro" free riding, which might occur if a country refuses to adopt all or a major part (e.g., services) of an agreement that other countries are willing to sign. For most of GATT history, macro free riding has been practiced, especially by developing countries, and is even enshrined in the special and differential provisions of GATT Part IV. The so-called "Single Undertaking" rule, which requires each country to accept all or none of a negotiated agreement, was employed in both the Uruguay and Doha negotiations as a way to combat macro free riding. Many WTO observers have blamed the Single Undertaking rule for the Doha stalemate and have recommended plurilateral and "critical mass" negotiations as practical ways forward (e.g., Gallagher and Stoler, 2009; Hoekman and Mavroidis, 2015).

"Micro" free riding refers to free riding that occurs at the importer-product level, when an exporter of a particular product refuses to help other exporters compensate the importer for its tariff cut. It is entirely possible that all countries in a negotiation have perfectly balanced concessions overall (and thus no macro free riding) and yet those concessions will be inefficiently small because of micro free riding. Hence, while a macro free rider is necessarily a micro free rider, the converse is not true. This paper is aimed at understanding the evolution of conditions under which micro free riding has been shown to occur. We are interested in whether

[8] While our model and estimates explain why certain key developing countries were unwilling to make tariff reductions in the Doha round, it does not provide a complete explanation for the stalemate of the Round. This is because our model is static. A dynamic model in which countries have the option to postpone the conclusion of the round until a more symmetric result can be achieved, could potentially rationalize the stalemate.

the world of today is better or worse than the world of 1994 from a micro free riding perspective, as we believe this is critical the to depth of any agreement that might be reached, should a strategy for successful multilateral negotiations at the macro level be found.

Section 2 outlines the theoretical framework while Section 3 describes the cross-country data used. Sections 4 and 5 present the results of the empirical analysis: in Section 4 we bring the theoretical model to the data and, based on our estimates, we explore how successful the GATT/WTO system has been up to the Uruguay round, in particular in its role of allowing countries to internalize the terms-of-trade effects of their tariff reductions; in Section 5 we provide evidence on prospects for multilateral trade liberalization during the Doha round, based on changes in exporter concentration between 1993 and 2012. Finally, in Section 6 we conclude.

## 2. Theoretical Framework

Our theoretical framework is based on the assumption that an importing country is more likely to lower its MFN tariff during GATT/WTO negotiations on a given product if it faces highly motivated exporting countries willing to offer concessions in exchange. What factors motivate the exporting countries? One factor is the extent to which the existing tariff depresses the prices exporting firms can charge in the protected market, otherwise known as the terms-of-trade externality. The more the tariff protection depresses external prices, the more motivated exporting countries will be to see the protection removed. In a competitive market, the terms-of-trade externality is measured by the inverse elasticity of export supply.

A second factor has to do with exporter concentration. Intuitively, a country that is the sole exporter to a given market would be willing to pay more for a tariff cut than would a group of countries sharing the market. Ludema and Mayda (2009) formalize this point and show that it derives from two effects. First, an exporting country's benefit from an MFN tariff reduction is proportional to its share of the total MFN exports destined for that market. However, because MFN implies that the country obtains the benefit whether it offers concessions or not, its willingness to pay also depends on how much its refusal to offer concessions would mitigate the tariff reduction. The larger the exporter, the more its refusal would mitigate the tariff cut and thus the more costly it would be for the exporter to refuse. Together these two effects imply that an exporter's maximum willingness to pay for a tariff cut is proportional to its squared export share. Summing over all exporters, the collective willingness to pay of all MFN exporters is proportional to the Herfindahl-Hirschman index (HHI) of exporter concentration.

Ludema and Mayda (2009) show that if the HHI is above a certain threshold, then all exporters offer concessions and the outcome is first best. That is, the terms-of-trade externality is fully internalized. In this case, negotiations lead the importer to reduce its tariff (relative to the non-cooperative optimal tariff) by the full amount of the terms-of-trade externality. If the HHI is below the threshold, then only a small group of large exporters (principal suppliers) offer concessions and full internalization is not achieved. However, since there is a positive relationship between the export share of the principal suppliers and the HHI, the degree of internalization increases with the HHI. It follows that the size of the negotiated tariff cut (relative to the non-cooperative optimal tariff) is some fraction of the terms-of-trade externality, and this fraction is an increasing function of the HHI.

Assuming that governments maximize social welfare and that all trade is governed by MFN, then (1 plus) the ad-valorem negotiated MFN tariff rate of country $i$ on product $k$ is given by: [9]

$$\tau_{ik}^{n}(A_{ik}) = 1 + \frac{1}{\varepsilon_{ik}}[1 - \Theta_{ik}(H_{ik}\ )] \qquad (1)$$

where $H_{ik}$ is the HHI of exporter concentration and $(\frac{1}{\varepsilon_{ik}})$ is the inverse elasticity of foreign export supply, i.e. the market power of country $i$ for product $k$. The function $\Theta_{ik}(\cdot)$ measures the degree of internalization: Technically, it is equal to the cumulative export market share of the exporters that elect to offer concessions in equilibrium: $\Theta_{ik} \equiv \sum_{j \in A_{ik}} \theta_{ik}^{j}$ where $A_{ik}$ denotes the set of exporting countries participating in negotiations over good $k$ with importing country $i$. It is an increasing function, with $\Theta_{ik}(0) = 0$ and $\Theta_{ik}(\overline{H}_{ik}) = 1$, where $\overline{H}_{ik}$ is the threshold value of HHI for full participation.

[9] The model of negotiations applied by Ludema and Mayda (2013) is based on the GATT's most common method of tariff negotiations, an item-by-item request and offer method which saw extensive use in the first five GATT rounds and the Uruguay Round. In this model, four consecutive stages occur: a request of tariff rates, an offer of tariffs, bilateral bargaining, and the setting of a mutually agreed tariff schedule where the negotiation between countries is solved according to the Nash bargaining solution. The negotiated tariff, chosen in the final stage, is Pareto efficient for the participants in the negotiations for each good.

Under noncooperation, $\Theta_{ik} = 0$, and the negotiated tariff reduces to the optimum tariff, which is increasing in importer market power. If $\Theta_{ik} > 0$, the effect of market power is decreasing in $\Theta_{ik}$. At full cooperation ($\Theta_{ik} = 1$) the negotiated tariff equals free trade and importer market power has no effect.

Shifting away from a pure welfare-maximization problem, the model can be extended to include political economy determinants as well as PTAs. The negotiated tariff becomes:

$$\tau_{ik}^{n}(A_{ik}) = \frac{1+\frac{1}{\varepsilon_{ik}}\left(1-\Theta_{ik}-\sum_{j\in MFN_i}\psi_{jk}\theta_{ik}^{j}\right)}{1-\frac{\lambda_{ik}}{\mu_{ik}}\frac{X_{ik}^{i}}{M_{ik}}-\frac{1-\emptyset_{ik}}{\mu_{ik}}\phi_{ik}} \tag{2}$$

where the values $\lambda_{ik}$ and $\psi_{ik}$ represent the political power of import-competing and export-oriented firms respectively. These weights may be indicators of political lobbying as per Grossman and Helpman (1994) or other political economy models (Baldwin 1987, Helpman 1997). $\phi_{ik}$ denotes country $i$'s concern about the interests of PTA partners (see Limão (2007)).

The negotiated tariff (2) is increasing in $\frac{\lambda_{ik}}{\mu_{ik}}\frac{X_{ik}^{i}}{M_{ik}}$, the political influence of domestic import-competing firms, and decreasing in $\sum_{j\in MFN_i}\psi_{jk}\theta_{ik}^{j}$, the influence of export-oriented firms in countries that are involved in the negotiations. The term $\frac{1-\emptyset_{ik}}{\mu_{ik}}\phi_{ik}$ captures the influence of PTA partners, which is ambiguous in sign, depending on whether a "stumbling bloc" vs. a "building bloc" effect of PTAs takes place. The tariff complementarity effect of Bagwell and Staiger (1998) and the findings of Estevadeordal, Freund, and Ornelas (2008) suggest that country $i$'s concern for its PTA partners should be small, i.e. $\phi_{ik} < 1$, such that the negotiated MFN tariff is decreasing in the PTA share of imports.[10] Instead Limão (2007) finds evidence from the United States that $\phi_{ik} > 1$ and his interpretation is that PTA countries have an incentive to raise external MFN tariffs to improve their bargaining position with PTA partners over non-trade issues.

Our empirical analysis follows two steps. First, in Section 4, we begin by asking how successful has the GATT/WTO system been so far. Since 1947, the GATT/WTO system has

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[10] Estevadeordal, Freund, and Ornelas (2008) find that in Latin America, the formation of PTAs has a lagged negative effect on the MFN tariff set by involved countries.

presided over an unprecedented liberalization of world trade. However, whether this liberalization is entirely attributable to the GATT/WTO system – and in particular to its role in allowing countries to internalize terms-of-trade effects – is an open question. Part of the difficulty in answering this question comes from the various tracks by which trade liberalization occurs. Some trade liberalization has occurred through GATT/WTO negotiations and accessions. At the same time, many countries have liberalized unilaterally and through regional trade agreements. Another difficulty is in knowing the counterfactual: how much trade liberalization would have occurred without the GATT/WTO system. Our theoretical model allows us to address this question – based on estimates of the theoretical model in Ludema and Mayda (2013) who use data for the Uruguay round, i.e. 1993 values for the regressors and 1995-2000 values for the tariff rates. Second, in Section 5, we examine the prospects for future multilateral trade liberalization through changes in exporter concentration between 1993 and 2012. We decompose the latter changes into the three components discussed in the introduction: the WTO accession of new countries, the creation of PTAs and the change in trade patterns due to emerging economies' high growth rates. Before proceeding to the empirical analysis, we describe the data we use in Section 3 below.

## 3. Data

We use the following data sources for the empirical analysis in Sections 4 and 5. In Section 4, applied MFN tariff rates for the period 1995-2000 are taken from UNCTAD's TRAINS through the World Bank's World Integrated Trade Solution (WITS) dataset. The dataset consists of 135,346 observations across 36 countries and 5,036 product categories. We merge these data with information from Nunn (2007), Broda, Greenfield, and Weinstein (2006), and Rauch (1999) and construct a composite measure of the power of the importing country to affect international prices through its trade policy, which we call the *market power index*. Rauch (1999)'s data consist of dummy variables for product differentiation (*Diff* in Ludema and Mayda (2013)). Nunn (2007) supplies an index of contract intensity and, finally, Broda, Greenfield and Weinstein (2006) provide values to construct indicators of high inverse elasticity of export supply (*HIEE* in Ludema and Mayda (2013)). See Section 4 below for more details about these three variables. This paper uses the average of these three variables to construct the *market power index* variable. Data on political organization by country and HS 4-digit product codes in 1993 are obtained from the World Guide to Trade Associations. For additional details about the variables used in the estimation of Section 4, see Ludema and Mayda (2013).

For use in Section 5, data for 1993 and 2012 aggregate and bilateral trade flows are collected from Comtrade through WITS. Each country's bilateral trade flows are merged into a single dataset in order to calculate the Herfindahl-Hirschman Index (HHI) of exporter concentration by importing country and product code (at the HS 6-digit level). We construct additional variables at the same level of disaggregation, for example, the share of imports from PTA partners and the share of imports from non-WTO-countries.[11]

## 4. How successful has the GATT/WTO system been up to the Uruguay round

### 4.1. Estimation of the theoretical model focusing on the Uruguay round

The empirical strategy employed in this paper is based on Ludema and Mayda (2013), who estimate a specification closely related to the theoretical model. Taking a first-order Taylor approximation of equation (2), we obtain:

$$\tau_{ik} = \frac{1}{\varepsilon_{ik}}\left(1 - \Theta_{ik} - \sum_{j\in MFN_i} \psi_{jk}\theta_{ik}^{j}\right) + \frac{\lambda_{ik}}{\mu_{ik}}\frac{X_{ik}^{i}}{M_{ik}} - \frac{1-\phi_{ik}}{\mu_{ik}}\phi_{ik} \tag{3}$$

There are several challenges to address to carry out the estimation of equation (3). First, the model needs a proxy for $\Theta_{ik}$, which captures the extent to which the terms-of-trade effects of tariff reductions are internalized by the participants in the negotiations over each product. Specifically, $\Theta_{ik}$ measures country *i*'s imports of product *k* from participants in GATT/WTO negotiations as a fraction of total imports of the same product from countries that receive MFN treatment and are not its PTA partners. We do not observe the set of participants but the

[11] Note that the only variable of the estimation which differs between this paper and Ludema and Mayda (2013) is the measure of importing country's market power: in this paper we use a composite measure, while in Ludema and Mayda we run separate specifications using, respectively, *Diff* and *HIEE*.

theoretical model predicts that there is a positive relationship between $\Theta_{ik}$ and the HHI. A larger value of the HHI means a higher concentration of exports of product $k$ to country $i$ (higher *exporter concentration*), i.e. the existence of relatively large exporters, which face a greater incentive to participate in the negotiations. Large exporters are deterred from free riding as they stand to gain more from a given tariff reduction and, also, their participation increases more the importing country's tariff reduction – relative to small exporters. Thus, country *i* having a higher HHI on product *k* suggests that participants in country *i*'s negotiation of the tariff on product *k* will cover a higher aggregate share of the exports of that product. Ludema and Mayda (2013) provide the relevant expression to calculate the HHI:

$$H_{ik} = \frac{\sum_{j \in MFN_i \cap WTO} (M_{ik}^{j})^2}{\left(\sum_{j \in MFN_i} M_{ik}^{j}\right)^2} \tag{4}$$

This expression excludes the importing country's PTA partners and countries not receiving MFN status. In addition, in the denominator, it accounts for non-GATT/WTO countries that receive MFN treatment. $MFN_i$ is the set of non-PTA-partner countries that are granted MFN status by country *i*, regardless of GATT/WTO membership, while the numerator considers a subset of $MFN_i$ that only includes GATT/WTO members. This study follows the literature and assumes that the list of countries receiving MFN status is for all importers the same as the U.S. one.[12] $M_{ik}^{j}$ is the value of country *i*'s imports of product *k* from country *j*.

The second challenge of the model is in capturing the value of $\frac{1}{\varepsilon_{ik}}$, the inverse elasticity of foreign export supply of product *k* in country *i*, which represents country *i*'s market power. The measurement of this variable is difficult due to unavailability of accurate and standardized estimates. Ludema and Mayda (2013) present two specifications, corresponding to two indicators of market power. First, using data from Broda, Greenfield and Weinstein (2006) and following Broda, Limão, and Weinstein (2008), they use a categorical variable for "high inverse export elasticity" (*HIEE*), which is equal to 1 if the inverse export elasticity estimate is in the top two thirds of all products' estimates within the same country and 0 otherwise. The second indicator used by Ludema and Mayda (2013), based on the Rauch classification, varies by product and

[12] From 1996 onwards, the only non-MFN countries were Afghanistan, Cuba, Laos, North Korea, Iran, Vietnam, Serbia and Montenegro. Before then, the US granted unconditional MFN to all other countries, except Communist countries. Communist countries began receiving MFN treatment in the nineties.

provides a value for each product of 1 if the product is differentiated and 0 otherwise (*Diff*). Rauch (1999) argues that product differentiation interferes with matching in international markets and, therefore, products categorized as differentiated should have lower export elasticities (higher importer market power) than homogeneous goods. In this paper we also take into account a third measure taken from Nunn (2007), who provides a contract intensity index based on the proportion of each good's intermediate inputs that require relationship-specific investments. In this paper we construct a measure of market power that averages the value of the three mentioned measures for each observation (*market power index*).

In addition to the main independent variables, the analysis includes controls for domestic and foreign political organization. Defining both is necessary to allow for import-competing and exporting firms to have different political clout. Domestic political controls follow Goldberg and Maggi (1999) and are defined as $\lambda_{ik} = (\gamma + \delta \cdot PO_{ik})$, where the political organization term $PO_{ik}$ is equal to 1 if a trade association is present for sector *k* in country *i* and 0 otherwise. The foreign political economy term is defined symmetrically as $\psi_{jk} = \delta^{*} \cdot PO_{jk}$.

Based on equation (3), we estimate the following specification:

$$\tau_{ik} = \alpha + \beta_1 MP_{ik} + \beta_2 MP_{ik} H_{ik} + \beta_3 H_{ik} + \omega \frac{\Phi_{ik}}{\mu_{ik}} + \alpha_i + Z_{ik} + \varepsilon_{ik} \qquad (5)$$

where $\tau_{ik}$ is the ad valorem MFN tariff rate on product *k* set by country *i*, averaged over the years 1995-2000, $H_{ik}$ denotes the HHI of country *i*'s imports on product *k* in 1993, $\Phi_{ik}$ is the PTA share of these imports in 1993, which is divided by the import demand elasticity $\mu_{ik}$ in country *i* on product *k*, and $MP_{ik}$ is the *market power index* (MPI). $\alpha_i$ and $Z_{ik}$ are controls, $\alpha_i$ comprising country fixed effects and $Z_{ik}$ capturing domestic and foreign political economy effects. $\varepsilon_{ik}$ is an idiosyncratic error term.

Based on the theoretical model, we expect $\beta_1 > 0$, as this captures the effect of market power when there is no cooperation (when $H_{ik}$= 0). Optimum tariff theory suggests that the higher country *i*'s market power is in sector *k*, the higher the tariff it sets (while a small open economy with $MP_{ik}$= 0 would have an optimum tariff of 0). Second, the effect of market power should decrease in the presence of higher HHI, suggesting $\beta_2 < 0$, as the interaction term captures the effect of the internalization of terms of trade effects through negotiations. This term also captures the MFN free rider effect since, with high market power, the HHI should have a negative effect on MFN tariffs, given that the free rider problem is less severe when exporter concentration is high. The coefficient $\beta_3$ should be 0 or slightly negative as it captures the effect of the HHI when there is no market power. The PTA share term is theoretically ambiguous. Finally, for domestic political economy effects, we expect $\delta > 0$, $\gamma < 0$ and $\gamma + \delta > 0$, as organized domestic producers prefer higher home tariffs on goods they produce and lower tariffs on goods they consume; however, $\gamma$ may equal zero if lobbying groups are a negligible share of the voting population. We expect $\delta^* < 0$, as organized foreign producers prefer lower home tariffs on the goods they export.

As previously shown in Ludema and Mayda (2103), our results support the theory. Column (1), Table 1 shows the OLS results of estimating equation (5). Column (2), Table 1 applies an IV approach to address endogeneity concerns, instrumenting for $H_{ik}$, $MPI_{ik}$, and foreign political organization (see Ludema and Mayda, 2013, for more details on the sources of endogeneity). For each country *i*, the three countries in the sample with the respective variables most strongly correlated with that of *i*'s are selected, and their average value of that variable is used as an instrument. The choice of 3 countries balances a tradeoff between losing observations from countries that lack overlapping product imports and decreasing the variance across instrument observations by expanding the selection. The comments which follow are based on the IV estimates. We find that the applied MFN tariff rate increases with market power in the absence of any internalization of terms-of-trade benefits, as demonstrated by the positive and statistically significant coefficient $\beta_1$. The effect of market power decreases with the HHI as shown by the statistically significant and negative $\beta_2$. The direct effect of the HHI, $\beta_3$, is comparatively small and only slightly significant, consistent with the prediction that concentration in the absence of market power should have no effect. The impact of domestic political organization when interacted with the inverse import penetration ratio is positive and slightly significant, which supports the idea of protection for sale as proposed by Goldberg and Maggi (1999). Similarly predictable is the negative and significant coefficient on foreign political organization, as foreign sectors push for lower tariff rates. Finally, the PTA share is negative but insignificant.[13]

### 4.2. Quantification of the effect of the GATT/WTO system up to the Uruguay round

We now quantify the effect of the GATT/WTO system so far – i.e. up to the most recent, completed round of negotiations, the Uruguay round – in particular in its role of allowing countries to internalize the terms-of-trade effects of tariff reductions.[14] To that goal, we apply the IV regression results of column (2), Table 1, to construct the following three estimates. First, we calculate the predicted negotiated MFN tariff rate $\tau_{ik}^{n}$ for each importer *i* and product *k*, i.e. the negotiated tariff rate as predicted by the empirical model based on the actual value of the HHI in 1993 at the end of the Uruguay round – this is the tariff rate which countries are expected to have reached through Uruguay round negotiations based on their ability in 1993 to internalize terms-of-trade effects. Second, we calculate the predicted noncooperative MFN tariff rate $\tau_{ik}^{u}$ for each importer *i* and product *k*, i.e. the tariff rate as predicted by the empirical model when $H_{ik} = 0$ – which corresponds to the situation when there is no internalization of terms-of-trade effects and free riding is complete, in other words when the tariff rate is set in the absence of negotiations. Finally, we calculate the predicted "potential" negotiated MFN tariff rate $\tau_{ik}^{*}$ for each importer *i* and product *k*, i.e. the tariff rate as predicted by the empirical model when the HHI is high enough ($H_{ik} = \overline{H}_{ik} = -\frac{\beta_1}{\beta_2}$) that market power has no impact on the negotiated tariff rate ($\beta_1 + \beta_2 H_{ik} = 0$, see expression (5)). In the last case, internalization of terms-of-trade effects is complete and free riding is absent. Given expression (5) and setting $\beta_3 = 0$[15], the following expressions hold: [16]

$$\tau_{ik}^{n} = \alpha + \beta_1 MP_{ik} + \beta_2 MP_{ik} H_{ik} + \omega \frac{\Phi_{ik}}{\mu_{ik}} + \alpha_i + Z_{ik} \qquad (6)$$

[13] The larger the set of averaged country values, the more the instruments overlap. At the extreme, an instrument using the average of all countries would be the same for all other countries as well. Hence, increasing this number reduces the variance of the data across observations.

[14] See also Section 4.C and Table II in Ludema and Mayda (2013).

[15] We set $\beta_3 = 0$ given that the IV estimate of this coefficient is only significant at the 10% level in column (2), Table 1 and in several additional robustness checks the estimate is completely insignificant (see Table I, Ludema and Mayda 2013).

[16] If in the data the actual value of the HHI is higher than $\overline{H}_{ik} = -\frac{\beta_1}{\beta_2}$, we set $\tau_{ik}^{n} = \tau_{ik}^{*}$.

$$\tau_{ik}^{u} = \tau_{ik}^{n} - \beta_2 MP_{ik} H_{ik} \tag{7}$$

$$\tau_{ik}^{*} = \tau_{ik}^{u} - \beta_1 MP_{ik} = \tau_{ik}^{n} - \beta_1 MP_{ik} - \beta_2 MP_{ik} H_{ik} \tag{8}$$

Figures 1 and 2 show the three sets of tariff rates for, respectively, developed and developing countries (see also Table 2). For each country, the height of the overall bar (blue plus brown plus green) gives the predicted non-cooperative MFN tariff rate $\tau_{ik}^{u}$; the height of the blue plus brown bar represents the predicted negotiated MFN tariff rate $\tau_{ik}^{n}$; finally, the height of the blue bar gives the predicted "potential" negotiated MFN tariff rate $\tau_{ik}^{*}$. Note that the height of the brown plus green bar represents the maximum extent of terms-of-trade effects on tariffs absent negotiations, i.e. the "overall" terms-of-trade effects. "Negotiated TOT cut" represents how successful the GATT/WTO system has been so far (up to the Uruguay round) in its role of allowing countries to internalize the terms-of-trade effects of tariff reductions. "TOT remaining" indicates the non-internalized terms-of-trade effects, representing the magnitude of the free rider problem. Finally, "Non-TOT factors" represents the impact on tariff rates of non-terms-of-trade factors such as domestic and foreign political-economy effects, PTA effects and other drivers captured by the country fixed effects. Note that all the tariffs and their components are defined in percentage-points terms.

As Table 2 shows, for the 24 countries in the sample, in 1993 the average negotiated tariff is 12.20 while the average noncooperative tariff is 16.76, which implies that the internalization of terms of trade effects through GATT/WTO negotiations, up to the Uruguay round, has lowered the average tariff of these countries by 27% compared to its non-cooperative level. For the nine developed countries in the sample, in 1993 the average negotiated tariff is 5.67, which is 43% lower than the average noncooperative tariff of 9.97. The developing countries' average negotiated tariff is 16.11, which is 23% lower than the average noncooperative tariff of 20.84. The difference between developed and developing countries – in terms of percentage change relative to the non-cooperative tariff – largely reflects the fact that average noncooperative tariffs are considerably higher for developing countries, due to domestic factors. However, in the Uruguay round, the free rider problem was smaller for developing countries as "ToT remaining" is 1.80 percentage points for developed countries and 1.31 percentage for developing countries. These values imply that developing countries have been able to internalize around 78% of the terms-of-trade effects of their tariff reductions – through the GATT/WTO system up to the Uruguay round – while developed countries have been able to internalize around 70%.[17] The difference between developed and developing countries is due to the fact that developing countries faced higher HHIs in 1993 on average relative to developed countries (0.61 versus 0.5) and thus confronted less of a free rider problem in negotiations.[18] Regarding specific countries, the U.S. has been able to internalize around 64% of the terms-of-trade effects, the EU around 48%, Japan around 64%, Brazil around 80% and, finally, India around 77%. Figures 1 and 2 also show that, in developing countries, most of the terms-of-trade effects have been internalized, yet tariffs remain high.

Figure 3 and Table 3 present the results organized by HS section. Figure 3 shows that, in percentage points terms, in 1993 the remaining free rider problem ("TOT remaining") was smallest for goods with high exporter concentration, for example goods in section II (vegetable products), section III (animal or vegetable fats and oils), section V (mineral products), and section XIX (arms and ammunition). These goods were exported by few large, developed countries in 1993 and thus had high HHI. By contrast, the free rider problem was greatest in sections VIII (raw hides and skins, leather, fur), XXII (footwear, headgear, etc) and XX (miscellaneous manufactured articles). The latter goods had low HHI (0.48, 0.42, and 0.46 respectively compared to 0.69 for arms and ammunition and a median of 0.53) because they are low-tech goods which were produced and exported by a large number of small exporters (largely developing countries). Table 3 shows a similar picture (see in particular the column indicating the percentage of terms-of-trade effects which have been internalized through the GATT/WTO system up to 1993).

To conclude, the analysis both across countries and across HS sections points in the same direction. At the end of the Uruguay round, while developed countries had lower average (negotiated) tariffs – due to lower unilateral motives – in fact they liberalized less relative to potential – due to lower HHIs on the goods they imported. At the same time, developed countries tended to export advanced manufactures, which are relatively concentrated (and thus

[17] The apparent asymmetry between developed- and developing-country internalization does not imply that developing countries have given up more concessions than they have received. Generally speaking, developed countries internalize a smaller share of their terms-of-trade externalities, because developing countries are willing to pay them less (in combined concessions) to make MFN tariff reductions, due to free riding.

[18] Note that in Ludema and Mayda (2013) we use different measures of market power, which explains the slight difference in results.

unencumbered by the MFN free rider problem) and high in market power, leading to successful negotiated liberalization. On the other hand, while developing countries had higher average (negotiated) tariffs – due to higher unilateral motives – in fact they liberalized more relative to potential – due to higher HHIs on the goods they imported. At the same time, developing countries tended to export manufactures, such as footwear, textiles and miscellaneous manufactures, which had relatively high potential for negotiated liberalization, but because they were produced by so many small countries, this potential went unrealized. The other major class of developing-country exports are agricultural products and raw materials, which are low-liberalization products, mainly because of low estimated levels of market power.

These results shed light on an ongoing debate between developed and developing countries regarding the extent of trade liberalization of each group of countries. Developing countries claim that the GATT/WTO system serves mainly the export interests of developed countries, since tariffs on products predominantly exported by developing countries are not liberalized as much as tariffs on those exported by developed countries. However, based on our analysis and consistent with Ludema and Mayda (2013), " … the lack of progress in cutting tariffs on developing-country exports [in the Uruguay round] is not so much a question of fairness of negotiations but of their efficiency [which is driven by exporter concentration]; and the solution does not lie in exempting developing countries from reciprocity but attracting them to it." (Ludema and Mayda 2013; statements in square brackets added).[19]

## 5. Prospects for future multilateral trade liberalization

### 5.1. Trends in Exporter Concentration between 1993 and 2012 by Importing Country

In Section 4, we analyzed the theoretical role of exporter concentration in determining MFN tariff rates through GATT/WTO negotiations and we discussed the state of the free rider problem up to the end of the Uruguay round. Next, we turn to examine changes in exporter

[19] This is also in line with the result, in Ludema and Mayda (2013), that for the U.S. the percentage reduction of the negotiated 1993 tariff, relative to the noncooperative tariff, was 26% for imports from the average developed country in the sample and 11% for imports from the average developing country. Importantly, this calculation accounts for the product mix imported by the U.S. from each group of countries.

concentration (HHI) over the following 20 years. These changes will allow us to make predictions on what value negotiated WTO tariff rates might take if a multilateral round were concluded, assuming that the other determinants of tariff rates do not change. As previously shown in equation (4), the HHI of importing country $i$ is the sum of squared values of imports from WTO countries receiving MFN treatment, divided by the squared sum of imports from countries receiving MFN status, regardless of WTO membership – we exclude imports from importing country $i$'s PTA partners from both the numerator and denominator of the HHI. The change in the HHI between 1993 and 2012 can be decomposed into each of the three channels discussed in the Introduction: the accession effect, which is related to accession of new members to the WTO; the PTA effect, which is related to the formation of new PTAs which include the importing country; and, finally, the trade growth effect, which is related to changes in trade flows during the period, largely due to high growth of emerging economies. We construct the change through each channel by measuring the change in the HHI when that channel is at work between 1993 and 2012, while the others are shut down. The following expressions give the total HHI change and each of the three components:

$$H_{ik}(T_{12}, PTA_{12}, WTO_{12}) - H_{ik}(T_{93}, PTA_{93}, WTO_{93}) \ = \qquad \textit{(Total HHI Change)}$$

$$H_{ik}(T_{93}, PTA_{93}, WTO_{12}) - H_{ik}(T_{93}, PTA_{93}, WTO_{93}) \ + \qquad \textit{(Accession Effect)}$$

$$H_{ik}(T_{93}, PTA_{12}, WTO_{12}) - H_{ik}(T_{93}, PTA_{93}, WTO_{12}) \ + \qquad \textit{(PTA Effect)}$$

$$H_{ik}(T_{12}, PTA_{12}, WTO_{12}) - H_{ik}(T_{93}, PTA_{12}, WTO_{12}) \qquad \textit{(Trade Growth Effect)}$$

Table 4 presents the results of this analysis by importing country. The mean change in HHI over this period is positive and equal to 0.07 suggesting that, *if concluded, a new round (or a resurrected Doha round) would on average lead to greater internalization of terms-of-trade benefits due to a smaller free rider problem*. Note that, for developing countries, the total HHI increase is smaller than for developed countries (0.06 instead of 0.09). Actually, six out of the twenty-four countries in the sample experienced declines in HHI – Brazil, Canada, Ecuador, India, Madagascar, and Mexico – and, with the exception of Canada, these are all developing countries. These results show that one possible cause for developing countries' reluctance to reduce MFN tariffs during the Doha round is their inability (or smaller ability) to internalize the benefits of their tariff reductions via negotiations, and not unwillingness for reciprocity. In the case of Canada, the decline in the overall HHI is driven by a particularly small PTA effect (0.02 compared to an average of 0.10).

The WTO accession effect is positive for all countries and on average equal to 0.03 which means that more inclusive membership to the WTO, through the accession of 45 countries including China and Russia since 1994, helps tariff negotiations. As equation (4) shows, a country's accession to the WTO always increases an importing country's HHI if the new WTO member was already granted MFN status by that importer, since in this case the denominator of the HHI is not affected while the numerator increases. Note that, for example, the U.S. granted MFN ("permanent normal trade relations") status to a number of countries before their WTO accession, including Albania, Bulgaria, Cambodia, China, Estonia, Latvia, and Lithuania (among others) (Pregelj 2005).

The PTA effect as well is positive for all countries and it is equal on average to 0.10, which is greater than the accession effect. From a theoretical point of view, the formation of new PTAs which include the importing country could either increase or decrease that importing country's HHI. Based on expression (4), the imports from the importer's PTA partners need to be removed from both the numerator and the denominator of the HHI, because they are no longer subject to the importer's MFN tariffs. Depending on the size of the PTA partner, measured by its share of the importer's total imports of a product, this could cause the HHI of the importing country to decrease or increase. It is more likely to increase the smaller is the PTA partner.[20] In other words, from a theoretical point of view, the PTA effect through exporter concentration could be either a "stumbling bloc" or a "building bloc" for multilateral trade negotiations. Here we find that on average PTAs are building blocs. Note that this is the first time that building/stumbling blocs of this type, i.e. through exporter concentration, have been pointed out in this literature.

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[20] Removing an exporter *j* from the HHI of country *i* is equivalent to setting *j*'s exports $M_i^j$ equal to zero in equation (4). This decreases both the numerator and denominator of (4) and thus produces an ambiguous net effect on *i*'s HHI, $H_i$. We can show that removal of an exporter causes $H_i$ to increase (decrease) if *j*'s share in *i*'s total imports, $\theta_i^j$, is less (greater) than $2H_i/(1+H_i)$. Thus, for a given HHI, the smaller is $\theta_i^j$ the more likely it is that removing country *j* (due to its PTA with country *i*) will increase *i*'s HHI.

In the data the PTA effect is positive, which means that the formation of PTAs should have had a "building-bloc" effect on multilateral trade negotiations during the Doha round. In particular, this means that one way in which exporter concentration increased over time between 1993 and 2012 is through the formation of PTAs with countries that account for a small fraction of exports to the importer in all but a handful of products. Since these new PTA partner countries are pulled out of the HHI calculation for all products once they join the PTA with the importer, they will increase the HHI for most products – those for which they are not major exporters to the importing country – thus raising the likelihood that there will be a critical mass of interested exporters at the negotiating table over time. The "building-bloc" result we find reinforces the conclusions of Estevadeordal, Ornelas, and Freund (2008) who show that, in South America, the signing of PTAs led to the reduction of MFN tariffs.

The PTA effect makes a large contribution to the overall HHI change. Absent the PTA effect, the overall HHI change would have been *negative* at -0.03, instead of 0.07 (on average for all countries in the sample). Absent the PTA effect, the overall HHI change would have been -0.05 instead of 0.06 and 0.01 instead of 0.09 for, respectively, developing and developed countries in the sample. In addition, note that the average PTA effect of the six countries with negative changes in overall HHI is only 0.03.

As mentioned above, from a theoretical point of view, the PTA effect through exporter concentration could be either a building bloc or a stumbling bloc for multilateral trade negotiations for countries joining the PTA, as each PTA member applies its MFN tariff to only non-members. This would be true whether the PTA is an FTA or custom union (CU). However, the effect of PTA formation on exporter concentration to non-member countries depends the type of PTA. The formation of an FTA will have no effect, because each PTA member continues to maintain and negotiate its own MFN tariffs. Instead, the formation of customs unions (CUs) unequivocally increases exporter concentration of countries outside the CU. Indeed, countries which form a CU negotiate MFN tariff rates as a group and thus their exports are grouped together in the calculation of the HHI of other countries which, as a consequence, increases.[21] Finally the countries joining the CU might experience either an increase or a decrease in exporter

[21] Indeed, Ludema and Mayda (2013) find that the average tariff reduction (compared to the non-cooperative level) received by the EU from the U.S. at the Uruguay round is 31%, whereas if the EU were to break apart, the resulting decrease in HHIs of the goods Europe exports would cause the figure to fall to 21%.

concentration. In this paper we do not analyze empirically the CU effect since no new CUs formed in the period considered.

The trade growth effect is on average equal to -0.06 for all countries in the sample, showing that the increasing multipolarity of global exporters has resulted in a decrease in exporter concentration and, thus, in a diminished ability of countries to internalize terms-of-trade benefits. Through the trade growth effect, the free rider problem has worsened on average, with very few countries experiencing increased concentration over the sample period through this channel (these countries are Argentina, Chile, Japan – interestingly, both the EU and the U.S. display a zero trade growth effect). In general, developing countries are characterized by a more negative trade growth effect (-0.07) than developed countries (-0.03). The countries with the most negative trade growth effect are Madagascar and India.

### 5.2. Implied HHI Impacts on Applied Tariffs

Using the IV coefficient estimates from Section 4.1, the next step is to calculate the implied change in negotiated tariffs, were the Doha round concluded, based on the observed changes in HHI by country and HS section (see Tables 2 and 3). In this exercise, we assume that the only determinant of negotiated tariffs which varies between 1993 and 2012 is the HHI and that all other variables in equation (5) are held constant at their 1993 levels. In other words, the predicted negotiated tariffs only reflect greater internalization of terms-of-trade effects stemming from HHI changes over the observed period. Equation (9) shows how the change in the predicted negotiated tariff $\tau_{ik}^{n}$ is calculated:

$$\Delta\tau_{ik}^{n} = \beta_2 MP_{ik} \Delta HHI_{1993-2012,ik} \tag{9}$$

Table 2 shows that, on average, countries would negotiate lower MFN tariffs as a result of greater internalization of terms-of-trade effects via increased exporter concentration. In percentage-point terms, the reduction in negotiated tariff rates from 1993 to 2012 is greater for developed countries (-0.92) than for developing countries (-0.46). Compared to the optimal noncooperative tariff level, the 2012 negotiated tariffs are 24% lower for developing countries and 52% lower for developed countries (the corresponding percentage differences were 23% and

43%, respectively, in 1993). This implies that, if the Doha round was concluded, increases in exporter concentration between 1993 and 2012 would result in around 85% of the potential terms-of-trade-driven tariff liberalization being realized (the latter result is approximately the same for developing and developed countries, respectively 84% and 86%). The remaining 15% would not be realized as a result of the MFN free rider problem. Compared to the Uruguay round, the changes in HHI would result in an increase of 10 percentage points for all countries in the sample, 6 percentage points for developing countries and 16 percentage points for developed countries with regards to the reduction of the free rider problem.

### 5.3. Trends in Exporter Concentration between 1993 and 2012 by Industry

So far, we have focused on country averages. We have shown that most countries have become better able to internalize MFN externalities on average, with a few notable exceptions, and these exceptional countries have experienced particularly unfavorable trade growth effects. However, this focus on country averages may mask important industry differences. Thus, we briefly consider the analysis of the three channels across HS sections in Table 5. We find that the overall HHI increases in all HS sections with the exception of Section XIV (pearls, precious stones, and metals), which is unaffected. The evidence across HS sections is similar to what we found across countries. Both the accession effect and the PTA effect are positive for each HS section, while the trade growth effect is negative for all HS sections except Section VIII (Raw hides and skins, leather, fur), Section XII (Footwear, headgear, etc.), Section XX (Miscellaneous manufactured articles) – further discussion of these exceptions appears below. Between the accession and the PTA effect, it is the latter one that is stronger (except for Section XII (Footwear, headgear, etc.)). Absent the PTA effect, the overall HHI change would be negative for fourteen of the twenty HS sections. Thus our findings across HS sections confirm the building-bloc effect of PTAs working through exporter concentration.

Interestingly, the sections facing the largest free rider problem in 1993, i.e. sections VIII (raw hides and skins, leather, fur), XXII (footwear, headgear, etc) and XX (miscellaneous manufactured articles), are also the ones which show the greatest increases in HHI between 1993 and 2012 – the total HHI change of these three sections is respectively, 0.21, 0.33 and 0.22 –

owing to a positive trade growth effect. Products in these sections are labor-intensive and are largely produced by developing countries, particularly China. For example, China exported \$50.8 billion USD (40.3% of world exports) of footwear in 2013. India and Brazil ranked 2nd and 3rd.[22] This illustrates the perhaps obvious point that export growth by emerging markets does not always depress exporter concentration. Rather, in products where emerging markets already dominate trade, emerging-market export growth increases exporter concentration and reduces the MFN free rider problem. This bodes well for the future, as emerging markets come to dominate more and more sectors.

### 5.4. The rise of China

The largest and most rapidly-growing of the new economies is China, which has become the second largest world economy by the end of the period of analysis, dramatically surpassing the other BRIC countries since 2001, when the term was first used.[23] Over the 20 years period of this paper's study, the median growth in exports from China by product category was an increase by a factor of 27, while the mean was 780, a result driven by observations in the upper tail of the distribution. More importantly, China has become the world's largest exporter in many sectors, meaning its growth has a substantial effect on the trade growth effect. This paper estimates an OLS regression of the trade growth effect on the change in value of Chinese imports over the 20 years sample, controlling for importing country.[24] The negative and statistically significant coefficient on the change in imports coming from China suggests that growth in exports from China is linked to a reduction in HHI via the trade growth effect. Column 2 of Table 6 drops outliers below the 10th and above the 90th percentile. The mean value for the change in imports from China after the dropping of outliers is 89, suggesting that on average China decreased the HHI of trading partners by 0.018 via the trade growth effect, which is 31% of the overall trade

[22] Bruha (2014).
[23] O'Neill (2001).
[24] The change in imports is calculated as $(\text{Imports}_{2012}-\text{Imports}_{1993})/\text{Imports}_{1993}$.

growth effect (-0.0578). The regressions of the trade growth effect on the change in imports from China by HS section are presented in Table 7.[25]

## 6. Conclusions

The central finding of this paper is that trends over twenty years have induced an overall increase in HHI across countries and products. The increase has been stronger for the HHI index of exporters to developed countries and for products exported primarily by developing countries. For some countries, like Brazil and India, the total HHI has decreased between 1993 and 2012: This may be one reason why these developing countries have been reluctant to make tariff reductions during the Doha Round. We also find that increasing membership in the WTO and formation of new PTAs have mitigated the free rider problem over the 20 years. These effects outweigh the dilution effect of emerging economies. Finally our results show that, were the Doha round concluded, unrealized potential terms-of-trade liberalization could on average decrease from 25% to 15%. Therefore the WTO still has a role to play in realizing further trade liberalization.

## References

Abboushi, S. (2014). “Transatlantic trade and investment partnership - overview.” *Competition Forum*, 12(1), 107-113.

Bagwell, Kyle, and Robert W. Staiger. “Regionalism and Multilateral Tariff Cooperation.” Working paper no. 5921. *NBER Working Papers*, 1998.

Bagwell, Kyle, and Robert W. Staiger. “The Economics of the World Trading System.” Cambridge, MA: MIT, 2002.

Bagwell, Kyle, and Robert W. Staiger. "What Do Trade Negotiators Negotiate About? Empirical Evidence from the World Trade Organization." *American Economic Review* 101.4 (2011): 1238-273.

Bagwell, Kyle, and Robert W. Staiger. "Can the Doha Round be a Development Round? Setting a Place at the Table.” Published in Robert C. Feenstra and Alan M. Taylor (eds.),

[25] Note that China’s growth should at one point have an inverse effect on the HHI once the country becomes large enough to concentrate rather than dilute export markets.

Globalization in an Age of Crisis: Multilateral Economic Cooperation in the Twenty-First Century, NBER, University of Chicago Press (2014): 91-124.

Baldwin, R. E., and T. Murray. "MFN Tariff Reductions and Developing Country Trade Benefits Under the GSP." *The Economic Journal* 87.345 (1977): 30-46.

Bhagwati, Jagdish N. "The Selfish Hegemon Must Offer a New Deal on Trade." Financial Times. N.p., 19 Aug. 2008. Web.

Blustein, Paul. “Misadventures of the Most Favored Nations: Clashing Egos, Inflated Ambitions, and the Great Shambles of the World Trade System.” New York: PublicAffairs, 2009.

Bown, Chad P. "The Economics of Trade Disputes, the GATT's Article XXIII, and the WTO's Dispute Settlement Understanding." *Economics and Politics* 14.3 (2002): 283-323.

Bown, Chad P., and Meredith A. Crowley. "Self-Enforcing Trade Agreements: Evidence from Time-Varying Trade Policy." *American Economic Review* 103.2 (2013): 1071-090.

Broda, Christian, Nuno Limão, and David E. Weinstein. "Optimal Tariffs and Market Power: The Evidence." *American Economic Review* 98.5 (2008): 2032-2065.

Bruha, Patrick. "Footwear Industry In Brazil." The Brazil Business., 13 Oct. 2014. Web.

Bun, Maurice, and Harrison, Teresa. “OLS and IV Estimation of Regression Models Including Endogenous Interaction Terms.” Discussion paper, Amsterdam School of Economics. 2014.

Busch, Marc L. and Reinhardt, Eric, "Industry Location and Protection: The Political and Economic Geography of U.S. Nontariff Barriers." *American Journal of Political Science* 43 (4) 1999: 1028-1050.

Caplin, Andrew, and Kala Krishna. “Tariffs and the Most-Favored-Nation Clause.” *Institute of Economics Research*, 1988.

Carpenter, Theresa, and Andreas Lendle. “How Preferential Is World Trade?” Working paper no. 2010-32. Geneva: Center for Trade and Economic Integration, 2010.

Estevadeordal, A., Freund, C., Ornelas, E. “Does Regionalism Affect Trade Liberalization Towards Non-Members?” *Quarterly Journal of Economics*, 123 (2008), 1531-1575.

FAO Trade and Markets Division. “World Statistical Compendium for Raw Hides and Skins, Leather and Leather Footwear 1993-2012.” Rep. Food and Agriculture Organization of the United Nations, 2013

Fergusson, Ian F. “The World Trade Organization: The Non-Agricultural Market Access (NAMA) Negotiations.” Rep.: Congressional Research Service, 2011.

Finger, J. Michael, and Julio J. Nogues. "The Unbalanced Uruguay Round Outcome: The New Areas in Future WTO Negotiations." *The World Economy* 25.3 (2002): 321-40.

Finger, J. M., and M. E. Kreinin. "A Measure of `Export Similarity' and Its Possible Uses." *The Economic Journal* 89.356 (1979): 905.

Finger, J.M., Reincke, U, and Castro, A. “Market Access Bargaining in the Uruguay Round: How Tightly Does Reciprocity Bind?” in *On Going Alone: The Case for Relaxed Reciprocity in Freeing Trade*, Jagdish N. Bhagwati, ed. (Cambridge MA: MIT Press, 2002)

Francois, Joseph.“Doha Round failure: This is the way the round ends…” CEPR, 1st August 2008. Web. <http://voxeu.org/article/doha-round-failure-way-round-ends>

Francois, Joseph and Ganeshan Wignaraja. “Economic Implications of Asian Integration.” *Global Economy Journal* 8, no. 3:1-46. 2008.

Johnson, H. “An economic theory of protectionism, tariff bargaining, and the formation of customs unions.” *Journal of Political Economy* 73, 256–283. 1965.

Jones, Vivian C. “Generalized System of Preferences: Background and Renewal Debate.” Rep.: *Congressional Research Service*, Dec 16, 2014.

Gallagher, Peter and Andrew Stoler, “Critical Mass as an Alternative Framework for Multilateral Trade Negotiations,” *Global Governance* 15 (3), pp. 375-392. 2009.

Goldberg, P.K. and G. Maggi. "Protection for Sale: An Empirical Investigation," *American Economic Review* 89, 5, pp. 1135-1155. 1999

Grossman, G. and E. Helpman. "Protection for Sale," *American Economic Review*, 84.4 (1994): 833-850.

Helpman, Elhanan. “Politics and Trade Policy,” *Advances in Economics and Econometrics: Theory and Applications*, vol. 2, D. M. Kreps and K. F. Wallis, eds. (Cambridge: Cambridge University Press, 1997).

Hoekman, Bernard M.  and Petros C. Mavroidis, “WTO ‘à la carte’ or ‘menu du jour’? Assessing the Case for More Plurilateral Agreements” *European Journal of International Law* 26 (2), pp. 319–343. 2015.

Hübner, Kurt. “Europe, Canada and the Comprehensive Economic and Trade Agreement.” *Abingdon, Oxon: Routledge*, 2011.

Kim, In-Song. “Political Cleavages within Industry: Firm Level Lobbying for Trade Liberalization.” Working Paper. Princeton University. Princeton. 2013.

Kleimann, David and Guinan, Joe. “The Doha Round: An Obituary.” Global Governance Program Policy Brief. 2011.

Limão, N. “Are Preferential Trade Agreements with Non-Trade Objectives a Stumbling Block for Multilateral Liberalization?” *Review of Economic Studies,* 74 (2007): 821-855.

Ludema, R. "International Trade Bargaining And The Most-Favored-Nation Clause." *Economics and Politics* 3.1 (1991): 1-20.

Ludema, R. and A.M. Mayda. "Do Countries Free Ride on MFN?," *Journal of International Economics*, 77.2 (2009): 137-150.

Ludema, R. and A.M. Mayda. "Do terms-of-trade effects matter for trade agreements? Evidence from WTO countries," *Quarterly Journal of Economics* 128.4 (2013): 1837-1893.

Nunn, N. "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade." *The Quarterly Journal of Economics* 122.2 (2007): 569-600.

O'Neill, Jim. “Building Better Global Economic BRICs,” *Global Economics*. no. 66. Goldman Sachs (2001).

Petri, Peter A, Michael G. Plummer, and Fan Zhai. “The Trans-Pacific Partnership and Asia-Pacific Integration: A Quantitative Assessment.” *Washington, DC: Peterson Institute for International Economics*, 2012.

Preeg, Ernest H. “Traders and Diplomats; an Analysis of the Kennedy round of Negotiations under the General Agreement on Tariffs and Trade.” *Washington: Brookings Institution*, 1970.

Pregelj, Vladimir N. “Country Applicability of the U.S. Normal Trade Relations (Most-Favored-Nation) Status.” Rep.: Congressional Research Service, 2005.

Rauch, James E. “Networks versus Markets in International Trade,” *Journal of International Economics*, 48 (1999), 7-35.

Schott, Jeffrey J, Barbara Kotschwar, and Julia Muir. “Understanding the Trans-Pacific Partnership.” *Washington, DC: Peterson Institute for International Economics*, 2013.

WTO. “Changing Face of Trade Pacts Requires Coherence with WTO, Report Says.” WTO, 20 July 2011.

Viner, J. “The most-favored-national clause.” Index, Svenska Handelsbanken, Stockholm. Reprinted in: Viner, J., 1951. *International Economics*. Glencoe, IL, The Free Press. 1931.

**Table 1: Regression Results**

| Dependent Variable | (1) | (2) |
|---|---|---|
| **Model** | **OLS** | **IV** |
| | | |
| **Market Power Indicator (MPI)** | **4.927*** ** | **10.55*** ** |
| | **-0.28** | **-2.23** |
| **Herfindahl-Hirschman Index * MPI** | **-3.458*** ** | **-15.43*** ** |
| | **-0.432** | **-3.604** |
| Herfindahl-Hirschman Index | 0.869*** | 4.774* |
| | -0.29 | -2.727 |
| Foreign Political Org. * MPI | -1.901*** | -1.156** |
| | -0.157 | -0.507 |
| X/Mμ | -0.00715 | 0.00992 |
| | -0.0233 | -0.0115 |
| Domestic Political Org. * X/Mμ | 0.119*** | 0.0722* |
| | -0.0353 | -0.0376 |
| PTA share/μ | -1.560** | -1.67 |
| | -0.694 | -2.546 |
| Constant | 13.13*** | 10.94*** |
| | -0.255 | -1.554 |
| | | |
| Observations | 80,207 | 76,157 |
| R-squared | 0.268 | 0.257 |

Note: The F-test statistics for the IV regression are as follows. With regards to the instrumentation of each variable in regression 2: 16.61 for the Herfindahl-Hirschman Index, 390.46 for the Market Power Index, and 72.17 for the interaction term. The instrument for foreign political organization has an F-statistic of 8110.45. The F-statistic for the final 2SLS regression is 1.24.

Standard errors are clustered by importing country and HS3 by country. Importing country fixed effects are included in each regression.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 2: Predicted tariff rates and changes, by country (1993-2012)**

| | 1993-2012 Noncoop. Tariff | 1993-2012 Potential Negotiated Tariff | 1993 Negotiated Tariff | 2012 Negotiated Tariff | Change Neg. Tariff from 1993-2012 | % TofT internalized 1993 | % TofT internalized 2012 | % Reduction Noncoop. To Neg 1993 | % Reduction Noncoop. To Neg 2012 |
|---|---|---|---|---|---|---|---|---|---|
| **All countries** | 16.76 | 10.70 | 12.20 | 11.62 | -0.58 | 75.31% | 84.83% | 27.22% | 30.66% |
| **Developing Countrie** | 20.84 | 14.80 | 16.11 | 15.74 | -0.37 | 78.27% | 84.37% | 22.68% | 24.45% |
| **Developed Countries** | 9.97 | 3.87 | 5.67 | 4.75 | -0.92 | 70.43% | 85.58% | 43.06% | 52.32% |
| **Argentina** | 19.11 | 12.89 | 14.89 | 13.64 | -1.25 | 67.88% | 87.92% | 22.11% | 28.64% |
| **Australia** | 9.99 | 4.13 | 6.48 | 5.14 | -1.34 | 59.79% | 82.72% | 35.10% | 48.55% |
| **Bolivia** | 14.89 | 8.33 | 9.52 | 8.92 | -0.60 | 81.89% | 91.09% | 36.05% | 40.10% |
| **Brazil** | 20.51 | 14.21 | 15.48 | 15.63 | 0.15 | 79.76% | 77.38% | 24.50% | 23.77% |
| **Canada** | 12.56 | 6.34 | 7.70 | 7.88 | 0.17 | 78.15% | 75.35% | 38.69% | 37.31% |
| **Chile** | 14.76 | 8.35 | 10.38 | 8.35 | -2.02 | 68.43% | 100.00% | 29.69% | 43.40% |
| **Colombia** | 17.61 | 11.47 | 12.77 | 11.86 | -0.91 | 78.86% | 93.65% | 27.50% | 32.65% |
| **Ecuador** | 17.48 | 11.07 | 12.25 | 12.83 | 0.58 | 81.63% | 72.56% | 29.92% | 26.60% |
| **European Union** | 8.42 | 2.44 | 5.55 | 4.30 | -1.26 | 47.94% | 68.94% | 34.05% | 48.97% |
| **Iceland** | 11.35 | 4.14 | 4.75 | 4.42 | -0.33 | 91.62% | 96.13% | 58.20% | 61.07% |
| **India** | 36.57 | 30.35 | 31.75 | 33.02 | 1.27 | 77.49% | 57.08% | 13.18% | 9.71% |
| **Indonesia** | 16.27 | 10.13 | 12.08 | 11.53 | -0.55 | 68.20% | 77.20% | 25.74% | 29.14% |
| **Japan** | 7.92 | 1.74 | 3.97 | 2.63 | -1.33 | 63.97% | 85.59% | 49.87% | 66.73% |
| **Korea** | 13.04 | 6.86 | 8.75 | 7.15 | -1.60 | 69.40% | 95.35% | 32.89% | 45.19% |
| **Madagascar** | 9.86 | 5.34 | 5.34 | 6.30 | 0.97 | 100.00% | 78.61% | 45.86% | 36.05% |
| **Malaysia** | 13.87 | 7.58 | 10.38 | 9.11 | -1.27 | 55.55% | 75.74% | 25.21% | 34.37% |
| **Mauritius** | 34.85 | 30.46 | 30.95 | 30.99 | 0.04 | 88.82% | 87.99% | 11.19% | 11.08% |
| **Mexico** | 21.62 | 15.28 | 15.52 | 15.94 | 0.42 | 96.19% | 89.63% | 28.21% | 26.29% |
| **Morocco** | 33.39 | 27.07 | 27.07 | 27.22 | 0.15 | 100.00% | 97.65% | 18.93% | 18.48% |
| **New Zealand** | 7.59 | 3.24 | 4.09 | 3.32 | -0.77 | 80.54% | 98.17% | 46.12% | 56.22% |
| **Norway** | 9.90 | 3.15 | 4.74 | 3.75 | -0.99 | 76.38% | 91.02% | 52.10% | 62.09% |
| **Peru** | 18.54 | 12.39 | 14.13 | 12.39 | -1.74 | 71.71% | 100.00% | 23.80% | 33.18% |
| **Thailand** | 23.25 | 17.08 | 19.18 | 18.43 | -0.75 | 66.01% | 78.15% | 17.52% | 20.74% |
| **USA** | 8.92 | 2.82 | 5.04 | 4.18 | -0.87 | 63.56% | 77.73% | 43.49% | 53.19% |

## Table 3: Predicted tariff rates and changes, by HS section (1993-2012)

| HS sections | 1993-2012 Noncoop. Tariff | 1993-2012 Potential Negotiated Tariff | 1993 Negotiated Tariff | 2012 Negotiated Tariff | Change Neg. Tariff from 1993-2012 | % TofT internalized 1993 | % TofT internalized 2012 | % Reduction Noncoop. To Neg 1993 | % Reduction Noncoop. To Neg 2012 |
|---|---|---|---|---|---|---|---|---|---|
| Section I: Live animals, animal products | 13.36 | 9.82 | 10.24 | 9.82 | -0.42 | 88.24% | 100.00% | 23.37% | 26.48% |
| Section II: Vegetable products | 12.62 | 10.00 | 10.14 | 10.00 | -0.14 | 94.65% | 100.00% | 19.67% | 20.78% |
| Section III: Animal or vegetable fats and oils | 14.02 | 11.39 | 11.57 | 11.51 | -0.06 | 93.02% | 95.15% | 17.48% | 17.88% |
| Section IV: Prepared foodstuffs | 14.99 | 10.35 | 11.05 | 10.76 | -0.29 | 84.93% | 91.20% | 26.26% | 28.20% |
| Section V: Mineral products | 13.65 | 11.53 | 11.53 | 11.53 | 0.00 | 100.00% | 100.00% | 15.51% | 15.51% |
| Section VI: Chemical and allied products | 15.07 | 11.13 | 11.72 | 11.53 | -0.19 | 85.11% | 90.03% | 22.23% | 23.52% |
| Section VII: Plastics and rubber products | 15.93 | 10.62 | 12.06 | 11.92 | -0.14 | 72.87% | 75.49% | 24.30% | 25.17% |
| Section VIII: Raw hides and skins, leather, fur | 18.24 | 10.15 | 13.25 | 10.43 | -2.82 | 61.70% | 96.52% | 27.37% | 42.82% |
| Section IX: Wood and wood products | 16.04 | 9.91 | 11.05 | 10.17 | -0.88 | 81.48% | 95.78% | 31.16% | 36.63% |
| Section X: Pulp and paper | 15.46 | 11.03 | 11.76 | 11.60 | -0.16 | 83.42% | 87.00% | 23.93% | 24.96% |
| Section XI: Textiles and textile articles | 16.41 | 9.84 | 11.91 | 10.38 | -1.53 | 68.51% | 91.82% | 27.42% | 36.75% |
| Section XII: Footwear, headgear, etc. | 18.06 | 9.18 | 12.93 | 9.18 | -3.75 | 57.77% | 100.00% | 28.43% | 49.21% |
| Section XIII: Stone, plaster, cement, ceramic, gl | 17.90 | 10.48 | 11.94 | 11.10 | -0.84 | 80.26% | 91.58% | 33.29% | 37.99% |
| Section XIV: Pearls, precious stones and metals | 14.50 | 9.79 | 10.61 | 10.31 | -0.31 | 82.60% | 89.10% | 26.84% | 28.95% |
| Section XV: Base metal and articles of base met | 15.35 | 10.69 | 12.01 | 11.24 | -0.77 | 71.68% | 88.32% | 21.75% | 26.80% |
| Section XVI: Machinery and electrical equipme | 19.59 | 10.54 | 12.70 | 12.17 | -0.53 | 76.14% | 82.00% | 35.18% | 37.89% |
| Section XVII: Transportation equipment | 19.77 | 10.36 | 11.80 | 11.62 | -0.18 | 84.61% | 86.52% | 40.29% | 41.20% |
| Section XVIII: Instruments | 19.73 | 10.10 | 12.62 | 12.37 | -0.25 | 73.83% | 76.46% | 36.03% | 37.31% |
| Section XIX: Arms and ammunition | 18.04 | 8.95 | 9.43 | 9.07 | -0.36 | 94.76% | 98.71% | 47.73% | 49.72% |
| Section XX: Miscellaneous manufactured articl | 18.30 | 9.45 | 12.95 | 10.01 | -2.95 | 60.45% | 93.77% | 29.23% | 45.33% |

**Table 4: Decomposition of changes in HHI, by country (1993-2012)**

| Country | Total HHI Change | Accession Effect | PTA Effect | Trade Growth Effect |
|---|---|---|---|---|
| **All countries** | 0.07 | 0.03 | 0.10 | -0.06 |
| **Developing Countries** | 0.06 | 0.02 | 0.11 | -0.07 |
| **Developed Countries** | 0.09 | 0.04 | 0.08 | -0.03 |
| **Argentina** | 0.12 | 0.01 | 0.10 | 0.01 |
| **Australia** | 0.15 | 0.04 | 0.11 | -0.01 |
| **Bolivia** | 0.07 | 0.01 | 0.16 | -0.10 |
| **Brazil** | -0.02 | 0.01 | 0.04 | -0.07 |
| **Canada** | -0.04 | 0.04 | 0.02 | -0.10 |
| **Chile** | 0.39 | 0.03 | 0.33 | 0.02 |
| **Colombia** | 0.12 | 0.01 | 0.24 | -0.13 |
| **Ecuador** | -0.06 | 0.03 | 0.05 | -0.13 |
| **European Union** | 0.14 | 0.04 | 0.10 | 0.00 |
| **Iceland** | 0.02 | 0.02 | 0.05 | -0.06 |
| **India** | -0.13 | 0.03 | 0.00 | -0.16 |
| **Indonesia** | 0.06 | 0.03 | 0.06 | -0.03 |
| **Japan** | 0.13 | 0.06 | 0.04 | 0.03 |
| **Korea** | 0.18 | 0.06 | 0.24 | -0.12 |
| **Madagascar** | -0.14 | 0.03 | 0.01 | -0.18 |
| **Malaysia** | 0.14 | 0.03 | 0.11 | 0.00 |
| **Mauritius** | 0.00 | 0.03 | 0.06 | -0.08 |
| **Mexico** | -0.03 | 0.01 | 0.05 | -0.08 |
| **Morocco** | 0.08 | 0.03 | 0.09 | -0.03 |
| **New Zealand** | 0.09 | 0.05 | 0.07 | -0.04 |
| **Norway** | 0.08 | 0.03 | 0.06 | -0.01 |
| **Peru** | 0.21 | 0.02 | 0.29 | -0.10 |
| **Thailand** | 0.09 | 0.03 | 0.08 | -0.03 |
| **USA** | 0.08 | 0.03 | 0.05 | 0.00 |

**Table 5: Decomposition of changes in HHI, by HS section (1993-2012)**

| HS Classification | Total HHI Change | Accession Effect | PTA Effect | Trade Growth Effect |
|---|---|---|---|---|
| Section I: Live animals, animal products | 0.12 | 0.04 | 0.11 | -0.03 |
| Section II: Vegetable products | 0.08 | 0.05 | 0.10 | -0.07 |
| Section III: Animal or vegetable fats and oils | 0.01 | 0.01 | 0.11 | -0.11 |
| Section IV: Prepared foodstuffs | 0.04 | 0.03 | 0.11 | -0.09 |
| Section V: Mineral products | 0.07 | 0.06 | 0.09 | -0.07 |
| Section VI: Chemical and allied products | 0.04 | 0.03 | 0.11 | -0.09 |
| Section VII: Plastics and rubber products | 0.01 | 0.01 | 0.10 | -0.10 |
| Section VIII: Raw hides and skins, leather, fur | 0.21 | 0.07 | 0.08 | 0.07 |
| Section IX: Wood and wood products | 0.11 | 0.04 | 0.09 | -0.02 |
| Section X: Pulp and paper | 0.03 | 0.01 | 0.11 | -0.09 |
| Section XI: Textiles and textile articles | 0.16 | 0.07 | 0.09 | -0.01 |
| Section XII: Footwear, headgear, etc. | 0.33 | 0.12 | 0.09 | 0.13 |
| Section XIII: Stone, plaster, cement, ceramic, glass | 0.07 | 0.02 | 0.11 | -0.06 |
| Section XIV: Pearls, precious stones and metals | 0.00 | 0.02 | 0.07 | -0.09 |
| Section XV: Base metal and articles of base metal | 0.07 | 0.02 | 0.10 | -0.05 |
| Section XVI: Machinery and electrical equipment | 0.03 | 0.01 | 0.09 | -0.07 |
| Section XVII: Transportation equipment | 0.01 | 0.01 | 0.09 | -0.09 |
| Section XVIII: Instruments | 0.04 | 0.02 | 0.08 | -0.06 |
| Section XIX: Arms and ammunition | 0.04 | 0.01 | 0.08 | -0.05 |
| Section XX: Miscellaneous manufactured articles | 0.22 | 0.04 | 0.08 | 0.10 |

**Table 6: Chinese Trade Growth Effect: Regression results**

| | (1) | (2) |
|---|---|---|
| **Dependent Variable** | **Trade Growth Effect** | |
| Change in Imports from China | -3.91e-07*** | -0.000207*** |
| | (1.49e-07) | (1.21e-05) |
| Outliers Dropped | NO | YES |
| Observations | 33,411 | 26,739 |
| Adjusted R-squared | 0.028 | 0.040 |

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

**Table 7: OLS Regression HS-Section Results for Chinese Trade Growth**

| Imports from China of HS Section | Coefficient on Trade Growth Effect |
|---|---|
| Section I: Live animals, animal products | -0.000332 |
| | (0.000387) |
| Section II: Vegetable products | -0.000422 |
| | (0.000378) |
| Section III: Animal or vegetable fats and oils | 0.000363 |
| | (0.000942) |
| Section IV: Prepared foodstuffs | -0.000211 |
| | (0.000173) |
| Section V: Mineral products | -0.000896** |
| | (0.000391) |
| Section VI: Chemical and allied products | -0.000346*** |
| | (4.62e-05) |
| Section VII: Plastics and rubber products | -0.000135*** |
| | (2.50e-05) |
| Section VIII: Raw hides and skins, leather, fur | 0.000346** |
| | (0.000165) |
| Section IX: Wood and wood products | -5.06e-05 |
| | (0.000233) |
| Section X: Pulp and paper | -0.000301*** |
| | (7.21e-05) |
| Section XI: Textiles and textile articles | 6.17e-05 |
| | (6.38e-05) |
| Section XII: Footwear, headgear, etc. | 8.32e-05 |
| | (0.000182) |
| Section XIII: Stone, plaster, cement, ceramic, g | -0.000234*** |
| | (6.29e-05) |
| Section XIV: Pearls, precious stones and metals | 2.97e-05 |
| | (0.000177) |
| Section XV: Base metal and articles of base met | -0.000244*** |
| | (3.31e-05) |
| Section XVI: Machinery and electrical equipme | -9.39e-05*** |
| | (1.12e-05) |
| Section XVII: Transportation equipment | -0.000127*** |
| | (3.33e-05) |
| Section XVIII: Instruments | -0.000287*** |
| | (3.40e-05) |
| Section XIX: Arms and ammunition | -0.000123 |
| | (0.00122) |
| Section XX: Miscellaneous manufactured articl | -0.000150*** |
| | (5.49e-05) |

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

## Table A1: HS Product Classifications

| HS Sections | 2-digit HS Codes |
|---|---|
| **Section I: Live animals, animal products** | 1-5 |
| **Section II: Vegetable products** | 6-14 |
| **Section III: Animal or vegetable fats and oils** | 15 |
| **Section IV: Prepared foodstuffs** | 16-24 |
| **Section V: Mineral products** | 25-27 |
| **Section VI: Chemical and allied products** | 28-38 |
| **Section VII: Plastics and rubber products** | 39-40 |
| **Section VIII: Raw hides and skins, leather, fur** | 41-43 |
| **Section IX: Wood and wood products** | 44-46 |
| **Section X: Pulp and paper** | 47-49 |
| **Section XI: Textiles and textile articles** | 50-63 |
| **Section XII: Footwear, headgear, etc.** | 54-67 |
| **Section XIII: Stone, plaster, cement, ceramic, glass** | 78-70 |
| **Section XIV: Pearls, precious stones and metals** | 71 |
| **Section XV: Base metal and articles of base metal** | 72-83 |
| **Section XVI: Machinery and electrical equipment** | 84-85 |
| **Section XVII: Transportation equipment** | 86-89 |
| **Section XVIII: Instruments** | 90-92 |
| **Section XIX: Arms and ammunition** | 93 |
| **Section XX: Miscellaneous manufactured articles** | 94-96 |

Note: The data used include 6-digit HS classifications for products. To create HS categories for simple analysis, these classifications are broken down into 20 sections. To do this, the 6-digit codes are reduced to 2-digit codes (new integers created by dividing the previous code by 10,000). The following table displays the arrangement for reference.Sections 21 (97) and 22 (98-99) are dropped from the analysis. 98-99 refer to services rather than goods, and 97 refers to works of art that are not a category of good that are produced for large-scale export. Section 21 analysis is included in the decomposition of HHI changes for the sake of completeness

**Table A2: Shares of 2012 Imports and Exports by Country Economic Status**

| HS Sections | Exports | | Imports | |
|---|---|---|---|---|
| | Developing | Developed | Developing | Developed |
| Section I: Live animals, animal products | 41% | 59% | 34% | 66% |
| Section II: Vegetable products | 58% | 42% | 42% | 58% |
| Section III: Animal or vegetable fats and oils | 80% | 20% | 58% | 42% |
| Section IV: Prepared foodstuffs | 51% | 49% | 27% | 73% |
| Section V: Mineral products | 76% | 24% | 33% | 67% |
| Section VI: Chemical and allied products | 31% | 69% | 37% | 63% |
| Section VII: Plastics and rubber products | 44% | 56% | 48% | 52% |
| Section VIII: Raw hides and skins, leather, fur | 67% | 33% | 28% | 72% |
| Section IX: Wood and wood products | 58% | 42% | 32% | 68% |
| Section X: Pulp and paper | 34% | 66% | 44% | 56% |
| Section XI: Textiles and textile articles | 77% | 23% | 25% | 75% |
| Section XII: Footwear, headgear, etc. | 90% | 10% | 15% | 85% |
| Section XIII: Stone, plaster, cement, ceramic, glass | 51% | 49% | 32% | 68% |
| Section XIV: Pearls, precious stones and metals | 38% | 62% | 35% | 65% |
| Section XV: Base metal and articles of base metal | 46% | 54% | 44% | 56% |
| Section XVI: Machinery and electrical equipment | 51% | 49% | 40% | 60% |
| Section XVII: Transportation equipment | 24% | 76% | 36% | 64% |
| Section XVIII: Instruments | 25% | 75% | 37% | 63% |
| Section XIX: Arms and ammunition | 19% | 81% | 12% | 88% |
| Section XX: Miscellaneous manufactured articles | 77% | 23% | 15% | 85% |

Note: Country development statuses taken from the CIA World Factbook

**Figure 1: Noncooperative vs Negotiated Tariffs for Developed Countries (Predicted Values Based on 1993 Data)**

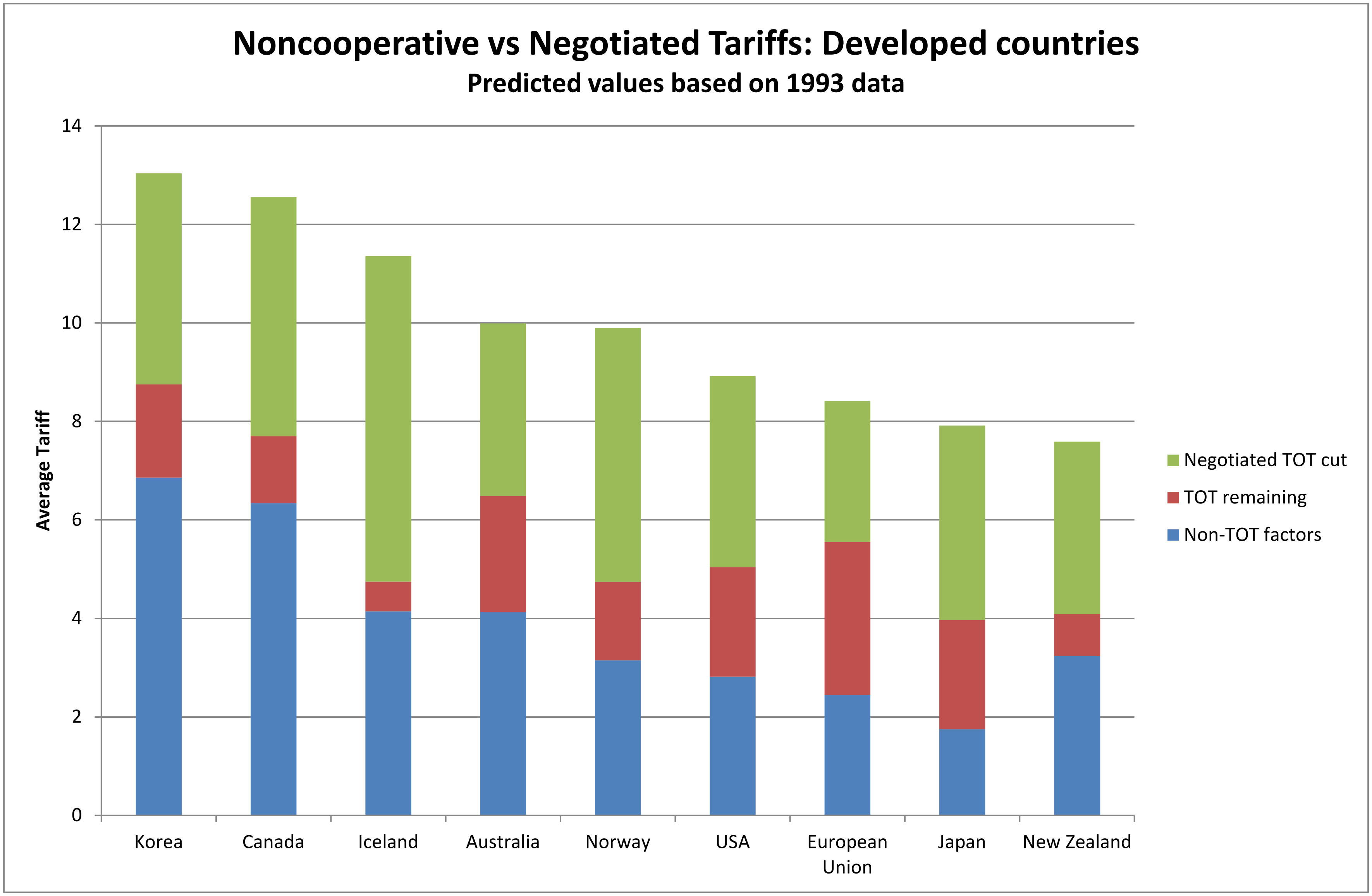


**Figure 2: Noncooperative vs Negotiated Tariffs for Developing Countries (Predicted Values Based on 1993 Data)**

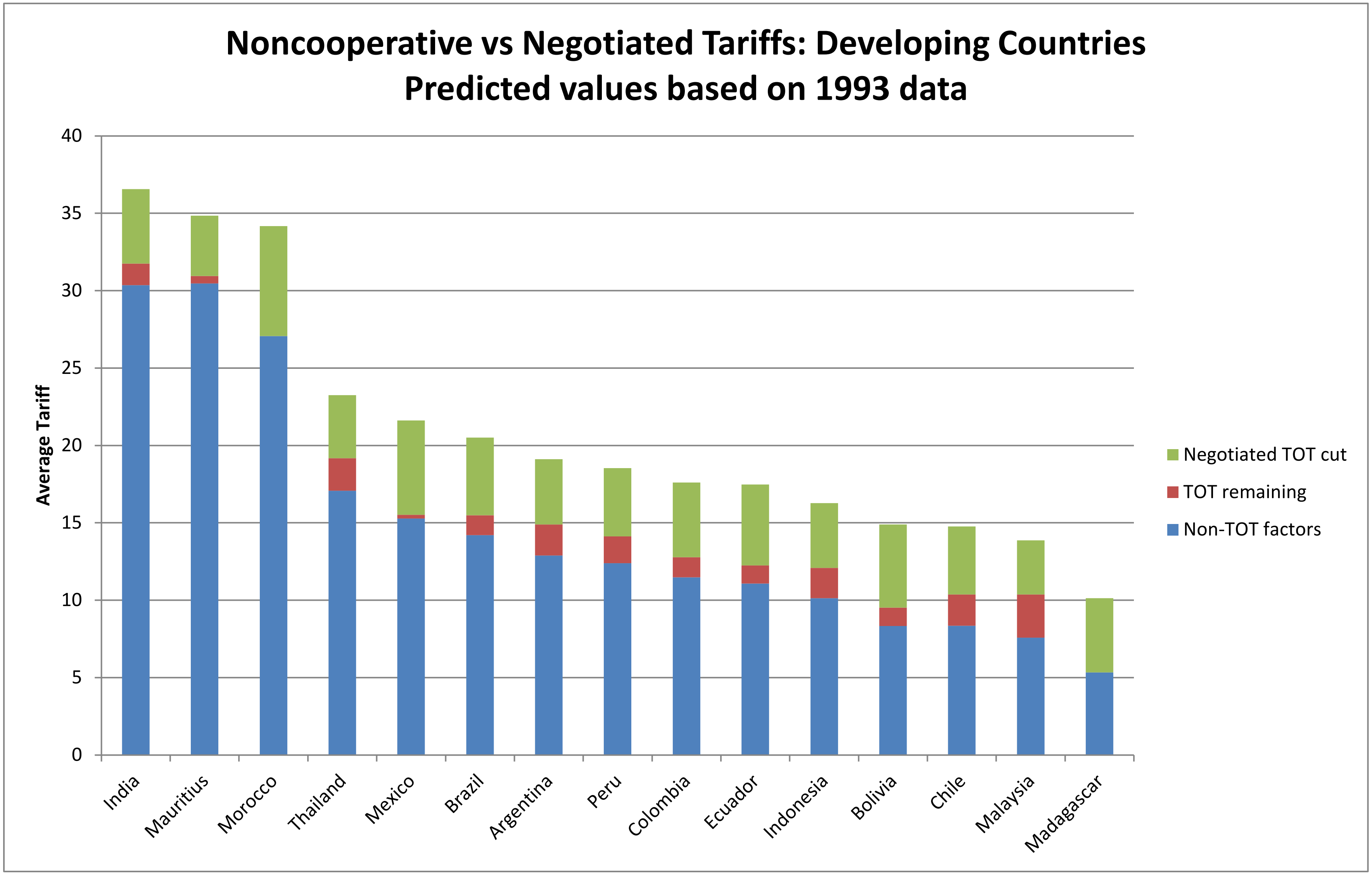
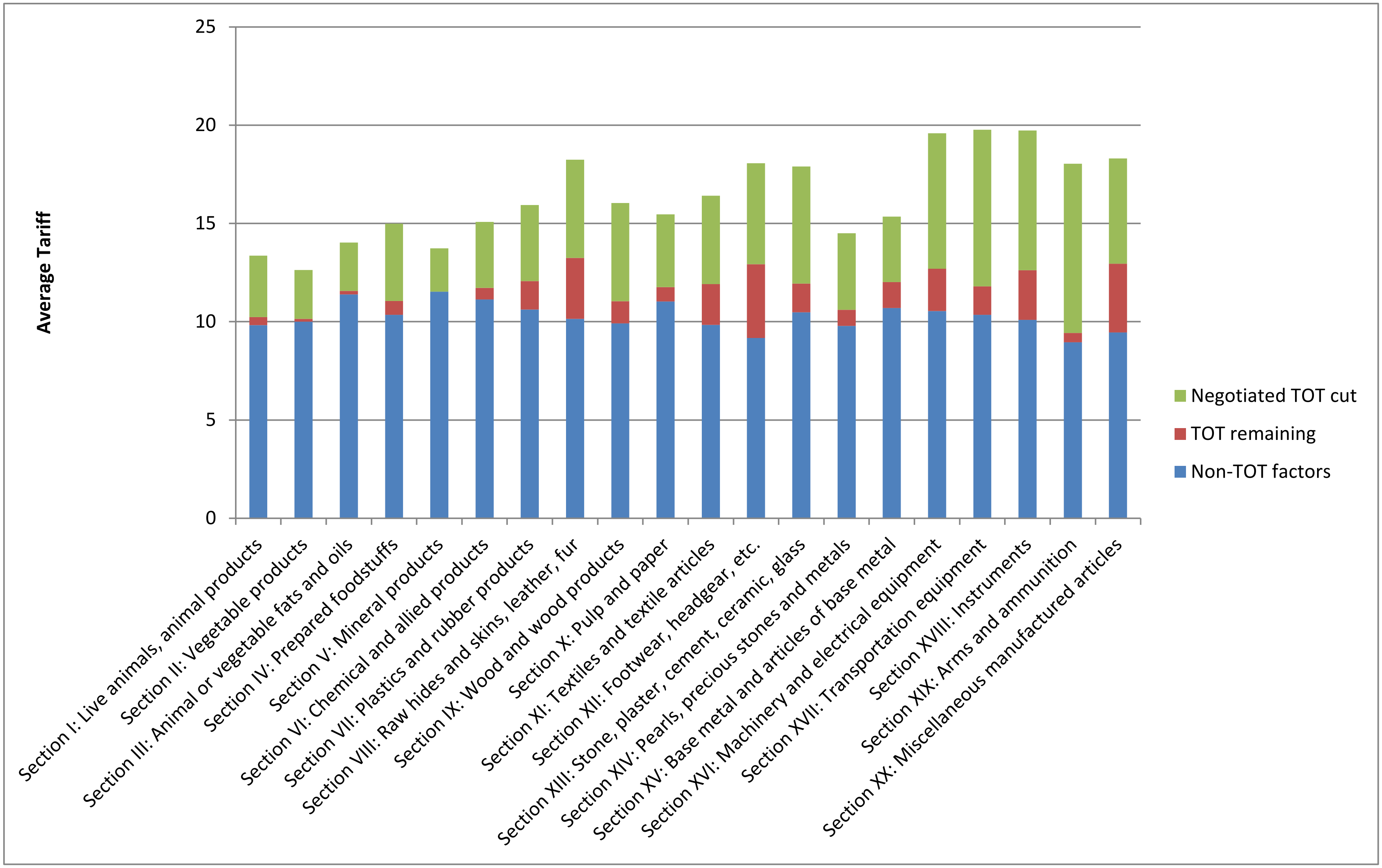


**Figure 3: Noncooperative vs Negotiated Tariffs by HS Sections (Predicted Values Based on 1993 Data)**



# The Impacts of the GATT/WTO on Trade:

# Formal Members versus Non-member Participants

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**Abstract:** Rose [2004] finds little evidence that the formal GATT/WTO membership has any impact on trade. A subsequent comment by Tomz, Goldstein and Rivers [2007] addresses this "ineffectiveness puzzle" by investigating the measurement errors in GATT membership. They find that non-member participants (NMPs) of the GATT on average trade more than outsiders and even more than formal members, everything else equal. It is hard to understand, however, why NMPs are even more liberalized than formal members ("NMP puzzle"). This paper addresses both puzzles by including zero trade flows in the analysis and applying a more appropriate econometric method to estimate the gravity regression.

***Keywords*:** GATT/WTO, Gravity Model, Sample Selection, Poisson Regression

***JEL Classification*:** F13, F15

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## 1. Introduction

It was often taken for granted that the General Agreement on Tariffs and Trade (GATT), signed in 1947 and replaced by the World Trade Organization (WTO) in 1995, has contributed significantly to the fast growth in international trade during the last several decades. Rose [2004], however, challenges the conventional view on the effectiveness of the GATT/WTO (simply GATT, hereinafter) in promoting world trade. Using a large dataset on bilateral trade covering 175 countries over 50 years, Rose finds little evidence that the GATT members have different trade patterns from non-members. A subsequent comment by Tomz et al. [2007] considers the measurement errors in GATT membership. They argue that Rose underestimates the trade impact of the GATT by misclassifying the non-member participants (*hereinafter NMPs*) of the GATT as outsiders. The NMPs include some colonies of formal GATT members, some newly–sovereign countries, and provisional applicants to the GATT. They do obtain stronger trade impact of the GATT after considering the NMPs. But surprisingly, they also find that NMPs are even more liberalized than formal members. Their preferred results imply that two formal GATT members trade 61% more than the baseline case of neither being a formal member nor an NMP; and two NMPs trade 140% more than the baseline case. Their point on the measurement errors in formal membership is well taken, but as they admit, "It is difficult to explain why the effect should be larger for nonmember participants than formal members…" We consider their finding as another puzzle – the "NMP puzzle", besides the "ineffectiveness puzzle" raised by Rose.

Figure 1 displays the shares of total bilateral trade by membership type over 1948-2001.[1] Each country pair falls into one of the following six categories: Both formal, One formal, Formal & NMP, Both NMPs, One NMP and None.[2] The world trade is dominated by formal members (i.e., "Both formal" and "One formal"). The share of "Both NMPs" is nearly zero and the sum of "Both NMPs" and "One NMP" is on average less than 1% of the total trade during 1948-2001 (with the highest share at around 2-3% in early 1950s). Similarly, the relative sizes of these NMPs are much smaller than formal members. For example, the average real GDP (population) of formal members over 1948-2001 is 31 (14) times larger than that of NMPs.[3] With such small trade shares and sizes of NMPs, it is difficult to understand why NMPs change the results substantially and why NMPs seem to matter more than formal members.[4]

This paper provides two solutions to these puzzles by including zero trade flows in the analysis and applying a more appropriate Poisson method to estimate the gravity regression. Firstly, zero trade observations are excluded by Rose and Tomz et al.[5] Without zero trade, they lose the information on the new trading relationships created by the GATT: some country pairs initially did not trade, but started to trade after one or both of them joined the GATT. GATT not only facilitates trade between existing trading partners at intensive margin, but also creates new trading relationships at extensive

[1] The trade data are based on the dataset used by Liu [2009].
[2] Detailed definitions of these categories can be found in the footnote of Figure 1.
[3] This is based on the GDP and population data from standard sources as used in Liu [2009].
[4] Country size may be related to the effectiveness of the GATT/WTO on trade, but the theoretical prediction can go either way. For example, Anderson and van Wincoop [2003, Implication 1] show in their comparative statics exercise that, conditioning on country size, big countries that liberalize are likely to have larger trade effects than small countries that liberalize. Shackmurove and Spiegel [2004], on the other hand, show in a duopoly model that small country benefits more from the large market size of the integrated economy. Cabrales and Motta [2001] argue that large countries are more likely to become leader after trade liberalization, but this can be reversed if small countries have huge cost advantages.
[5] Rose [2004] drops the zero trade due to his concern about missing regressor data of small countries. In a later survey paper, Rose [2006] discusses this issue and correctly envisions the possible effects of sample selection on Tomz et al.'s results although he does not take this to data.

margin. Restricting the analysis to only positive trade flows can cause underestimation of the GATT's trade promoting effects. Following the same gravity regression specifications as Rose and Tomz et al. but including zero trade, this paper finds that the GATT has strongly promoted bilateral trade between its formal members; and the formal members are significantly more liberalized than the NMPs. This is to be expected because many colonial economies have established trade relationship with limited number of countries and their trading partners usually expand slowly. Therefore NMPs might not contribute as much as formal members to world trade at extensive margin. The different roles played by formal members and NMPs are demonstrated graphically in Figure 2. Based on the trade data used by Liu [2009], Figure 2 shows the average numbers of trading partners by membership type over years.[6] To make sure that the numbers of partners are not driven by newly-born nations, only the country pairs with complete series of trade data over 1948-2001 are used in Figure 2. This restricted subsample covers more than 70% of the total observations and nearly 90% of the total world trade. Although NMPs have an increasing trend in the number of partners before 1980, they trade with fewer countries on average than formal members and even fewer than outsiders; the average number of their trading partners stopped increasing and actually decreased after 1980.

Secondly, this paper finds that the traditional log-linear gravity regression method should be reconsidered. Zero trade only solves part of the puzzles because it still cannot explain why we have the puzzles at the intensive margin (i.e., when only positive trade is included). This paper goes on to show that, even when only positive trade is included, a

[6] A country is considered as a trade partner of country A as long as country A imports from this country in a given year.

more appropriate econometric method can address the problems. The Poisson regressions show that formal GATT members are significantly more liberalized than both outsiders and NMPs with and without zero trade in the regressions. With only positive trade, two formal GATT members on average trade 45% more than the baseline case of neither being a formal member nor NMPs while two NMPs trade only 22% more than the baseline category. With both positive and zero trade, two formal GATT members trade 60% more than the baseline case of neither being a formal member nor an NMP; while two NMPs trade even 10% less than the baseline case. In sum, the two puzzles raised by Rose and Tomz et al. can be solved by considering zero trade and/or a better econometric method.

This paper is closely related to Liu (2009) by using the same datasets and econometric methods. Although Liu (2009) also considers NMPs, it treats them the same as formal members. The current paper, however, distinguishes NMPs from formal members and focuses on their different effects.

The significant impact of formal GATT membership on trade and the larger role it plays than NMP are what we could reasonably hope for. Since the WWII, international trade has been increasing at much faster rate than national GDP growth and cross country trade barriers have been cut substantially especially in rich countries. During this period, the GATT as the only international organization governing world trade should have played a role. Two pillars of the GATT rules, nondiscrimination and reciprocity, are important for its trade-promoting effects. Nondiscrimination or the most-favored-nation (MFN) clause requires members to extend their tariff reductions to all the members of the GATT. Reciprocity makes liberalization concessions politically more acceptable. Besides tariff reduction, cooperative and multilateral negotiations under the GATT can avoid the prisoners' dilemma problem arising from the terms-of-trade externality (see, e.g., Bagwell and Staiger, 1999, 2003). In addition, the GATT can also alleviate time-inconsistency problem of trade policy (see, e.g., Staiger and Tabellini, 1987, 1999; Maggi and Rodriguez-Clare, 1998; and Mitra, 2002).

The result that NMPs are less liberalized than formal members is consistent with the fact that NMPs are mostly developing countries and only reap part of the benefits of their de facto membership status. Subramanian and Wei [2007] also find that the WTO promotes trade strongly but unevenly, where the unevenness comes from member countries' level of development: developed members appear to have experienced faster growth in trade than developing members. GATT has many "special and differential treatments" designed for developing countries. These rules make poor countries' participation in the GATT less stringent and allow for many exceptions. For example, former colonies of GATT members as one type of NMPs could avoid offering tariff concessions according to GATT Article XXXVI: (8) (see Hoekman and Kostecki, 1995, page 388).[7] Without corresponding concessions, the extent of trade liberalization in those NMPs is likely limited compared to formal members. Using a multilateral approach based on total trade, openness and trade policy measures, Rose [2007] also casts doubt on Tomz et al.'s finding that NMPs are more liberalized than formal members.

[7] This was true before the Uruguay Round, which was completed in 1994. After that, the rule of "single undertaking" was adopted, i.e., all agreements were to apply to all members, and all members were to submit schedules of concessions and commitments. The special and differential treatments, however, still apply as stated explicitly in the Punta del Este Ministerial Declarations (GATT, 1996:7). Besides GATT Article XXXVI: (8), other similar provisions regarding a de facto member status related to decolonization include Article XXVI: 5(c) and Article XXXIII as discussed by Tomz et al. [2007].

There are many further steps that could be taken to further improve the accuracy of the measured effects of the GATT on world trade flows. For instance, a sector level structural gravity equation with both positive and zero trade flows may help to achieve more precise estimates of these effects. And continued efforts are needed to improve further data quality, refine the measurements of key variables, and investigate the heterogeneity of the impact in various dimensions. Nevertheless, the contribution of the present paper is to show that the two main puzzles identified in the prior literature, the 'ineffectiveness puzzle' and the 'NMP puzzle' can both be addressed by undertaking two relatively simple modifications to the original gravity equation approach of Rose (2004).

The rest of the paper proceeds as follows. Section 2 presents the data, methods and results. Conclusions are presented in the third and final section. A table presenting the results from robustness checks is presented in the Appendix.

## 2. Data, Methods and Results

For easy of comparison, the log-linear gravity regressions in this paper follow closely Rose [2004] and Tomz et al. [2007].[8] GATT formal membership and non-member participant (NMP) data are from Tomz et al. [2007]. Other covariates include the logarithm of the products of GDP and GDP per capita, the logarithm of distance, colonial relationship, common language, common country, regional trade agreement (RTA), custom unions (CU) and Generalized System of Preferences (GSP), etc. Because zero trade flows have already been dropped in the dataset used by Rose and Tomz et al., their

[8] The dependent variable is the total trade between two countries in a given year. Subramanian and Wei [2007] among others suggest using only import data. No matter whether total trade or only import data are used, the main conclusions in this paper always hold. Therefore this paper follows Rose and Tomz et al. to use total trade for easy comparison between our results and theirs.

data cannot be used. The dataset used in this paper is based on Liu [2009] and has systematic records of zero trade.[9] The panel dataset includes more than 200 countries or regions over 1948-2001.[10] The number of observations used in regressions can be as large as 544 thousand, among which zero trade observations account for 52%. The number of positive observations (259,433) is larger than that in Rose and Tomz et al. (234,597) due to the expanded trade data from various sources.[11]

### *2.1. Traditional Log-linear Regressions*

The traditional long-linear gravity regression is specified as follows:

$$\begin{aligned}\ln T_{ijt} &= \beta_0 + \beta_1 Bothin_{ijt} + \beta_2 Onein_{ijt} + \beta_3 \ln(Y_{it} * Y_{jt}) + \beta_4 \ln[(Y_{it} / Pop_{it}) * (Y_{jt} / Pop_{jt})] \\ &+ \beta_5 Current\ Colonizer_{ij}t + \beta_6 RTA_{ijt} + \beta_7 CU_{ijt} + \beta_8 GSP_{jit} + a_t + a_{ij} + \varepsilon_{ijt}\end{aligned}$$

where $T_{ijt}$ is the total trade between *i* and *j* in year *t*; $Bothin_{ijt}$ dummy equals to one if both *i* and *j* were GATT/WTO members in year *t*; $Onein_{ijt}$ dummy equals to one if either *i* or *j* was a GATT/WTO member in year *t*; *Y* is real GDP and *Pop* is population; $Current\ Colonizer_{ijt}$ dummy equals to one if one of the countries in a dyad was currently a colony of the other country in year *t*; $RTA_{ijt}$ dummy equals to one if *i* and *j* belonged to the same regional trade agreement in year *t*; $CU_{ijt}$ dummy equals to one if *i* and *j* used the same currency in year *t*; $GSP_{ijt}$ dummy equals to one if one of the countries in a dyad offered GSP to the other country in year *t*; $a_t$ is the year dummy variable; $a_{ij}$ is the country pair dummy; $\varepsilon_{ijt}$ is the residual. Because country dyad fixed effects are included in the regression, the time-invariant variables at country or dyad levels are not included due to

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[9] Liu [2009] has data for 1948-2003. The last two years are not used in this paper to be consistent with Rose [2004] and Tomz et al. [2007].
[10] There are 175 countries in Rose [2004] and Tomz et al. [2007].
[11] More details on these data and sources can be found in Rose [2004], Tomz et al. [2007], and Liu [2009].

collinearity. More detailed information regarding the data sources and variable construction can be found in Liu [2009].

Table 1 reports the traditional log-linear regressions with year dummies and country pair fixed effects. Alternatively, exporter and importer fixed effects could be used. With country fixed effects, log-linear regressions offer similar results as country pair fixed effects regressions, but Poisson regressions are sometimes difficult to converge. We therefore report only the results with country pair fixed effects. Many time-invariant covariates are dropped from the fixed effects regressions. Regressions (1)–(3) in Table 1 use only positive trade flows with different GATT membership measures. Considering only formal membership, regression (1) shows a very small and insignificant coefficient on "*Both formal members*" (0.016), consistent with Rose's "ineffectiveness puzzle". In column (2), formal GATT memberships are distinguished from NMPs, so we add three additional variables: Formal & NMP, Both NMPs, and One NMP. Same as in Tomz et al. [2007], larger coefficients are obtained for all the GATT variables; and in particular we see a stronger trade promoting effect for NMPs than formal GATT members. Column (3) combines the formal members and NMPs and shows that they are significantly more liberalized than outsiders. This is why Tomz et al. claim that NMPs can help to explain Rose's "ineffectiveness puzzle".

Without accounting for zero trade, Rose [2004] and Tomz et al. cannot capture the effect of the GATT on trade at the extensive margin. The marginal change ($\Delta$) in trade (*T*) with respect to the change in a binary covariate (*D*) such as GATT dummy can be written as:

$$\Delta E(t \mid x) = t^1 - t^0 = P(T > 0 \mid x) * \Delta E(t \mid x, T > 0) + \Delta P(T > 0 \mid x) * E(t \mid x, T > 0)$$

where $t^1$ and $t^0$ are estimated *ln(T)* measured at *D=1* and *D=0* respectively and *P(T>0)* is the probability of positive trade, with other covariates usually measured at their mean values. The two terms on the right hand side of the above equation account for the changes in trade at intensive and extensive margins respectively. We would underestimate the impact of the GATT if we ignored the extensive margin and considered only positive trade.

After including zero trade, the two puzzles disappear as shown in the last three columns of Table 1. To keep the zero trade values after taking logarithm, the dependent variable *ln(T)* is substituted by *ln(T+1)*.[12] In regression (4), we use only formal membership and obtain much larger coefficients on "*Both formal members*" and "*One formal member*" variables than in regression (1). Regression (5) distinguishes formal members from NMPs and shows that formal members trade much more than NMPs. This is opposite from what Tomz et al. find when using only positive trade flows. Results from pooled data analysis, with many time-invariant variables, offer the same conclusions (see Appendix Table).

The economic magnitude of the effect as implied by the log-linear gravity regression results is large, and sometimes seems too large to be true. The results reported in Column (5) of Table 1 imply that two formal GATT members trade 640% (i.e., exp(2.002)-1=640%) more than the baseline case of neither being a formal member (a large "trade creation" effect)! If only one country in a dyad is a formal GATT member with the other one being a NMP, they trade 53% [i.e., exp(0.423)-1=53%] more than the baseline case. The dyads with both countries being NMPs trade 45% [i.e., exp(0.371)-1=45%] more

[12] The measurement error created is small because the unit of measurement of trade flows is *one* dollar.

than the baseline case. If only one country in a dyad is a formal member with the other being neither a formal member nor a NMP ("outsider"), they actually trade 244% (i.e., exp(1.236)-1=244%) more than the baseline case (no "trade diversion" effect)! If only one country in a dyad is a NMP with the other being an outsider, they still trade 17% (i.e., exp(0.158)-1=17%) more than the baseline case.

Zero trade makes a big difference, but still cannot explain the NMP puzzle at the intensive margin (i.e., when only positive trade is included) as in regression (2) of Table 1. In addition, some unreasonably large coefficients reported in Table 1 also indicate potential estimation issues with the log-linear specification. To address these concerns, a more appropriate econometric method is considered in the next subsection.

*2.2. Poisson Quasi-maximum Likelihood Estimation*

Santos-Silva and Tenreyro [2006] show that taking logarithm of trade in traditional gravity regressions can create biased estimates because what we are really interested in is the expected trade in level rather than the expected trade in logarithm. According to the Jensen's Inequality, $E(\ln T) \neq \ln E(T)$. The expected value of the logarithm of a random variable depends both on its mean and on the higher-order moments of the distribution. The log-linear gravity regression only picks up the first order approximation, leaving the higher-order moments in the residual and creating a heteroskedasticity problem. To tackle this problem, they suggest using the Poisson regression to estimate bilateral trade in level multiplicatively. This method is also justified by non-parametric tests as in Henderson and Millimet [2008]. The most commonly used conditional mean specification in the Poisson model is $E(T_{ijt} \mid X_{ijt}) = \exp(X_{ijt}\hat{\beta})$. Note that, to apply the Poisson model, the dependent variable (bilateral trade in this paper) does not have to be count data. As emphasized by Wooldridge [2002, p.676], "while the leading application is to count data, the fixed effect Poisson estimator works whenever the conditional mean assumption holds. Therefore, the dependent variable could be a nonnegative continuous variable, or even a binary response if we believe the unobserved effect is multiplicative...". Liu [2009] uses this method to show that the GATT has been effective at both intensive and extensive margins.[13]

Based on the Hausman specification test, we choose the country pair fixed effect Poisson model as the preferred specification.[14] The results are shown in Table 2. Same as in Table 1, the first three regressions use only positive trade with different GATT membership measures, while the last three regressions use both positive and zero trade.

In Table 2, regression (1) considers only formal membership. Even with only positive trade, "*Both formal members*" and "*One formal member*" variables bear positive and negative signs respectively as in Table 1. Differently from Table 1, the coefficient estimate for "Both formal members" is highly significant. The coefficient estimate for "One formal member" is significant in Table 2, as it was in Table 1. The results imply that two formal GATT members trade 18.6% (i.e., exp(0.171)-1=18.6%) more than the baseline case of neither being a formal member ("trade creation" effect). If only one country in pair is a GATT formal member, they actually trade 11% [i.e., exp(0.092)-

[13] Gamma Pseudo Maximum Likelihood (GPML) method has also been used to address the zero trade issue in the literature. Santos-Silva and Tenreyro (2011), however, find that the GPML has a larger bias than the Poisson estimation. Martinez-Zarzaso (2013) also show that the GPML estimation can be imprecise when the variance function is misspecified or the log-scale residuals have high kurtosis. We take Poisson estimation as the preferred method in this paper.

[14] As shown by Wooldridge [1999], the fixed effect Poisson estimator is consistent as long as the conditional mean assumption holds. The distribution of the dependent variable given $X$ and the fixed effects components is entirely unrestricted. In particular, this estimator is still consistent under over-dispersion or under-dispersion and there is no restriction on the serial correlation of the dependent variable over time.

1=11%] less than the baseline case ("trade diversion" effect). These results show that, even at the intensive margin, the GATT has also been effective in promoting the world trade when a more appropriate econometric method is used.

Regression (2) distinguishes formal members from NMPs. Even with only positive trade, the Poisson results show that formal members are more liberalized than NMPs at intensive margin: two formal GATT members on average trade 45% [i.e., exp(0.371)-1=45%] more than the baseline case of neither being a formal member nor an NMP; formal-NMP dyads trade 30% [i.e., exp(0.259)-1=30%] more than the baseline category, while two NMPs trade 22% [i.e., exp(0.196)-1=22%] more than the baseline category. These results indicate a stronger trade promoting role of formal GATT membership than NMPs. This is different from what we obtained from the traditional gravity estimation, where NMPs seem to trade even more than formal members (Table 1, column (2)). The estimated coefficients on "*One formal member*" and "*One NMP*" variables are now both positive, with the former being larger than the latter. The lack of evidence for a trade diversion effect is likely due to the externalities or a spillover effect of GATT membership.[15]

In Poisson regressions, zero trade still matters, as shown by the last three regressions in Table 2. Regression (4) shows that, with zero trade, the trade creation effect of the GATT is bigger (exp(0.235)-1=26.5%) compared to column (1) (18.6%). Their difference (26.5%-18.6%=7.9%) can be taken as the effect of the GATT at the extensive margin and it is close to one third of the total impact. When NMPs are considered, column (5) shows

[15] For example, countries may extend their MFN tariffs to many non-WTO members. For example, China enjoyed a "normal trading relationship" with the U.S. and some other WTO members for a long time before its formal entry into the WTO. As another example, an agreement signed at the Hong Kong WTO Ministerial Meetings allows tariff-free access to WTO member markets for 97% of imported products from the world's 50 least-developed countries by 2008.

that two formal GATT members trade 60% [i.e., exp(0.467)-1=60%] more than the baseline case of neither being a formal member nor an NMP; formal-NMP trade 35% [i.e., exp(0.303)-1=35%] more than the baseline case, while two NMPs trade actually 10% [i.e., exp(0.099)-1=10%] ***less*** than the baseline case.

Combined with the positive coefficient of "*Both NMPs*" in column (2) at the intensive margin, the negative coefficient of "*Both NMPs*" in column (5) is driven primarily by the effect at the extensive margin. It implies that, at extensive margin, NMPs have experienced even slower growth in new trading relations than the default category (outsiders). This is plausible because NMPs are usually relatively smaller developing countries with less diversified trading relationships (e.g., only with former colonizers), so the expansion of their trading relationships has been slower than other countries including outsiders. As shown by Figure 2, NMPs on average have fewer trading partners than formal members and even outsiders; their average number of trading partners has actually decreased since 1980s. In addition, the negative effect of NMP at the extensive margin might be driven by a trade diversion effect of formal WTO membership. When more and more countries joined the WTO officially, this might have diverted trade of NMPs from other NMPs to formal members. Finally, another factor behind the result can be limited obligations with respect to other NMPs.[16] Overall, these results from Poisson regressions

[16] As Tomz et al. [2007] document, "… Article XXXV, a clause signatory sometimes used to limit their obligations with respect to another signatory. Article XXXV states that the GATT "shall not apply as between any contracting party and any other contracting party if: (a) the two contracting parties have not entered into tariff negotiations with each other, and (b) either of the contracting parties, at the time either becomes a contracting party, does not consent to such application." They show that the use of this Article by one country in a dyad reduces the benefit of the GATT by a half on average, and the use of the Article by both countries in a dyad wipes out completely the benefit. They also mention that some NMPs such as provisional members do not possess negotiating rights, which might have limited the obligations of concessions made between NMPs.

show that NMPs trade significantly less than formal members at both intensive and extensive margins. This result contrasts sharply to the finding by Tomz et al. [2007].

Some robustness checks are also performed using different subsets of countries. These country pair fixed effects Poisson regression results are reported in Table 3. Regression (1) covers the observations with both countries in a pair as developed countries (IFS country code less than 200) and regression (2) covers the cases when both countries are developing countries (IFS country code greater than 200), while regression (3) covers the rest of the sample (i.e., developed and developing countries in a pair).[17] In all the cases, GATT formal membership is estimated to be effective in promoting world trade. The coefficients of "*Both NMPs*" variable are always smaller than those of "*Both formal members*". Regression (4) uses a sample without communist and Middle East countries; and regression (5) drops micro states which are defined as countries with average population over 1948-2001 less than half million. Our main conclusions still hold in both cases. China is often considered as an outlier in cross country studies. The last regression drops China from the analysis but this does not change much the results either. In sum, the regression results using different country subsamples are consistent with those using the whole sample as in column (5) of Table 2.

*2.3. Alternative econometric methods*

In this sub-section, we consider some alternative ways to address zero trade and discuss some recent developments in gravity specification.

[17] The definitions for developed and developing countries follow Rose [2004] and Tomz et al. [2007]. Developed countries including Switzerland, Japan, Iceland, Malta, and Yugoslavia were NMPs for some years during 1953-1965.

Tobit regressions may be used to address zero trade as a corner solution problem as in Felbermayr and Kohler [2006]. This method relies crucially on the assumptions of homoscedastic and normal residuals. If either of these assumptions fails, the entire functional form of the conditional mean in Tobit will change. Nevertheless, we have tried this method to show the robustness of our findings. Table 4 shows the results from country pair random effects Tobit regression with both positive and zero trade.[18] We also include many time-invariant variables at country or dyad level. Please refer to the footnote of Table 4 and Liu [2009) for more details about the construction and data sources of these variables.

The estimation of random effects Tobit regression is computationally cumbersome because it uses quadrature to approximate the integrals in the likelihood function. To reduce the time of estimation, we keep only the data sampled at five-year intervals: 1950, 1955, 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995 and 2000. For each specification of the GATT variables, we report the marginal effects on the unconditional expected value of *ln(T)* in the first three columns and the marginal effects on the probability of positive trade in the last three columns of Table 4. Although both positive and zero trade observations are covered by these regressions, the sample size is smaller than previous regressions because only the data at five-year intervals are used.

The results in the first three columns of Table 4 show that the marginal effects of "*Both formal members*", "*Formal & NMP*" and "*One formal member*" on trade are even bigger than those from the log-linear regressions reported in the last three columns of Table 1. The marginal effects of "*Both NMPs*" and "*One NMP*" on trade as shown by

[18] No fixed effect Tobit procedure is available, as there is no sufficient statistic allowing the fixed effects to be conditioned out of the likelihood.

column (2) are actually negative and significant. These results are consistent with the Poisson regression results in column (5) of Table 2. As for the marginal effects on the probability of positive trade, the same pattern holds in the last three columns. Column (5) shows that, all other things equal, two formal GATT members are 10% [i.e., exp(0.094)-1=10%] more likely to trade with each other than the baseline case of neither being a formal member nor an NMP, while two NMPs are actually 9% [i.e., exp(0.084)-1=9%] ***less*** likely to trade with each other compared to the baseline case.

Using separate dummies for each RTA to account for potentially heterogeneous effects of different RTAs, Eicher and Henn (2011) find no significant trade promoting effect of the WTO. However, they consider only about a dozen major RTAs although there are hundreds of others. I have tried adding to the regressions more than 150 separate RTA dummies. The fixed effect log-linear regression results are reported in Table 5.[19] The results still suggest that formal WTO membership matters more than informal membership once zero trade flows are included in regressions, despite some quite significant changes in the estimated coefficients.

Helpman, Melitz and Rubinstein [2008] propose a two-step procedure to consider both firm heterogeneity and selection bias in gravity model estimation. They apply this method primarily to cross section data in 1986.[20] We apply their method to the panel data sampled at five-year intervals from 1950-2000, as well the cross section data for each of these years. We include exporter and importer fixed effects in both stages and adopt the

[19] CU is also replaced with individual Customs Union dummies in the regressions. The dummy for current colonial relationship is dropped from the regressions due to collinearity, probably with some of the newly added RTA or CU dummies. The dyad fixed effect Poisson regressions cannot converge with so many separate RTA dummies.

[20] They do try using multiple years in 1980s without including country pair fixed effects or some traditional time-varying covariates (e.g., GDP and GDP per capita). Country pair fixed effects could be included in the second stage, but this will introduce some complication into the first stage probit regression. In probit, only random effects regression is available and this can complicate the probability prediction.

same regulation cost variables as instruments, but do not achieve reasonable estimates. Most of the covariates including the sum of GDPs and distance variables are surprisingly insignificant. These results are not reported in the tables but available upon request.[21]

To facilitate the comparisons between our results and those in Rose [2004] and Tomz et al. [2007], this paper sticks closely to their setup in both data and gravity specification. To control for the “multilateral resistance” term in the theories of gravity model as in Anderson and van Wincoop [2003], we include in the regressions some time-varying country variables such as GDP and per capita GDP. We have also tried adding a “remoteness” variable, which is defined as the distance to the rest of the world weighted by all the other countries’ GDPs in a given year. The results change little with this variable. Baier and Bergstrand [2009] show using simulations that ad-hoc remoteness variables are actually of little use in the gravity equation. Baldwin and Taglioni [2006], among others, suggest that time-varying country fixed effects can fully absorb the “multilateral resistance” effects in a panel data gravity regression. However, it is often computationally cumbersome and impossible to run regressions with such a large number of dummies. This method often offers unreasonable estimates possibly due to the over-correction by the time-varying country dummies (see, e.g., Clark et al, 2004 and Liu, 2009). We did try including these dummies as well as country pair fixed effects with the data sampled at ten-year intervals, but obtained unreasonably large and negative GATT

[21] Santos-Silva and Tenreyro (2015) argue that this two-step estimation procedure is only valid under strong distributional assumptions, which are rejected by statistical tests. Moreover, their numerical experiments show that the two-stage estimator is very sensitive to departures from the assumption of homoscedasticity. In addition, we conjecture that this can also be caused by the lack of good instrumental variables. Conceptually it is difficult to find a valid instrument that is related to decision to trade but uncorrelated to the volume of trade. The regulation cost variables are often insignificant in the first stage. As shown by Bound, Jaeger, and Baker (1995), weak instruments in the first stage can lead inaccurate estimation in the second stage.

effects.[22] Given that most of major trading nations have already joined the GATT, much of the effect of the GATT might be picked up by these time-varying country dummies, which can magnify the effect of noise in the data and make it difficult to identify the effect of the GATT.

## 3. Conclusions

To address the "ineffectiveness puzzle" of the GATT raised by Rose [2004], Tomz et al. [2007] consider the measurement error in formal GATT memberships. After considering the non-member participants (NMPs) of the GATT, they find a much larger positive impact of the GATT on trade and NMPs trade even more than formal members. Their paper gives the right answer to the questions it is designed to address. It contributes to the understanding of the measurement of GATT membership. It is difficult, however, to understand why the NMPs should trade even more than formal members. Rose is also skeptical about this result. In a survey paper, Rose [2006] says that "Another uncomfortable feature of the results of Tomz et al. is that *informal participation* in the GATT consistently matters more for trade than *formal membership.* This doesn't seem wholly plausible to me (at least not without some explanation), and is a cause for concern. I simply don't understand why informal participation could create more trade than actual membership in the GATT." Rose [2006] also mentions the conflicting results between Tomz et al. [2007] and Subramanian and Wei [2007]. Tomz et al. argue that the NMPs, mostly developing countries, seem to trade more than outsiders; while Subramanian and

[22] The coefficients of "*Both Formal Members*", "*Both NMPs*", "*Formal & NMP*", "*One Formal Member*" and "*One NMP*" are -8.17, -4.33, -2.35, -4.10 and -2.41 respectively and significant.

Wei say that the GATT is effective only for developed countries, not developing countries.

In this paper, we have addressed both the “ineffectiveness puzzle” raised by Rose and the “NMP puzzle” raised by Tomz et al. simultaneously. Estimating the gravity model using the Poisson regressions and a large dataset covering both positive and zero bilateral trade flows, we have shown that the GATT has been very effective in both the intensive and extensive margins, and NMPs turn out to be less liberalized than formal members as we would expect. This paper thus demonstrates the importance of considering zero trade flows and gravity model specification.

## Reference


Anderson, J., E. van Wincoop, 2003. “Gravity with Gravitas: A Solution to the Border Puzzle.” *American Economic Review* 93(1): 170-92.

Bagwell, K., and R.W. Staiger, 1999. “An Economic Theory of GATT.” *American Economic Review* 89(1): 215–48.

Bagwell, K., and R.W. Staiger. 2003. *The Economics of the World Trading System*. The MIT Press. Cambridge, MA.

Baier, S.L., Bergstrand, J.H., 2009. “Bonus Vetus OLS: A Simple Method for Approximating International Trade-Cost Effects using the Gravity Equation.” *Journal of International Economics* 77: 77-85

Baldwin, R. and D. Taglioni, 2006. “Gravity for Dummies and Dummies for Gravity Equations.” Graduate Institute of International Studies (HEI). Working Paper.

Bound, J., Jaeger, D. A., and Baker, R., 1995. “Problems With Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogenous Explanatory Variables Is Weak.” *Journal of the American Statistical Association* 90: 443-450.

Cabrales, A., and M. Motta, 2001. “Country Asymmetries, Endogenous Product Choice and the Timing of Trade Liberalization.” *European Economic Review* 45(1): 87-107.

Clark, P., N. Tamirisa, S-J. Wei, A. Sadikov, and L. Zeng, 2004. “Exchange Rate Volatility and Trade Flows - Some New Evidence.” *IMF Policy Paper*, Washington D.C.

Eicher, Theo S., and Christian Henn, 2011. “In Search of WTO Trade Effects: Preferential Trade Agreements Promote Trade Strongly, But Unevenly.” *Journal of International Economics* 83 (2): 137-53

Felbermayr, G.J. and W. Kohler, 2008. “Exploring the Intensive and Extensive Margins of World Trade.” *Review of World Economics* 142(4): 642-74.

Helpman, E., M. Melitz and Y. Rubinstein, 2008. “Estimating Trade Flows: Trading Partners and Trading Volumes. ” *Quarterly Journal of Economics* 123(2): 441-487.

Henderson, D.J. and D.L. Millimet, 2006. “Is Gravity Linear? ” *Journal of Applied Econometrics* 23(2): 137-72.

Hoekman, B. and M. Kostecki, 1995. *The Political Economy of the World Trading System: from GATT to WTO*. Oxford: Oxford University Press.

Liu, X., 2009. “GATT/WTO Promotes Trade Strongly: Sample Selection and Model Specification. ” *Review of International Economics* 17(3), 428-46, 2009.

Maggi, G., and A. Rodríguez-Clare, 1998. “The Value of Trade Agreements in the Presence of Political Pressures. ” *Journal of Political Economy* 106(3): 574–601.

Martinez-Zarzoso, I., 2013. “The log of Gravity Revisited.” *Applied Economics* 45(3): 311-327.

Mitra, D., 2002. “Endogenous Political Organization and the Value of Trade Agreements. ” *Journal of International Economics* 57(2): 473-85.

Rose, A.K., 2004. “Do We Really Know that the WTO Increases Trade? ” *American Economic Review* 94(1): 98-114.

Rose, A.K., 2006. “The Effect of Membership in the GATT/WTO on Trade: Where Do We Stand?” Forthcoming in *The WTO and Economic Welfare*, edited by Z. Drabek.

Rose, A.K., 2007. “Do We Really Know That the WTO Increases Trade? Reply.” *American Economic Review* 97(5): 2019-25.

Santos-Silva, S. and S. Tenreyro, 2006. “The Log of Gravity.” *Review of Economics and Statistics* 88(4): 641-58.

Santos-Silva, S. and S. Tenreyro, 2011. “Further Simulation Evidence on the Performance of the Poisson-PML Estimator.” *Economics Letters* 112(2): 220-222.

Santos-Silva, S. and S. Tenreyro, 2015. “Trading Partners and Trading Volumes: Implementing the Helpman–Melitz–Rubinstein Model Empirically”. *Oxford Bulletin of Economics and Statistics* 77(1): 93–105.

Shackmurove, Y. and U. Spiegel, 2004. “Size Does Matter: International Trade and Population Size.” PIER Working Paper 04-035. http://ssrn.com/abstract=590242

Staiger, R.W. and G. Tabellini, 1987. “Discretionary Trade Policy and Excessive Protection.” *American Economic Review* 77(5): 823–37.

Staiger, R.W. and G. Tabellini, 1999. “Do GATT Rules Help Governments Make Domestic Commitments?” *Economics and Politics* 11(2): 109–44.

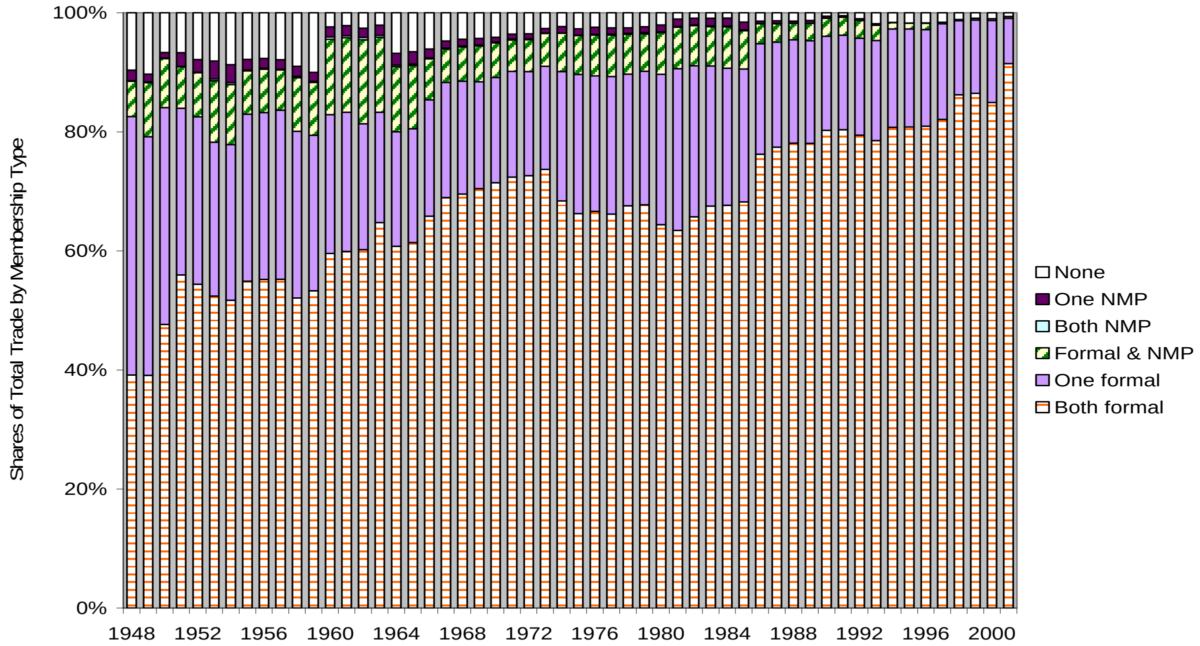
Subramanian A. and S-J. Wei, 2007. “The WTO Promotes Trade, Strongly but Unevenly.” *Journal of International Economics* 72(1): 151-75.

Tomz, M., J. Goldstein and D. Rivers, 2007. "Do We Really Know that the WTO Increases Trade? Comment." *American Economic Review* 97(5): 2005-18.

Wooldridge, J., 1999. "Distribution-Free Estimation of Some Nonlinear Panel Data Models." *Journal of Econometrics* 90(1): 77-97.

Wooldridge, J., 2002. *Econometric Analysis of Cross Section and Panel Data*. The MIT Press. Cambridge, MA.

Figure 1: Shares of Total Trade by Membership Type over 1948-2001




Notes: Each country pair is classified into one of the following six categories:
1). Both countries are formal GATT members;
2). Only one country is formal member and the other is neither formal member nor NMP;
3). One country is formal member while the other is NMP;
4). Both countries are NMPs;
5). Only one country is NMP and the other is neither formal member nor NMP;
6). Neither country is formal member or NMP (the default category in regressions).

Figure 2: Average Numbers of Trading Partners by Membership Type over 1948-2001

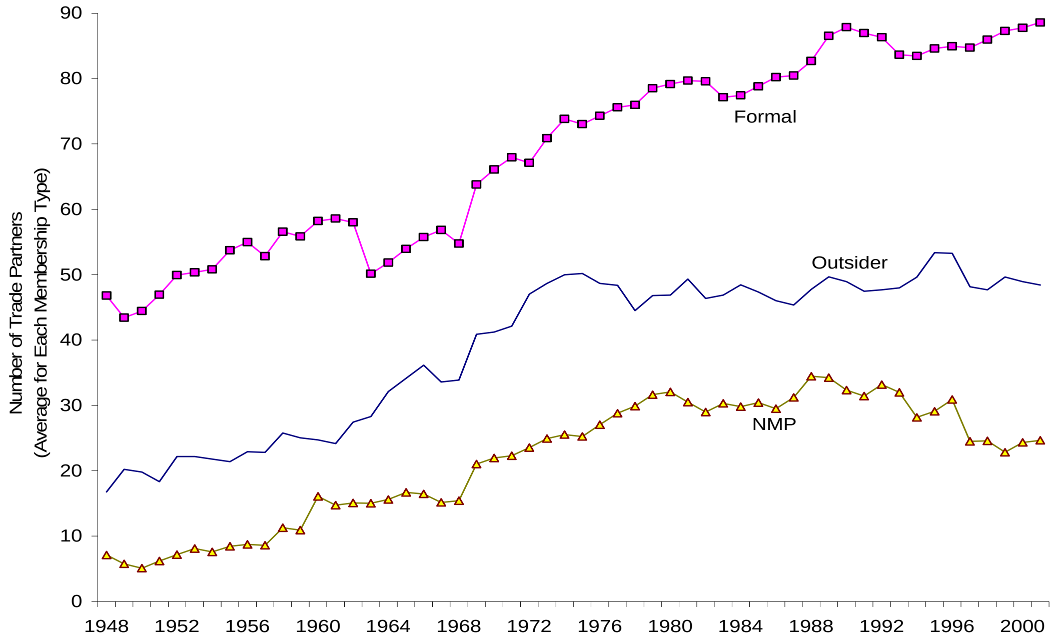


Table 1: Log-linear Gravity Regressions with Country Pair Fixed Effects

| | T>0 | | | Full Sample | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Both in GATT** | | | | | | |
| Both formal members | 0.016 | 0.515*** | | 1.658*** | 2.002*** | |
| | (0.011) | (0.021) | | (0.028) | (0.051) | |
| Formal & NMP | | 0.586*** | 0.581*** | | 0.423*** | 0.957*** |
| | | (0.022) | (0.021) | | (0.050) | (0.048) |
| Both NMPs | | 1.143*** | | | 0.371*** | |
| | | (0.042) | | | (0.061) | |
| **Only One in GATT** | | | | | | |
| One formal member | -0.146*** | 0.266*** | | 0.985*** | 1.236*** | |
| | (0.011) | (0.019) | 0.304*** | (0.027) | (0.045) | 0.693*** |
| One NMP | | 0.396*** | (0.019) | | 0.158*** | (0.043) |
| | | (0.027) | | | (0.049) | |
| Log product of GDP | 0.699*** | 0.716*** | 0.689*** | 2.671*** | 2.679*** | 2.741*** |
| | (0.015) | (0.015) | (0.015) | (0.031) | (0.031) | (0.031) |
| Log product of GDP per capita | 0.427*** | 0.413*** | 0.432*** | -0.724*** | -0.733*** | -0.764*** |
| | (0.015) | (0.015) | (0.015) | (0.030) | (0.030) | (0.030) |
| Currently colonized | 0.545*** | 0.504*** | 0.525*** | -4.729*** | -4.782*** | -5.229*** |
| | (0.068) | (0.069) | (0.068) | (0.364) | (0.364) | (0.361) |
| RTA | 0.387*** | 0.369*** | 0.371*** | 0.357*** | 0.345*** | 0.298*** |
| | (0.013) | (0.013) | (0.013) | (0.037) | (0.037) | (0.037) |
| Currency union | 0.689*** | 0.668*** | 0.667*** | 5.505*** | 5.498*** | 5.562*** |
| | (0.047) | (0.047) | (0.047) | (0.152) | (0.152) | (0.150) |
| GSP | 0.164*** | 0.171*** | 0.182*** | 1.343*** | 1.368*** | 1.324*** |
| | (0.009) | (0.009) | (0.009) | (0.028) | (0.028) | (0.028) |
| Observations | 313695 | 313695 | 313695 | 544195 | 544195 | 544195 |

Notes: All the regressions use year dummies and country pair fixed effects; Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2: Fixed Effect Poisson Regressions

| | T>0 | | | Full Sample | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Both in GATT** | | | | | | |
| Both formal members | 0.171*** | 0.371*** | | 0.235*** | 0.467*** | |
| | (0.000) | (0.000) | | (0.000) | (0.000) | |
| Formal & NMP | | 0.259*** | 0.348*** | | 0.303*** | 0.425*** |
| | | (0.000) | (0.000) | | (0.000) | (0.000) |
| Both NMPs | | 0.196*** | | | -0.099*** | |
| | | (0.000) | | | (0.000) | |
| **Only One in GATT** | | | | | | |
| One formal member | -0.092*** | 0.080*** | | -0.010*** | 0.189*** | |
| | (0.000) | (0.000) | 0.073*** | (0.000) | (0.000) | 0.171*** |
| One NMP | | 0.034*** | (0.000) | | 0.049*** | (0.000) |
| | | (0.000) | | | (0.000) | |
| Log product of GDP | 0.243*** | 0.237*** | 0.260*** | 0.409*** | 0.398*** | 0.441*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Log product of GDP per capita | 0.857*** | 0.858*** | 0.841*** | 0.717*** | 0.722*** | 0.688*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Currently colonized | 0.533*** | 0.500*** | 0.446*** | 0.299*** | 0.256*** | 0.178*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| RTA | 0.400*** | 0.398*** | 0.397*** | 0.404*** | 0.401*** | 0.399*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Currency union | 0.710*** | 0.703*** | 0.697*** | 0.780*** | 0.772*** | 0.767*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| GSP | -0.174*** | -0.175*** | -0.178*** | -0.162*** | -0.161*** | -0.165*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Observations | 312838 | 312838 | 312838 | 533727 | 533727 | 533727 |

Notes: All the regressions use year dummies and country pair fixed effects; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Fixed Effect Poisson Regressions, Robustness Checks

| | (1) Developed & Developed | (2) Developing & Developing | (3) Developed & Developing | (4) Without Communist\ Middle East | (5) Without Micro States | (6) Without China |
|---|---|---|---|---|---|---|
| **Both in GATT** | | | | | | |
| Both formal members | 0.342*** | 0.502*** | 0.980*** | 0.781*** | 0.474*** | 0.464*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Formal & NMP | 0.171*** | 0.207*** | 0.774*** | 0.598*** | 0.310*** | 0.282*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Both NMPs | -0.145*** | 0.139*** | 0.073*** | 0.232*** | -0.428*** | -0.124*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| **Only One in GATT** | | | | | | |
| One formal member | 0.252*** | 0.302*** | 0.645*** | 0.414*** | 0.191*** | 0.166*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| One NMP | -0.301*** | 0.092*** | -0.096*** | 0.354*** | -0.076*** | -0.014*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Log product of GDP | -0.177*** | 1.104*** | 0.766*** | 0.104*** | 0.371*** | 0.381*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Log product of GDP per capita | 1.547*** | -0.097*** | 0.448*** | 0.967*** | 0.760*** | 0.694*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Currently colonized | | | 0.167*** | 0.190*** | 0.249*** | 0.265*** |
| | | | (0.000) | (0.000) | (0.000) | (0.000) |
| RTA | 0.326*** | 0.227*** | 0.750*** | 0.383*** | 0.399*** | 0.403*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Currency union | 0.702*** | 1.547*** | 0.858*** | 0.750*** | 0.763*** | 0.769*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| GSP | -0.095*** | 0.133*** | -0.160*** | -0.207*** | -0.167*** | -0.188*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Observations | 18098 | 324637 | 190992 | 365277 | 398512 | 525505 |

Notes: Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; Developed countries are those with IFS country code less than 200 with the rest as developing countries; Communist countries are those with IFS country code greater than 900; Middle East includes Bahrain, Cyprus, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, UAE, and Yemen; Micro states are defined as the countries with average population over 1948-2001 less than half million.

Table 4: Random effects Tobit Regressions (Marginal Effects), Full Sample

| | $\partial E(\ln T)/\partial X$ | | | $\partial P(T>0)/\partial X$ | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Both in GATT** | | | | | | |
| Both formal members | 2.159*** | 2.085*** | | 0.100*** | 0.097*** | |
| | (0.067) | (0.112) | | (0.003) | (0.005) | |
| Formal & NMP | | 0.450*** | 1.090*** | | 0.022*** | 0.054*** |
| | | (0.113) | (0.103) | | (0.005) | (0.005) |
| Both NMPs | | -1.662*** | | | -0.094*** | |
| | | (0.146) | | | (0.009) | |
| **Only One in GATT** | | | | | | |
| One formal member | 1.881*** | 1.671*** | | 0.086*** | 0.078*** | |
| | (0.065) | (0.104) | 0.784*** | (0.003) | (0.005) | 0.038*** |
| One NMP | | -1.526*** | (0.099) | | -0.084*** | (0.005) |
| | | (0.111) | | | (0.007) | |
| Log product of GDP | 1.791*** | 1.756*** | 1.919*** | 0.088*** | 0.087*** | 0.095*** |
| | (0.021) | (0.021) | (0.020) | (0.001) | (0.001) | (0.001) |
| Log product of GDP per capita | 0.533*** | 0.534*** | 0.439*** | 0.026*** | 0.026*** | 0.022*** |
| | (0.030) | (0.030) | (0.030) | (0.001) | (0.001) | (0.001) |
| Log product of area | -0.349*** | -0.339*** | -0.362*** | -0.017*** | -0.017*** | -0.018*** |
| | (0.017) | (0.017) | (0.017) | (0.001) | (0.001) | (0.001) |
| Log distance | -2.396*** | -2.444*** | -2.412*** | -0.118*** | -0.121*** | -0.119*** |
| | (0.048) | (0.048) | (0.048) | (0.002) | (0.002) | (0.002) |
| Land border | 0.699** | 0.741** | 0.516 | 0.033** | 0.035** | 0.024* |
| | (0.269) | (0.266) | (0.268) | (0.012) | (0.012) | (0.012) |
| Landlock | -0.792*** | -0.833*** | -0.707*** | -0.039*** | -0.041*** | -0.035*** |
| | (0.070) | (0.070) | (0.070) | (0.003) | (0.003) | (0.003) |
| Island | 0.225** | 0.222** | 0.033 | 0.011** | 0.011** | 0.002 |
| | (0.080) | (0.080) | (0.080) | (0.004) | (0.004) | (0.004) |
| Common language | 1.232*** | 1.222*** | 1.221*** | 0.057*** | 0.057*** | 0.056*** |
| | (0.119) | (0.118) | (0.119) | (0.005) | (0.005) | (0.005) |
| Ever colonized | 2.549*** | 2.323*** | 2.526*** | 0.103*** | 0.096*** | 0.102*** |
| | (0.377) | (0.375) | (0.379) | (0.012) | (0.013) | (0.012) |
| Currently colonized | -0.916 | -1.325* | -1.610** | -0.049 | -0.073 | -0.091* |
| | (0.634) | (0.611) | (0.599) | (0.036) | (0.038) | (0.039) |
| Common colonizer | 0.707*** | 0.676*** | 0.654*** | 0.034*** | 0.032*** | 0.031*** |
| | (0.119) | (0.119) | (0.119) | (0.005) | (0.005) | (0.005) |
| Common Country | -0.464 | -0.830 | -1.530 | -0.024 | -0.044 | -0.086 |
| | (2.826) | (2.731) | (2.585) | (0.151) | (0.155) | (0.165) |
| RTA | -0.063 | -0.087 | -0.117 | -0.003 | -0.004 | -0.006 |
| | (0.089) | (0.089) | (0.089) | (0.004) | (0.004) | (0.004) |
| Currency union | 3.978*** | 3.977*** | 4.152*** | 0.145*** | 0.145*** | 0.150*** |
| | (0.248) | (0.246) | (0.249) | (0.006) | (0.006) | (0.006) |
| GSP | 0.867*** | 0.958*** | 0.878*** | 0.041*** | 0.045*** | 0.041*** |
| | (0.068) | (0.068) | (0.068) | (0.003) | (0.003) | (0.003) |
| Observations | 115143 | 115143 | 115143 | 115143 | 115143 | 115143 |

Notes: Year coverage: 1950, 1955, 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995 and 2000; All the regressions use year dummies and country pair random effects; * significant at 10%; ** significant at 5%; *** significant at 1%. *Distance* is the great circle distance between two countries in a dyad; *Area* is the geographic area of a country; *Land border* dummy equals to one if two countries in a dyad share land border; *Landlock* is the number of landlocked nations in a dyad (0, 1, or 2); *Island* is the number of island nations in a dyad (0, 1, or 2); *Common language* dummy equals to one if two countries in a dyad share a common language; *Ever colonized* dummy equals to one if one of the countries in a dyad has ever been a colony of the other country; *Common colonizer* dummy equals to one if two countries in a dyad had ever been colonized by the same colonizer; *Common country* dummy equals to one if two countries in a dyad had ever been parts of the same country.

Table 5: Log-linear Gravity Regressions with Country Pair Fixed Effects (separate RTA dummies)

| | T>0 | | | Full Sample | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Both in GATT** | | | | | | |
| Both formal members | -0.120 | 0.257 | | 1.697*** | 1.596*** | |
| | (0.081) | (0.173) | | (0.304) | (0.536) | |
| Formal & NMP | | 0.407** | 0.407** | | -0.096 | 0.928* |
| | | (0.180) | (0.161) | | (0.577) | (0.504) |
| Both NMPs | | 0.683*** | | | -0.337 | |
| | | (0.264) | | | (0.783) | |
| **Only One in GATT** | | | | | | |
| One formal member | -0.389*** | -0.035 | | 0.494* | 0.412 | |
| | (0.076) | (0.159) | 0.071 | (0.254) | (0.505) | 0.313 |
| One NMP | | 0.493** | (0.151) | | 0.014 | (0.485) |
| | | (0.231) | | | (0.691) | |
| Log product of GDP | 0.627*** | 0.612*** | 0.541*** | 0.955 | 0.974 | 1.080* |
| | (0.192) | (0.197) | (0.194) | (0.605) | (0.612) | (0.610) |
| Log product of GDP per capita | 0.230 | 0.260 | 0.320 | 0.527 | 0.497 | 0.509 |
| | (0.223) | (0.230) | (0.225) | (0.621) | (0.634) | (0.634) |
| GSP | -0.124 | -0.120 | -0.133 | -0.472 | -0.475 | -0.382 |
| | (0.143) | (0.143) | (0.141) | (0.470) | (0.470) | (0.476) |
| Observations | 313695 | 313695 | 313695 | 544195 | 544195 | 544195 |

Notes: All the regressions use year dummies and country pair fixed effects; Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table: Log-linear Gravity Regression, Pooled Data

| | T>0 | | | Full Sample | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Both in GATT** | | | | | | |
| Both formal members | -0.046*** | 0.294*** | | 1.711*** | 1.952*** | |
| | (0.010) | (0.018) | | (0.022) | (0.037) | |
| Formal & NMP | | 0.440*** | 0.354*** | | 0.613*** | 1.284*** |
| | | (0.020) | (0.018) | | (0.038) | (0.035) |
| Both NMPs | | 1.311*** | | | 0.034 | |
| | | (0.042) | | | (0.052) | |
| **Only One in GATT** | | | | | | |
| One formal member | -0.253*** | 0.074*** | | 1.116*** | 1.320*** | |
| | (0.011) | (0.018) | 0.097*** | (0.022) | (0.036) | 0.823*** |
| One NMP | | 0.239*** | (0.018) | | -0.487*** | (0.035) |
| | | (0.027) | | | (0.041) | |
| Log product of GDP | 0.913*** | 0.920*** | 0.907*** | 1.562*** | 1.558*** | 1.660*** |
| | (0.002) | (0.002) | (0.002) | (0.005) | (0.005) | (0.005) |
| Log product of GDP per capita | 0.368*** | 0.359*** | 0.365*** | 0.802*** | 0.787*** | 0.736*** |
| | (0.003) | (0.003) | (0.003) | (0.007) | (0.007) | (0.008) |
| Log product of area | -0.085*** | -0.082*** | -0.083*** | -0.240*** | -0.236*** | -0.245*** |
| | (0.002) | (0.002) | (0.002) | (0.004) | (0.004) | (0.004) |
| Log distance | -1.107*** | -1.115*** | -1.119*** | -2.257*** | -2.277*** | -2.285*** |
| | (0.005) | (0.005) | (0.005) | (0.011) | (0.011) | (0.011) |
| Land border | 0.576*** | 0.589*** | 0.593*** | 0.763*** | 0.776*** | 0.691*** |
| | (0.023) | (0.023) | (0.023) | (0.066) | (0.066) | (0.066) |
| Landlock | -0.412*** | -0.403*** | -0.415*** | -0.689*** | -0.700*** | -0.640*** |
| | (0.008) | (0.008) | (0.008) | (0.016) | (0.016) | (0.016) |
| Island | 0.045*** | 0.017** | 0.039*** | 0.203*** | 0.170*** | 0.062*** |
| | (0.008) | (0.008) | (0.008) | (0.018) | (0.018) | (0.018) |
| Common language | 0.398*** | 0.398*** | 0.409*** | 0.963*** | 0.952*** | 0.947*** |
| | (0.012) | (0.012) | (0.012) | (0.025) | (0.025) | (0.025) |
| Ever colonized | 1.311*** | 1.314*** | 1.297*** | 2.209*** | 2.145*** | 2.192*** |
| | (0.021) | (0.021) | (0.021) | (0.060) | (0.060) | (0.060) |
| Currently colonized | 1.301*** | 1.279*** | 1.306*** | -0.659* | -0.923** | -1.248*** |
| | (0.094) | (0.093) | (0.094) | (0.385) | (0.386) | (0.385) |
| Common colonizer | 0.457*** | 0.433*** | 0.438*** | 0.872*** | 0.821*** | 0.812*** |
| | (0.013) | (0.013) | (0.013) | (0.026) | (0.026) | (0.026) |
| Common country | 0.410** | 0.412** | 0.453** | 0.552 | 0.311 | -0.417 |
| | (0.202) | (0.200) | (0.201) | (0.561) | (0.561) | (0.556) |
| RTA | 0.643*** | 0.629*** | 0.617*** | 1.198*** | 1.166*** | 1.207*** |
| | (0.013) | (0.013) | (0.013) | (0.031) | (0.031) | (0.031) |
| Currency union | 0.868*** | 0.820*** | 0.826*** | 1.927*** | 1.926*** | 2.061*** |
| | (0.024) | (0.024) | (0.024) | (0.053) | (0.053) | (0.053) |
| GSP | 0.801*** | 0.794*** | 0.777*** | 2.841*** | 2.803*** | 2.887*** |
| | (0.009) | (0.009) | (0.009) | (0.021) | (0.021) | (0.021) |
| Observations | 313695 | 313695 | 313695 | 544195 | 544195 | 544195 |
| R-squared | 0.64 | 0.64 | 0.64 | 0.50 | 0.50 | 0.50 |

Notes: All the regressions use year dummies; Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

# Opportunities for Cooperation in Removing Prohibitive Trade Barriers

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**Abstract**

Much potential for trade liberalization exists in industries and markets with trade barriers that are prohibitive for all or many firms. In standard political economic theories of trade policy, observed prohibitive barriers must be globally optimal according to both individual and joint government preferences, leaving no possibility for a trade agreement. This chapter shows that in a standard imperfectly competitive model, observed prohibitive barriers may be optimal according to individual government preferences but not joint government preferences, so that a trade agreement would be valuable. Theory can then further identify market characteristics for which liberalization is most likely to be feasible. To illustrate, we consider a two-country model with Cournot firms in segmented markets. For plausible ranges of political weights on firm profits, there is a role for a trade agreement in eliminating prohibitive trade barriers. We then consider how the potential for cooperation varies with trade costs, Ricardian technological differences, competition, and firm heterogeneity. The implications of these results are discussed for negotiations involving developing countries, for whom prohibitive trade barriers remain important.

JEL Classification: F12, F13, F15

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# 1 Introduction

This chapter provides a distinct theory of how nations can achieve cooperation in eliminating prohibitive trade barriers. New theory is valuable here because such cooperation is not possible in the canonical two-good model of trade agreements with perfect competition and political economy (Bagwell and Staiger, 1999, 2011). In the canonical model, cooperation in reducing import tariffs is possible only for industries for which trade already exists under noncooperative policy. The model permits extreme political economy forces that could cause governments to impose prohibitive protection for import-competing industries, but under such forces, the unilateral preference for prohibitive protection must imply a joint preference for prohibitive protection.[1] The possibility that cooperation can eliminate prohibitive barriers has then been relatively unexplored.[2]

Cooperation in eliminating prohibitive trade barriers, particularly services trade barriers, is important for economic development. Presently, trade barriers are higher for developing countries than developed countries in goods (Kee, Nicita, and Olarreaga, 2009) and in services (Jafari and Tarr, 2015). The importance of removing services trade barriers for growth and development is the focus of a seminal survey by Francois and Hoekman (2010). The authors remark, "Evidence from the literature on both OECD and developing countries strongly suggests that producer services, in particular, play a critical role in productivity growth in general, including manufacturing competitiveness. The contribution of services in this regard is closely related to patterns of market segmentation, openness, and trade" (644). Consequently, distortions in global services trade are significant barriers to growth and development. Trade barriers in services often take the form of restrictions rather than tariffs in developing countries (Borchert, Gootiz, and Mattoo, 2013). For example, Laos, Nepal, and Zambia maintain barriers that limit foreign entry into telecommunications and air transport, and these restrictions exacerbate their economic isolation and enable monopoly and government rents (Borchert, Gootiiz, Goswami, and Mattoo, 2015). Though the WTO has achieved some success in reducing services trade barriers, most notably through China's WTO accession protocol (Mattoo, 2004; Miroudot, Sauvage, and Shepherd, 2013), overall there has been much less cooperation in services trade than in goods trade (Francois and Hoekman, 2010). Theory focusing on cooperation over prohibitive barriers, more common in services, can then be helpful in addressing the challenges of services trade liberalization.

[1] This result is most transparent in equation (11) of Bagwell and Staiger (2011), which shows that cooperation has no effect on import tariffs if trade volume is zero under noncooperative policies.

[2] This chapter follows the literature that presumes trade agreements' role is to correct global inefficiencies due to nations' failure to internalize cross-border effects of their unilateral policy choices (Bagwell, Bown, and Staiger, 2016). Another explanation for the elimination of prohibitive trade barriers could follow if trade agreements instead solve governments' commitment problem when facing pressure from domestic lobbies (Maggi and Rodriguez-Clare, 1998). We discuss this possibility further at the end of this section.

Prohibitive trade barriers are also relevant for import substitution industrialization (ISI), the textbook example of developing country protectionism. Often associated with Latin American and Indian trade policy in the 1950s and 1960s, ISI sought to protect "infant" industries (Krugman, Obtsfeld, and Melitz, 2014, Ch. 11). Latin American ISI policy had an "emphasis on autarky" that limited integration even within the continent (Baer, 1972). Whether such trade protection overall promoted industrial development is still debated (Rodrik, 2001). Such trade protection fell into disrepute among policymakers in the 1980s, though some firms born in this era still survive and thrive (e.g. Brazil's Embraer in aircraft and Marcopolo S.A. in bus bodies). The chapter's theory helps to illuminate when developing countries could achieve cooperation in trade while seeking to promote such national champions. Such cooperation is important to free resources for development by reducing distortions from ill-advised promotion of national champions.

To develop theory for cooperation in eliminating prohibitive policies, there first must be an explanation for why governments would unilaterally impose prohibitive protection. We do not focus on models that rationalize the infant industry argument, because the success of such policy has been questionable. Instead we model governments that weigh profits of particular firms in excess of national-income maximization, as is common practice in the trade agreement literature. Such a weight could result from government's political desire to promote a national champion like Embraer or a monopoly providing services. The first-best policies to maximize such government preferences are domestic subsidies (Dixit, 1985), but developing nations are more likely to lack the state capacity for such transfers (Besley and Persson, 2009).[3] Absent such subsidies, governments can use import protection to shift profits from abroad to favored domestic firms. The government trade policy choice thus imposes a profit-shifting externality on the trading partner, as in Venables (1985). This externality is distinct from the terms-of-trade externality that is the focus of the canonical trade agreement model. Because of the additional profit-shifting externality, cooperation over prohibitive trade policies may be possible, depending on how much governments value the profits.

This chapter's formal contribution is to solve for the political parameters in a two-country model such that prohibitive policies are unilaterally optimal for each government, but free trade is jointly optimal for the two governments. We then extend the model to consider how market characteristics affect the possibility of liberalization when prohibitive policies are unilaterally optimal. The paper thus provides a comprehensive framework that could be used to evaluate which sectors have the greatest potential for cooperative gains from a starting point of prohibitive trade barriers.

To model cooperation in eliminating prohibitive policies, this chapter adopts a par-

[3]Most literature on import restrictions and imperfect competition abstracts from the possibility of domestic subsidies that could correct distortions from imperfect competition (Bagwell, Bown, and Staiger, 2016). The persistence of markup heterogeneity across industries (Epifani and Gancia, 2011) suggests nations are not actually imposing such first-best subsidies.

tial equilibrium framework of two countries with Cournot firms competing in segmented markets. The firms have constant marginal production costs and iceberg trade costs. Consumer demand for the Cournot product is linear with a choke price, and we can endogenize whether or not governments choose prohibitive barriers. Cournot competition is a typical choice for modelling import restrictions that shift rents between nations (e.g. Venables, 1985). Though the model is stylized, it has relevance for both trade in goods and in services, though the parameter interpretation can differ across sectors. The trade cost for goods is easily interpreted as a transport cost, while the trade cost for services can be interpreted as a relative inefficiency for a domestic firm serving a foreign market.[4] We further discuss the appropriateness and robustness of the model in Section 2.

We first derive results for a baseline case in which marginal costs of production are equal across firms and destinations. In this setting, prohibitive policies are not optimal if governments maximize national income, but governments will impose a prohibitive policy if they assign an additional 50 percent weight on firm profits. We must still verify that such political preferences do not also imply that barriers are jointly preferable to no barriers. We find that liberalization is desirable as long as the political weight is not considerably larger.

The model extensions in Section 3 yield testable predictions for when trade cooperation is feasible. The model allows for three possible outcomes, depending on the governments' political weight on firm profit: (1) for a sufficiently low weight, governments always impose nonprohibitive policies, (2) for an intermediate weight, governments choose prohibitive policies noncooperatively and free trade cooperatively, and (3) for a sufficiently large weight, governments always choose prohibitive policies. The model can then help us identify the relative likelihood of being in state (2) conditional on observing that we may be in either state (2) or state (3), i.e., the relative likelihood of cooperative liberalization given that we are currently observing prohibitive policies. The model predicts how this likelihood varies conditional on market characteristics, which are likely to be more transparent than estimated parameters of a government's objective function.

The first extension that we consider is symmetric trade costs. When trade costs are higher, the prohibitive tariff level is lower. Trade costs then lower the cutoff of the political parameter necessary to rationalize the imposition of prohibitive trade barriers. The larger the trade cost, the narrower is the parameter range for which nations could cooperate even if prohibitive policies are unilaterally optimal. Though trade costs make a potential agreement less harmful to domestic profits, they make the agreement less appealing both in terms of consumer welfare and export profits. The results provide an explanation for why more distant countries could have more difficulty achieving trade

[4] High trade costs for services are empirically plausible. Crozet, Milet and Mirza (2016) find that French firms face large regulatory barriers for service exports, even those destined for other European Union members.

liberalization.

Our baseline case allows for only pro-competitive gains from trade, so an interesting extension is the possibility of Ricardian gains from trade when nations have different technologies. We extend the standard model by introducing a second imperfectly competitive sector in each country, and we consider the simplest case of two countries with mirror-image differences in productivity between the two sectors. Relative to the case of equal productivities across industries, a small cross-industry difference in productivity increases the political parameter necessary to rationalize prohibitive policy, but causes little effect on the difference in payoffs between free trade and autarky—thus, a sufficiently small difference in productivity leads to less cooperation in eliminating prohibitive barriers. But for sufficiently large differences in productivity, industry profits flatten or even increase following liberalization. When profits increase from liberalization, free trade is preferable to autarky regardless of the political parameter.

We then consider the level of competition in each country, parameterized by the number of symmetric Cournot firms in each nation. We first consider a symmetric increase in competition in each country. This narrows the range of the political parameter for which cooperation is possible. When markets are already competitive, there are limited pro-competitive gains from trade, so governments prefer to maintain protection relative to the case in which both nations have limited competition. Liberalization is then possible for national monopolies but impossible for perfect competition in this framework. We also consider the potential for cooperation between a nation with limited competition and a nation with high competition. In the limiting case as the number of firms in the high-competition nation approaches infinity, there is zero potential for liberalization if prohibitive policies are unilaterally optimal, so the impossibility of liberalization is the same as in the perfectly competitive case.

Lastly, we consider the case of within-country firm heterogeneity in productivity among symmetric countries. We focus on the simple yet rich case of asymmetry in productivity among two firms in each country. When there is a small asymmetry in productivity, the results approach those from competing duopolies, and with a large asymmetry, the results approach those from competing monopolies. With a more intermediate level of asymmetry, we obtain the most interesting case of firm heterogeneity. In this case, both consumer surplus and industry profits can increase upon cooperation, so liberalization is always preferable to autarky regardless of political economy considerations. And if industry profits decrease somewhat, very strong political economy considerations are still necessary to rule out the possibility of liberalization. The results suggest that industries with such an intermediate level of heterogeneity are suitable targets for achieving liberalization.

To my knowledge this is the first work to emphasize a class of two-country models and solve for parameters such that (1) prohibitive policies are unilaterally preferable to nonprohibitive policies and (2) nonprohibitive policies are jointly preferable to prohibitive policies. While the profit-shifting externalities we consider are also the focus of a large literature of the 1980s (surveyed in Brander, 1995), that literature focuses on national-income maximizing objectives. The current chapter finds that for prohibitive tariffs to arise noncooperatively while free trade arises cooperatively, government preferences must depart from standard national-income maximizing objectives. Later literature that considers political economic preferences (e.g. Bagwell and Staiger, 1999) focuses on cases in which the unilaterally optimal import policies are nonprohibitive. More recent trade policy literature with imperfect competition maintains the focus on nonprohibitive policies (e.g. Ossa 2011). The current chapter focuses instead on the corner solutions, and in that sense it relates to Romer (1994) on the importance for development of policy that expands trade in new goods rather than expanding volumes of goods that are already traded. Concurrent work by Staiger and Sykes (2017) on services trade does mention the possibility of cooperation starting from prohibitive policies for a restricted version of their model. We discuss the relationship with their paper in more detail in Section 2.

Several recent papers assume Cournot competition in addressing other trade agreement issues. Mrázová (2011) is the first to rationalize the principles of reciprocity and nondiscrimination in a Cournot framework. Bagwell and Staiger (2012a) show how a linear Cournot model can rationalize export subsidy bans under free trade, and Bagwell and Staiger (2012b, 2015) focus on how international externalities from imperfect competition can disappear when nations negotiate over both import and export policies. Horn and Levinsohn (2001) consider nations choosing the number of Cournot firms to model coordination over competition policy. Fung and Siu (2008) consider profit-shifting effects of entry restrictions on services. Lebrand (2016) considers agreements over a foreign direct investment (FDI) restriction on the number of identical Cournot firms allowed to operate abroad. Deardorff and Stern (2008) also consider profit-shifting in the context of services trade when modeling the effects of a unilateral barrier to entry.

Lastly, we mention other related literatures which provide alternative explanations for cooperation in eliminating prohibitive policies. There is a literature in which trade agreements allow governments to tie their hands to avoid political pressure from import-competing special interests (Maggi and Rodriguez Clare, 1998, 2007). In such frameworks, political pressure absent an agreement could lead to prohibitive policies, while a trade agreement could commit governments to free trade. Though these papers already provide an explanation for how trade agreements could eliminate prohibitive policies, the legal literature expresses some doubt over whether the commitment theory can plausibly explain cooperation in services trade.[5] There is a literature on prohibitive product standards in the presence of consumption externalities (Fischer and Serra, 2000; Essaji, 2010) but its

[5]Marchetti and Mavroidis (2011) note the number of legal loopholes in WTO services agreements, and economists echo this concern (Francois and Hoekman, 2010).

focus is different from the current chapter. This chapter also relates to a literature on why Latin American import substitution industrialization ended during macroeconomic crises of the 1980s. This work argues that liberalization can result after crises shift the domestic balance of political power (Drazen and Grilli, 1993; Rodrik, 1994). Our results suggest that liberalization can occur without any exogenous change that would alter either the unilaterally optimal policies or the jointly optimal policies absent contracting costs—common crises could spur change simply by reducing the costs of coordinating on the cooperative equilibrium.

The rest of the chapter proceeds as follows. Section 2 presents the baseline model and then derives the parameter restrictions for which liberalization from prohibitive policies is possible. Section 3 explores how various market characteristics affect the potential for trade cooperation. Section 4 then concludes by discussing further applications of the framework.

# 2 Model of Prohibitive Trade Policies

This section develops a tractable setting in which countries impose prohibitive trade policies noncooperatively but nonetheless can benefit from trade cooperation.

## 2.1 Baseline Model Structure

The baseline model is partial equilibrium with two countries, each with one firm. There is Cournot competition between firms in the two segmented markets. We call the nations Home and Foreign, with asterisks (*) denoting Foreign variables. Consumer demand is linear with prices $P(Q) = 1 - Q$ and $P^*(Q) = 1 - Q^*$ for aggregate domestic quantity $Q$ and foreign quantity $Q^*$. The home tariff is $\tau$ and the foreign tariff is $\tau^*$, and we restrict these to be nonnegative. Each firm can produce with constant marginal labor requirement $c$ and iceberg trade cost $\phi$. As is standard for partial equilibrium, there is an outside sector that is perfectly competitive with unit labor requirement. Assumptions of costless trade in the outside sector and perfect labor mobility between sectors imply equal wages across sectors and countries, and we pick this wage as the numeraire.

We introduce here notation for firm-level variables. Throughout the chapter, we use lowercase $q$ to denote the quantity sold by a single firm in a single market, and lowercase $\pi$ for profits of a single firm in a single market. The subscript $h$ is used for Home firms, and $f$ for Foreign firms. The asterisk (*) denotes outcomes in the Foreign market, while no asterisk denotes outcomes in the Home market. For example, $q_f$ denotes a Foreign firm's exports to the Home market. Home market quantity $Q$ is then the sum of quantities sold by either nation's firms in the Home market, and $Q^*$ is defined similarly for the Foreign market.

Following a large political economy literature starting with Baldwin (1987), governments maximize national income, except they assign to firm profits a political economy weight $\alpha \geq 1$. Such preferences can be microfounded through a specific factor that absorbs profits in the outside sector (Helpman and Krugman, 1989, Section 7.3) and organized lobbying among owners of the specific factor that leads governments to give excess weight to specific factor rewards (Grossman and Helpman, 1994). The Home government objective defined over its own import tariff $\tau$, given $\alpha$ and the Foreign import tariff $\tau^*$, takes the form

$$G(\tau; \alpha, \tau^*) = CS(\tau) + \alpha n(\pi_h(\tau) + \pi_f(\tau^*)) + TR(\tau) \tag{1}$$

where $CS$ is Home consumer surplus and $TR$ is Home tariff revenue. In our framework with partial equilibrium and segmented markets, the Foreign tariff does not affect Home's consumer surplus, domestic profits, or tariff revenue, and the Home tariff does not affect profits from Home's exports. The Foreign government objective takes a similar form.

Throughout this chapter we maintain a similar set of assumptions, though we later vary trade costs, the number of firms, and firm productivities. Having laid out the model, this is an appropriate place to discuss the suitability and robustness of its structure.

One natural question is whether our results will be specific to Cournot competition, rather than a more general set of profit-shifting models. Based on related work, we can conclude that the possibility of cooperation eliminating prohibitive policies is not specific to Cournot or even imperfect competition. Staiger and Sykes (2017) also remark that cooperation in eliminating prohibitive policies is possible in their model of price-taking service producers, but only under certain restrictions. We consider here the common characteristics between their restricted setting and our model. One explicit similarity is that export subsidies are exogenously absent. A well-established result is that negotiating over both import policies and export policies can eliminate international externalities related to rent-shifting (Bagwell and Staiger, 2012a, 2012b), though the absence of export policies is a reasonable setting to consider under current WTO law which prohibits export subsidies, as noted by Ossa (2011).[6] A key logical consequence is that a model in which rent-shifting matters for trade agreements must fail to satisfy the conditions for Lerner symmetry—otherwise import and export policies would be equivalent. Failure of Lerner symmetry requires that there are multiple sectors with markups that are not equated through use of domestic subsidies (Epifani and Gancia, 2011). Such is the case for any partial equilibrium model featuring a markup from imperfect competition and

[6] Introducing export subsidies would not be straightforward in our framework. For the strong political economy forces that we consider, governments would seek unbounded transfers to the firms. A richer public finance framework that appropriately models the financing costs of subsidies would be necessary to develop reasonable predictions.

no corrective subsidies, because the outside sector has no markup.[7] Failure of Lerner symmetry can also be introduced in a perfectly competitive, partial equilibrium economy in which export sectors receive a political economy weight, supply curves slope upwards, and firms make short-run profits (Bagwell and Staiger 2016).[8] So to summarize, the absence of export subsidies and the failure of Lerner symmetry are more essential to our model than the specific mode of competition.

Another natural question is whether results will be sensitive to how we model the choice between prohibitive and nonprohibitive policies. One concern is that nonprohibitive policies might be infeasible—this can be true for certain types of services trade (Francois and Hoekman, 2010). A second concern is whether a more appropriate model might involve firms that are unable to cover fixed costs of trade. Robustness here would be particularly important in applying the model to services trade delivered through foreign direct investment rather than exporting, though any exporting could involve fixed costs. A third concern is to what extent prohibitive policies are maintained through local content requirements of intermediates rather than on final goods, and how much the economy's input-output structure matters (see Baer, 1972, for specifics on Latin American ISI). Ultimately, the modeling choice here follows Bagwell and Staiger (2012a) in using Cournot with linear demand, and the model is highly tractable. Given the dearth of literature on how cooperation can eliminate prohibitive policies, the stylized approach here is a suitable starting point.

The final critical evaluation of our assumptions here relates to textbook criticisms of the strategic trade literature (e.g. Feenstra, 2004, Ch. 7). One concern is the robustness of our results on optimal unilateral policy, given that optimal unilateral export policy for third-market competition hinges on modelling assumptions.[9] The focus here, however, is on rents for import-competing firms, and there is no similar fragility in the claim that import-competing firms benefit from import protection. Other criticisms of the strategic trade literature include that rent-shifting is not robust to free entry (Hortsmann and Markusen, 1986) or foreign ownership (Feeney and Hillman, 2001), but we note that these corrective forces are more likely to fail in the developing-country context given higher barriers to entry and ownership restrictions for nationalized industries or services.

[7] Lerner symmetry can also fail in a general equilibrium model with multiple sectors, but the discussion here mainly focuses on partial equilibrium examples, as this is the simplest way to introduce a second sector.

[8] Under the standard long-run assumptions of perfect competition—perfect factor mobility and no barriers to entry—such profits would be dissipated, however.

[9] Specifically, a subsidy is optimal for Cournot competition in homogeneous products (Brander and Spencer, 1985) and a tax is optimal for Bertrand competition in differentiated products (Eaton and Grossman, 1986).

## 2.2 Baseline Model Results

For the baseline model, we assume $\phi = 0$. Using standard results and definitions from Cournot competition, we can derive outcomes in the home market under autarky (the usual monopoly case), free trade (the usual duopoly case), and a nonprohibitive tariff.[10] Each row of Table 1 lists the results under the various policy choices. For all tables in this chapter, the "Free Trade" column contains outcomes for joint free trade, while the "Tariff" column contains outcomes for nonprohibitive Home and Foreign tariffs ($\tau$ and $\tau^*$, respectively).

Table 1: Results for Baseline Model

| Outcome \\ Policies | Autarky | Free Trade | Tariffs |
|---|---|---|---|
| Home domestic sales $q_h$ | $\frac{1}{2}(1-c)$ | $\frac{1}{3}(1-c)$ | $\frac{1}{3}(1-c+\tau)$ |
| Foreign exports $q_f$ | 0 | $\frac{1}{3}(1-c)$ | $\frac{1}{3}(1-c-2\tau)$ |
| Home exports $q_h^*$ | 0 | $\frac{1}{3}(1-c)$ | $\frac{1}{3}(1-c-2\tau^*)$ |
| Market quantity $Q$ | $\frac{1}{2}(1-c)$ | $\frac{2}{3}(1-c)$ | $\frac{1}{3}(2(1-c)-\tau)$ |
| Market price $P$ | $\frac{1}{2}(1+c)$ | $\frac{1}{3}(1+2c)$ | $\frac{1}{3}(1+2c+\tau)$ |
| Consumer surplus $CS$ | $\frac{1}{8}(1-c)^2$ | $\frac{2}{9}(1-c)^2$ | $\frac{1}{2}\left(\frac{2(1-c)-\tau}{3}\right)^2$ |
| Home domestic profits $\pi_h$ | $\frac{1}{4}(1-c)^2$ | $\frac{1}{9}(1-c)^2$ | $\left(\frac{1-c+\tau}{3}\right)^2$ |
| Home export profits $\pi_f$ | 0 | $\frac{1}{9}(1-c)^2$ | $\left(\frac{1-c-2\tau^*}{3}\right)^2$ |
| Tariff revenue $TR$ | 0 | 0 | $\tau\left(\frac{1-c-2\tau}{3}\right)$ |
| Government objective $G$ | $\left(\frac{1+2\alpha}{8}\right)(1-c)^2$ | $\left(\frac{2+2\alpha}{9}\right)(1-c)^2$ | (Given below) |

We write the Home government objective $G(\tau;\alpha,\tau^*)$ as a function of the Home trade policy choice $\tau$, as well as the parameter $\alpha$ and the Foreign trade policy $\tau^*$. Denote the prohibitive tariff levels as $\bar{\tau}$ and $\bar{\tau}^*$, so Home's objective equals $G(\bar{\tau};\alpha,\bar{\tau}^*)$ under autarky and $G(0;\alpha,0)$ under free trade. To define the government objective as a function of the tariff $\tau$, we must define it piecewise with a cutoff at the prohibitive tariff level. The tariff is prohibitive when $\frac{1}{3}(1-c-2\tau) \leq 0$, i.e. $\tau \geq \frac{1}{2}(1-c)$. Using equation (1) and results in Table 1, the Home government objective is

$$G(\tau;\alpha,\tau^*) = \begin{cases} \frac{1}{2}\left(\frac{2(1-c)-\tau}{3}\right)^2 + \alpha\left(\frac{1-c+\tau}{3}\right)^2 + \alpha\pi_f(\tau^*) + \frac{\tau(1-c-2\tau)}{3}, & \text{if } \tau \leq \frac{1}{2}(1-c), \\ \left(\frac{1+2\alpha}{8}\right)(1-c)^2 + \alpha\pi_f(\tau^*), & \text{if } \tau \geq \frac{1}{2}(1-c), \end{cases} \tag{2}$$

[10] Throughout the paper we regularly apply the following general Cournot-Nash equilibrium results: for a given market with $n$ active firms that can serve the market at costs $\{c_1, ..., c_n\}$ (here costs include trade costs and tariffs), then the equilibrium quantity $q_i$ produced by the firm that serves the market at cost $c_i$ is $q_i = \frac{1-c_i+\sum_{j\neq i}(c_j-c_i)}{n+1}$. Then the implied equilibrium market quantity is $Q = \frac{n-\sum_i c_i}{n+1}$ and the equilibrium market price is $P = \frac{1+\sum_i c_i}{n+1}$ (see e.g. Bagwell and Staiger, 2012a).

where we have written Home export profits as a function of the Foreign tariff. Observe that in this segmented market, partial equilibrium case, the effects of the Home tariff and Foreign tariff are additively separable. This greatly simplifies analysis, as there is no strategic interaction between the tariff choices, and the optimal tariff of this objective is a dominant strategy. Proving that a prohibitive tariff maximizes this objective is then sufficient to prove that autarky is the noncooperative equilibrium.

Under standard national-income maximizing preferences with $\alpha = 1$, duopoly yields the payoff of $\frac{4}{9}(1-c)^2$ which is preferable to the payoff of $\frac{3}{8}(1-c)^2$ obtained under monopoly. So here we obtain a typical outcome of trade under imperfect competition: pro-competitive gains from trade can result from the reduction in markups that arises from greater competition.

Under more general political economic preferences with $\alpha \geq 1$, the difference between the free trade payoff and the monopoly payoff is

$$G(\bar{\tau};\alpha,\bar{\tau}^*) - G(0;\alpha,0) = \frac{7-2\alpha}{72}(1-c)^2, \tag{3}$$

so the governments acting jointly will strictly prefer free trade to autarky as long as $\alpha < \frac{7}{2}$. If autarky is the noncooperative outcome, then this upper bound on $\alpha$ implies that governments benefit from a trade agreement. Because tariffs serve to reduce joint production in the sector distorted by imperfection competition and political economy, it is immediately clear that either autarky or free trade must be the optimal joint outcome on the boundary of the policy space.[11] Which is optimal again depends on whether $\alpha$ is above or below the cutoff. When $\alpha = \frac{7}{2}$, the optimal joint policy is not unique—governments are indifferent between autarky and free trade.

To derive the optimal unilateral policies, first observe that

$$\frac{dG}{d\tau} = \tau\left(\frac{2\alpha-11}{9}\right) + \left(\frac{2\alpha+1}{9}\right)(1-c), \text{ if } \tau < \frac{1}{2}(1-c). \tag{4}$$

Substituting the cutoff $\tau$ for the prohibitive tariff into the first-order condition, we can easily derive that if $\alpha < \frac{3}{2}$, there is an optimal nonprohibitive tariff satisfying $\frac{dG(\tau)}{d\tau} = 0$ (the second-order condition is satisfied for $\alpha < \frac{11}{2}$). For $\alpha \in (\frac{3}{2}, \frac{11}{2})$, $\frac{dG(\tau)}{d\tau} > 0$ for all nonprohibitive tariffs, and the optimal unilateral trade policy is prohibitive. So the optimal unilateral policy satisfies

$$\tau^N(\alpha) = \begin{cases} \left(\frac{2\alpha+1}{11-2\alpha}\right)(1-c), & \text{if } \alpha < \frac{3}{2}, \\ \text{prohibitive} & \text{if } \alpha \in (\frac{3}{2}, \frac{11}{2}). \end{cases} \tag{5}$$

Notice that when $\alpha = \frac{3}{2}$, there is no unique optimal policy.

[11] Globally optimal policy here is then like in Ossa (2011), in which only import tariffs are available, and free trade is a corner solution. The policy space is thus distinct from Bagwell and Staiger (2012b, 2015), who allow for import and export subsidies and find interior solutions.

A second method to derive the optimal policy involves writing the government objective as a function of equilibrium quantities, which depend on trade policy. This approach allows for easier economic interpretation. The Home government objective is

$$G(\tau;\alpha,\tau^*) = \frac{1}{2}(q_h(\tau)+q_f(\tau))^2 + \alpha(q_h^2(\tau)+q_h^{*2}(\tau^*)) + \tau q_f(\tau). \tag{6}$$

Observe that the left-derivative at $\bar{\tau} = \frac{1}{2}(1-c)$ is

$$\begin{aligned} \frac{d\_G}{d\tau}|_{\tau=\bar{\tau}} &= q_h(\bar{\tau})(q_h' + q_f') + 2\alpha q_h(\bar{\tau})q_h' + \bar{\tau}q_f' & (7) \\ &= \frac{1}{6}(1-c)(-3+2\alpha). & (8) \end{aligned}$$

where from Table 1, $q_h(\bar{\tau}) = \frac{1-c}{2}$, $q_h' = \frac{1}{3}$, and $q_f' = -\frac{2}{3}$. The three additive terms in equation (7) are the effects of Home's tariff on Home's consumer surplus, profits, and tariff revenue, respectively, as Home's tariff approaches the prohibitive level. Clearly when $\alpha > \frac{3}{2}$, $\frac{d\_G}{d\tau}|_{\tau=\bar{\tau}} > 0$. Given the satisfaction of the second-order condition ($\alpha < \frac{11}{2}$ derived above), the Home government objective is strictly increasing in $\tau$ over the domain $[0,\bar{\tau})$, and the prohibitive policy is unilaterally optimal.

Table 2 summarizes the optimal unilateral policies and optimal joint policies.

| Table 2 | | |
|---|---|---|
| $\alpha$ range | Optimal unilateral policy | Optimal joint policy |
| $[1, \frac{3}{2})$ | Nonprohibitive tariff | Free trade |
| $(\frac{3}{2}, \frac{7}{2})$ | Prohibitive trade policy | Free trade |
| $(\frac{7}{2}, \frac{11}{2})$ | Prohibitive trade policy | Prohibitive trade policies |

The following proposition highlights the $\alpha$ interval of interest:

**Proposition 1** *For our baseline model, if governments assign a weight $\alpha \in (\frac{3}{2}, \frac{7}{2})$ to firm profits, then the unique Nash equilibrium trade policies are prohibitive, free trade is the unique joint optimum, and governments can benefit from a trade agreement.*

To support the relevance of our first proposition, we argue that the political economy parameters in the interval of interest are empirically reasonable. Ossa (2014) estimates industry-level weights for agriculture and manufacturing industries. Though his largest weights are for industries in agriculture that do not easily fit into our imperfectly competitive framework, he does still find substantial variation across political weights for Chinese manufacturing industries: either textiles or motor vehicles have roughly a 50 percent larger political economy weight than transport equipment (a representative industry with a low weight). There is less variation in Brazilian manufacturing, but leather goods receive a 30 percent larger weight than electronic equipment. Since Ossa estimates his political weights for a single-factor model, we would expect the estimated political weights to be lower than in a model like ours in which only the specific factor is politically weighted and the mobile labor factor has no excess political power. Moreover, as we extend the model in the next section, the minimum $\alpha$ necessary to explain the unilateral imposition of prohibitive policies will decline.

# 3 How Market Characteristics Affect Cooperation

This section extends our baseline model to illustrate how various market characteristics can affect the potential for cooperation. The extensions we consider are symmetric trade costs, mirror-image differences in productivity for two industries, increases in competition for symmetric nations, asymmetry in competition across nations, and firm heterogeneity in productivity for symmetric nations. As detailed in the introduction, these extensions can be useful to help identify when liberalization is more likely to be feasible if nations are starting from prohibitive policies. We will characterize how market characteristics impact the possibility of cooperation, based on whether changes in a market parameter lengthen or shorten the $\alpha$ interval of interest, in which prohibitive policies are unilaterally optimal but liberalization is still feasible.[12]

## 3.1 Trade Costs

We introduce symmetric trade costs $\phi > 0$ into the model. The autarky case is the same as in Table 1, while payoffs for free trade and tariffs are listed in Table 3:

Table 3: Results with Trade Costs

| Outcome \\ Policies | Free Trade (duopoly) | Tariffs |
|---|---|---|
| Home domestic sales $q_h$ | $\frac{1}{3}(1-c+\phi)$ | $\frac{1}{3}(1-c+\phi+\tau)$ |
| Foreign exports $q_f$ | $\frac{1}{3}(1-c-2\phi)$ | $\frac{1}{3}(1-c-2\phi-2\tau)$ |
| Home exports $q_h^*$ | $\frac{1}{3}(1-c-2\phi)$ | $\frac{1}{3}(1-c-2\phi-2\tau^*)$ |
| Market quantity $Q$ | $\frac{1}{3}(2(1-c)-\phi)$ | $\frac{1}{3}(2(1-c)-\phi-\tau)$ |
| Market price $P$ | $\frac{1}{3}(1+2c+\phi)$ | $\frac{1}{3}(1+2c+\phi+\tau)$ |
| Consumer surplus $CS$ | $\frac{1}{2}\left(\frac{2(1-c)-\phi}{3}\right)^2$ | $\frac{1}{2}\left(\frac{2(1-c)-\phi-\tau}{3}\right)^2$ |
| Home domestic profits $\pi_h$ | $\left(\frac{1-c+\phi}{3}\right)^2$ | $\left(\frac{1-c+\phi+\tau}{3}\right)^2$ |
| Home export profits $\pi_f$ | $\left(\frac{1-c-2\phi}{3}\right)^2$ | $\left(\frac{1-c-2\phi-2\tau^*}{3}\right)^2$ |
| Tariff revenue | 0 | $\tau\left(\frac{1-c-2\phi-2\tau}{3}\right)$ |

[12] We acknowledge that this characterization does not fully solve for the likelihood of liberalization from prohibitive policies, conditional on market characteristics and a distribution of $\alpha$. Such a solution would depend heavily on the distribution of $\alpha$. We focus on the length of the $\alpha$ interval described above because it is a simple measure and still captures much of the variation of interest in the potential for liberalization from prohibitive policies.

For the standard case of $\alpha = 1$, free trade is welfare improving when $\frac{\phi}{1-c} < \frac{5}{22}$, while for $\frac{\phi}{1-c} \in (\frac{5}{22}, \frac{1}{2})$ competition from trade is detrimental to welfare.[13] Free trade is socially inefficient in this parameter range because of a well-known pathology. In models of intra-industry trade with homogeneous products and imperfect competition, "cross-hauling" trade costs can exceed the gains from trade (Feenstra, 2004. Ch. 7). We focus throughout on the $\frac{\phi}{1-c} \in [0, \frac{5}{22})$ case.

More generally, the difference between the free trade payoff and the monopoly payoff is

$$\frac{7-2\alpha}{72}(1-c)^2 - \left(\frac{2}{9} + \frac{2}{9}\alpha\right)(1-c)\phi + \left(\frac{1}{18} + \frac{5}{9}\alpha\right)\phi^2, \tag{9}$$

so free trade is jointly optimal provided that

$$\alpha < \frac{7(1-c)^2 - 16(1-c)\phi + 4\phi^2}{2(1-c)^2 + 16(1-c)\phi - 40\phi^2}. \tag{10}$$

Next we derive the set of parameters for which autarky is the noncooperative equilibrium. We first derive the government objective as a function of the tariff $\tau$. The tariff is prohibitive if $\tau \geq \frac{1}{2}(1-c) - \phi$.

$$G(\tau; \alpha, \phi, \tau^*) = \begin{cases} \frac{1}{2}\left(\frac{2-2c-\phi-\tau}{3}\right)^2 + \alpha\left(\frac{1-c+\phi+\tau}{3}\right)^2 + \alpha\pi_f + \frac{\tau(1-c-2\tau-2\phi)}{3}, & \text{if } \tau \leq \frac{1}{2}(1-c) - \phi, \\ \left(\frac{1+2\alpha}{8}\right)(1-c)^2 + \alpha\pi_f, & \text{if } \tau \geq \frac{1}{2}(1-c) - \phi. \end{cases}$$

The derivative for non-prohibitive tariff values is

$$\frac{dG}{d\tau} = \tau\left(\frac{2\alpha - 11}{9}\right) + \left(\frac{2\alpha - 1}{9}\right)(1-c) + (2\alpha - 5)\phi, \text{ if } \tau < \frac{1}{2}(1-c) - \phi. \tag{11}$$

Lastly, we derive the optimal unilateral policy conditional on $\alpha$

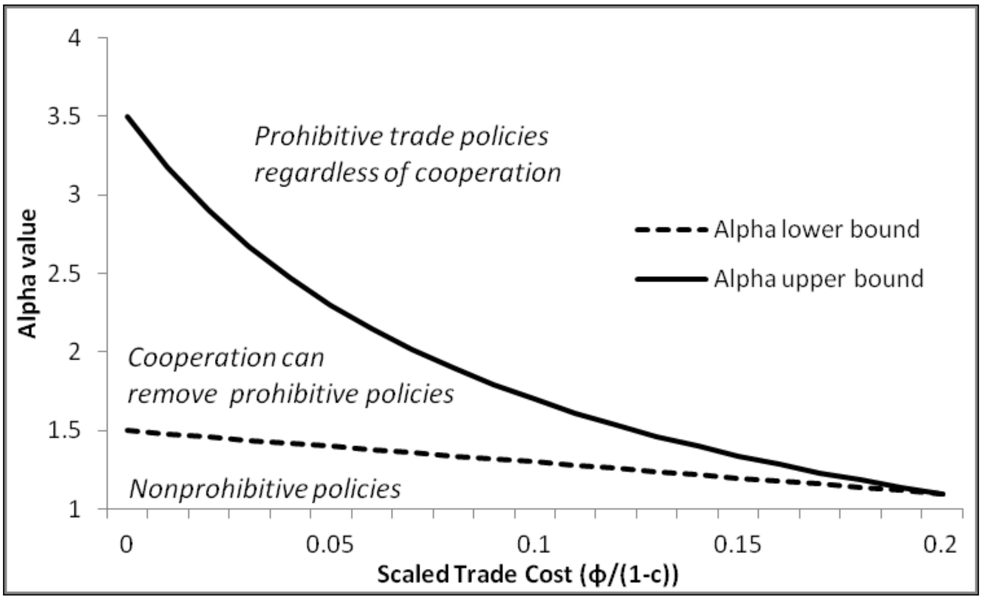
$$\tau^N(\alpha) = \begin{cases} \frac{(1+2\alpha)(1-c)+(2\alpha-5)\phi}{11-2\alpha}, & \text{if } \alpha < \frac{3}{2} - \frac{2\phi}{1-c}, \\ \text{prohibitive} & \text{if } \alpha \in \left(\frac{3}{2} - \frac{2\phi}{1-c}, \frac{11}{2}\right). \end{cases} \tag{12}$$

So prohibitive policies are unilaterally optimal when

$$\alpha > \frac{3}{2} - \frac{2\phi}{1-c}. \tag{13}$$

[13] To solve for the cutoffs, consider the difference between the free trade payoff and the monopoly payoff when $\alpha = 1$. The resulting polynomial, rescaled by $\frac{72}{(1-c)^2}$, is $5 - 32(\frac{\phi}{1-c}) + 44(\frac{\phi}{1-c})^2$. The polynomial is negative between the two roots of $\frac{5}{22}$ and $\frac{1}{2}$.

Figure 1: Effects of symmetric trade costs




To interpret inequalities (10) and (13), notice both are at their threshold when $\frac{\phi}{1-c} = \frac{1}{5}$ and $\alpha = \frac{11}{10}$. When $\frac{\phi}{1-c} \in [0, \frac{1}{5})$, both are satisfied for $\alpha \in \left(\frac{7(1-c)^2-16(1-c)\phi+4\phi^2}{2(1-c)^2+16(1-c)\phi-40\phi^2}, \frac{3}{2} - \frac{2\phi}{1-c}\right)$. As $\frac{\phi}{1-c}$ increases from 0 to $\frac{1}{5}$, the length of the $\alpha$ interval for which free trade is jointly optimal while prohibitive policies are unilaterally optimal then decreases from 2 to 0. We summarize the result in the following proposition:

**Proposition 2** *If we extend the baseline model to allow for symmetric trade costs satisfying $\frac{\phi}{1-c} < \frac{1}{5}$, then there exists an interval of $\alpha$ such that governments unilaterally impose prohibitive policies and jointly prefer free trade. The length of this interval of $\alpha$ is strictly decreasing in the scaled trade cost $\frac{\phi}{1-c}$.*

We plot the relevant bounds on $\alpha$ as a function of the scaled trade cost $\frac{\phi}{1-c}$ in Figure 1. With trade costs, the lower bound of $\alpha$ for which prohibitive policies are unilaterally optimal decreases to $\frac{11}{10}$ from $\frac{3}{2}$. To the extent that a $\frac{11}{10}$ value is more empirically plausible than $\frac{3}{2}$, this finding improves the empirical relevance of the theory. In addition, the exercise provides an explanation for why distant markets could have difficulty achieving trade cooperation, because the range of cooperation over prohibitive policies narrows as the trade costs increase.

To understand the economic intuition for why the range narrows, the key is the $-\left(\frac{2}{9} + \frac{2}{9}\alpha\right)$ term in the expression (9) representing the first-order changes in payoffs from an increase in trade costs. The term is negative because the increase in trade costs leads to a reduction in export profits and consumer surplus from an agreement. The trade cost increase also mitigates the fall in domestic profits from an agreement, but this effect is dominated. The agreement as a whole is less appealing as trade costs increase, so the $\alpha$ upper bound in Figure 1 decreases. The lower bound also decreases but at a slower rate. This lower-bound decrease is the consequence of a lower tariff being sufficient to achieve prohibitive policies.

## 3.2 Mirror-Image Differences in Productivity

Because our baseline model allows for only pro-competitive gains from trade, a worthwhile extension is to consider how cooperation is affected by other sources of gains from trade. One straightforward extension from our single-factor framework is to allow for Ricardian gains from trade. To explore this possibility, we allow for two imperfectly competitive sectors in each country plus the usual outside sector, and we allow for costs to differ between the two imperfectly competitive sectors. We assume that utility is additively separable between the three sectors, so there is no complementarity or substitution between the imperfectly competitive sectors. To further simplify the analysis, we assume that each nation has an equal absolute advantage in production in exactly one of the two sectors, so there are mirror-image (i.e. anti-symmetric) differences in productivity for the two nations. The technological differences imply that there are Ricardian gains from trade in this extension in addition to pro-competitive gains. We capture the difference in productivities with a single parameter $\psi$ and evaluate how the possibility of cooperation varies with $\psi$. Each nation produces with cost $c$ in the sector for which it has absolute advantage, and cost $c + \psi$ in the other sector, for $\psi \in (0, 1 - c)$.

Based on our baseline results, we can easily derive that the value of either government objective in autarky is

$$\left(\frac{1 + 2\alpha}{8}\right)(1 - c)^2 + \left(\frac{1 + 2\alpha}{8}\right)(1 - (c + \psi))^2 \tag{14}$$

given that we have monopoly with cost $c$ in one industry and cost $c + \psi$ in the other.

The value of the government objective under free trade takes a form similar to the trade cost extension in Table 3. The cost difference $\psi$ plays a similar role as the trade cost $\phi$, as both represent cost differences between competing firms in the same market:

$$\left(\frac{2(1 - c) - \psi}{3}\right)^2 + \alpha\left(2\left(\frac{1 - c + \psi}{3}\right)^2 + 2\left(\frac{1 - c - 2\psi}{3}\right)^2\right) \tag{15}$$

The difference between the autarky and free trade payoffs is

$$\frac{7 - 2\alpha}{36}(1 - c)^2 + \left(\frac{2\alpha - 7}{36}\right)(1 - c)\psi + \left(\frac{62\alpha - 1}{72}\right)\psi^2. \tag{16}$$

While the previous expression lacks any immediately obvious interpretation, it can be rewritten as

$$2\left[\frac{7-2\alpha}{72}(1-c)^2-\left(\frac{2}{9}+\frac{2}{9}\alpha\right)(1-c)\psi+\left(\frac{1}{18}+\frac{5}{9}\alpha\right)\psi^2\right]+\left[(2(1-c)\psi)-\psi^2)\left(\frac{1+2\alpha}{8}\right)\right].$$

Notice the similarity between the left bracketed term above and the expression (9) from the trade cost extension. Each term reflects pro-competitive gains from trade when there is a cost difference among the competing firms in a particular market post-liberalization. This cost difference is the trade cost $\phi$ in the previous subsection, and $\psi$ in the above expression. Since the current extension now has two imperfectly competitive sectors, these joint pro-competitive gains from free trade are now achieved twice, hence the doubling of the bracketed term on the left. In addition to the pro-competitive gains from trade, there is an additional strictly positive bracketed term on the right. This term represents the promised Ricardian gains from trade that result from gaining access to the producer abroad with lower costs.

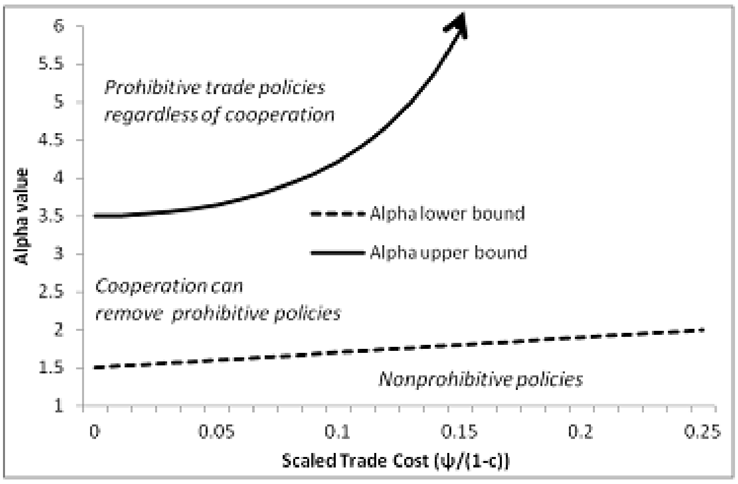
We can then derive the following restriction on $\alpha$ for free trade to be jointly preferable to autarky.

$$\alpha<\frac{14-14(\frac{\psi}{1-c})-(\frac{\psi}{1-c})^2}{4-4(\frac{\psi}{1-c})-62(\frac{\psi}{1-c})^2}. \tag{17}$$

We now have the cutoff for when free trade is preferable to autarky as a function of the scaled difference in productivities $\frac{\psi}{1-c}$. We plot this cutoff in Figure 2—labelled as the alpha upper bound—as a function of $\frac{\psi}{1-c}$. To interpret this function, notice that it is a ratio of polynomials in $\frac{\psi}{1-c}$ and strictly increasing over the range of interest. Because the denominator has a root of $\frac{3\sqrt{7}-1}{31}\approx .224$, the cutoff function bends up toward a vertical asymptote at this value. When the scaled productivity difference exceeds this value, free trade increases profits for either nation, so there is no value of $\alpha$ for which autarky would be jointly preferable to free trade.

Next, we derive the lower bound on $\alpha$ for which prohibitive policies are unilaterally optimal. We derive a sufficiently high $\alpha$ which motivates a tariff large enough to choke off trade in both the high-productivity industry and the low-productivity industry. Naturally, a higher tariff is necessary to choke off trade for the higher-productivity imports than for the lower-productivity imports, so we need only consider the cutoff $\alpha$ for imports from the higher-productivity industry. The derivation of this cutoff is then the same as in inequality (13), except the difference in costs for the relevant industry between the domestic producer and imports is now $-\psi$ instead of $+\phi$. This is because the total cost of imports is now cheaper by $\psi$ due to the superior technology abroad in this sector, instead of being $\phi$ more expensive due to the trade cost. The lo wer bound on $\alpha$ for prohibitive tariffs is then

Figure 2: Effect of mirror-image differences in productivity




$$\alpha > \frac{3}{2} + 2(\frac{\psi}{1-c}). \tag{18}$$

Figure 2 summarizes the results. The range of $\alpha$ for which cooperation removes prohibitive policies is represented by the area between the solid line (the upper bound for when cooperation is jointly preferable to autarky) and dashed line (the lower bound for which prohibitive policies are unilaterally optimal). The length of the $\alpha$ interval of interest initially shrinks as $\psi$ increases from 0 but then sharply widens. We summarize the results with the following proposition:

**Proposition 3** *If we extend the baseline model to allow for two industries with mirror-image costs of $c$ and $c+\psi$, such that $\frac{\psi}{1-c} < 1$, there exists an interval of $\alpha$ such that governments unilaterally impose prohibitive policies and jointly prefer free trade. For sufficiently small differences in productivity $\psi$, the length of this interval of $\alpha$ is shorter than in our baseline model. For sufficiently large $\psi$, the length of this interval of $\alpha$ is larger than in our baseline model.*

To establish the proposition, we first explain the initial narrowing of the $\alpha$ interval as $\psi$ increases from 0. When $\psi = 0$, any small change $d\psi > 0$ has only a second-order effect on the upper bound of $\alpha$. We know that $\psi = 0$ must be an inflection point in the upper bound function if we momentarily consider the additional domain of negative $\psi$, as either a small positive or small negative change in $\psi$ from $\psi = 0$ implies there are Ricardian gains from trade and a higher $\alpha$ that equates the free trade and autarky payoffs. For the lower bound on $\alpha$, any small change $d\psi > 0$ implies a first-order increase in the lower bound as $\psi$ increases from 0, because a larger productivity difference implies larger gains from trade and a larger weight $\alpha$ for prohibitive policies to be unilaterally optimal. The first-order increase in the lower bound and second-order increase in the upper bound implies that the $\alpha$ range of interest initially narrows as $\psi$ increases. But for larger $\psi$, the upper bound of $\alpha$ increases sharply as $\psi$ approaches the asymptote where trade increases global profits rather than decreasing them. Because of this sharp increase in the upper bound of $\alpha$, the $\alpha$ range of interest must widen for sufficiently large $\psi$.

### 3.3 Competition

The next extension we consider is multiple homogeneous firms in each nation. Increasing the number of symmetric Cournot firms is a reasonable way to model the level of competition in each nation. For example, the international competition policy study of Horn and Levinsohn (2001) follows the same approach. Let $n$ be the number of Home firms and $n^*$ be the number of Foreign firms. The environment we consider again features only pro-competitive gains from trade, so to preview results, we should expect that there will be less benefit from trade liberalization as domestic competition increases.

Table 4 gives values of various economic quantities under Cournot competition, with some elements of the tariff column defined from previous rows. As before, the Home government objective is $G = CS + \alpha n(\pi_h + \pi_f) + TR$.

Table 4: Results with Domestic Competition

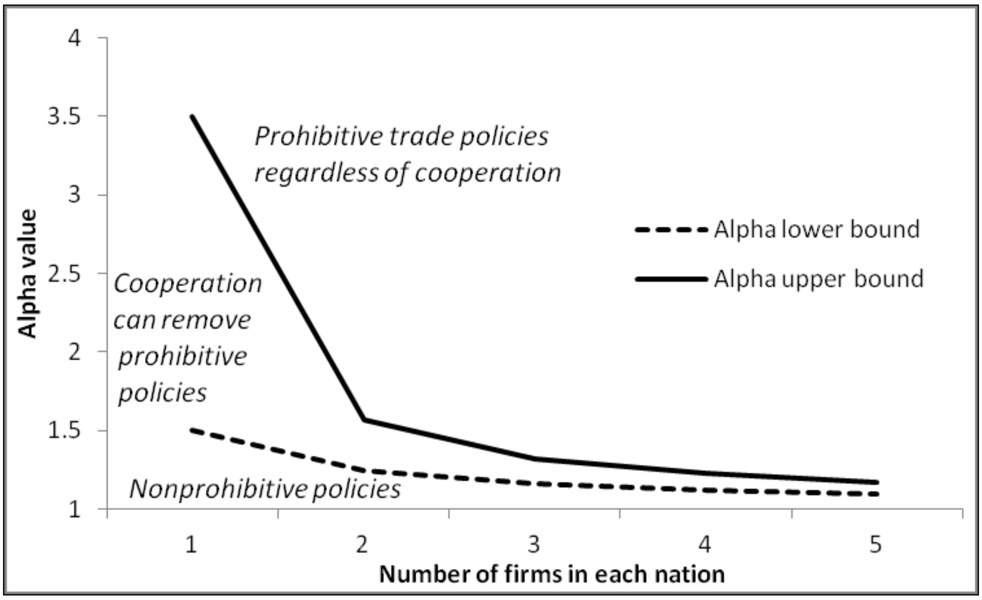
| Outcome \\ Policies | Autarky | Free Trade | Tariffs |
|---|---|---|---|
| Home domestic sales per firm $q_h$ | $\frac{(1-c)}{n+1}$ | $\frac{1-c}{n+n^*+1}$ | $\frac{(1-c+\tau n^*)}{n+n^*+1}$ |
| Foreign exports per firm $q_f$ | 0 | $\frac{1-c}{n+n^*+1}$ | $\frac{(1-c-\tau(1+n))}{n+n^*+1}$ |
| Home exports per firm $q_h^*$ | 0 | $\frac{1-c}{n+n^*+1}$ | $\frac{(1-c-\tau^*(1+n))}{n+n^*+1}$ |
| Market quantity $Q$ | $\frac{n(1-c)}{n+1}$ | $\frac{(n+n^*)(1-c)}{n+n^*+1}$ | $\frac{((n+n^*)(1-c)-\tau n^*)}{n+n^*+1}$ |
| Market price $P$ | $\frac{(1+nc)}{n+1}$ | $\frac{(1+(n+n^*)c)}{n+n^*+1}$ | $\frac{(1+(n+n^*)c+\tau n^*)}{n+n^*+1}$ |
| Consumer surplus $CS$ | $\frac{n^2(1-c)^2}{2(n+1)^2}$ | $\frac{(n+n^*)^2(1-c)^2}{2(n+n^*+1)^2}$ | $\frac{1}{2}Q^2$ |
| Domestic profits per firm $\pi_h$ | $\frac{(1-c)^2}{(n+1)^2}$ | $\frac{(1-c)^2}{(n+n^*+1)^2}$ | $(P-c)q_h$ |
| Export profits per firm $\pi_f$ | 0 | $\frac{(1-c)^2}{(n+n^*+1)^2}$ | $(P-c)q_h^*$ |
| Tariff revenue $TR$ | 0 | 0 | $\tau n^* q_f$ |
| Government objective $G$ | $\left(\frac{n^2+2\alpha n}{2(n+1)^2}\right)(1-c)^2$ | $\frac{((n+n^*)^2+4\alpha n)(1-c)^2}{2(n+n^*+1)^2}$ | (in text) |

We first consider the case of symmetric firms in each country such that $n = n^*$. Consider the cutoff $\alpha$ for which free trade is jointly preferable to autarky. We find that

$$\alpha < \frac{4n^2 + 3n}{4n^2 - 2}. \tag{19}$$

To solve for the lower $\alpha$ bound at which point prohibitive policies are unilaterally optimal, notice first that the prohibitive tariff is $\tau = \frac{1-c}{1+n}$. The Nash equilibrium tariff equals the prohibitive level when

Figure 3: Effects of intranational competition




$$\left(\frac{2\alpha n+1}{2(n+1)(2n+1)-n(1+2n\alpha)}\right)(1-c) > \frac{1-c}{n+1},$$

which then simplifies to the following simple inequality:

$$\alpha > 1 + \frac{1}{2n}. \tag{20}$$

We then plot the cutoffs as a function of $n$ in Figure 3. As $n$ goes to infinity, thus increasing competition in both markets, there is a shorter interval of $\alpha$ values for which cooperation can eliminate prohibitive policies. The potential pro-competitive gains are smaller as competition increases, so the agreement becomes relatively less appealing for any given value of $\alpha$. In the limiting case as $n \to \infty$, there is no potential for cooperation if prohibitive trade policies are unilaterally optimal. This result is expected, because Cournot competition approaches perfect competition in the limiting case, and we know there is no possibility of cooperating to eliminate prohibitive policies under perfect competition with zero profits.

So far we have considered cooperation only among nations with symmetric levels of competition. An interesting alternative possibility is cooperation between nations with different levels of competition. For example, we might imagine cooperation between a developed country with many firms due to low barriers to entry and a developing country with few firms due to high barriers to entry. For this asymmetry, a limiting case is again insightful. Consider a fixed number of firms $n$ for Home and the limiting case as $n^* \to \infty$, so Home has the less competitive industry and Foreign has the more competitive industry. Consider the upper and lower bound on $\alpha$ such that Home unilaterally prefers prohibitive policies but joint cooperation to free trade is possible. As $n^* \to \infty$, both the upper and lower bound on $\alpha$ equal $1 + \frac{1}{2n}$ (which recall was the lower bound for $\alpha$ for the case with symmetric $n$ plotted in Figure 3). So if Home has a protected monopoly or oligopoly, Foreign has a perfectly competitive industry, and Home and Foreign each unilaterally prefer to impose prohibitive trade barriers, then there is no possibility for cooperation.

We summarize the results in the following proposition.

**Proposition 4** *Suppose we extend the baseline model to allow for $n$ identical firms in Home and $n^*$ firms in Foreign. As $n$ and $n^*$ increase symmetrically, there is a progressively shorter interval of $\alpha$ for which cooperation is jointly optimal and prohibitive policies are unilaterally optimal. As the number of firms in either nation approaches infinity, then there is no potential for liberalization when prohibitive policies are unilaterally optimal.*

We qualify the results on competition here in a few ways. First, notice that the results are highly sensitive to the possibility that there are significant domestic barriers to entry, yet international liberalization is still possible. This is a strong assumption, but one that could be more relevant in developing nations with high barriers to entry.

Another significant limitation is that this extension again only allows for pro-competitive gains from trade. If we also allow for gains from trade due to comparative advantage as in the previous subsection, we would no longer find that the gains from trade fall to zero as the number of firms increases. This suggests there could be additional insight in exploring how competition and comparative advantage jointly affect cooperation.

## 3.4 Firm Heterogeneity

The final extension that we consider is firm heterogeneity. We consider a simple kind of heterogeneity—two firms with different productivities within each nation, but symmetry between nations—but the model is still rich in implications. We index the firms within each country as 1 and 2 with costs $c_1$ and $c_2$. Assume $c_1 \leq c_2$ so 1 indexes the superior firm and 2 indexes the inferior firm. We denote the equilibrium domestic quantity for the more productive Home firm as $q_h^1$ and the less productive Home firm as $q_h^2$. We denote Foreign exports to the Home market similarly as $q_f^1$ and $q_f^2$.

Table 5 reports the results of Cournot competition with heterogenous firms. As before, the first column describes outcomes under autarky and the second describes outcomes under free trade. The third column requires more explanation than our previous extensions. We include here results for the case in which Foreign imposes prohibitive barriers on Home firms, and Home imposes a barrier that is prohibitive for the inferior Foreign firm but nonprohibitive for the more productive Foreign firm. This case will be most relevant in determining the lower bound on $\alpha$ such that the prohibitive policy is unilaterally optimal. The derivation of consumer surplus, profits, tariff revenue, and government objectives from the quantities in Table 5 is straightforward, but we do not report these outcomes.

| Table 5: Results with Firm Heterogeneity | | | |
|---|---|---|---|
| Outcome \\ Policies | Autarky | Free Trade | Home Tariffs |
| Domestic quantity $q_h^1$ | $\frac{1-2c_1+c_2}{3}$ | $\frac{1-3c_1+2c_2}{5}$ | $\frac{1-2c_1+c_2+\tau}{4}$ |
| Domestic quantity $q_h^2$ | $\frac{1-2c_2+c_1}{3}$ | $\frac{1-3c_2+2c_1}{5}$ | $\frac{1-3c_2+2c_1+\tau}{4}$ |
| Foreign exports $q_f^1$ | 0 | $\frac{1-3c_1+2c_2}{5}$ | $\frac{1-2c_1+c_2-3\tau}{4}$ |
| Foreign exports $q_f^2$ | 0 | $\frac{1-3c_2+2c_1}{5}$ | 0 |
| Home exports $q_h^{i*}$ | 0 | $\frac{1-3c_i+2c_j}{5}$ | 0 |
| Market quantity $Q$ | $\frac{2-c_1-c_2}{3}$ | $\frac{4-2c_1-2c_2}{5}$ | $\frac{3-2c_1-c_2-\tau}{4}$ |
| Market price $P$ | $\frac{(1+c_1+c_2)}{3}$ | $\frac{1+2c_1+2c_2}{5}$ | $\frac{1+2c_1+c_2+\tau}{4}$ |

To capture the extent of firm heterogeneity, we define the parameter $\omega \equiv \frac{1-c_1}{1-c_2}$. We focus on the $\omega \geq 1$ case without loss of generality. Using the definition of $\omega$ and the expressions for $q_h^2$ in Table 5 we can derive that $\omega < 2$ is a necessary condition for both firms to be producing in autarky, and $\omega < \frac{3}{2}$ is a necessary condition for both firms to be producing under free trade.

We first derive the upper bound on $\alpha$ for which free trade is jointly preferable to autarky. When $\omega = 1$, all firms are active, and we have the same results as the competing duopoly model from the previous subsection. As $\omega$ increases from 1, the cutoff $\alpha$ initially increases. For a particular range of $\omega$, however, no cutoff $\alpha$ exists because liberalization increases total profits summed across all firms, in which case free trade is jointly preferable to autarky regardless of $\alpha$. The lower end of this range is $\bar{\omega} \equiv \frac{116-15\sqrt{7}}{109} \approx 1.43$ and the upper end of this range is $\frac{5}{3}$. The bounds on this domain of $\omega$ are plotted as gray vertical lines in Figure 4. For $\omega \in (\frac{5}{3}, 2)$, an interval in which only the more productive firms are active under free trade, profits again begin to decline under liberalization, and the cutoff $\alpha$ declines as $\omega$ increases. As $\omega \longrightarrow 2$, the inferior firm output $q_h^2 \longrightarrow 0$, and the model approaches the baseline model. The complete results for the $\alpha$ upper bound, plotted as solid curves in Figure 4, are as follows.

1. For $\omega \in [1, \bar{\omega})$, $\alpha < \frac{11(1+\omega)^2}{2(-109\omega^2+232\omega-109)}$.
2. For $\omega \in [\bar{\omega}, \frac{5}{3}]$, free trade is always jointly preferable to autarky.
3. For $\omega \in (\frac{5}{3}, 2]$, $\alpha < \frac{3\omega^2-2\omega-1}{6\omega^2-16\omega+10}$.

As a check of our results, notice that for $\omega = 1$, we obtain the same upper bound $\alpha < \frac{11}{7}$ as in the symmetric duopolies model from the previous subsection, which can be found by evaluating inequality (19) at $n = 2$. Similarly, for $\omega = 2$, we obtain the same upper bound $\alpha < \frac{7}{2}$ as in the baseline model.

Next we derive the lower bound on $\alpha$ for which a prohibitive policy is unilaterally optimal. We first observe that for any $\omega \in (1, 2)$ there exists a tariff level such that both Home firms are active and only the superior Foreign firm is exporting.[14] For this set of active firms in the Home market, we derive the lower bound on $\alpha$ such that the Home government objective is strictly increasing. To confirm that we have indeed derived the optimum, we must also verify that if $\alpha$ is above the derived bound, then the Home objective is still strictly increasing in the tariff even for tariff levels at which other sets of firms are active.

We follow the second method of deriving the $\alpha$ lower bound, similar to equations (6) and (7) in Section 2.2. The left derivative of the government objective at prohibitive policies is

$$\frac{d\_G(\tau; \alpha, \omega, \tau^*)}{d\tau}|_{\tau=\bar{\tau}} = Q(q_h^{1\prime} + q_h^{2\prime} + q_f^{1\prime}) + 2\alpha(q_h^1 q_h^{1\prime} + q_h^2 q_h^{2\prime}) + \bar{\tau} q_f^{1\prime} \tag{21}$$

where have omitted the dependence of quantities on $\bar{\tau}$ and $\omega$ to economize on notation. From the first column of Table 5 and our definition of $\omega$, we substitute in the autarky values $Q = \frac{1}{3}(1 + \frac{1}{\omega})(1 - c_1)$, $q_h^1 = \frac{1}{3}(2 - \frac{1}{\omega})(1 - c_1)$, and $q_h^2 = \frac{1}{3}(\frac{2}{\omega} - 1)(1 - c_1)$. The derivatives $q_h^{1\prime} = \frac{1}{4}$, $q_h^{2\prime} = \frac{1}{4}$, and $q_f^{1\prime} = \frac{-3}{4}$ derive from the third column of Table 5. The prohibitive tariff level that implies $q_f^1 = 0$ is $\bar{\tau} = \frac{1}{3}(2 - \frac{1}{\omega})(1 - c_1)$. We then obtain

$$\frac{d\_G}{d\tau}|_{\tau=\bar{\tau}} = \left( (\frac{2}{\omega} + 2)\alpha - (7 - \frac{2}{\omega}) \right) \left( \frac{1 - c_1}{12} \right). \tag{22}$$

This and the appropriate second-order conditions imply that the objective is increasing in $\tau$ for this set of active firms provided that

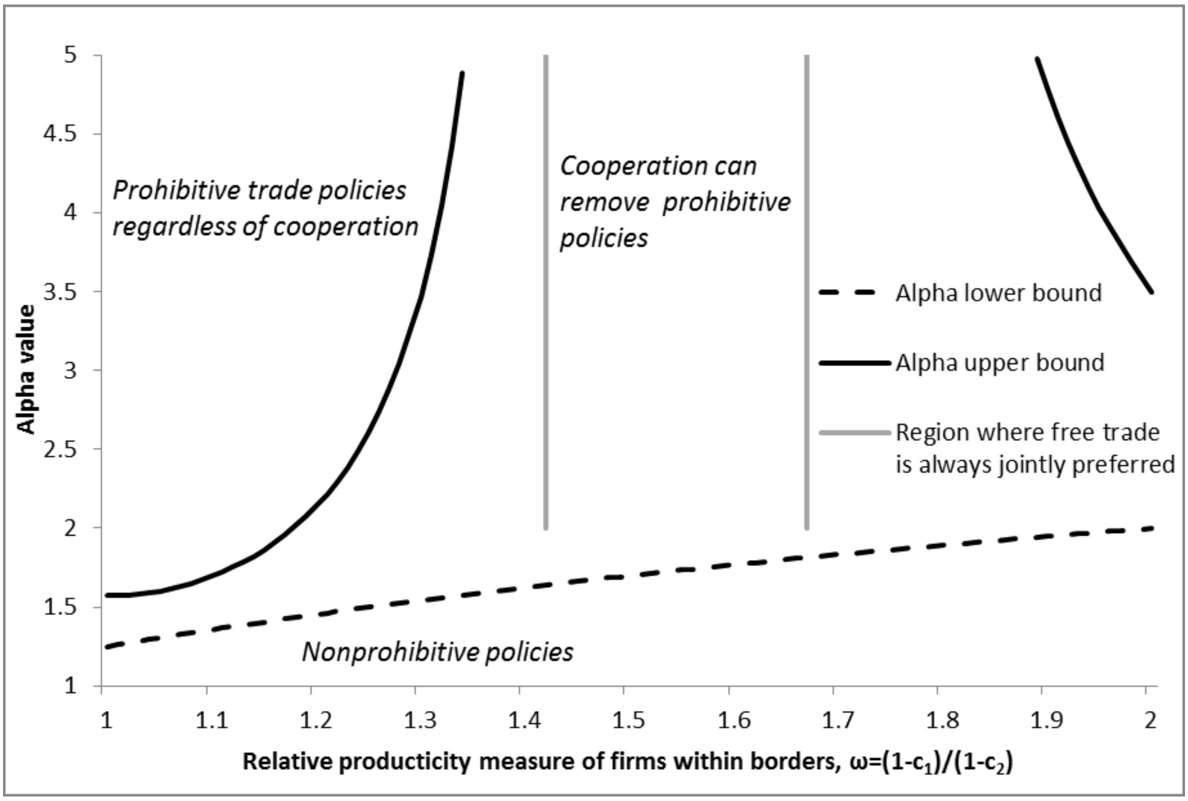
$$\alpha > \frac{7\omega - 2}{2\omega + 2} \text{ for } \omega \in [1, 2), \tag{23}$$

This lower bound on $\alpha$ is the dashed curve plotted in Figure 4. Notice that as $\omega$ increases, the size of the prohibitive tariff (scaled by $1 - c_1$) increases, so a larger political economic weight is necessary to rationalize the choice of prohibitive policy.

To verify that the prohibitive policies are indeed unilaterally optimal when $\alpha$ satisfies this lower bound, we also need to check that the Home government objective is still increasing when other sets of firms are active. We can derive that when all firms all active, the Home government objective is increasing in the tariff level as long as $\alpha > \frac{33-23\omega}{4(3-\omega)}$, which is always satisfied when inequality (23) holds for $\omega \in (1, 2)$. The other possible set of active firms is the two superior firms alone. Both inferior firms exit the Home market for a sufficiently large productivity difference and sufficiently small tariff level: $\omega > \frac{3}{2}$ and $\tau \in [0, \frac{2\omega-3}{w}(1 - c_1)]$. We need to verify that the Home government objective is

[14] A tariff that yields this combination of firms in the Home market must exist because (1) both Home firms are active under prohibitive tariffs for $\omega \in [1, 2)$, and (2) there exists some tariff range such that the inferior Foreign firm exits the Home market but not the superior Foreign firm for $\omega \in (1, 2)$.

Figure 4: Effects of firm heterogeneity




strictly increasing in this case. But indeed, this is the competing monopolist case from the baseline model, and the objective is increasing whenever $\alpha > \frac{3}{2}$, which is always satisfied when (23) is satisfied and $\omega \geq \frac{5}{4}$. Other combinations of active firms are not possible. Lastly, we note that the Home government objective is always continuous over $\omega \in [1, 2]$. Consequently, inequality (23) indeed defines the lower bound on $\alpha$ such that prohibitive policies are unilaterally optimal.

As a check on our results, notice that for $\omega = 1$, the bound is $\alpha > \frac{5}{4}$. When we evaluate inequality (20) at $n = 2$ for the equivalent symmetric duopoly model, we obtain the same result. As $\omega \longrightarrow 2$, the lower bound approaches $\alpha > 2$. This may seem surprising because when $\omega = 2$, the inferior firms exit and the model becomes equivalent to our baseline model, for which the lower bound is $\alpha > \frac{3}{2}$. The reason for the distinction is that the derivative of the Home government objective does not exist at this point: for any $\omega < 2$, the derivative $q_h^{2\prime}$ is always $\frac{1}{4}$, but the right-derivative at $\omega = 2$ is 0 as the inferior Home firm ceases to be active.

Figure 4 summarizes all the results. To interpret the figure, first observe that when the two firms are homogeneous, there is a narrow range of parameter values $(\frac{3}{2}, \frac{11}{7})$ for which liberalization would be feasible if prohibitive policies are unilaterally optimal. But as the productivity difference between the firms increases, the parameter ranges for which cooperation is possible increases dramatically, and cooperation is possible for all $\alpha > \frac{3}{2}$

provided that $\omega \in [\bar{\omega}, \frac{5}{3}]$. Taking the derivatives of the respective curves at $\omega = 1$, we verify that the interval of $\alpha$ between the bounds lengthens as $\omega$ increases from 1. When firms have a more intermediate level of heterogeneity, liberalization can lead to an increase in total profits for all Home firms and total profits for all Foreign firms, even if liberalization causes the inferior firms to cease production. Though firms lose domestic sales when trade competition increases, exports can more than make up for those losses.

As $\omega$ increases beyond $\frac{5}{3}$, liberalization increasingly reduces profits relative to autarky. When the inferior domestic firm is providing sufficiently low competition for the superior firm in autarky, industry profits decrease once each *de facto* monopoly is exposed to trade. As the losses in profits from liberalization increase with $\omega$, the political weight on profits necessary to ensure a joint preference for autarky over free trade decreases with $\omega$, so liberalization is possible for a shorter $\alpha$ interval. The increase in the lower bound of $\alpha$ also contributes to the shortening of the $\alpha$ interval as $\omega$ increases.

We summarize all these results in our final proposition.

**Proposition 5** *Suppose we extend the baseline model to allow for two firms in each country with asymmetric costs, and we maintain cross-country symmetry. Consider the interval of $\alpha$ for which cooperation is jointly optimal and prohibitive policies are unilaterally optimal. As firm heterogeneity increases, the length of this interval of $\alpha$ initially expands and then contracts.*

Crucial for this result is the assumption that any lobbying would be at the industry level. If the inferior firm could lobby more than the superior firm to protect its existence from trade liberalization, then results would be different. Empirical evidence suggests, however, that larger firms lobby more (Bombardini, 2008).

# 4 Conclusion

The first contribution of this chapter is to show that cooperation is possible starting from prohibitive policies, even if there is no change in any nation's domestic political environment. This is a nontrivial result, because such cooperation does not occur in the canonical trade agreement model with two goods, general equilibrium, and perfect competition. We then extend our baseline model to determine under which market characteristics liberalization from prohibitive policies is likely to be feasible. We find that such cooperation is more likely for lower levels of trade costs, sufficiently large cross-industry differences in productivity, weaker levels of intranational competition, and intermediate ranges of firm heterogeneity.

Our framework could be relevant in guiding future liberalization from prohibitive policies, though like any theoretical study, the results here motivate checks of empirical validity and theoretical robustness. As mentioned in Section 2, an important check would be to consider prohibitive policies resulting from fixed costs of exporting rather than a choke price in linear demand. As for empirical validity, a valuable exercise would be to test the model's predictions on prohibitive barriers that have later been removed. A complete empirical treatment of cooperation in eliminating prohibitive barriers would have to consider both the motives described here and also the possibility of commitment motives for trade agreements. Another concern is that our exogenous political parameters could be related to market characteristics. Ideally, the framework can guide future trade negotiations by identifying which sectors with prohibitive barriers have the greatest potential for cooperation.

We conclude by discussing how our theory relates to the limited success of developing countries in negotiations under the WTO and the General Agreement on Tariffs and Trade (GATT) that preceded the WTO. The liberalization in our theory—cooperation for industries and country pairs where trade does not already exist—does not fit well with prior GATT/WTO norms. Lamp (2015) argues that developed countries shut out developing nations on the basis of the *principal supplier rule*, as developing countries rarely had the capacity to be principal suppliers of any product. Consequently, developing countries rarely obtained liberalization that suited their interests. Indeed, Ludema and Mayda (2013) find that the Uruguay Round tariff reductions (negotiated between 1986-1994) are consistent with a theory in which negotiations internalize benefits only for the principal suppliers for any industry. As Bagwell and Staiger (2014) detail, the hope was that developing nations could nonetheless free-ride off the nondiscriminatory (MFN) tariffs obtained by other nations' reciprocal negotiations, yet we should expect that developing nations would achieve limited gains unless they themselves engage in reciprocal liberalization. The principal supplier rule is one explanation for limited developing country participation, particularly for the liberalization in our theory.

An additional obstacle facing developing countries is the "latecomers problem" described by Bagwell and Staiger (2014). The problem arises when developed countries have achieved their politically optimal tariffs and have no desire for further liberalization with developing nations who have yet to participate in reciprocal negotiations. The framework in the current chapter also suggests an additional possible dimension to the latecomers problem, when developed countries have already achieved all politically feasible cooperation from prohibitive policies through prior trade negotiations with other developed countries.

But on a more optimistic note, the theory here suggests an alternative hypothesis that more liberalization could be achieved if only there were better institutional norms that could facilitate cooperation from prohibitive policies. This possibility then offers a partial solution to the latecomers problem. Even if trade cooperation opportunities were exhausted under previous institutional norms for products and countries where trade already exists, there could still be potential for cooperation between developed and developing countries where trade does not yet exist. There are then potentially significant gains from determining which institutional designs could aid the negotiation process for country pairs and industries in which trade is absent or severely limited.

# References


Baer, W. (1972), "Import Substitution and Industrialization in Latin America: Experiences and Interpretations," *Latin American Research Review* 7, 95-122.

Baldwin, R. (1987), "Politically Realistic Objectives and Trade Policy," *Economic Letters* 24, 287-90.

Bagwell, K., C. P. Bown, and R.W. Staiger (2016), "Is the WTO Passé?" *Journal of Economic Literature* 54, 1125-1231.

Bagwell, K. and R. W. Staiger (1999), "An Economic Theory of GATT," *American Economic Review* 89, 215-48.

Bagwell, K. and R. W. Staiger (2010), "The WTO: Theory and Practice," *Annual Reviews of Economics* 2, 223-56.

Bagwell, K. and R. W. Staiger (2011), "What Do Trade Negotiators Negotiate About? Empirical Evidence from the World Trade Organization," *American Economic Review* 101, 1238-73.

Bagwell, K. and R. W. Staiger (2012a), "The Economics of Trade Agreements in the Linear Cournot Delocation Model," *Journal of International Economics* 88, 32-46.

Bagwell, K. and R. W. Staiger (2012b), "Profit Shifting and Trade Agreements in Imperfectly Competitive Markets," *International Economic Review* 53, 1067-1104.

Bagwell, K. and R. W. Staiger (2014), "Can the Doha Round be a Development Round? Setting a Place at the Table," in R.C. Feenstra and A.M. Taylor (eds.), *Globalization in an Age of Crisis: Multilateral Economic Cooperation in the Twenty-First Century*, University of Chicago Press: Chicago.

Bagwell, K.,and R. W. Staiger (2015), "Delocation and Trade Agreements in Imperfectly Competitive Markets," *Research in Economics* 69, 132-56.

Bagwell, K. and R. W. Staiger (2016), "The Design of Trade Agreements," in K. Bagwell and R. W. Staiger (eds), *Handbook of Commercial Policy* 1, 435-529, Elsevier.

Besley, T. and T. Persson (2009), "The Origins of State Capacity: Property Rights, Taxation, and Politics," *American Economic Review* 99, 1218-44.

Bombardini, M. (2008), "Firm Heterogeneity and Lobby Participation," *Journal of International Economics* 75, 329-348.

Borchert, I., B. Gootiiz, and A. Mattoo (2013), "Policy Barriers to International Trade in Services: Evidence from a New Database," *World Bank Economic Review* 28, 162-188.

Borchert, I., B. Gootiiz, A. G. Goswami, and A. Mattoo (2015), "Services Trade Protection and Economic Isolation," *World Economy*, doi: 10.1111/twec.12327.

Brander, J. A. (1995), "Strategic trade policy," in G. M. Grossman and K. Rogoff (eds.), *Handbook of International Economics* 3, 1395-1455, Amsterdam: North Holland.

Crozet, M., E. Milet and D. Mirza (2016), "The Discriminatory Effect of Domestic Regulations on International Trade in Services: Evidence from Firm Level Data," *Journal of Comparative Economics* 44, 585-607

Deardorff, A. and R.M. Stern (2008), "Empirical Analysis of Barriers to International Services Transactions and the Consequences of Liberalization," in A. Mattoo, R. M. Stern, and G. Zanini (eds.), *A Handbook of International Trade in Services*, New York: Oxford University Press.

Dixit, A. (1985), "Tax Policy in Open Economies," in *Handbook of Public Economics*, A. J. Auerbach and M. Feldstein (eds.), 313-374.

Drazen, A. and V. Grilli (1993), "The Benefits of Crises for Economic Reform," *American Economic Review* 83, 598-607.

Eaton, J. and G. Grossman (1986), "Optimal Trade and Industrial Policy Under Oligopoly," *Quarterly Journal of Economics* 101, 383-406.

Epifani, P. and G. Gancia (2011), "Trade, markup heterogeneity and misallocations," *Journal of International Economics* 83, 1–13.

Essaji, A. (2010), "Trade Liberalization, Standards and Protection," *B. E. Journal of Economic Analysis and Policy* 10.

Feeney, J. and A. Hillman (2001), "Privatization and the Political Economy of Strategic Trade Policy," *International Economic Review* 42, 535-556.

Feenstra, R. C. (2004), *Advanced International Trade: Theory and Evidience*, Princeton, N.J.: Princeton University Press.

Fischer, R. and P. Serra (2000), "Standards and protection," *Journal of International Economics* 52, 377-400.

Francois, J. and Hoekman B. (2010), "Services Trade and Policy," *Journal of Economic Literature* 48, 642-692.

Fung, K. C. and Siu A. (2008), "Political Economy of Service Trade Liberalization and the Doha Round," *Pacific Economic Review* 13, 124-133.

Grossman, G. M. and E. Helpman (1994), "Protection for Sale," *American Economic Review* 84, 833-50.

Helpman, E., and P. R. Krugman (1989), *Trade Policy and Market Structure*, Cambridge: MIT Press.

Horn, H. and J. Levinsohn (2001), "Merger Policies and Trade Liberalization," *Economic Journal* 111, 244-276.

Horstmann, I. and J. Markusen (1986), "Up the Average Cost Curve: Inefficient Entry and the New Protectionism," *Journal of International Economics* 20, 225-247.

Jafari, Y. and D. G. Tarr (2015), "Estimates of Ad Valorem Equivalents of Barriers Against Foreign Suppliers of Services in Eleven Services Sectors and 103 Countries," *World Economy*, doi: 10.1111/twec.12329.

Kee, H. L., A. Nicita, and M. Olarreaga (2009), "Estimating Trade Restrictiveness Indices," *Economic Journal* 119, 172-199.

Krugman, P. R., M. Obtsfeld, and M. Melitz (2014), *International Economics: Theory and Policy* 10th edition, Boston: Pearson Education.

Lamp, N. (2015), "How Some Countries Became Special: Developing Countries and the Construction of Difference in Multilateral Lawmaking," *Journal of International Economic Law* 18, 743-771.

Lebrand, M. (2016), "Profit shifting and FDI restrictions," CESifo Working Paper No. 5885.

Ludema, R. D. and A. M. Mayda (2013), "Do Terms- of-Trade Effects Matter for Trade Agreements? Evidence from WTO Countries," *Quarterly Journal of Economics* 128, 1837-93.

Maggi, G. and A. Rodriguez-Clare (1998), "The Value of Trade Agreements in the Presence of Political Pressures." *Journal of Political Economy* 106, 574-601.

Maggi, G. and A. Rodriguez-Clare (2007), "A Political Economy Theory of Trade Agreements," *American Economic Review* 97, 1374-1406.

Marchetti, J. A. and P. C. Mavroidis (2011), "The Genesis of the GATS," *European Journal of International Law* 22, 689-721.

Mattoo, A. (2004), "The services dimension of China's accession to the WTO," in D. Bhattasali, S. Li, and W. Martin (eds.), *China and the WTO: Accession, Policy Reform, and Poverty Reduction Strategies*. World Bank.

Miroudot, S., J. Sauvage, and B. Shepherd (2013), "Measuring the cost of international trade in services," *World Trade Review* 12, 719-735.

Mrázová, M. (2011), "Trade agreements when profits matter," mimeo, February.

Rodrik, D. (1994), "The Rush to Free Trade in the Developing World: Why So Late? Why Now? Will It Last?" in S. Haggard and S. Webb (eds.), *Voting For Reform*, 61-88, New York: Oxford University Press.

Rodrik, D. (2001), "The Global Governance of Trade as if Development Really Mattered," UNDP background paper, October.

Romer, P. (1994), "New goods, old theory, and the welfare costs of trade restrictions," *Journal of Development Economics* 43, 5-38.

Ossa, R. (2011), "A New Trade Theory of GATT/WTO Negotiations," *Journal of Political Economy* 199, 122-152.

Ossa, R. (2014), "Trade Wars and Trade Talks with Data," *American Economic Review* 104, 4104-46.

Staiger, R. W. and A. O. Sykes (2017), "The Economic Structure of International Trade-in-Services Agreements," mimeo., May.

Venables, A. J. (1985), "Trade and Trade Policy with Imperfect Competition: The Case of Identical Products and Free Entry," *Journal of International Economics* 19, 1-20.

# China's Dual Export Sector*

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**Abstract**

China has transitioned from being an almost autarkic economy to become the world's largest exporter in less than three decades. Given this unique transformation, this paper investigates if the key stylized facts that characterize the behavior of firms' exports around the world, can also describe China's experience after joining the World Trade Organization. We find that, consistent with received wisdom, relatively few Chinese firms engage in exporting, and those doing so, are on average, larger and more productive than their domestic counterparts. However, unlike other large and developed countries, a substantial share of Chinese exporters sell the majority of their output abroad. In fact, the distribution of Chinese exporters according to their export intensity —the share of their revenues accounted for by exports— is strikingly bimodal. In contrast to recent work that has focused on the technological factors that explain the prevalence of high-intensity exporters, we instead concentrate on the role played by China's heterodox trade policy regime in promoting pure exporters. Our empirical analysis suggests that trade policy has played an instrumental role in fostering a dual export sector. Notably, nine out of ten manufacturing exporters in China are eligible to enjoy fiscal incentives contingent on export performance.

**Keywords:** China; Firm-level exports; Export Intensity; Free Trade Zones; Export Processing Regimes; China.

**JEL classification:** F12, F13, O47.

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## 1 Introduction

Over the last two decades, international trade theory has increasingly shifted its focus towards understanding individual firms' decision to serve foreign markets, following, most notably, the seminal work by Melitz (2003). This paradigm change has been facilitated by the parallel emergence of a robust set of stylized facts which point at a substantial degree of heterogeneity across firms in terms of size and productivity within narrowly-defined industries and according to their export status. More specifically, researchers have established three key empirical regularities that hold across a wide range of countries and time periods (Bernard et al., 2007; Melitz and Redding, 2014):

(i) Relatively few firms engage in exporting.

(ii) Exporters tend to be larger and more productive than firms that only sell domestically, and,

(iii) The vast majority of exporting firms sell only a small share of their output abroad.

In this chapter we ask whether these stylized facts also reflect the patterns observed in China's manufacturing sector after joining the World Trade Organization (WTO) in 2001. We believe that this is a fruitful question to pose for three reasons. Firstly, China has transitioned from being a quasi-autarkic economy in the late 1970s to become the world's largest exporter in little less than three decades, while at the same time maintaining distinctive traits of a centrally-planned economy (Naughton, 1996, 2007; Xu, 2011). Thus, it is not straightforward to expect its exporters to share the same traits as their counterparts operating in the U.S., France and other market-oriented economies for which the aforementioned stylized facts have been established.

Secondly, China is widely recognized for having followed an unconventional and heterodox approach to trade opening — placing a strong emphasis on encouraging exports while at the same time protecting its domestic market (Naughton, 1996; Feenstra, 1998; Rodrik, 2010, 2014). Throughout its integration into the world economy, China has implemented a wide range of policy measures that have sought to facilitate its interaction with the rest of the world, while minimizing disruptions to its socialist economy. This mixture of policy objectives has led Feenstra (1998) to aptly characterize China's trade policy regime as "one country, two systems": a large collection of export-oriented enclaves co-existing within a highly protected economy. Prominent examples of policy measures with these characteristics include Free Trade Zones (FTZ)[1] (World Bank, 2008; Wang, 2013), the export processing duty drawback scheme (Feenstra and Hanson, 2005; Ianchovichina, 2007), and a broad-range of tax concessions and subsidies featuring export share requirements, i.e. fiscal incentives conditioned on the recipient firm exporting more than a certain stated share of its output (Defever and Riaño, 2015, 2017a).

Thirdly, China also stands at the heart of a long-standing debate on the role of FTZ as an industrial policy to foster economic development. On the one hand, FTZ have been very successful in promoting exports and may be the first steps toward political-economic reforms. On the other hand, these policies have been shown to distort the market selection mechanism that lies at the heart of the observed performance premium of exporting firms (Chor, 2009; Demidova and Rodríguez-Clare, 2009; Defever and Riaño, 2017a), and given the unprecedented scale of their implementation in China over the last three decades, it is only natural to wonder about how similar Chinese exporters are to their peers elsewhere.

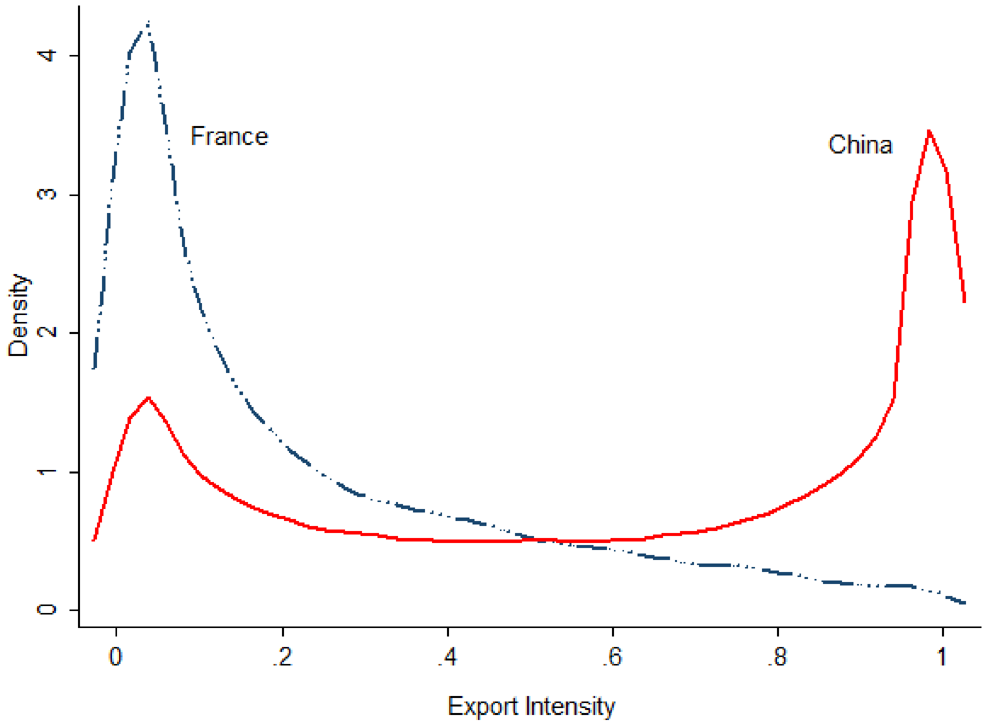
At first pass, our analysis suggests that exporters in China are not so different from exporters elsewhere. Only 28 percent of the firm-year observations in our data —which is a census of relatively large firms, and is therefore likely to overestimate the share of exporting firms— report positive export sales. Furthermore, exporters' total shipments are, on average, more than twice as big as those of domestic firms and are also significantly more productive than the latter.

The most striking difference that we observe among Chinese manufacturing exporters against the backdrop of the stylized facts outlined above, is the existence of a large number of exporters that sell almost all their output abroad. To be more precise, between 2000 and 2006, more than a third of Chinese manufacturing exporters sold 90 percent or more of their output in foreign markets. In contrast, only 1.9 percent of French exporters and 0.7 percent of U.S. exporters display such high export intensity (Bernard et al., 2003). Figure 1 vividly illustrates this point by comparing the distribution of export intensity, i.e. the share of total sales accounted for by exports, for Chinese manufacturing exporters during our period of study with the equivalent distribution for French exporters in 2000.

Two major groups of exporters can therefore be identified in China, 'pure exporters' (by which

[1] Throughout the chapter we use the term Free Trade Zone to encompass special economic zones and other geographically-defined areas of export promotion.

Figure 1: Export Intensity Distribution for Chinese and French Manufacturing Exporters




The figure depicts the kernel density of export intensity, defined as the share of exports in total sales, for firms reporting a positive value of exports. Data for Chinese manufacturing exporters is for the period 2000-2006 and is described in detail in Section 3. Data on French exporters are from the Enquete Annuelle Entreprises, SESSI, for the year 2000.

we mean firms that export more than 90 percent of their output), and 'regular exporters', which sell most of their output domestically. Our empirical analysis reveals that these two types of exporters differ significantly from one another across several dimensions. Firstly, although both pure and regular exporters are more productive than firms that only operate domestically, we find that pure exporters are significantly less productive than regular ones —a result which is at odds with the workhorse models of international trade with heterogeneous firms— all of which predict a positive correlation between firms' export intensity and productivity. We also find that pure exporters are less likely to undertake R&D expenditures and spend a smaller share of their value added in taxes than both domestic firms and regular exporters. Despite these differences, pure exporters are not confined to a narrow set of industries, and are in fact ubiquitous within China's manufacturing sector.

Although Defever and Riaño (2017b) have shown that countries in which exporters selling most of their output domestically coexist with a pure exporters are more common than initially thought, one of our objectives in this chapter is to investigate the extent to which China's trade policy regime has contributed towards the remarkable degree of duality observed in its export sector. To do so, we combine firm-level data with customs transaction information to identify three types of firms, which, based on the typology developed by Defever and Riaño (2017a), have been consistently targeted to receive incentives conditioned on them exporting the majority of their output. These firms are foreign-owned enterprises, firms located in free trade zones and firms exporting via the export processing regime.[2]

Our empirical analysis suggests that China's trade policies have played an instrumental role in fostering a dual export sector. Notably, nine out of ten manufacturing exporters in China are eligible to enjoy incentives contingent on export performance. Pure exporters are substantially more prevalent among the group of firms that are eligible to benefit from these policy measures. However, we show that pure exporters are also not confined to the export processing regime; a substantial number of them are foreign-owned firms not engaged in processing as well as privately-owned Chinese firms located in free trade zones. Lastly, we find that pure exporters pay on average 2.52 percent less taxes (as a share of their value-added) than regular exporters. This result crucially holds even within each group of exporters, i.e. processing trade enterprises, foreign-owned firms not specialized in processing and domestically-owned exporters.

**Related Literature.** The previous literature studying the prevalence of high-intensity exporters in China has focused on the technological differences between pure and regular exporters —e.g. in terms of the magnitude of foreign market access costs faced by each type of exporter and their factor usage intensity (Lu, 2010; Dai et al., 2016; Lu et al., 2014). In this chapter we emphasize instead the role played by the heterodox trade policy regime in promoting pure exporters. We also contribute to the extensive body of work seeking to establish robust empirical regularities regarding the export behavior of firms, exemplified by the summaries by Bernard et al. (2007) and Melitz and Redding (2014), which we hope will inform future theoretical work regarding the effects of trade

[2]Export processing is a legal arrangement between a foreign partner and a local producer, where all or part of the intermediate inputs are imported, and the finished product is re-exported after processing or assembly by enterprises within the mainland.

policy on firm-level outcomes.

The rest of the chapter is organized as follows. Section 2 provides an overview of the trade policies implemented in China that have fostered the development of its dual export sector. This section also discusses potential reasons for their persistent use. Section 3 describes the data we utilize. Section 4 presents our empirical findings, and Section 5 concludes.

## 2 China's Heterodox Trade Opening

Since China's trade liberalization reforms have been amply described in several sources (Naughton, 1996; Lardy, 2002; Naughton, 2007; Branstetter and Lardy, 2008), our objective in this section is to highlight the key economic policy elements that have fostered dualism in China's export sector. Since, as we argue below, the initial objectives of policies fostering export dualism was quite rapidly achieved, we speculate about the potential reasons that could rationalize their use long after China joined the WTO.

The death of Mao Zedong in 1976 marked a watershed moment in which the Chinese Communist Party (CCP) began its transition away from a command economy after the disastrous consequences of the Great Leap Forward (see Li and Yang, 2005). The party's ideology was reoriented to emphasize economic development as the foundation for both socialism and the political monopoly of CCP (Xu, 2011).

The process of market reform relied on the establishment of a dual-track system in which the centrally-planned economy coexisted with a market mechanism Lau et al. (2000). This approach was pursued more intensively in areas such as international trade that were perceived to be least embedded in the socialist economy. Naughton (2007) notes that the main objective of this development strategy was not necessarily to reduce distortions but rather to experiment with reforms in a controlled environment. Doing so allowed policymakers to contain problems more easily and to undertake the necessary adjustments before rolling out policies at the provincial and national level. Additionally, Xu (2011) argues that this setup also facilitated the implementation of schemes aimed at compensating interest groups opposing the reforms.

The creation of special economic zones in 1978, the establishment in 1986 of a separate corporate tax regime for foreign-invested enterprises, which provided tax breaks conditioned on a 50 percent export share requirement, and the institution of the processing trade regime in 1987, all conform to the general pattern outlined above. These three policy measures provided incentives for firms to export the majority of their output, and as a consequence helped in shielding state-owned enterprises from import competition, as shown by Defever and Riaño (2017a). Of course, export subsidies foster exports and import competition may increase to balance trade. However, subsidies associated with export requirements force firms that expand on the export market to also contract their domestic sales, which decreases domestic competition. By attracting multinational affiliates and compelling them to export all of their production, China has protected its low-productivity domestic companies from competition while simultaneously boosting exports. The Promotion of processing trade enterprises and the establishment of FTZ are geared towards the same objective.

The reforms targeting pure exporters were initially implemented with the narrow objective of increasing and diversifying China's sources of foreign exchange —a goal which was very quickly achieved by the early 1990s (Naughton, 2007). Why then, has the use of incentives targeted towards firms exporting the majority of their output persisted so long after the early phases of transition? After all, it is well known that export promotion is not a desirable objective per se; as Krugman (1993) notes, exports are essentially just an input to acquire imports. Moreover, a large body of work has shown that policies that incentivize firms to export all their output can only be considered second-best policies from a welfare perspective in the presence of other distortions such as externalities, imperfect competition or unemployment (Hamada, 1974; Miyagiwa, 1986; Davidson et al., 1985; Rodrik, 1987). Similarly, Defever and Riaño (2017a) show from a quantitative perspective, that imposing export share requirements on export subsidies exacerbates their distortions relative to standard, unconditional subsidies.

Since all models listed above are set up in a static environment, they are not well suited to speak to the dynamic consequences of China's export promotion efforts. It is plausible that the policies targeted at pure exporters played a significant role in the rapid industrialization process observed in China, helping to ease the reallocation of labor from agriculture towards manufacturing, although to the best of our knowledge, this hypothesis has not yet been formalized or quantified. Thus, static distortions in terms-of-trade or within-industry market shares could in principle be compensated by dynamic gains in physical capital and knowledge accumulation (Young, 2003). A related advantage associated with maintaining tight control over its domestic market, is that it allowed Chinese policymakers to successfully trade market access in exchange for technology transfers from foreign multinationals, as noted by Holmes et al. (2015).

A second potential explanation for the continuing promotion of pure exporters —from a political economy perspective— relies on the regionally decentralized authoritarian nature of Chinese policymaking (Xu, 2011). Local governments in China have enjoyed substantial autonomy in the design and implementation of rules and legislation affecting the export sector, grounded in the principle of reform experimentation described above. As the number of free trade zones expanded dramatically following their initial success,[3] an intense regional competition developed among local officials for bureaucratic promotion based on performance rankings in which exports and FDI growth featured prominently (Li and Zhou, 2005; Xu, 2011). Branstetter and Feenstra (2002) however, have shown that besides the promotion of international trade and foreign investment, local governments also placed significant importance on the performance of state-owned enterprises. Estimating a variant of Grossman and Helpman's (1994) seminal paper on protection for sale, extended to account for FDI and government ownership of domestic firms, Branstetter and Feenstra (2002) find that provincial governments in China assign a weight to consumer welfare of one-seventh to one-quarter of the weight applied to the output of domestic firms in their political objective function. This result is all the more striking since protection-for-sale models estimated across a wide range of countries usually imply that the weight assigned to consumer welfare in policymakers' objective function is substantially larger than that given to interest groups (Gawande and Krishna, 2003). Defever and Riaño (2017a) show that subsidies with export requirements foster aggregate exports, but unlike unconditional export subsidies, they also increase the profitability of firms operating only in the domestic market. As noted above, these two effects have a direct impact on key performance indicators affecting the career progression of local officials. Maintaining the profitability of domestic producers is consistent both with the well-documented gradualist approach to transition followed by Chinese authorities (McMillan and Naughton, 1992), as well as with a desire to implement "reforms without losers" as suggested by Lau et al. (2000).

A third plausible motivation could be attributed to 'strategic trade policy' objectives. The aggressive subsidization of pure exporters by China can be viewed as a means to increase its market share in international markets at the expense of its competitors, as illustrated by the seminal work

[3] See Wang (2013) for a detailed account of the evolution of special economic zones.

by Brander and Spencer (1985). The fact that over the last decade China has been the most targeted country in terms of temporary trade barriers such as anti-dumping and countervailing duty measures attests to the popularity of this view across the world (Bown, 2011). Rodrik (2013) argues that China has become the leading perpetrator of modern mercantilism. In his view, Chinese policymakers do not consider —as most economic models show— that the main source of gains from trade arise from the increased possibility of imported consumption. Instead, China has actively subsidized exports, perhaps at the expense of their own consumers, with the objective of supporting domestic production and employment.

Rodrik (2014) aptly summarizes the combination of export promotion and domestic protection elements underlying the Chinese approach to trade opening thus:

> Rather than liberalize its trade regime in the standard way, which would have decimated the country's inefficient state enterprises, China allowed firms in special economic zones to operate under near-free-trade rules while maintaining trade restrictions elsewhere until the late 1990s. This enabled China to insert itself in the world economy while protecting employment and rents in the state sector. The Chinese Communist Party was strengthened and enriched, rather than weakened, as a result.

Although incentives targeted at pure exporters are one of the most important instruments of industrial policy deployed across developing countries —in no small part due to the perception of their success in China— their potential to foster economic development has been less convincing (Rodrik, 2004; World Bank, 2008; Farole and Akinci, 2011). The encouragement of a dual export sector through the provision of subsidies conditioned on export performance limits the creation of productive linkages with the local economy, curtails the extent of potential knowledge spillovers and can even harm the local economy, as shown by Rodríguez-Clare (1996).

# 3 Data

Our first data source is the annual survey of Chinese manufacturing firms compiled by the National Bureau of Statistics (NBS) for the years 2000 to 2006. This dataset includes both state-owned enterprises and private firms with sales above five million Chinese Yuan and contains detailed balance sheet information as well as firms' ownership status and total export sales.

In order to clean the data we follow Brandt et al. (2012) and drop firms reporting less than 8 employees, or reporting missing or incoherent values for our key variables of interest. We drop observations that report missing, null or negative values for total output, employment, intermediate inputs, fixed capital, value-added or if the export/sales, value-added tax/value-added, output tax/output, income tax/value-added ratios exceed one. We also exclude firms with operating status recorded as "inactive", "bankrupt" or "closed". Lastly, we drop a small number of observations in which firms report no exports in the manufacturing survey but for which we observe export transactions in the custom data (discussed below) in that particular year. After applying these filters, our final sample consists of 1,100,600 firm-year observations with 386,185 different firms. Our sample represents approximately 95 percent of China's industrial output and 98 percent of its manufacturing exports.

For the purposes of our empirical analysis, we define a **pure exporter** as a firm exporting more than 90 percent of its production in a given year; a firm reporting a positive value of export sales with an export intensity below 90 percent is classified as a **regular exporter**, and a **domestic firm** is a firm that does not export at all in a given year.

## 4 Empirical Analysis

**Are exporters a minority in China?** In a nutshell, yes. Table 1 presents a first cut at the manufacturing survey data. Column (2) reveals that only 28 percent of firm-year observations feature positive export flows. Since ours is a survey of large firms, it is likely that the share of exporters among the universe of Chinese manufacturing firms is even lower. Column (3) shows that, conditional on exporting, more than a third of firms fall in the pure exporter category. This share is substantially higher than what has been previously documented in the U.S., France and Colombia —three countries that have figured prominently in the empirical literature on the decision to export at the firm-level (Bernard and Jensen, 1999; Bernard et al., 2003; Arkolakis, 2010; Eaton et al., 2011; Roberts and Tybout, 1997)— in none of which the share of pure exporters (among exporting firms) exceeds 8 percent.

Díaz de Astarloa et al. (2013) document the existence of a large number of "born-to-export" firms in the apparel sector in Bangladesh, and argue that they could arise due to a lack of domestic demand for the specific products they manufacture. This explanation does not suit the Chinese case because, (as shown below), pure exporters in China are prevalent across a wide range of manufacturing industries, and second, because domestic absorption in China exceeds exports in most manufacturing industries (Brandt and Morrow, 2013).

Table 1: Summary Statistics - Manufacturing Survey, 2000-2006

| | Manufacturing Survey, 2000-2006 | | |
|---|---|---|---|
| | Number of observations | Percentage among | |
| | | All firms | Exporters |
| | (1) | (2) | (3) |
| Pure exporters | 105,543 | 9.59 | 34.37 |
| Regular exporters | 201,563 | 18.31 | 65.63 |
| Domestic firms | 793,494 | 72.10 | |
| Total | 1,100,600 | 100 | 100 |

**Are exporters more productive than domestic firms?** In order to answer this question, we first estimate 2-digit sector-specific production functions for the firms in the NBS survey over the period 2000-2006. Total factor productivity (TFP) is computed as the difference between a firm's observed and predicted output. We next regress our TFP measure on an export status dummy in order to estimate export performance premia following Bernard and Jensen (1999) and Bernard et al. (2007), including year, 4-digit sector and prefecture-city fixed effects. The latter are included to capture potential productivity differences arising from a firm's location in a FTZ, as well as differences in cities' skill endowments, which might affect firm-level productivity, as shown by Cheng et al. (2012).

Total factor productivity for firm $i$ in year $t$, denoted by $\varphi_{it}$, is estimated as the residual of the following two-factor Cobb-Douglas production function:

$$Q_{it} = \lambda_0 + \lambda_K K_{it} + \lambda_L L_{it} + \varphi_{it} + \epsilon_{it}, \tag{1}$$

where $Q_{it}$, $L_{it}$ and $K_{it}$ denote firm $i$'s value-added before taxes, labor and capital stock respectively (all in logarithms), and $\epsilon_{it}$ stands for measurement error in output; $\lambda_0$ is a constant term and $\lambda_L$ and $\lambda_K$ are the elasticities of output with respect to labor and capital respectively. We use the deflators computed by Brandt et al. (2012) to calculate real values for intermediate inputs, capital and output.[4] Real value added is obtained by subtracting the deflated value of intermediate inputs used in production from the firm's deflated output. As Feenstra et al. (2014) note, it is preferable to estimate a valued-added rather than a gross output production function in the case of China, due to the importance of processing trade. The production functions represented by equation (1) are estimated both by OLS and using the semi-parametric method proposed by Levinsohn and Petrin (2003) (LP). We cluster the standard errors at the firm level to account for any potential within-firm correlation over time.

Table 2: Exporters' Productivity Premium

| | (1) log Sales | (2) TFP LP | (3) TFP OLS | (4) log Sales | (5) TFP LP | (6) TFP OLS |
|---|---|---|---|---|---|---|
| | Comparison group: All domestic firms | | | | | |
| Exporter | $0.824^a$ | $0.563^a$ | $0.151^a$ | | | |
| | (0.005) | (0.004) | (0.003) | | | |
| • Pure exporters | | | | $0.575^a$ | $0.383^a$ | $0.073^a$ |
| | | | | (0.007) | (0.006) | (0.005) |
| • Regular exporters | | | | $0.917^a$ | $0.631^a$ | $0.181^a$ |
| | | | | (0.006) | (0.005) | (0.004) |
| Year fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sector fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Prefecture-city fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| # Obs | 1,100,600 | 1,100,600 | 1,100,600 | 1,100,600 | 1,100,600 | 1,100,600 |
| # firms | 386,185 | 386,185 | 386,185 | 386,185 | 386,185 | 386,185 |
| $R^2$ | 0.217 | 0.265 | 0.313 | 0.221 | 0.268 | 0.314 |

Robust standard error clustered at the firm-level in brackets. $^a$, $^b$ , $^c$ significantly different from 0 at 1%, 5% and 10% level, respectively.

The first three columns of Table 2 reveal that Chinese exporters are indeed larger and more productive than domestic firms —just as their counterparts in other countries. More precisely, Chinese exporters are 128 percent larger in terms of sales and 76 percent more productive (using the LP estimator) than firms selling solely at home, with both differences being significant at the 1 percent confidence level.[5] Using the OLS-based TFP measure yields the same productivity

[4]Nominal values of output and capital are deflated using two-digit sectoral price indexes. The deflators are obtained from the system of national accounts of the Chinese Bureau of Statistics. The 2-digit intermediate input deflators have been computed using both output deflators and the 2002 Chinese input-output table.

[5]$\exp(0.824) - 1 \approx 1.28$ and $\exp(0.563) - 1 \approx 0.76$ respectively.

ranking, although the magnitude of the productivity premium is lower. These results are in line with previous findings by Dai et al. (2016), Ma et al. (2014) and Feenstra et al. (2014).

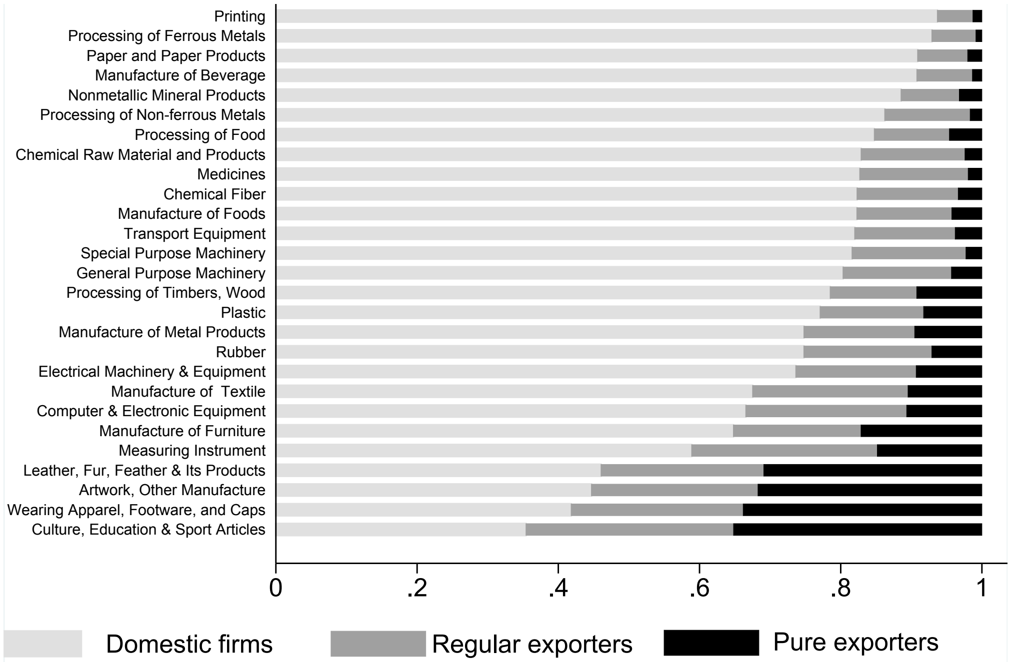
In columns (4)-(6), we present estimated performance premia —again, relative to domestic firms— for regular and pure exporters separately. We find that both types of exporter are larger and more productive than domestic firms. However, and more interestingly, we find that regular exporters are significantly larger and more productive than firms selling all their output abroad. This result is at odds with most workhorse models of international trade with heterogeneous firms such as Melitz (2003) (with more than two countries), Melitz and Ottaviano (2008), Arkolakis (2010), and Eaton et al. (2011), all of which predict a positive correlation between a firm's productivity and its export intensity.[6]

Lu et al. (2014) show that adding a fixed cost to access both the domestic and foreign market (over and above the fixed cost associated with setting up a production facility) to a partial equilibrium version of the Melitz (2003) model generates pure exporters that are less productive than regular ones, as long as the foreign market is larger than the domestic one. Another possibility is that the majority of pure exporters are engaged in processing activities, which are in turn associated with low fixed costs (Manova and Yu, 2016), e.g. if these firms do not engage in product design, marketing or R&D or have lower search costs to find foreign buyers. While the two mechanisms outlined above emphasize differences in 'technology' between regular and pure exporters, lower fixed costs of servicing export markets can also be the result of incentives subject to export share requirements, as noted by Defever and Riaño (2017a). In this case, pure exporters enjoy advantages such as provision of utilities at below-market rates or priority access to infrastructure and land, which reduce the fixed cost of exporting relative to that faced by firms that choose to sell a substantial share of their output domestically. Relatively less productive firms select themselves to operate as pure exporters instead of regular exporters, in order to save on fixed costs.

**Is the prevalence of pure exporters due to inter-industry differences?** It is plausible that the figures reported in Table 1 are the result of a composition effect related to significant inter-industry heterogeneity in market access costs. The standard Melitz (2003) model assumes that the

[6] All exporting firms allocate the same share of their total sales to the export market in the Melitz (2003) model with two countries. With three or more countries, the most productive firms sell to more destinations and therefore exhibit a higher export intensity than firms selling in fewer markets.

Figure 2: Distribution of Firm Types across 2-digit Industries




fixed cost of servicing the foreign country —relative to the market's effective size— is higher than the corresponding cost of selling domestically. The implications following from this assumption are that the most productive firms select themselves into exporting and that all exporters sell some of their output domestically; in other words, it precludes the existence of pure exporters. Lu (2010) shows that in a multi-sector extension of the Melitz model, the sign of the selection condition can be reversed in the comparative advantage sector. Under these circumstances, the least productive firms in the comparative advantage sector export all their output, while the most productive sell both domestically and abroad. Conversely, domestic firms and regular exporters coexist in the comparative disadvantage sector. If this is the case, we would expect to see pure exporters disproportionably concentrated in certain sectors while being absent in others.

The data does not support this hypothesis. Figure 2 shows that pure exporters are not confined to a narrow set of industries; they coexist with regular exporters and domestic firms across all 2-digit industries covered in the NBS dataset.[7] Pure exporters are less frequently observed in sectors such as printing, processing of ferrous metals and paper and are most prevalent in the manufacture

[7] Redoing Figure 2 at the 4-digit level of aggregation yields the same conclusion.

of textiles, apparel and sporting goods as well as in the production of electronics and electrical machinery.

**Identifying firms eligible to receive support subject to exporting the majority of their output.** As noted in Section 2, a key element of China's heterodox trade regime has been to actively incentivize firms that sell the majority of their output abroad. As documented in more detail by Defever and Riaño (2017a), policies favoring pure exporters have primarily targeted three groups of firms: Foreign Invested Enterprises (FIEs), Processing Trade Enterprises (PTEs) and firms located in Free Trade Zones (FTZs).

Although the NBS data provide information on firms' ownership status (with a further breakdown, based on whether a firm's capital originates from Hong Kong, Macau or Taiwan or other sources), it does not allow us to directly distinguish PTEs, because the survey does not record the value of exports sold through different customs regimes. To obtain information about a firm's reliance on processing exports, we merge the NBS dataset with a transaction-level customs dataset from the Chinese General Administration of Customs. We follow Manova and Yu (2016) and match the two datasets using firms' names as a common variable. While each uses a different identifier, firms' names are a reliable matching variable since, by law, two firms cannot have the same name in the same administrative region. Table 3 provides summary statistics for the merged sample. We are able to successfully match approximately half of the observations reporting a positive value of export sales in the NBS sample with their respective customs records. Nevertheless, it is reassuring that the share of pure exporters in the matched sample (Column 3 of Table 3) is almost identical to the one we find using the NBS data (Column 3 of Table 1).

We calculate the average share of exports sold under the processing trade regime in every year for each firm in the matched sample. The distribution of firms' export processing share is strikingly bimodal: 72.1 percent of firms use the processing regime for less than 10 percent of their exports, while 15.5 percent sell more than 90 percent of their exports under this regime. Therefore, we define **Processing Trade Enterprises (PTEs)** as firms selling more than 90 percent of their exports through the processing trade regime. It is important to highlight the fact that based on this definition, PTEs encompass both firms that export all their output as well as firms selling

Table 3: Summary Statistics - Matched Data, 2000-2006

| | Matched Data, 2000-2006 | | |
|---|---|---|---|
| | Number of observations | Percentage among All firms | Exporters |
| | (1) | (2) | (3) |
| Pure exporters | 51,113 | 5.40 | 33.58 |
| Regular exporters | 101,104 | 10.69 | 66.42 |
| Domestic firms | 793,494 | 83.90 | |
| Total | 945,711 | 100 | 100 |

domestically and using the processing regime to serve foreign markets. We then proceed to identify **Foreign Invested Enterprises (FIEs)** as firms with a positive amount of foreign capital but that do not satisfy the criteria to be considered a PTE.

Although the NBS survey does not explicitly state whether a firm is located in a Free Trade Zone or not, it does record firms' administrative area of location. We use this information to identify **firms operating in a Free Trade Zone (FTZ)** as producers located in prefecture-level cities promoted as Special Economic Zones, Coastal Development Zones as well as the Yangtze and Pearl River Delta Economic Zones. Our definition of FTZ excludes smaller industrial parks such as "Economic and Technological Development Zones", "New and High-Tech Industrial Development Zones" and "Export Processing Zones", in which firms also enjoy preferential treatment. Many of these are located along the coast within prefecture-level cities already classified as a FTZ in our definition.[8] Appendix A provides the exact list of prefecture-cities included in our definition of FTZs.

**Prevalence of different firm types.** Panel A of Table 4 presents the share of exporters across each category described above (FIE, PTE, neither) and also according to firms' location in a FTZ. The main message from Panel A is that approximately 90 percent of Chinese manufacturing exporters are potentially eligible to receive preferential treatment, conditional on exporting the

[8] Using a word search on firms' addresses, Schminke and van Biesebroeck (2011) report 891 new firms established in "Economic and Technological Development Zones" between 1999 and 2005, and 47 percent of them were located either in the Yangtze or Pearl river Delta Economic zone, already accounted as a FTZ in our definition. Tracking firms located in an "Export Processing Zone" in our data is easier since the customs data provide a special code identifying them. However, in 2006, only 166 firms can be classified as being located in any of these processing zones, 85 percent of which are located in a city already classified as a FTZ.

majority of their output. Panel B shows the percentage of pure exporters among exporters across different firm groups. Pure exporters are highly concentrated among FIEs and PTEs, accounting for approximately a half and third of all exporters in these categories respectively. Table 4 also shows that pure exporters, regardless of their ownership status or the customs regime used to sell their output, are more likely to be located in a FTZ.

Table 4: Percentage of Exporters and Percentage of Pure Exporters by Firm Type and Location

Panel A: Percentage of Exporters

| | PTE | FIE | Neither FIE nor PTE | Total |
|---|---|---|---|---|
| In a FTZ | 22.63 | 35.79 | 24.08 | 82.51 |
| Outside a FTZ | 1.42 | 5.66 | 10.41 | 17.49 |
| Total | 24.06 | 41.45 | 34.49 | 100.00 |

Panel B: Percentage of Pure Exporters Among All Exporters

| | PTE | FIE | Neither FIE nor PTE | All Exporters |
|---|---|---|---|---|
| In a FTZ | 52.63 | 34.67 | 22.49 | 36.04 |
| Outside a FTZ | 35.56 | 27.85 | 16.85 | 21.93 |
| All locations | 51.62 | 33.74 | 20.79 | 33.58 |

Figure 3: Export Intensity Distribution by Firm Type and Location

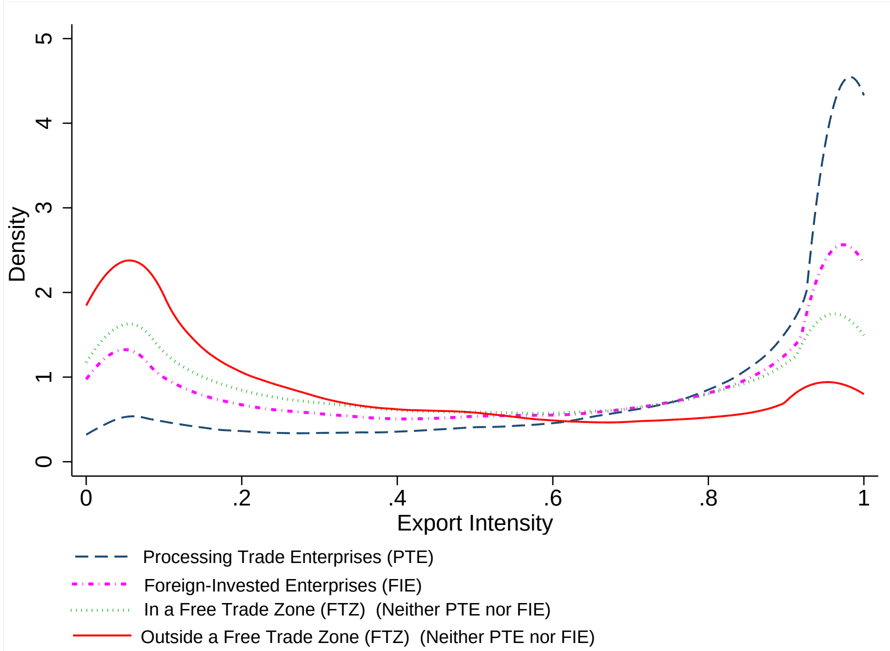



Figure 3 presents the distribution of export intensity across the four groups of exporters described in Table 4. Pure exporters are significantly more prevalent among PTEs, whereas the distribution of export intensity for FIEs and firms located in a FTZ appears more bimodal. Interestingly, more than a third of PTEs sell 30% or more of their output domestically. This challenges the commonly held view that firms engaged in processing activities are fully specialized in production for exporting (Brandt and Morrow, 2013). The distribution of export intensity for the residual group of firms (i.e. exporters not located in a FTZ which are neither PTEs nor FIEs) shows a majority of firms selling a small share of their output abroad —the more common pattern documented for manufacturing firms in other countries— although, there is still a discernible hump in the upper bound of the export intensity distribution for this group of firms. This could be due to the fact that our definition of FTZ excludes small industrial parks, which also provide preferential treatment for pure exporters, or because our firm grouping does not capture policies benefitting pure exporters enacted at the local level, such as the 'Famous Brands' initiative or the 'Auto Export Base' program.

Figure 4 presents the geographical distribution of FTZs and the distribution of the share of pure exporters among all exporting firms across prefecture-cities (by quartiles). 25% of the prefectures have 33.6% or more of their exporters that can be classified as pure exporters.[9] It can be clearly seen that pure exporters are highly concentrated along coastal areas, the same places where FTZs have been established. Unlike the traditional definition of a free trade zone, which stresses the fact that they usually are small, fenced-in geographically-delimited areas (World Bank, 2008), the scale of FTZ in China is unprecedentedly massive. FTZ often encompass entire prefectures, and in fact, as shown in Figure 4, cover a substantial fraction of China's eastern seaboard.

**Foreign affiliates from Hong Kong, Macau and Taiwan.** Foreign direct investment (FDI) has played an instrumental role in China's integration into the world economy. A notable characteristic of FDI inflows into China, as Branstetter and Foley (2010) point out, is that a substantial share of them originates from Hong Kong, Macau or Taiwan (HKMT). Anecdotal evidence suggests that an important share of HKMT-originated capital flows are the result of "round-tripping" (Prasad and Wei, 2007), i.e. Chinese investors creating shell companies in HKMT to operate production facilities located in mainland China in order to enjoy preferential tax treatment as foreign investment, which is also often conditioned on export performance (Defever and Riaño, 2017a).

Table 5: Percentage of firms with capital originating in Hong Kong, Macau or Taiwan by firm-type

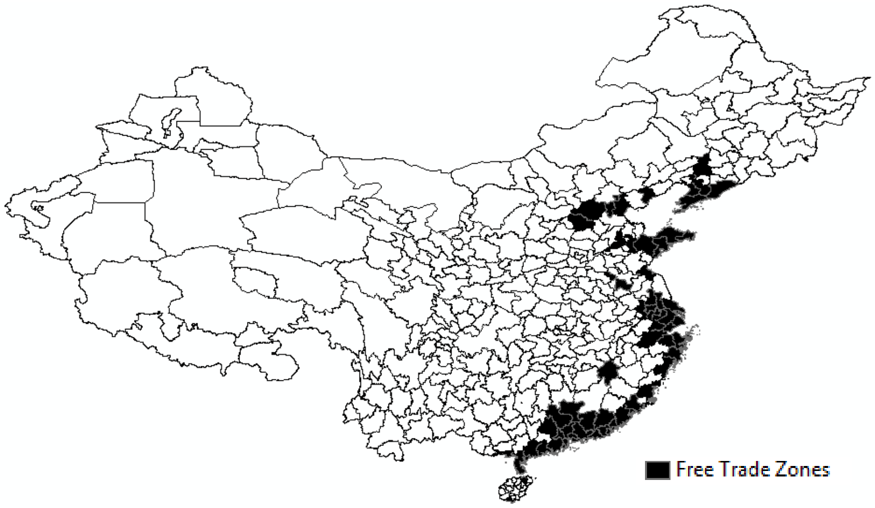
| | Manufacturing Survey | Matched Data | | | |
|---|---|---|---|---|---|
| | All exporters | FIEs | PTEs | Neither FIEs or PTEs in a FTZ | Neither FIEs or PTEs outside a FTZ |
| Non-HKMT foreign affiliate | 11.37 | 23.97 | 28.56 | | |
| Non-HKMT foreign JV | 11.24 | 32.54 | 16.08 | | |
| HKMT foreign affiliates | 12.25 | 20.30 | 33.43 | | |
| HKMT foreign JV | 10.01 | 23.19 | 16.31 | | |
| State Owned Enterprises | 6.77 | | 1.29 | 8.55 | 26.38 |
| Chinese Private firms | 48.37 | | 4.33 | 91.45 | 73.62 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Using the information available in the NBS data regarding firms' ownership, we now explore the role of HKMT foreign firms in China's export sector. The first column of Table 5 shows that foreign-owned firms are extremely important in China's export sector, accounting for slightly less

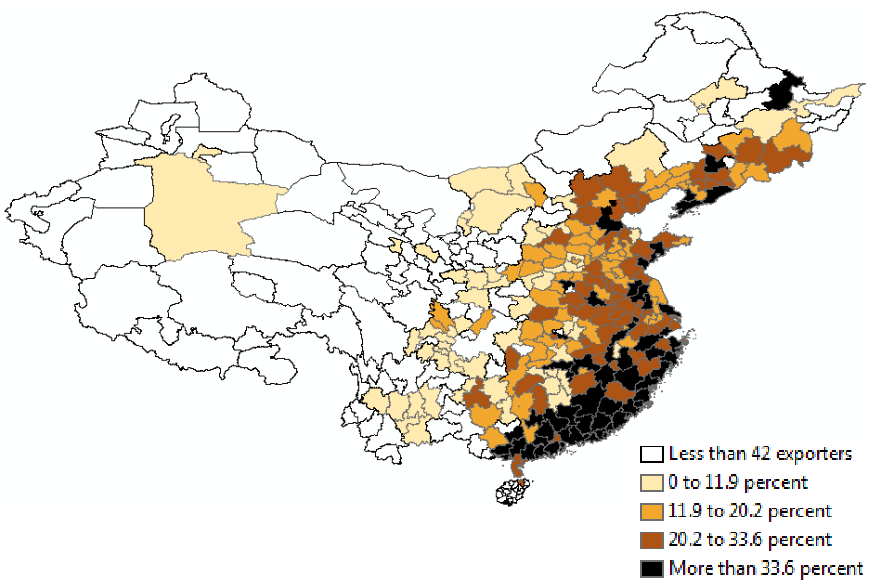
[9] Locations with fewer than 42 observations have been excluded in order to avoid inaccuracies.

Figure 4: Free Trade Zones and Share of Exporting Firms Classified as Pure Exporters

Free Trade Zones Established Between 1979 and 2000




Quartiles of the Share of Pure Exporters




A detailed description of the Free Trade Zones is included in Appendix A.

than half of exporters. To provide a reference point, Rodrigue (2008) finds that foreign-owned firms account for only 19 percent of Indonesian exporters. FIEs are evenly distributed between wholly-owned foreign affiliates and joint ventures and also across the sources of origin of their capital. Columns (2)-(4), which are based on our matched sample, show first that PTE are overwhelmingly foreign-owned (only 5 percent of them are domestically owned), and second, that approximately half of all PTEs and 44 percent of FIEs not specialized in processing activities are owned by HKMT-based investors. These figures provide suggestive evidence of the importance of round-tripping and its close association with incentives conditioned on export performance.

A recurring argument put forward by policy-makers to rationalize the use of incentives to attract foreign-owned firms is that their activity generates knowledge spillovers that can be appropriated by domestic firms through technology transfer, imitation of best practices, worker flows and access to new markets (Keller, 2004). Inasmuch as HKMT-based FDI flows are targeted towards export-oriented activities with the objective of enjoying tax incentives, the potential for FDI spillovers for Chinese firms appears quite limited, as shown by Agarwal et al. (2014). Table 6 presents the percentage of observations reporting a positive value of R&D in the NBS survey. Column 1 shows that the proportion of pure exporters reporting a positive level of expenditure in R&D is three times smaller than that among regular exporters. Similarly, large differences in the share of firms reporting any R&D expenditure can also be identified in the matched data for all firm categories presented in Columns (2)-(5). Regulations such as the 2002 *Provisions on Guiding Foreign Direct Investment* for example, can help in explaining the stark differences in R&D activity between pure and regular exporters, since they provide preferential treatment to foreign enterprises which are *either* technology-intensive *or* export the majority of their production. As a result, foreign-investors seeking access to the Chinese market might choose to invest in R&D in order to qualify as technologically-intensive firms, whereas pure exporters would tend to concentrate on labor-intensive activities.

**Firm-level tax outlays.** Defever and Riaño (2017a) document a wide variety of policy measures utilized in China (even after joining the WTO), providing incentives to firms under the condition that they export the majority of their output. Although it is extremely difficult to obtain systematic

Table 6: Percentage of Observations Featuring Positive Expenditure in R&D

| Year | Manufacturing Survey | Matched Data | | | |
|---|---|---|---|---|---|
| | All exporters | FIEs | PTEs | Neither FIEs or PTEs in a FTZ | Neither FIEs or PTEs outside a FTZ |
| Pure exporters | 6.99 | 7.35 | 7.40 | 11.71 | 14.04 |
| Regular exporters | 20.78 | 17.07 | 15.92 | 26.99 | 36.26 |

information indicating which firms receive these incentives and how big they are, we can investigate if pure exporters pay less taxes than domestic firms and regular exporters. To do so, we use the information provided by the NBS survey regarding firms' income, value-added and sales tax outlays as reported in their balance sheet.

Table 7 presents the tax outlay premia of pure exporters vis-à-vis other firms. The upper panel of the table uses domestic firms as a reference group, while the lower one presents a group-wise comparison with regular exporters. The latter compares, for instance, pure exporters that rely primarily on the processing customs regime to export with PTE firms that sell less than 90 percent of their output abroad in terms of their share of value-added devoted to each specific tax. Just as in the productivity premia regressions, we include year, 4-digit sector and province-city-specific fixed effects and cluster standard errors at the firm-level. The dependent variables used in the regressions reported in columns (1)-(3) are respectively the income tax, value-added tax and sales tax outlay as a share of a firm's value-added.

Table 7: Pure Exporters' Tax Expenditure Premia Relative to Domestic Firms and Regular Exporters

| | | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| | | Comparison group: Domestic Firms | | | | | |
| | | Manufacturing Survey | | | Matched Data | | |
| | | Income tax | VAT | Sales tax | Income tax | VAT | Sales tax |
| | | as share of value-added | | | as share of value-added | | |
| | | Comparison group: All domestic firms | | | Comparison group: All domestic Firms | | |
| Pure exporter | | -0.687[a] | -3.325[a] | -1.082[a] | | | |
| | | (0.019) | (0.042) | (0.023) | | | |
| × | FIE | | | | -1.110[a] | -5.914[a] | -2.095[a] |
| | | | | | (0.036) | (0.080) | (0.033) |
| × | PTE | | | | -1.092[a] | -8.621[a] | -2.023[a] |
| | | | | | (0.034) | (0.072) | (0.032) |
| × | Neither FIE or PTE | | | | -0.194[a] | -3.239[a] | -0.859[a] |
| | | | | | (0.052) | (0.102) | (0.050) |
| | | Comparison group: All regular exporters | | | Comparison group: Each type of regular exporter | | |
| Pure exporter | | -0.471[a] | -1.881[a] | -0.171[a] | | | |
| | | (0.020) | (0.043) | (0.023) | | | |
| × | FIE | | | | -0.460[a] | -3.497[a] | -0.049 |
| | | | | | (0.041) | (0.088) | (0.039) |
| × | PTE | | | | -0.330[a] | -4.299[a] | -0.236[a] |
| | | | | | (0.047) | (0.103) | (0.043) |
| × | Neither FIE or PTE | | | | -0.413[a] | -0.501[a] | -0.183[a] |
| | | | | | (0.056) | (0.107) | (0.054) |
| Year fixed effects | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sector fixed effects | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Prefecture-city fixed effects | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| # Obs | | 1,100,600 | 1,100,600 | 1,100,600 | 945,711 | 945,711 | 945,711 |
| # firms | | 386,185 | 386,185 | 386,185 | 348,860 | 348,860 | 348,860 |
| $R^2$ | | 0.060 | 0.103 | 0.120 | 0.061 | 0.122 | 0.118 |

Robust standard error clustered at the firm level into brackets. [a], [b], [c] significantly different from 0 at 1%, 5% and 10% level, respectively.

The coefficients reported in Table 7 can be interpreted as the difference in the share of value-added devoted to the payment of each type of tax by pure exporters relative to the corresponding control group defined above. By adding the coefficients, we obtain the overall difference (in percentage points) of firms' value-added spent on taxes. Domestic firms devote, on average, an additional 5.08 percent ($\approx 0.68 + 3.32 + 1.08$) of their value-added to pay these taxes compared to pure exporters, while regular exporters spend 2.52 percent ($\approx 0.47 + 1.88 + 0.17$) more. Columns (4)-(6) present the difference in tax expenditure for each of the three groups of pure exporters, i.e. PTEs, FIEs and the residual group, compared to domestic firms and regular exporters of each type. All the estimates, except the one comparing the sales tax outlay of pure and regular exporters that are FIEs, indicate that pure exporters pay significantly less taxes than other firms.

## 5 Concluding Remarks: Dualism Here to Stay?

China's transition to become the world's largest exporter over the last thirty years has been nothing short of spectacular, spurring great interest on the economic reforms that made it possible. In this chapter we have shown that China's heterodox approach towards trade opening combining strong incentives for export promotion with domestic protection, has resulted in a starkly dual export sector.

In this chapter we have shown that although Chinese exporters resemble their counterparts elsewhere —namely in terms of being a minority among manufacturing firms and being larger and more productive— economic policies favoring firms exporting the majority of their output have engendered a rather unique degree of dualism among them. Using a rich data of Chinese manufacturing firms for the period 2000-2006 matched with customs transaction data, we have shown that the vast majority of Chinese exporters belong to one of two groups: regular exporters, firms that sell most of their output domestically, and pure exporters, producers that sell almost exclusively abroad. A large share of pure exporters are engaged in processing activities, i.e. assembling imported inputs into final goods to be sold in foreign markets, but many of them also export through the ordinary trade customs regime. Pure exporters are primarily located in close proximity to the eastern seaboard in prefectures with free trade zones and are also likely to be foreign owned. When compared to regular exporters, pure exporters tend to be significantly smaller and less productive, are less likely to engage in R&D activities, and crucially, devote a smaller share of their value added to tax payments.

Incentives contingent on export performance have remained a prominent element of China's trade policy regime, even after becoming a member of the WTO in 2001. For instance, tax concessions granted by the central government to foreign-invested enterprises conditioned on them exporting more than 70 percent of their output were maintained until 2008, despite several complaints voiced by WTO members during China's annual Transitional Review Mechanism (TRM). At the same time, while China was required to disclose any subsidy programs in place on a yearly basis under the provision of Article 1 of the Agreement on Subsidies and Countervailing Measures (ASCM), it ended up submitting just two notifications in 2006 and 2011 when the TRM ended. Both notifications were deemed to be highly incomplete, since they failed to state the level and annual amount spent in a large number of subsidies listed (Haley and Haley, 2013). Additionally, subsidies granted at sub-national, provincial and local levels were not acknowledged in either notification.[10] Similarly, the 'Famous Brands' initiative —a large umbrella of export support programs which featured several subsidies contingent on export performance— was introduced in 2005, and was only abandoned in 2009 after being challenged by the U.S. and the EU at the WTO one year before.

The persistence of export promotion policies and their protectionist implications after China's successful integration into the global economy, brings to mind Matoo and Subramanian's (2011) allegorical portrayal of China and its trade policy as Penelope, Ulysses' wife, unraveling by night the shroud she wove by day to keep her suitors at bay. As member countries maintain pressure on China to abide by WTO rules, one natural question to ask is whether the dual nature of China's export sector will endure. In this respect, Defever and Riaño (2015) find, using data from the World Bank Enterprise Survey available for 2002 and 2013, that the importance of pure exporters in China has declined significantly over the last decade. These results suggest that China's trade policy might have shifted focus away from the active promotion of firms exporting the majority of their output, thereby reducing the extent of dualism in its export sector.

Understanding the potential impact of ending policies that incentivize pure exporters is crucial for a large number of developing economies that rely on subsides with export requirements. Crucially, 19 developing countries had been exempted from complying with the Agreement on Subsidies and Countervailing Measures (ASCM) by the WTO until December 31$^{st}$ 2015.[11] Defever et al. (forthcoming) have shown, however, that efforts to make free trade zones compliant with the

[10] See "Request from the United States to China," October 11, 2011, reference G/SCM/Q2/CHN/42.

[11] See: General Council decision of July 31, 2007 WT/L/691. The beneficiaries of this extension are Antigua and Barbuda, Barbados, Belize, Costa Rica, Dominica, Dominican Republic, El Salvador, Fiji, Grenada, Guatemala, Jamaica, Jordan, Mauritius, Panama, Papua New Guinea, St. Kitts and Nevis, St. Lucia, Saint Vincent and the Grenadines, and Uruguay. The notification also lists the subsidy programs that need to be reformed.

subsidy disciplines of the WTO by removing explicit export performance requirements —specifically in the Dominican Republic— have not been very successful in reducing the extent of duality of the export sector.

## References


Agarwal, N., C. Milner, and A. Riaño (2014): "Credit constraints and spillovers from foreign firms in China," *Journal of Banking & Finance*, 48, 261–275.

Arkolakis, C. (2010): "Market Penetration Costs and the New Consumers Margin in International Trade," *Journal of Political Economy*, 118, 1151 – 1199.

Bernard, A. B., J. Eaton, J. B. Jensen, and S. Kortum (2003): "Plants and Productivity in International Trade," *American Economic Review*, 93, 1268–1290.

Bernard, A. B. and J. B. Jensen (1999): "Exceptional exporter performance: cause, effect, or both?" *Journal of International Economics*, 47, 1–25.

Bernard, A. B., J. B. Jensen, S. J. Redding, and P. K. Schott (2007): "Firms in International Trade," *Journal of Economic Perspectives*, 21, 105–130.

Bown, C. P. (2011): "Taking Stock of Antidumping, Safeguards and Countervailing Duties, 19902009," *The World Economy*, 34, 1955–1998.

Brander, J. A. and B. J. Spencer (1985): "Export subsidies and international market share rivalry," *Journal of International Economics*, 18, 83–100.

Brandt, L. and P. M. Morrow (2013): "Tariffs and the Organization of Trade in China," Manuscript, University of Toronto.

Brandt, L., J. van Biesebroeck, and Y. Zhang (2012): "Creative Accounting or Creative Destruction? Firm-level Productivity Growth in Chinese Manufacturing," *Journal of Development Economics*, 97, 339–351.

Branstetter, L. G. and R. C. Feenstra (2002): "Trade and Foreign Direct Investment in China: a Political Economy Approach," *Journal of International Economics*, 58, 335–358.

Branstetter, L. G. and C. F. Foley (2010): "Facts and Fallacies about U.S. FDI in China," in *China's Growing Role in World Trade*, ed. by R. C. Feenstra and S.-J. Wei, National Bureau of Economic Research, 513–539.

Branstetter, L. G. and N. R. Lardy (2008): "China's Embrace of Globalization," in *China's Great Economic Transformation*, ed. by L. Brandt and T. G. Rawski, Cambridge: Cambridge University Press.

Cheng, W., J. Morrow, and K. Tacharoen (2012): "Productivity as if Space Mattered: An Application to Factor Markets Across China," Manuscript, London School of Economics.

Chor, D. (2009): "Subsidies for FDI: Implications From a Model with Heterogeneous Firms," *Journal of International Economics*, 78, 113–125.

Dai, M., M. Maitra, and M. Yu (2016): "Unexceptional Exporter Performance in China? The Role of Processing Trade," *Journal of Development Economics*, 121, 177–189.

Davidson, C., S. J. Matusz, and M. E. Kreinin (1985): "Analysis of Performance Standards for Direct Foreign Investments," *Canadian Journal of Economics*, 18, 876–90.

Defever, F., J.-D. Reyes, A. Riaño, and M. E. Sánchez-Martín (forthcoming): "Special Economic Zones and WTO Compliance: Evidence from the Dominican Republic," *Economica*.

Defever, F. and A. Riaño (2015): "Gone for Good? Subsidies with Export Share Requirements in China: 2002-2013," *World Bank Economic Review Papers & Proceedings*, 29, S125–S144.

——— (2017a): "Subsidies with export share requirements in China," *Journal of Development Economics*, 126, 33–51.

——— (2017b): "Twin Peaks," Cep discussion paper no 1505.

Demidova, S. and A. Rodríguez-Clare (2009): "Trade Policy Under Firm-level Heterogeneity in a Small Economy," *Journal of International Economics*, 78, 100–112.

Díaz de Astarloa, B., J. Eaton, K. Krishna, B. Y. Aw-Roberts, A. Rodríguez-Clare, and J. Tybout (2013): "Born-to-Export Firms: Understanding Export Growth in Bangladesh," International Growth Centre Working Paper.

Eaton, J., S. Kortum, and F. Kramarz (2011): "An Anatomy of International Trade: Evidence From French Firms," *Econometrica*, 79, 1453–1498.

Farole, T. and G. Akinci (2011): *Special Economic Zones: Progress, Emerging Challenges and Future Directions*, Washington DC: The World Bank.

Feenstra, R. C. (1998): "One Country, Two Systems: Implications of WTO Entry for China," Manuscript, University of California, Davis.

Feenstra, R. C. and G. H. Hanson (2005): "Ownership and Control in Outsourcing to China: Estimating the Property-Rights Theory of the Firm," *The Quarterly Journal of Economics*, 120, 729–761.

Feenstra, R. C., Z. Li, and M. Yu (2014): "Exports and Credit Constraints under Incomplete Information: Theory and Evidence from China," *The Review of Economics and Statistics*, 96, 729–744.

Gawande, K. and P. Krishna (2003): "The Political Economy of Trade Policy: Empirical Approaches," in *Handbook of International Trade*, ed. by J. Harrigan and E. K. Choi, Oxford: Basil Blackwell.

Grossman, G. M. and E. Helpman (1994): "Protection for Sale," *American Economic Review*, 84, 833–50.

Haley, U. C. V. and G. T. Haley (2013): *Subsidies to Chinese Industry: State Capitalism, Business Strategy and Trade Policy*, Oxford: Oxford University Press.

Hamada, K. (1974): "An Economic Analysis of the Duty Free Zone," *Journal of International Economics*, 4, 225–241.

Holmes, T. J., E. R. McGrattan, and E. C. Prescott (2015): "Quid Pro Quo: Technology Capital Transfers for Market Access in China," *Review of Economic Studies*, 82, 1154–1193.

Ianchovichina, E. (2007): "Are Duty Drawbacks on Exports Worth the Hassle?" *Canadian Journal of Economics*, 40, 881–913.

Keller, W. (2004): "International Technology Diffusion," *Journal of Economic Literature*, 42, 752–782.

Krugman, P. R. (1993): "What Do Undergrads Need to Know about Trade?" *American Economic Review*, 83, 23–26.

Lardy, N. R. (2002): *Integrating China into the Global Economy*, Washington, DC: Brookings Institution Press.

Lau, L. J., Y. Qian, and G. Roland (2000): "Reform without Losers: An Interpretation of China's Dual-Track Approach to Transition," *Journal of Political Economy*, 108, 120–143.

Levinsohn, J. and A. Petrin (2003): "Estimating Production Functions Using Inputs to Control for Unobservables," *Review of Economic Studies*, 70, 317–341.

Li, H. and L.-A. Zhou (2005): "Political Turnover and Economic Performance: The Incentive Role of Personnel Control in China," *Journal of Public Economics*, 89, 1743–1762.

Li, W. and D. T. Yang (2005): "The Great Leap Forward: Anatomy of a Central Planning Disaster," *Journal of Political Economy*, 113, 840–877.

Lu, D. (2010): "Exceptional Exporter Performance? Evidence from Chinese Manufacturing Firms," Manuscript, University of Chicago.

Lu, J., Y. Lu, and Z. Tao (2014): "Pure Exporter: Theory and Evidence from China," *The World Economy*, 37, 1219–1236.

Ma, Y., H. Tang, and Y. Zhang (2014): "Factor Intensity, Product Switching, and Productivity: Evidence from Chinese Exporters," *Journal of International Economics*, 92, 349–362.

Manova, K. and Z. Yu (2016): "How firms export: Processing vs. ordinary trade with financial frictions," *Journal of International Economics*, 100, 120–137.

Matoo, A. and A. Subramanian (2011): "China and the World Trading System," Policy Research Working Paper 5897, World Bank.

McMillan, J. and B. Naughton (1992): "How to Reform a Planned Economy: Lessons from China," *Oxford Review of Economic Policy*, 8, 130–43.

Melitz, M. J. (2003): "The Impact of Trade on Intra-Industry Reallocations and Aggregate Productivity," *Econometrica*, 71, 1695–1725.

Melitz, M. J. and G. I. P. Ottaviano (2008): "Market Size, Trade, and Productivity," *Review of Economic Studies*, 75, 295–316.

Melitz, M. J. and S. J. Redding (2014): "Heterogeneous Firms and Trade," in *Handbook of International Economics*, ed. by E. Helpman, K. Rogoff, and G. Gopinath, Elsevier, vol. 4 of *Handbook of International Economics*, 1 – 54.

Miyagiwa, K. F. (1986): "A Reconsideration of the Welfare Economics of a Free-trade Zone," *Journal of International Economics*, 21, 337–350.

Naughton, B. (1996): "China's Emergence and Prospects as a Trading Nation," *Brookings Papers on Economic Activity*, 27, 273–344.

——— (2007): *The Chinese Economy: Transitions and Growth*, Cambridge, MA: MIT Press.

Prasad, E. and S.-J. Wei (2007): "The Chinese Approach to Capital Inflows: Patterns and Possible Explanations," in *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*, ed. by S. Edwards, Chicago, IL: Chicago University Press.

Roberts, M. J. and J. R. Tybout (1997): "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs," *The American Economic Review*, 87, 545–564.

Rodrigue, J. (2008): "Foreign Direct Investment, Exports and Aggregate Productivity," Manuscript, Queen's University.

Rodríguez-Clare, A. (1996): "Multinationals, Linkages, and Economic Development," *American Economic Review*, 86, 852–873.

Rodrik, D. (1987): "The Economics of Export-Performance Requirements," *The Quarterly Journal of Economics*, 102, 633–50.

——— (2004): "Industrial Policy for the Twenty-First Century," CEPR Discussion Paper 4767.

——— (2010): "Making Room for China in the World Economy," *American Economic Review*, 100, 89–93.

——— (2013): "The New Mercantilist Challenge," Project syndicate column, January 9, 2013.

——— (2014): "When Ideas Trump Interests: Preferences, Worldviews, and Policy Innovations," *Journal of Economic Perspectives*, 28, 189–208.

Schminke, A. and J. van Biesebroeck (2011): "Using Export Market Performance to Evaluate Regional Preferential Policies in China," Center for Economic Studies Discussion Paper 11.33, Katholieke Universiteit Leuven.

Wang, J. (2013): "The Economic Impact of Special Economic Zones: Evidence from Chinese Municipalities," *Journal of Development Economics*, 101, 133–147.

World Bank (2008): *Special Economic Zones: Performance, Lessons Learned and Implications for Zone Development*, Washington, DC: The World Bank Group.

Xu, C. (2011): "The Fundamental Institutions of China's Reforms and Development," *Journal of Economic Literature*, 49, 1076–1151.

Young, A. (2003): "Gold into Base Metals: Productivity Growth in the People's Republic of China during the Reform Period," *Journal of Political Economy*, 111, 1220–1261.

# Appendix

## A List of Free Trade Zones

### A.1 Special Economic Zones

Special Economic Zones include the six prefectures: Haikou, Sanya, Shantou Shi, Shenzhen, Xiamen, Zhuhai and the entire province of Hainan.

### A.2 Coastal Development Zones

Coastal Development Zones include the Shanghai Economic area established in 1982. This zone does not cover entirely the Shanghai prefecture, and notably does not include the city center of Shanghai. We make use of the firm postcode to exclude firms located in the city center from our definition of FTZ, i.e. postcode starting with "2000".

Coastal Development Zones also include the prefecture-cities of Anshan, Baoding, Beihai, Dalian, Dandong, Fuzhou, Guangzhou, Jinan, Langfang, Lianyungang, Nantong, Ningbo, Qingdao, Qinhuangdao, Quanzhou, Shenyang, Shijiazhuang, Tianjin, Weifang, Wenzhou, Weihai, Yantai, Yingkou, Zhanjiang, Zhangzhou, Zibo.

### A.3 Yangtze River Delta Economic Zone

Yangtze River Delta Economic Zone includes cities located in the Yangtze River Delta but also some cities located outside the area due to mutual economic development. In 1982, the Chinese government set up the Shanghai Economic Area. Besides Shanghai, 4 cities in Jiangsu (Changzhou, Nantong, Suzhou, Wuxi) and 5 cities in Zhejiang (Hangzhou, Huzhou, Jiaxing, Ningbo, Shaoxing) were included. In 1992, a 14-city cooperative joint meeting was launched. Besides the previous 10 cities, the members included Nanjing, Yangzhou and Zhenjiang in Jiangsu, and Zhoushan in Zhejiang. In 1998, Taizhou became a new member.

### A.4 Pearl River Delta Economic Zone

The boundaries of the Pearl River Delta as an economic zone differ from those associated with the geographic boundaries of the delta. In 1985, the State Council designated the Pearl River Delta as an open economic zone. It contained three Special Economic Zones that were established earlier: Shantou, Shenzhen and Zhuhai. Other leading cities in the open zone are: Dongguan, Foshan, Guangzhou, Huizhou, Jiangmen and Zhongshan. 'Peripheral' cities that were declared open cities include: Chaozhou, Heyuan, Jieyang, Maoming, Meizhou, Qingyuan, Shanwei, Shaoguan, Yangjiang, Zhanjiang and Zhaoqing.

# Compensation, Gradualism, and Safeguards*

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**Abstract**

This paper examines the optimal phase-in period for trade agreements when there are adjustment costs of moving resources between sectors and the government wants to compensate resource owners harmed by trade liberalization. We focus on the case in which governments are able to commit to policies, and show that the optimal agreement will front-load tariff reductions when the tariff is the only instrument. The optimal policy in response to import surges and the role of labor market instruments is also considered.

## 1 Introduction

Although trade liberalization has the potential to lead to a more efficient allocation of resources, the cost of moving resources between sectors can be significant and require a substantial period of time. This is particularly true for developing countries, where adjustment frequently requires geographic

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relocation as in the case of rural to urban migration associated with agricultural liberalization. For example, Carneiro [9] finds that adjustment costs in Brazil could represent between 14 and 42% of the gains from trade, and that the adjustment process can take 5 years or longer.

In addition to the resource costs of adjustment, trade liberalization also can result in substantial income redistribution, since factors initially located in the import-competing sector will be harmed by the increased competition from imported goods. The idea that the redistributive costs can be mitigated by reducing tariffs gradually goes back at least as far as Adam Smith [20], who in discussing the gains from trade noted: "Humanity may in this case require that freedom of trade should be restored only by slow gradations and with a good deal of reserve and circumspection. Were those duties and prohibitions taken away all at once, cheaper foreign goods of the same kind might be poured so fast into the home market, as to deprive all at once many thousands of our people of their ordinary employment and means of subsistence."

Countries thus face a trade-off in choosing the time path of tariff reductions: slowing the pace of trade liberalization may mitigate the negative effects of trade liberalization on factor owners in the import-competing sector, but it may also slow the adjustment process of reallocating factors to more productive uses. The purpose of this paper is to address the question of how rapid the rate of tariff reduction should be, and how it should vary across sectors in the economy and across countries. Should developing countries be granted preferential treatment by allowing more lengthy phase in periods, as was the case in the Uruguay Round, or should they be encouraged to accelerate the liberalization process in order to achieve more efficient resource allocation more rapidly? Should the tariff reductions be front-loaded, in the sense that the largest reductions occur at the beginning of the adjustment period, or should they be back-loaded to occur largely at the end of the adjustment period? Should safeguard measures be included that allow countries to slow the adjustment process

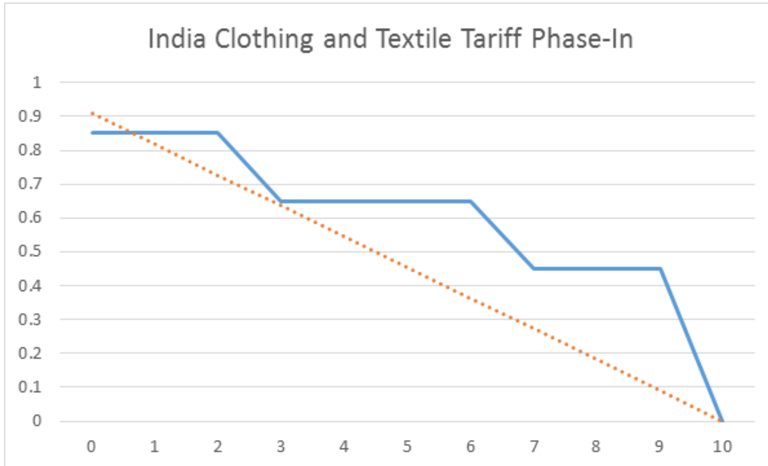



Figure 1: India Phase-In (solid) and Equal Increments Phase-In (dotted)

in the event of import surges that occur during the transition period?

Recent periods of trade liberalization illustrate a variety of approaches to this question. The Marrakesh Protocol that implemented the tariff schedules negotiated in the Uruguay Round called for countries to reduce their tariffs over a period of 5 years using 5 equal rate reductions. However, a number of countries (primarily developing ones) were allowed longer phase-in periods in some sectors. For example, Egypt and Pakistan used a 10 year transition period for tariff reductions in textiles and agriculture. India also followed a ten year phase-in for clothing and textiles, with the fraction of the difference between the initial applied rate and the new tariff binding in each year of the phase-in illustrated by the solid line in Figure 1. Note that India's tariff reductions were significantly back-loaded relative to a path with equal reductions in each period (illustrated by the dotted line), with 45% of the total tariff reduction occurring in the last year of the phase-in period.

Mussa [19] has shown that the fact that a small country faces costs of adjustment is not sufficient to justify gradual trade liberalization. If markets are complete and perfectly competitive and the government has a full set of policy instruments at its disposal, the income maximizing path of resource reallocation is obtained by moving immediately to free trade. Adjustment will be gradual when there are increasing marginal costs of adjustment, but an immediate move to free trade provides the signal to move resources at the rate that maximizes national income. Distributional concerns can then be addressed using lump sum transfers. In order for gradual trade liberalization to be optimal, it is necessary to introduce some friction into this benchmark model.

In this paper we investigate the optimal path of trade liberalization in an agreement between two large countries that would like to provide compensation to workers in the import-competing sector but lack the lump sum instrument to make this redistribution in a non-distorting way. We initially consider the case in which the tariff is the only policy instrument, and then extend the analysis to add the ability to use a subsidy to factor owners that move between sectors. The absence of a lump sum instrument introduces a tension between income redistribution and factor mobility. Delaying tariff reductions provides greater compensation to import-competing factors, but slows the adjustment process.

The analysis in this paper is primarily normative, since the objective is to derive the optimal policy that should be followed if preferences, technologies, and the access to policy instruments take the form that is assumed here. The results can then be used to discuss how policy should be designed in governments.

### 1.1 The Government Objective Function and Related Literature

In deriving the optimal phase-in period for trade liberalization, it will be assumed that the government maximizes a weighted social welfare function that puts greater weight on the welfare of factors who are initially in the import-competing sector at the time that the trade liberalization program is announced. It will be assumed that there is a single factor of production in the import-competing sector, which will be referred to as labor. With this objective function, the exit of workers from the protected sector, whether through retirement from the labor force or through re-employment in another sector, will reduce the marginal benefit of protection over time.

One interpretation of this objective function is that it represents a "conservative social welfare function" as defined by Corden [8]. According to this view, governments want to prevent workers from suffering significant reductions in real incomes. Therefore, governments will place a positive value on transferring income to workers who are displaced due to import competition as a result of trade liberalization or supply shocks from international markets. For example, Brander and Spencer [6] have used this assumption in their analysis of the design of trade adjustment assistance programs and Ethier [10] uses it in his study of the role of unilateral actions in the presence of multilateral trade agreements.

A second interpretation of this objective function is that it reflects the political power of factors in the import-competing sector. The political economy models of Grossman and Helpman assume that politicians put a greater weight on the welfare of factor owners in sectors that are organized as a result of their willingness to make campaign contributions to influence policy. In their model, the weight on organized interest groups is larger the greater the willingness of politicians to trade off reductions in national welfare in order to obtain campaign contributions. The model in this paper differs from the standard political economy formulation because the extra weight is assumed to apply only to factors initially in the import-competing sectors and to decline as labor exits the sector. One justification for why governments may support declining industries is given by Hillman [13], who points out that there is a stronger incentive to organize an industry when it is facing tariff reductions. Because firms in the import competing will be earning below normal returns during the period of liberalization, slowing the rate of tariff reduction will not induce additional entry. The returns from organizing will all accrue to existing members of the industry. Once the industry has shrunk and factors are earning a market rate of return, there is no longer an incentive to organize because additional entry would dissipate the returns from tariff increases.[1]

If the lobby in the import-competing sector is able to obtain a commitment to a particular level of compensation for its members at the time of the trade agreement, then the government will choose the path for its policy instruments to maximize social welfare subject to the promised compensation to the lobby. The Lagrange multiplier on this promised compensation will thus be equivalent to an additional weight placed on payoffs to the lobby members. Thus, either the conservative social welfare function or the political economy model with commitment can be used to motivate the payoff function we consider.

Given this objective function, we derive the optimal path of trade liberalization for an agreement between two large countries under the assumption of increasing marginal costs of moving workers between sectors and an exogenously given retirement of workers from the labor force. As in static models of trade agreements, the motive for a trade agreement in the dynamic model is to solve the prisoner's dilemma that arises due to the adverse effect of tariffs on the partner's terms of trade. Therefore, in the absence of a government objective function that puts greater weight on the welfare of factor owners in the import-competing sector, the optimal path would result in immediate free trade.[2] We show that when government preferences reflect a compensation motive for workers initially located in the import-competing sector and workers are forward looking, the optimal policy involves a gradual tariff reduction at a rate that exceeds the retirement rate of workers.

The motivation for gradualism comes from two sources. One is due to the fact that the retire-

[1] Baldiwn and Robert-Nicoud [2] formalize this argument in a monopolistic competition model.

[2] This generalizes the results obtained by Lapan [15] and Mussa ([18],[19]) for the small country case to the large country case

ment of workers reduces the weight on the payoff to the import-competing sector, which reduces the incentive to raise the tariff over time. The second reason is that the time path of reductions can be used to influence moving decisions. Tariffs that are further in the future have a bigger impact on the mobility decision than tariffs immediately following the agreement because they influence the decision to move between sectors for a larger number of periods. As a result, the optimal agreement will call for a decline in tariffs that exceeds the rate of retirement of workers from the labor force, and will reach free trade in finite time.

The approach taken here can be contrasted with two closely related papers that use dynamic models to analyze the optimal path of trade liberalization. Karp and Paul [14] consider the case where the government is maximizing social welfare and there are convex adjustment costs of moving workers between sectors. They depart from the benchmark competitive model by assuming that there are externalities in the adjustment cost process, so that workers do not incur the full social cost of their decision to move between sectors. In this case the optimal policy will depart form immediate free trade to mitigate this distortion, rather than to redistribute income to workers affected by trade liberalization. They show that in the case where the government can commit to a time path for tariffs, the optimal policy will involve the phasing in and phasing out of tariffs in order to mitigate congestion of workers moving between sectors.

Maggi and Rodriguez-Clare [16] consider a political economy model where the government is able to commit to tariffs in its trade agreement with the foreign country, but is unable to commit in its deal with a domestic special interest group. They highlight the role of tariff ceilings under a trade agreement, because negotiated tariff ceilings act as a constraint on the negotiation between the government and the interest group over the setting of the tariff. They assume that an exogenously given fraction of the factor owners are allowed to move between sectors at a given point in time, so they do not allow factor owners to choose the timing of their move between sectors as in the current paper. Their approach also differs in that they examine Markov perfect equilibria, in which the tariffs under the agreement depend only on the state of the economy. In contrast, we consider the case where there is commitment to tariffs in calendar time.

We also consider the case in which the government has access to a labor market instrument in addition to the tariff. With both instruments available, the government uses the tariff to provide compensation to workers in the importable sector and a labor market subsidy to encourage exit from the importable sector. It is shown that when the government has a compensation motive, the tariff will decline at a rate equal to the rate of retirement of workers from the labor force in the optimal agreement. In this case the tariff is assigned the role of compensating workers and the labor market instrument is used to provide the incentive to move workers out of the importable sector. The optimal path of employment in the importable sector is shown to be non-monotonic, with employment in the importable sector falling below the level that maximizes national income in the early phase of the agreement and then rising asymptotically to the income maximizing level.

The analysis in this paper assumes that the parties to the trade agreements are able to commit to their promises to their trading partner. This approach contrasts with the literature, initiated by Staiger [21], which examines how the requirement that trade agreements be self-enforcing can lead to gradual tariff reduction. In this literature, the incentives to deviate are larger the greater the stock of factors employed in the import-competing sector. As resources leave the sector, the no deviation constraint is relaxed, making further trade liberalization sustainable. Furusawa and Lai [11] extended this approach to consider a model with adjustment costs of moving workers between sectors, and show that the efficient trade agreement between welfare maximizing governments will involve gradual tariff reduction.[3]

Section 2 of the paper presents the basic model in the case where labor is fully mobile between sectors, and characterizes the non-cooperative equilibrium that exists prior to the signing of the trade agreement. Section 3 derives the features of the optimal trade agreement when only a tariff is used, and section 4 considers agreements over both tariffs and labor market policies. Section 5 offers some concluding remarks on the implications of these results for developing country policy.

# 2 The Model

We consider an infinite horizon two country trade model in which each country produces a numeraire good $(N)$ and two traded goods. We begin by examining equilibrium under the assumption of frictionless mobility of factors between production activities, and then introduce adjustment costs of moving factors of production between sectors.

Home country preferences are represented by the utility function $U = \sum_{s=0}^{\infty} u(d_{1s}, d_{2s}, d_{Ns})\beta^s$, where $\beta \in (0,1)$ is the discount factor, $d_{is}$ is consumption of good $i \in \{1, 2, N\}$ in period $s$, and $u(d_1, d_2, d_N) = \sum_{i=1}^{2}(Ad_i - .5d_i^2) + d_N$. These preferences yield demand functions for the traded goods $i \in \{1, 2\}$ at each point in time of $d(p_{is}) = A - p_{is}$, where $p_{is}$ is the home country price of good $i$ in period $s$. The indirect utility function is

$$V = \sum_{s=0}^{\infty} \sum_{i=1,2} s(p_{is})\beta^s + Y, \tag{1}$$

where $s(p_i) = .5(A - p_i)^2$ is the consumer surplus from consuming good i and $Y$ is the present value of national income. Preferences in the foreign country have the same quasi-linear form, with

[3] Bond and Park [5] show that gradual tariff reduction may arise without adjustment costs when countries are asymmetric and agreements must be self-enforcing.

demand for trade goods given by $d^*(p^*_{is}) = A^* - p^*_{is}$ for $i \in \{1, 2\}$.

There are two types of labor, referred to as type $m$ and type $x$ labor, in each country. Type $m$ labor can produce either one unit of good $N$ or one unit of the importable good (good 1 in the home country and good 2 in foreign). Letting $l^m$ denote the total supply of $m$ labor in the home country and $l_{1s}$ quantity of $m$ labor located in sector 1 in period $s$, the income of $m$ labor at home in period $s$ is $l^m + (p_{1s} - 1)l_{1s}$. A unit of type $x$ labor can produce either good $N$ or good 2. Type $x$ workers are assumed to be of heterogeneous ability, resulting in an supply function for good 2 of $y_2(p_{2s}) = -a + \phi p_{2s}$.[4] The aggregate income of $x$ labor in period $s$ will be $l^x + R(p_{2s})$ where $R(p_{2s}) = \frac{(p_{2s}-a)(p_{2s}-a(2-\phi))}{2}$.

A similar production structure is assumed in the foreign country so that foreign supply of good 1 is $y_1(p^*) = -a^* + \phi^* p^*_1$, which allows for differences in export sector productivity across countries. The following restrictions on parameters will be made throughout.

**Assumption 1** *The preference and technology parameters in sector 1 satisfy:*

*(a)* $\frac{A^*+a^*}{1+\phi^*} < 1, \frac{A+a}{1+\phi} < 1$

*(b)* $A + A^* + a^* - 2 - \phi^* > 0,$

Part (a) is simply the requirement that the autarkic price of good 1 (2) in the foreign country be less (more) than that in the home country, which is required for our identification of good 1 as the home country importable and good 2 as its exportable. Part (b) ensures that there will be a positive level of employment of labor in sector 1 at home with free trade in the frictionless equilibrium. This assumption is not essential, but reduces the number of cases to be considered.

[4] Suppose that a worker can produce 1 unit of $N$ or $\theta$ units of good 2. A linear supply function will be obtained if the distribution of ability is given by $f(\theta) = 2\left(\underline{\theta}\overline{\theta}\right)^2 \theta^{-3}/(\overline{\theta}^2 - \underline{\theta}^2)$ on $[\underline{\theta}, \overline{\theta}]$, which yields $\phi = 2\left(\underline{\theta}\overline{\theta}\right)^2/(\overline{\theta}^2 - \underline{\theta}^2)$ and $a = 2\underline{\theta}^2(1 + \underline{\theta}\overline{\theta})/(\overline{\theta}^2 - \underline{\theta}^2)$.

These assumptions result in a separability between sectors for goods 1 and 2, so that we can solve for the equilibrium of sector 1 independently of policies in sector 2. Therefore in the subsequent discussion we focus on the market for the home country importable, good 1. The analysis for the market for good 2 is similar.

We begin by characterizing the equilibrium when there is costless movement of factors between sectors and the home country's trade instrument is a specific tariff on imports of good 1, $t$. The home country price of good 1 will satisfy $p = p^* + t$.[5] The foreign export supply is given by $x^*(p_s) = (\phi^* + 1)(p_s - t_s) - A^* + a^*$, which under Assumption 1(b), is not sufficient to satisfy the domestic market at $p = 1$. The remaining demand that cannot be satisfied by imports at $p = 1$ will be met by domestic production, which results in employment of

$$\tilde{l}(t_s) = A + A^* + a^* - 1 - \phi^*(1 - t_s) \tag{2}$$

The effect of trade liberalization with costless factor mobility is illustrated in Figure 2. At the initial non-prohibitive tariff $t_0$, the home country employs $l_0$ workers in production of good 1. The elimination of the tariff results in the reduction of home country employment in sector 1 to $l_1 = d_1(1) - x^*(1)$.

In the presence of adjustment costs that restrict the movement of factors between sectors, the initial effect of trade liberalization will be to reduce the domestic price of good 1 below 1 because the domestic output will exceed $l_1$. As a result, labor that is initially allocated to sector 1 will suffer losses because the return in the import-competing sector will fall below that available in sector $N$ until the time at which sector 1 employment declines to $l_1$. The following section introduces a specification of adjustment costs to moving factors between sectors to formalize that idea.

[5] We drop the sectoral subscripts in the subsequent discussion to simplify notation.

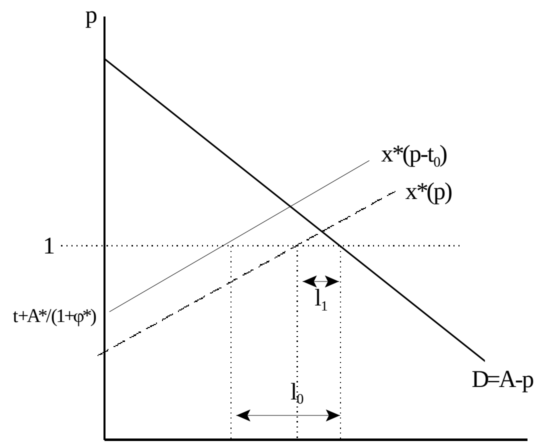



Figure 2: Home Market for Imported good 1

## 2.1 Adjustment Costs

Type $m$ labor will be treated as a quasi-fixed factor, which must make a location decision at the end of each period to determine which good it produces in the following period. A decision to move between sectors requires the worker to incur an adjustment cost. Let $l_s$ denote the quantity of labor located in the home importable sector at the beginning of period $s$. It will also be assumed that at the end of the period, a fraction $\delta$ of type $m$ labor retires from the labor force and is replaced in the labor force by a newly entering unit of labor. The contraction of employment in sector 1 as a result of trade liberalization can thus occur through a combination of retirement of workers who are not replaced and through the movement of continuing workers out of the sector. The quantity of labor located in the import-competing sector at the beginning of period $s+1$ will be $l_{s+1} = (1-\delta)l_s + i_s$, where $i_s$ is the quantity of labor entering (exiting) the sector for $i > 0$ ($i < 0$).

New labor entering the market at the end of period $s$ can choose to locate costlessly in either sector 1 or sector $N$. However, adjustment costs will be incurred if continuing units of labor choose to move from the importable sector to the numeraire sector (i.e. $i_s < 0$) or from the numeraire sector to the importable sector ($i_s > \delta l^m$). It will be assumed that there is congestion in the moving process, so that there are increasing marginal cots of adjustment. The aggregate costs of adjustment (measured in units of the non-traded good) will be assumed to take the following form:

$$G(i) = \begin{cases} \frac{\gamma(i-\delta l^m)^2}{2} & i > \delta l^m \\ 0 & 0 \leq i \leq \delta l^m \\ \frac{\gamma i^2}{2} & i < 0 \end{cases} \tag{3}$$

where $\gamma > 0$.

Home country imports of good 1 in period $s$ will be $m(p_s, l_s) = A - p_s - l_s$. In order to simplify the presentation, we assume that type $x$ labor is freely mobile between activities, so foreign exports of good 1 will be $x^*(p_s^*) = (\phi^* + 1)p_s^* - A^*$. We can then solve for the equilibrium prices as a function of home trade policy and the stock of labor

$$p(t_s, l_s) = \frac{A + A^* + a^* + (1 + \phi^*)t_s - l_s}{2 + \phi^*} \tag{4}$$

The returns to $m$ labor will not necessarily be equalized across sectors at a point in time due to the quasi-fixed nature of $m$ labor, so it will be useful to denote the differential in returns to labor between sector 1 and sector $N$ by

$$\Delta(t_s, l_s) = p(t_s, l_s) - 1 \tag{5}$$

which is increasing in $t_s$ and decreasing in $l_s$.

A continuing worker will find it profitable to move between sectors at time $s$ if the present value of wage gains exceeds the cost of moving. It will be assumed that there are no externalities in the labor adjustment process, which means that a worker moving at the end of period $s$ faces a moving cost equal to the marginal social cost of adjustment, $G'(i_s)$. In periods where $i_s \in [0, \delta l^m]$, workers entering the labor force will be indifferent between sectors 1 and $N$ and the present value of wage income in the two sectors will be equalized. In periods where workers move between sectors, the wage differential will equal the marginal cost of adjustment. Thus, at any time $s$ we have

$$\sum_{u=1}^{\infty} \Delta(t_{s+u}, l_{s+u})(1-\delta)^{u-1}\beta^u = G'(i_s) \tag{6}$$

where workers forecasts of future tariffs and employment levels are assumed to be rational.

To illustrate how this adjustment process works, suppose that $t$ is expected to be constant and initial employment $l_0$ in sector 1 is greater than $\tilde{l}(t)$ as defined in (2), so $\Delta(t_s, l_s) < 0$. All newly entering workers will enter the $N$ sector until the wage differential is eliminated. Even if no continuing workers were to move out of sector 1, the allocation of new workers to the $N$ sector would eliminate the wage gap in finite time by the attrition of workers in the import-competing sector. We refer to this as the attrition path. If $\left(l_0 - \tilde{l}(t)\right) > \delta l_0$, attrition will not be sufficient to close the wage gap in period 1. Since $G'(0) = 0$, the movement of workers out of sector 1 will accelerate the adjustment process relative to the attrition path. The intertemporal no arbitrage condition (6) must hold at $s$ and $s+1$, so

$$\Delta(t_s, l_s) = G'(i_{s-1})/\beta - (1-\delta)G'(i_s) \tag{7}$$

Equation (7) requires that the wage loss from staying in sector 1 for an additional period equal the savings in expected adjustment costs from waiting an additional period to move.

## 2.2 Sectoral Payoff Functions

Due to the separability between sectors, we can use (1) to obtain an expression for the indirect utility derived by the home country from sector 1,

$$V = \sum_{s=0}^{\infty} \left[ W^M(t_s, l_s) - G(l_{s+1} - (1-\delta)l_s) \right] \beta^s \tag{8}$$

where

$$W^M(t_s, l_s) = s(p(t_s, l_s)) + (p(t_s, l_s) - 1) + t_s m(p(t_s, l_s), l_s) \tag{9}$$

$W^M$ is the sum of consumer surplus, producer surplus (the wage differential between sectors 1 and $N$), and tariff revenue associated with the home importable good. $W^M$ is strictly concave in $t_s$ and $l_s$.

The foreign indirect utility associated with its exportable sector 1 is the discounted sum of consumer and producer surplus,

$$V^* = \sum_{s=0}^{\infty} \left[ W^{X^*}(t_s, l_s) \right] \beta^s$$

where

$$W^{X^*}(t_s, l_s) = s(p^*(t_s, l_s)) + R^*(p^*(t_s, l_s))$$

$W^X$ is decreasing and convex in $t_s$, reflecting the adverse effect of the home country tariff on the exporter's terms of trade.

The impact of home tariff and employment choices on world welfare can be expressed as the sum of payoff to home and foreign,

$$\begin{aligned} V^W &= \sum_{s=0}^{\infty} [W^W(t_s, l_s) - G(i_s)]\beta^s \qquad (10) \\ \text{where } W^W(t_s, l_s) &= W^M(t_s, l_s) + W^{X^*}(t_s, l_s) \end{aligned}$$

is the sum of surplus in the home and foreign countries in good 1 plus home country surplus in the non-traded goods sector. The per period world surplus from sector 1 has the properties that

$$W_t^W(t_s, l_s) = -t_s \left(\tfrac{1+\phi^*}{2+\phi^*}\right) \quad W_l^W(t_s, l_s) = \Delta(t_s, l_s) - t_s \left(\tfrac{1+\phi^*}{2+\phi^*}\right) \tag{11}$$

An increase in the tariff reduces world welfare if $t_s > 0$, with the effect being proportional to the change in trade volume resulting from the tariff increase. An increase in employment in sector 1 at home affects world welfare through two channels: the first term is the effect on income of moving a worker from sector $N$ to sector 1 and the second term is the impact of the move on trade volume. The private benefit of moving a worker into the import-competing sector, $\Delta(t_s, l_s)$, exceeds the social benefit when $t_s > 0$.

The existence of a negative spillover from the importing country's tariff means that if countries are setting tariffs unilaterally, they will choose tariffs that exceed the world welfare maximizing level of 0. The non-cooperative equilibrium will thus reflect a terms of trade driven prisoner's dilemma, so there will exist mutually beneficial tariff reductions as has been emphasized by Bagwell and Staiger [1].

# 3 Trade Agreements with Tariffs

We now turn to the case in which the two countries sign a trade agreement that commits them to a time path $\{t_s, t_s^*\}$ for tariffs. It will be assumed that the two countries are initially in a steady state equilibrium with tariffs $\bar{t}, \bar{t}^* > 0$, which result in initial labor allocations in the respective import competing sectors that are above the free trade level (i.e. $\bar{l} > \tilde{l}(0), \bar{l}^* > \tilde{l}^*(0)$). The expected lifetime income under the agreement of a worker who is initially located in the import-competing sector at home will be

$$\Omega_m = \sum_{s=0}^{\infty} p(t_s, l_s)(1-\delta)^{s-1}\beta^s,$$

where future returns are discounted by $(1-\delta)^{s-1}\beta^s$ reflecting the probability that the worker will still be in the labor force in period $s$.

As discussed above, it is assumed that in negotiating the trade agreement the home country government's objective function is $V + \lambda\Omega_m$, where $\lambda > 0$ reflects the additional weight placed by the government on the welfare of workers initially in the import-competing sector. In the case where the only instrument available to the government is the tariff, the objective function of the agreement is to the time path of tariffs to maximize $V^W + \lambda\Omega_m$ subject to the labor market adjustment constraint (6) for each period $s$. We assume that lump sum transfers of the numeraire good between countries are available ex ante, so that the goal of the agreement is to maximize the sum of welfare for the two countries. The solution to this contracting problem is obtained by choosing $\{t_s, l_s\}$ to maximize the Langrangian

$$L = V^W + \lambda\Omega_m + \sum_{s=0}^{\infty} \mu_s \left( \sum_{u=1}^{\infty} \Delta(t_{s+u}, l_{s+u})(1-\delta)^{u-1}\beta^u - G'(l_{s+1} - (1-\delta)l_s) \right) \beta^s \qquad (12)$$

where $\mu_s$ is the current value multiplier associated with the adjustment constraint at time $s$. If $\mu_s < 0$ ($> 0$), the payoff under the agreement can be raised by inducing more labor to move to the numeraire (importable goods) sector, so an increase in $\Delta$ for $s' > s$ will tighten (relax) the labor mobility constraint at time $s$.

In analyzing this problem, it is convenient to rewrite the last term in the Lagrangian as $\sum_{s=0}^{\infty} M_s\Delta(t_s, l_s)\beta^s - \mu_s G'(i_s)$, where $M_s = \sum_{u=0}^{s-1} \mu_u (1-\delta)^{s-1-u}$ summarizes the effect of an increase in $\Delta_s$ on the labor mobility constraint for all $s' < s$. $M_s < 0$ ($> 0$) indicates that an increase in

$\Delta_s$ will tighten (relax) the labor mobility constraint for $s' < s$. The definition of $M_s$ then implies

$$M_{s+1} = (1-\delta)M_s + \mu_s \qquad\qquad M_0 = 0 \tag{13}$$

The multiplier $M_s$ reflects the presence of commitment in the trade agreement, because it shows that the planner's decisions at time $s$ incorporates the effects of these decisions on agent decisions at $s' < s$.[6] The initial condition $M_0 = 0$ is due to the fact that the location of labor is predetermined at $s = 0$, so the time 0 tariff will not affect mobility decisions.

The necessary condition for choice of $t$ is

$$t_s = \lambda(1-\delta)^s + M_s \tag{14}$$

An increase in the tariff transfers income to workers originally in the import-competing sectors, which is beneficial for world welfare when $\lambda > 0$. However, it will also make moving to the $N$ sector less attractive, which tightens the labor mobility constraint when $M_s < 0$. The time path of the tariff will thus reflect the tension between these two effects. Utilizing (13), it can be seen that the rate of decline of the tariff along the optimal path will be $(t_{s+1} - t_s)/t_s = -\delta + \mu_s/t_s$. The tariff rate will decline at a rate greater than $\delta$ if $\mu < 0$ and $t_s > 0$, because the decline in the tariff is being used to relax the labor mobility constraint by encouraging labor to move out of the importable sector.

The necessary condition for location of labor is obtained by differentiating the Lagrangian with respect to $l_s$ and then substituting using (7), which yields the necessary condition

$$t_s = (1-\delta)\mu_s G''(i_s) - \mu_{s-1} G''(i_{s-1})/\beta. \tag{15}$$

[6] This problem can also be formulated as a recursive saddle point problem, as shown by Marcet and Marimon (1998).

The left hand side of (15) is the difference between the wage and the marginal social product of labor, which is equal to the tariff. The right hand side of (15) the impact of moving an additional unit of labor to sector 1 on the labor mobility constraints. The optimal choice of labor thus trades off the static distortions against the dynamic distortions.

Equation (15) can be used to generate a second order difference equation that can be solved for $\{M_1, .., M_{T-1}\}$ for a given terminal date of the phase-in, $T$. The resulting time path of tariffs can be substituted into the intertemporal arbitrage conditions for labor, (6), to obtain a second order difference equation for $l_s$. The optimal value of $T$ is then determined as the time at which the adjustment of labor eliminates the sectoral wage differences. The necessary conditions for the optimal trade agreement can be used to obtain the following characterization of the optimal path of tariff and employment levels, which is proven in the Appendix:

**Proposition 1** *When the tariff is the only instrument available to the government in the trade agreement, there will be finite time $T$ such that $t_s = 0$ and $l_s = \tilde{l}(0)$ for $s \geq T$.*

*(a) For $\lambda = 0$, the optimal trade agreement is the immediate removal of trade barriers.*

*(b) If $\lambda > 0$, $t_s > 0$ and the tariff declines at a rate exceeding $\delta$ for $s < T$.*

*(c) The level of employment in sector 1 is increasing in $\lambda$ for $s < T$ for given $T$, and the optimal length of the phase-in period is non-decreasing in $\lambda$.*

The solutions for $M_s$ and $t_s$ are homogeneous of degree one in $\lambda$, which is used to establish part (a) of the proposition. Referring to (14), a reduction in $\lambda$ reduces both the incentive to transfer income to workers in the importable sector and the incentive to intervene in the labor adjustment process. If $\lambda = 0$, $M_s = 0$ for all $s$ because workers make the socially optimal location decisions and there is no incentive to alter the pace of adjustment. Mussa [19] obtained the result that immediate elimination of trade barriers is optimal for a small country model where there are no terms of trade effects. The optimality of immediate free trade also holds in the two country model because the trade agreement acts to neutralize terms of trade effects.

This front-loading of tariff reductions reflects the trade-off between compensating workers in the importable sector and providing incentives to move out. The retirement of workers from the labor force at rate $\delta$ means that the benefit of providing compensation will also decline at rate $\delta$. However, the fact that future tariffs affect the incentive to move for a greater number of periods provides an additional incentive to front-load the tariff protection.

The optimal $T$ is the value for which the path of employment eliminates the wage differential at $T$. The solutions for $M_s$, given $T$, will depend on the parameters of the adjustment process $(\delta, \gamma)$ and the discount factor, but are independent of the parameters of the demand and supply parameters for given $T$. Thus, the demand and supply parameters affect the path of tariffs only through their effect on $T$.

Figure 3 illustrates how the desire to compensate workers in the import-competing sector affects the time path of their employment for a specific numerical example. The example assumes an initial tariff with an ad valorem equivalent of 12% and initial employment level of $l_0 = .7$, which corresponds to the level when the home country imposes its long run Nash equilibrium. The dotted line in the left panel illustrates the path of employment when the adjustment is accomplished only by attrition of workers in the import-competing sector, where it is assumed that the attrition rate is $\delta = .05$ in each period. The attrition path achieves the employment level $\tilde{l}(0) = .4$, which is the free trade steady state, in period 11. The dashed line is the path of employment if the trade agreement were to result in an immediate elimination of the tariff in period 0, which results in the elimination of the wage differential between sectors in period 8. The solid line in Figure 3 is the path associated with a value of $\lambda = .2$, which compensates the workers for half of the losses that they would suffer if they had gone to immediate free trade. This path results in a slower rate of departure from sector 1 than does the path with immediate free trade, and reaches the steady state level in period 9.

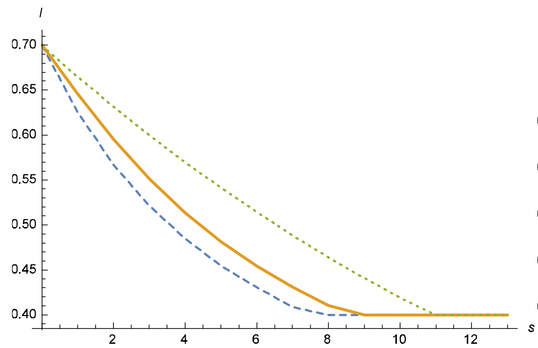
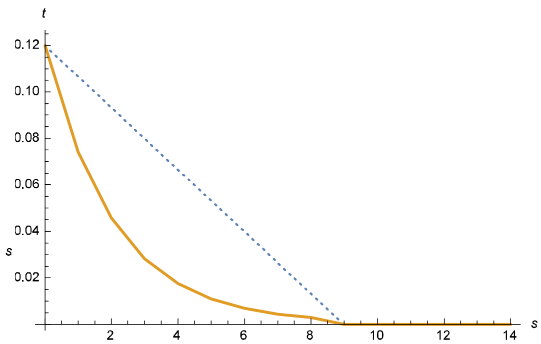



Figure 3:Employment Paths: Optimal (Solid), Free Trade (Dashed) and Attrition (Dotted)




Tariff Paths: Optimal (solid) and equal reductions (dotted)

The right hand panel in Figure 3 shows the time path of tariffs in the optimal agreement (solid line) and the path under equal tariff reductions per period (dotted). The optimal path front-loads the tariff reductions by cutting the tariff rate by approximately 40% in the first period of liberalization.

The above analysis has focused on the case in which the tariff setting is unconstrained and comes as a surprise to factor owners. If the government is constrained not to raise its tariff above the initial level, then the schedule derived in Proposition 1 will be modified if the unconstrained path exceeds the initial tariff. In that case, the tariff will be kept at the ceiling for some period, after which the path will be determined by the derived above.

### 3.1 Safeguards

We now extend the model to introduce uncertainty about the future volume of imports. Suppose that there is a probability $\pi^H$ that there will be a permanent increase in the foreign country supply of good 1 of an amount $e^H > 0$ from period $\tau < T$ onward. The foreign supply remains constant at its initial level with probability $\pi^L = (1-\pi^H)$. We examine the optimal trade agreement, where the agreement can specify a state-contingent tariff $t_s^i$ for $i = H, L$ and $s \geq \tau$. Since state $H$ corresponds to an import surge in the home country, an agreement that specifies higher tariffs in state $H$ can be interpreted as having a transitional safeguard.

The equilibrium prices for state $i$ will be

$$p(t_s, l_s, e^i) = \frac{A + A^* + a^* + (1+\phi^*)t_s - l_s - e^i}{2+\phi^*} \quad i = H, L, \quad s \geq \tau \tag{16}$$

where $e^L \equiv 0$. In the event of an import surge, the remaining factor owners in the import-competing sector will experience a loss in income at the initial tariff rate. The import surge will also require a greater movement of labor out of the import-competing sector to equalize wages between sectors at free trade, because $\tilde{l}^H(0) = \tilde{l}(0) - e^H$. The question is how tariff adjustments will be allocated over the life of the optimal agreement in response to an import surge.

Expressing the state contingent wage differential as $\Delta(t_s^i, l_s, e^i) = p(t_s, l_s, e^i) - 1$, the labor mobility constraints will be

$$\sum_{u=1}^{\tau-s-1} \Delta(t_{s+u}, l_{s+u},)(1-\delta)^{u-1}\beta^u + \sum_{i=L,H} \sum_{u=\tau-s}^{\infty} \pi^i \Delta(t_{s+u}^i, l_{s+u}, e^i)(1-\delta)^{u-1}\beta^u = G'(i_s) \quad s < \tau \tag{17}$$

$$\sum_{u=1}^{\infty} \Delta(t_{s+u}^i, l_{s+u}, e^i)(1-\delta)^{u-1}\beta^u = G'(i_s) \quad i = H, L, \quad s \geq \tau \tag{18}$$

where $t_s^i$ is the tariff anticipated in state $i$ for $s \geq \tau$. The labor market constraint shows that the promise of a higher tariff to compensate workers in the event of an import surge will have the effect of raising the return to workers from staying in sector 1 for $s < \tau$ and will deter labor reallocation.

Letting $\mu$ denote the multiplier associated with the labor mobility constraint (17) and $\mu_s^i$ the multiplier for the mobility constraint (18), we can define the accumulated effect of a relaxation of the mobility constraint in state $i$ at time $s \geq \tau$ to be $M_s^i = \sum_{u=0}^{\tau-1} \mu_u (1-\delta)^{s-1-u} + \sum_{u=\tau-s}^{\tau} \mu_u^i (1-\delta)^{s-1-u}$. The necessary condition for the choice of a tariff will be at

$$
\begin{aligned}
t_s &= \lambda(1-\delta)^s + M_s \ \text{ for } s \leq \tau \\
t_s^i &= \lambda(1-\delta)^s + M_s^i \text{ for } s > \tau \text{ and } i = L, H
\end{aligned}
$$

The effect of $\lambda$ on the setting of the tariff is the same in both the $L$ and $H$ states because of the assumption of risk neutrality on the part of workers. Although the price is lower in the import surge state $H$, the value of an additional dollar of income to workers is the same in either state. Therefore, state $H$ will have a higher tariff than state $L$ iff $M_s^H > M_s^L$, which requires that the labor mobility constraint be more binding in state $L$ than state $H$.

The solutions for the $M_s^i$ will be independent of the parameters of the export supply function for a given $T$. If the import surge is not sufficiently large that it leads to an increase in the optimal $T^H$, then there should be no adjustment in the tariff schedule in response to the import surge. In this case the effect of the import surge can be handled by attrition of the workforce in the import-competing sector at $T-1$ without requiring an adjustment in the tariff schedule. If the surge is sufficiently large, it will require an increase in the length of the transition period. Thus, an optimal safeguard will extend the transition period for shocks that are sufficiently large. However, the optimal safeguard will not increase the optimal agreement tariff at all points following the shock. Since workers are assumed risk neutral, the marginal utility of income for date $s > \tau$ is the same whether or not there is an import surge and there is no reason to transfer income to the states where the surge takes place. The adjustments in the tariff schedule that occur following an import surge are done to achieve an efficient exit path of workers from the industry.

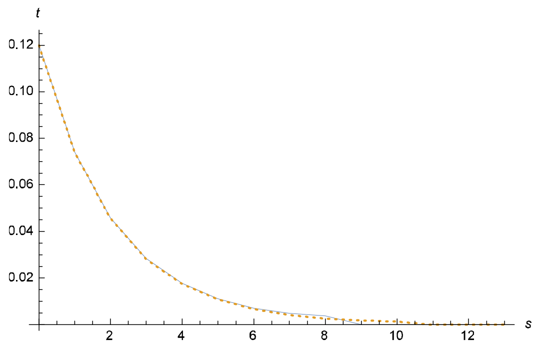



Figure 4:Tariff path with an import suge

(dashed) and without a surge (solid)

These points are illustrated in Figure 4, which compares the optimal tariff path in the event of an import surge in period 1 (dashed path) with that without an import surge (solid path). The parameter values for the case without an import surge are the same as in Figure 3, with the import surge being chosen to be sufficiently large that it extends the time required to eliminate the wage differential by 4 periods. Figure 4 illustrates that despite the significant magnitude of the import surge, it has virtually no effect on the optimal tariff path for these parameter values. The tariff policy in response to the import surge is a safeguard in the sense that it postpones the time until the tariff goes to 0, but the tariff path is also lower at some points. This could be interpreted as rotation of the tariff path in order to smooth out the larger adjustment required in response to an import surge. One reason the import surge has a minimal impact is that even though the adjustment period is extended, the optimal tariff is already so low near the end of the adjustment period that any extension of the path has minimal effect.

This result contrasts with the common inclusion of safeguards in trade agreements that allow significant postponement of tariff reductions in the event of import surges. If the assumptions of the present model regarding the objective function of the government and its ability to commit to policies are correct, then the above result suggests that the emphasis on including safeguards in trade agreements is misplaced. Under the assumption that labor is risk neutral, state contingent differences in tariffs are designed to alter the speed of adjustment rather than to affect the level of compensation to workers.

One extension that would justify a significant response of tariffs to import surges would be to introduce risk aversion on the part of workers When workers are risk averse, the marginal utility of income is higher in states where there is an import surge and the government could raise the expected utility of income by responding with an increase in the tariff.

## 4 Agreements with Trade Adjustment Compensation

Proposition 1 showed that the requirement of compensation for labor in the import-competing sector results in an exit from the import competing sector that is less than the socially optimal level when the only available policy instrument

is the tariff. In this section we allow for the possibility of an additional instrument by allowing the government to use labor market policies that influence the movement of workers between sectors. A trade agreement will thus specify both a time path for the tariff and a time path for labor market policies.

We can formalize this problem by choosing $l_s$ and $t_s$ to maximize the weighted world welfare function, $V^W + \lambda\Omega_m$, given the initial employment level in sector 1. Note that this problem modifies (12) by dropping the labor mobility constraints, since the government can directly control the movement of labor through the use of labor market instruments. We discuss below the labor market policies required to implement the optimal path for labor.

The necessary condition for the time path of the tariff is

$$t_s^L = \lambda^L (1-\delta)^s \tag{19}$$

In contrast with the necessary condition when there is no labor market instrument, (14), the tariff will be used only for compensation purposes when direct intervention in labor markets is possible. The labor market instrument will be targeted to influence the movement of workers out of the import-competing sector. As a result, the tariff will decline over time at rate $\delta$ due to the attrition from the labor force of workers initially employed in sector 1. Thus the availability of the labor market instrument reduces the rate of tariff reduction for $s > 0$. In particular, the tariff will not be eliminated in finite time, in contrast to the result of Proposition 1. A second effect of the labor market instrument is to reduce the distortion introduced by the existence of the payoff constraint, so that $\lambda^L < \lambda$. The multiplier on the payoff constraint reflects the reduction in world welfare due to an increase in the compensation paid to the workers in sector 1, which will be lower when the government has more policy instruments available.

The condition for the optimal choice of labor in sector 1 at time $s$ is

$$\Delta(t_s, l_s) - t_s = G'(i_{s-1}) - \beta(1-\delta)G'(i_s) \tag{20}$$

Condition (20) equates the loss in "social" value from delaying the move of a worker out of sector 1 to the savings in adjustment costs from delaying the move, where the "social" value of output in sector 1 is its value at the world price. This contrasts with the private no arbitrage condition, (7), which evaluates the value of moving at the domestic price. Workers value their wage in the import-competing sector at more than its social value when $t > 0$, which means that the optimal trade agreement will use a subsidy to workers moving out of the importable sector to speed up the adjustment process.

The adjustment process given by (20) will eventually reach a finite period $T^L$ at which there is no movement of continuing workers between sectors. With no adjustment costs incurred by workers for $s > T^L$, the right hand side of (20) will equal 0 and the market wage differential between sectors will satisfy $\Delta(t_s, l_s) = t_s > 0$. The optimal employment level in sector 1 will be

$$\tilde{l}_s^L = A + A^* + a^* - (2 + \phi^*) + \lambda^L (1 - \delta)^s \text{ for } s > T^L, \tag{21}$$

so employment in sector 1 will increase asymptotically to $\tilde{l}(0)$ as $t_s \to 0$. With a positive tariff, it will be optimal to hold employment in sector 1 below $\tilde{l}(0)$ because the domestic price of good 1 exceeds its social value.

For $s < T^L$, (20) can be used to obtain a system of equations that can be solved for $\{l_1, .., l_{T^L-1}\}$. It is shown in the Appendix that the employment level in the import competing sector will be decreasing in $\lambda$, with the $\lambda = 0$ resulting in the equilibrium with immediate free trade and no labor market intervention. This establishes that the adjustment path for labor in the import-competing sector will necessarily be non-monotonic. The initial level of employment is above the optimal level given by (21), so there will be an exit of workers until the time $T^L$ at which employment reaches $l^L(T^L)$. For the remaining time, employment will be increasing.

The following result, which is proven in the Appendix, formalizes these observations.

**Proposition 2** *The optimal trade agreement when both tariffs and labor market instruments are available has the following properties:*

*(a) The tariff at time s will be* $t_s^L = \lambda^L (1 - \delta)^s$.

*(b)The time path of labor in the importable sector will be non-monotonic. There will be a finite*

*time $T^L \geq 1$ such that the labor stock in the importable will be increasing as given by (21) for $s > T^L$. For $s \leq T^L$ , the labor stock will follow a decreasing path that reduces the labor stock from $l_0$to $l^L(T^L)$,*

*(c) Employment in the import-competing sector is decreasing in $\lambda^L$ for all $s$. There are no labor market interventions for $\lambda^L = 0$.*

The adjustment process characterized in Proposition 2 is illustrated in Figure 5 using the same demand, supply, and adjustment cost parameters as in Figure 3. Since the adjustment process is more efficient when the government can use a subsidy to labor that moves out of the import-competing sector, a given value of $\lambda$ results in a higher payoff to workers in the import-competing sector when the subsidy to mobility is used. Therefore, the employment and tariff paths in Figure 5 for the case with a mobility subsidy are derived using a value of $\lambda = .029$, which results in the same payoff to factors displaced by trade policy as in the case where the mobility subsidy is not available.

The left panel in Figure 5 shows the adjustment paths for employment in the import-competing sector. The employment path in the optimal policy with a mobility subsidy (solid line) lies below the path when only the tariff is used (dashed line). The path with a mobility subsidy results in declining employment in the import-competing sector until period 9, at which point all sectoral labor adjustments are done through attrition and without incurring any adjustment costs. The employment level in the import-competing sector rises over time after period 9, and asymptotically approaches the free trade level.

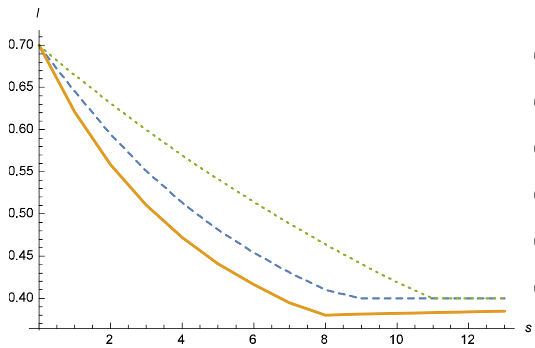
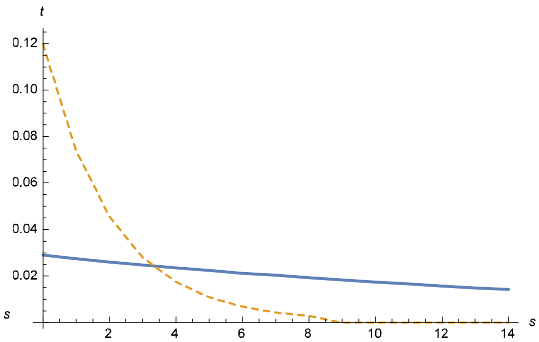



Figure 5:Employment Paths in Optimal Agreements: Tariff and labor subsidy (solid), Tariff only (Dashed)




Tariff path under optimal agreement with (solid) and without (dashed) labor subsidies

The right hand panel in Figure 5 compares the path of the tariff when the labor mobility subsidy is available (solid) with that when only the tariff can be used (dashed). When only a tariff is available, a high tariff in period 0 is used to transfer income to the workers adversely affected by the tariff because it has the least impact on the mobility constraints. When the labor market subsidy is available, there is a substantial reduction in the tariff in period 0, followed by a decline at rate $\delta$ thereafter. The labor market subsidy is used to influence movements of workers between sectors, so the tariff can be used to compensate workers without having to worry about its impact on moving decisions.

To derive the labor market interventions required to implement the optimal path, observe that a worker in the import-competing sector will earn a return of $\sigma_s - \sum_{u=1}^{\infty} \Delta(t_{s+u}, l_{s+u})(1-\delta)^{u-1}\beta^u$ from moving to the numeraire sector, where $\sigma_s$ is the moving subsidy. The optimal moving subsidy will be the value that equates the return to moving to the marginal cost of adjustment when evaluated at the optimal path, $\{t_s^L, l_s^L\}$,

$$\sigma_s = \sum_{u=1}^{\infty} \Delta(t_{s+u}^L, l_{s+u}^L)(1-\delta)^{u-1}\beta^u - G'(i_s^L) \; if \; i_s^L < 0 \tag{22}$$

Since $\Delta(t_s^L, l_s^L) = t_s > 0$ for $s > T^L$, the return to workers in the import-competing sector will exceed that in the numeraire sector at market prices for some $s > 0$. Therefore, it will also be necessary to impose a tax $v_s = \sum\limits_{u=1}^{\infty} \Delta(t_{s+u}, l_{s+u})(1-\delta)^{u-1}\beta^u$ for any $s$ at which $v_s$ to discourage additional workers from moving into the importable sector.

Figure 6 shows the optimal subsidy to moving out of the import competing sector (solid line) and the optimal tax on entry to the import-competing sector (dashed line). The tax on entry into the importable sector must be positive in periods where the present value of wages in the importable sector exceeds that in the numeraire sector. Referring to Figure 6, it can be seen that the combination of tariff protection and exit of workers from the importable sector means that the present value of wages in the importable sector exceeds that in the numeraire sector for $s > 0$,so it is necessary to tax entry into that sector to discourage new labor market entrants from locating there. This differential initially increases and reaches its maximum at the point point where exit of workers initially in the importable sector ceases. From period $T_L$ onward, the labor tax will decline and asymptotically approach 0 as the tariff is reduced.

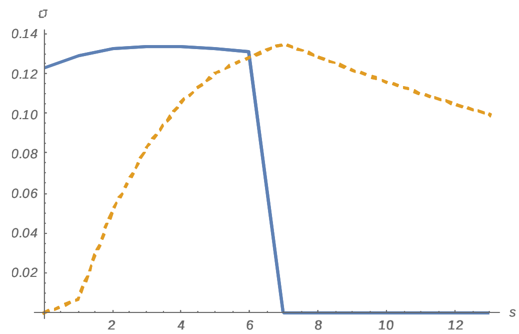



Figure 6: Subsidy to moving (Solid) and Tax on Entry to Importable Sector (Dashed)

Figure 6 also illustrates that the optimal moving subsidy to encourage exit of workers from the importable sector is relatively constant over the adjustment period. Observe from (22) that the optimal moving subsidy is the sum of the present value of the wage gap between the importable and numeraire sectors and the marginal cost of adjustment. As the adjustment period proceeds, the exit rate of workers from the importable sector decreases, which reduces the marginal adjustment cost. However, this effect is offset by the rising gain from remaining in the importable sector, as illustrated by the optimal wage tax. As a result of these offsetting effects, the subsidy to moving to the numeraire sector varies little over the adjustment period. Once period $T_L$ is reached, it is no longer necessary to move workers out of the importable sector and the moving subsidy is eliminated.

## 5 Discussion

The results of this paper can be used to address the questions raised in the introduction concerning the optimal path of tariffs during the phase-in period. The first question concerned how phase-in periods for developing countries should compare with those in developed countries. The model showed that the desire of the government to compensate workers in the import-competing sector will results in tariff reductions being spread over the entire adjustment period until wage rates are equalized between sectors when the tariff is the only instrument being used. The length of the adjustment period will depend on the level of adjustment costs and on the difference between the initial employment level and the free trade employment level. It will be appropriate for developing countries to have longer phase-in periods than developed countries if their marginal costs of adjustment are higher and/or if the initial employment levels are further from the free trade level. The latter case is likely to arise if initial tariffs are higher in developing countries.

On the other hand, developed countries may have access to more tools to facilitate the adjustment process. For example, suppose that developed countries are able to use subsidies/taxes on movements of labor between sectors that are not available to developing countries. In that case developing countries should be liberalizing more rapidly, because tariff reductions must be used to encourage movement out of the import competing sector when subsidies to movements between sectors.

A second question concerned whether agreements should involve equal adjustments in each period, as in the phase-in of new bindings following the Uruguay round. The results showed that when labor market instruments are not available, the tariff reductions should be front-loaded in order to accelerate the movement of factors out of the import competing sector. This result contrasts sharply with the back-loading of tariff and quota liberalization that occurred in the phasing out of the Multi-Fibre Agreement. [7]

[7] Cassing and Hillman [7] consider the case of a declining industry, and argue that the shrinking of the industry over time may result in a collapse in political support for protection.

A final question concerned the use of safeguards that allow countries to slow the pace of liberalization if it results in a surge of imports. Under the assumption of risk neutrality of labor, it was shown that when the likelihood of an import surge is high, the response should be to have higher tariffs at all points along the path rather than to have them respond only in states when the surge occurs. With risk neutrality, the main goal of tariff changes in response to an import surge should be to facilitate adjustment rather than to redistribute income.

The results have also suggested ways in which the model could be extended to examine other factors that affect the pace of trade liberalization. The assumption that workers pay for moving between is equal to the marginal social cost of moving means that trade policy does not have to be concerned with correcting distortions in factor markets. When there are externalities in the adjustment process, the optimal pace of trade liberalization may be affected. Relaxing the assumption of risk neutrality for workers is also of interest, since it would provide an incentive to respond to negative price shocks by raising tariffs.

# 6 Appendix

*Proof of Proposition 1:* The world welfare function is concave in the choice variables and the constraints are linear in the choice variables, so the Lagrangian function (12) is concave.

The necessary conditions for an optimum are given by

$$W_t^W(t_s, l_s) + (\lambda(1-\delta)^s + M_s)\, p_t(t_s, l_s) = 0$$

$$\begin{aligned} W_l^W(t_s, l_s) + (\lambda(1-\delta)^s + M_s)\, p_l(t_s, l_s) + & \quad (1-\delta)\left(G'(i_s) + \mu_s G''(i_s)\right) \\ -(1-\delta)\left(G'(i_{s-1}) + \mu_{s-1} G''(i_{s-1})\right)/\beta & \quad = \quad 0 \end{aligned}$$

Substituting from (11) and (7) yields the conditions (14) and (15) in the text.

Suppose that the optimal path has the property that there exists a time $T$ such that wages are equalized between sectors for $s \geq T$. We characterize this path, and then show that the optimal path must have this property. If $\Delta(t_s, l_s) = 0$ for $s \geq T$, then it follows from the labor mobility constraint (6) that $G'(i_{T-1}) = 0$ and hence $i_{T-1} \in [0, \delta l^m]$. Equalization of wages will imply $G'(i_s) = 0$ and $G''(i_s) = 0$ for $s \geq T-1$, so the necessary condition for choice of $l_s$ in (15) yields $t_s = 0$. The result that free trade is achieved for $s \geq T$ yields $M_s = -\lambda(1-\delta)^s$ from (14). Thus, there is free trade with wages equalized between sectors 1 and $N$ for $s \geq T$. The fact that $M_T < 0$ ensures that labor mobility constraint is binding for policy makers for $s < T$.

For $s < T$, we use (13) in (15) to obtain the system of equations

$$\begin{aligned} -\beta(1-\delta)M_{s+1}G''(i_s) + \quad & (\beta + G''(i_{s-1}) + \beta(1-\delta)^2 G''(i_s))M_s \\ -(1-\delta)G''(i_{s-1})M_{s-1} + \quad & \beta\lambda(1-\delta)^s = 0 \quad \text{for } s = 1,..,T-1 \end{aligned} \tag{23}$$

This system can be written in matrix form as $\mathbf{ZM} = -\boldsymbol{\lambda}\mathbf{D}$, where $\mathbf{M}$ is the $T-1$ vector whose $s^{th}$ element is $M_s$ and $\mathbf{D}$ is the $T-1$ vector with $s^{th}$ element $(1-\delta)^s$. Using the fact that $G"(i_s) = \gamma$ for $s = 1, ..., T-1$ and $G"(i_T) = 0$, the matrix $\mathbf{Z}$ will have diagonal elements $z_{ss} = \left(1 + \frac{\gamma}{\beta} + \gamma(1-\delta)^2\right)$ for $s = 1, .., T-2$ and $z_{T-1,T-1} = \left(1 + \frac{\gamma}{\beta}\right)$. The off-diagonal elements are $z_{s,s+1} = -\gamma(1-\delta)$ for $i = 1, ...T-2$, $z_{s,s-1} = -\gamma(1-\delta)/\beta$ for $i = 2, ...T-1$, and 0 for all other elements.

Since the matrix $\mathbf{Z}$ is independent of $\lambda$, the solution $\mathbf{M} = -\lambda\mathbf{Z}^{-1}\mathbf{D}$ is homogeneous of degree 1 in $\lambda$. Also, since $\mathbf{Z}$ is a matrix with positive and negative off diagonal elements and has positive column sums, $\mathbf{Z}$ has a dominant diagonal . It then follows from Theorem 4.C.3 in Takayama [23] that $\lambda\mathbf{D} < 0$ implies $\mathbf{M} \leq 0$. To show that $\mathbf{M} < 0$ in this case, suppose that $M_s = 0$ for some $s$.

Then the $s^{th}$ element of $\mathbf{ZM}$ will be $\sum_{j \neq s} z_{sj} M_j \geq 0$, since $z_{sj} \leq 0$ for $j \neq s$ and $M_j \leq 0$. However, this cannot be a solution because it contradicts $\mathbf{D} < 0$. Therefore, we have $M_s < 0$ for all $s$. The necessary condition (14) can then be used to solve for the time path of tariff rates $\mathbf{t}$, which will be homogeneous of degree 1 in $\lambda$.

This system of equations (23) yields solution $\mathbf{M}(T)$ and $t(T)$ that depend on the terminal time $T$. The optimal value of $T$ will be the one for which $l_{T-1}(\lambda) \leq \tilde{l}(0)/(1-\delta)$, which means that wages can be equalized between sectors in the following period from attrition of workers in the import-competing sector. To solve for the path of employment levels for a given terminal time $T$, we note that for $s < T$, (7) yields a system of equations $\tilde{\mathbf{Z}}\mathbf{l} = \mathbf{B}$. The diagonal elements of $\tilde{\mathbf{Z}}$ are given by $\tilde{z}_{ss} = \left(\frac{1}{2+\phi^*} + \frac{\gamma}{\beta} + \gamma(1-\delta)^2\right)$ for $s = 1, .., T-2$ and $\tilde{z}_{T-1,T-1} = \left(\frac{1}{2+\phi^*} + \frac{\gamma}{\beta}\right)$. The off-diagonal elements of $\tilde{\mathbf{Z}}$ are identical to those in $\mathbf{Z}$. $\mathbf{l}$ denotes the vector of employment levels, and $\mathbf{B}$ is the vector with $b_1 = \frac{A+A^*+a^*-t_1(1+\phi^*)}{2+\phi^*} - 1 + \frac{\gamma(1-\delta)}{\beta} l_0$ and $b_s = \frac{A+A^*+a^*-t_s(1+\phi^*)}{2+\phi^*} - 1$ for $s = 2, .., T-1$.

Since $t(s)$ is increasing in $\lambda$, $\mathbf{B}$ is decreasing in $\lambda$ and we can use an argument similar to that above to establish that $\mathbf{l}$ will be increasing in $\lambda$. Denoting the terminal point in the optimal agreement by $T^*(\lambda)$,the fact that $l_{T-1}(\lambda)$ is increasing in $\lambda$ means that $T^*(\lambda)$ is non-decreasing in $\lambda$.

**Proof of Proposition 2:** The Lagrangian for this problem will be

$$\max_{l_s, t_s} L = \sum_{s=0}^{\infty} \left[W^W(t_s, l_s) - G(l_{s+1} - (1-\delta)l_s) + \lambda^L p(t_s, l_s)(1-\delta)^s\right] \beta^s$$

The necessary conditions for choice of $t_s$ and $l_s$ are

$$\begin{aligned} W_t^W(t_s,l_s) + \lambda^L p_t(t_s,l_s) &= 0 \\ W_l^W(t_s,l_s) + \lambda^L p_l(t_s,l_s) + (1-\delta)G'(i_s) - G'(i_{s-1})/\beta &= 0 \end{aligned}$$

Substituting from (11) and (7) yields the necessary conditions (19) and (20) in the text.

The fact that $i_s < 0$ for $s < T^L - 1$ and $i_{T^L-1} \in (0, \delta l^m)$ means that $G'(i_s) = \gamma i_s$ for $s < T^L - 1$ and $G'(i_{T^L-1}) = 0$. Substituting these results into (20) gives the system of $T^L - 1$ equations that can be expressed in matrix form as $\mathbf{Zl} = \mathbf{B}^L$, where $\mathbf{B}$ and $\mathbf{l}$ are as defined in the proof of Proposition 1 and $b_1^L = \frac{A+A^*+a^*-\lambda^L(1-\delta)}{2+\phi^*} - 1 + \frac{\gamma(1-\delta)}{\beta}l_0$ and $b_s = \frac{A+A^*+a^*-\lambda^L(1-\delta)^s}{2+\phi^*} - 1$ for $s = 2,..,T-1$.This system of equations will determine $l_1,..l_{T-1}$, given $l_0$ and $T^L$. In order for this system to be consistent with reaching no adjustment costs at $T^L$, the solution must yield $l_{T^L-1} \in [l^L(T^L-1)/(1-\delta), l^L(T^L))$. Since $\mathbf{B}^L$ is decreasing in $\lambda$ and $\mathbf{Z}$ has a dominant diagonal, we can use the same arguments as in the proof of Proposition 1 to show that employment in sector 1 is decreasing in $\lambda$ for $s < T^L$.

# References


[1] Bagwell Kyle and Robert W. Staiger (2002), *The Economics of the World Trading System*, MIT Press (Cambridge)

[2] Baldwin, Richard and Frederic Robert-Nicoud (2007), Entry and Asymmetric Lobbying: Why Governments Pick Losers, *Journal of the European Economic Association*, 5 (5), 1064-93.

[3] Beshkar, Mostafa and Eric W. Bond (2015), The Escape Clause in Trade Agreements, manuscript.

[4] Bond, Eric W (2008), "Adjustment Costs and Sequencing of Trade Liberalization," World Economy, 31, 97-111.

[5] Bond, Eric W. and Jee-Hyeong Park, Gradualism in Trade Agreements with Asymmetric Countries, *Review of Economic Studies,* 2002,

[6] Brander, James and Barbara Spencer (1994), "Trade Adjustment Assistance: Welfare and Incentive Effects of Payments to Displaced Workers," J*ournal of International Economics*, 36.239-261.

[7] Cassing, James and Arye Hillman (1986), Shifting Comparative Advantage and Senescent Industry Collapse, *American Economic Review*, 76 (3), 516-523.

[8] Corden, W.M. (1974), *Trade Policy and Economic Welfare*, Oxford University Press.

[9] Carneiro, "Trade Liberalization and Labor Market Dynamics," *Econometrica*, 2014.

[10] Ethier, Wilfred J. (2002), "Unilateralism in a Multilateral World," *Economic Journal*, 112, 266-292.

[11] Furusawa, Taiji and Edwin Lai (1997), “Adjustment Costs and Gradual Trade Liberalization”, *Journal of International Economics*, 49, 333-361.

[12] Grossman, Gene M and Elhanan Helpman, 1995. " Trade Wars and Trade Talks," *Journal of Political Economy*, 103, 675-708.

[13] Hillman, Arye (1982), Declining Industries and Political Support Protectionist Motives," *American Economic Review*, 72 (5), 1180-87.

[14] Karp, Larry and Thierry Paul (1994), “Phasing in and Phasing out Protectionism with Costly Adjustment,” *Economic Journal*, 104, 1379-92.

[15] Lapan, Harvey E (1978), “International Trade, Factor Market Distortions, and the Optimal Dynamic Subsidy,” *American Economic Review,* 66, 335-46.

[16] Maggi, Giovanni and Andres Rodriguez-Clare (2007), “A Political Economy Theory of Trade Agreements," *American Economic Review*, 97, 1374-1406.

[17] Marcet, Albert and Ramon Marimon (2011), "Recursive Contracts," manuscript.

[18] Mussa, Michael (1978), “Dynamic Adjustment in the Heckscher-Ohlin Samuelson Model,” *Journal of Political Economy*, 775-91.

[19] Mussa, Michael (1982), “Government Policy and the Adjustment Process,” in Import Competition and Response, J. Bhagwati (ed), University of Chicago Press (Chicago).

[20] Smith, Adam (1776), *The Wealth of Nations*,

[21] Staiger, Robert (1995), "A Theory of Gradual Trade Liberalization", in J. Lenvinsohn, A. Deardorff, and R. Stern (eds), *New Directions in Trade Theory* (Ann Arbor: University of Michigan Press)

[22] Stokey, Nancy and Robert Lucas, with Edward Prescott (1989), *Recursive Methods in Economic Dynamics*, Harvard University Press (Cambridge).

[23] Takayama, Akira (1974), *Mathematical Economics*, Dryden Press (Hinsdale).

# Price controls versus compulsory licensing: effects on patent-holders and consumers

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**Abstract**

We extend the model of Bond and Saggi (2014) in which a patent-holder chooses between direct entry and the voluntary licensing of its technology to a local firm in a developing country. We compare two scenarios: one where the country imposes a price control on the patent-holder and another where it issues a compulsory license to the local firm if the patent-holder decides to neither enter nor license its technology voluntarily. A price control makes entry less attractive to the patent-holder relative to voluntary licensing whereas the threat of compulsory licensing has the opposite effect. While a price control always makes the patent-holder worse off, the option of compulsory licensing can sometimes be to its advantage.

*Keywords*: Patented Goods, Compulsory Licensing, Voluntary Licensing, Price Controls, Quality, Welfare. *JEL Classifications*: F13, F10, F15.

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# 1 Introduction

When the Doha Round of trade negotiations was launched in 2001, there was an expectation among developing countries that their interests would figure prominently in the ensuing negotiations. Indeed, the Doha ministerial conference explicitly stated that since majority of the members of the World Trade Organization (WTO) were developing countries, the Doha work programme would seek to place their needs and interests at its core. This was a welcome development from the viewpoint of developing countries, many of whom viewed the Uruguay Round (1986-1993) as having bequeathed a bargain that was biased in favor of developed countries. Perhaps the most problematic outcome of the Uruguay Round from the perspective of developing countries was the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) – a multilateral agreement that requires all WTO members, regardless of their level of economic development, to grant certain minimum levels of protection to all major forms of intellectual property.

Of course, by their very nature, intellectual property rights (IPRs) create monopoly power for rights holders. For example, the holder of a patent over an invention has the right to exclude others from making, using, or offering the invention for sale. The expansion in the global reach of such monopoly power via the world-wide enforcement of IPRs can be rather problematic in the realm of patented pharmaceuticals, at least some of which are frequently needed for addressing significant public health concerns. While the issue of affordability of patented pharmaceuticals takes on a special urgency in the context of poor developing countries, it is also relevant within the developed world. It is no surprise then that governments across the world use price controls and other such regulations to combat the monopoly power of firms selling patented pharmaceuticals.[1]

As one might expect, price regulation in the pharmaceutical industry has important consequences for consumers. For example, in her structural study of 155 pharmaceutical products sold in India during 2001-03, Dutta (2011) found that consumers derived substantial benefits from price controls. Similarly, Chatterjee et al. (2013) argue that the removal of price controls in the oral anti-diabetic segment of the Indian pharmaceutical market would have significant negative repercussions for consumers. While appealing, the use of price controls can become counter-productive if foreign pharmaceutical companies refuse to sell their patented medicines in markets where they find such controls to be too stringent. In her large sample study spanning 68 countries over the time period 1982-2002, Lanjouw (2005) found that the presence of price regulations in countries delayed the introduction of new drugs by pharmaceutical companies into their markets. Similar results were found by Kyle (2005) in her study of the 28 largest pharmaceutical

[1]It is noteworthy that while TRIPS requires patented inventions to be protected from imitation for a duration of twenty years, it does not constrain countries from combating the market power of patent-holders by the use of price regulations.

markets in the world. Thus, while price controls can be effective in improving consumer access to patented pharmaceuticals conditional on local availability, they run the risk that patent-holders deliberately choose to make their products unavailable in countries that impose them.

An alternative strategy that governments can use for providing local consumers access to patented foreign pharmaceuticals that are not sold locally is to issue compulsory licenses for such products to local firms.[2] Multilateral rules governing the use of compulsory licensing (CL) by member countries of the WTO are contained in Article 31 of TRIPS. As per this Article, the use of CL is only justified if the entity seeking a compulsory license has failed to obtain a voluntary license from the patent-holder on "reasonable" commercial terms. Furthermore, the government issuing the compulsory license has to ensure that "adequate remuneration" is paid to the patent-holder in return for the right to produce its patented product locally.[3] While Article 31 requires that any sales under CL should be predominantly for the domestic market of the country issuing the license, the 2001 Doha Ministerial conference relaxed this rule by allowing compulsory licenses for patented foreign products to be issued to producers in third countries. The objective of this modification was to bring CL within reach of those countries that lacked the technological capability to produce patented pharmaceuticals and other necessary products locally.

Building on related previous work (Bond and Saggi, 2014), in this paper we contrast the roles of price controls and CL as alternative instruments for improving consumer access to patented foreign products in developing countries. In the model, a developing country (called South) sets the level of the price control while the patent-holder chooses between direct entry and the voluntary licensing (VL) of its technology to a local firm. The model assumes that while the fixed costs incurred under VL are relatively lower, so is the quality of production. We compare two scenarios: one where the South attempts to improve consumer access via the use of a price control and another where it resorts to CL if the patent-holder chooses to not work its patent locally. In accordance with the available case-study evidence pertaining to the implementation of CL in developing countries, we assume that the local firm's quality of production under CL is lower than that under entry.[4] For simplicity, we assume that there is no quality differential between the two types of licensing.

[2] As Saggi (2016) notes, the right to issue a compulsory license is perhaps the most important flexibility that is available to WTO members under TRIPS.

[3] Overall, Article 31 seems to grant a fair bit of discretion to countries seeking to use CL. For example, "reasonable commercial terms" remains undefined and open to different interpretations. Similarly, it is far from clear as to what level of remuneration to the patent-holder should be considered "adequate" in the event of CL.

[4] For a discussion of some of the relevant case studies, see Baron (2008), Lybecker and Fowler (2009), Daemmrich and Musacchio (2011), Bond and Saggi (2014), and Harris (2014).

The analysis in Bond and Saggi (2014) focused on the case where the licensee's fixed cost advantage is large relative to its quality disadvantage and it showed that, depending on parameter values, the patent-holder may choose to serve the Southern market by either VL or entry in the absence of price controls. In this paper we consider the case where the licensee's fixed cost advantage is small relative to its quality disadvantage. The present case is likely to arise for sophisticated production processes in which a potential Southern licensee faces a significant handicap when attempting to undertake local production of the patented product and/or where the patent-holder has a high degree of familiarity with the Southern market so that the fixed cost disadvantage of entry is small. We show that in such a case, in the absence of a price control, the patent-holder either directly enters the market or it stays out – i.e. VL does not emerge in equilibrium when monopoly pricing is permitted. However, it turns out that the use of a price control by the South tilts the patent-holder's choice in favor VL. Indeed, we find that there exists a range of price controls and fixed costs for which VL can end up emerging in equilibrium. Intuitively, due to the higher quality of production under entry, the monopoly price under entry exceeds that under VL so that a price control penalizes the profitability of entry to a relatively larger degree.

Due to the presence of mode-specific fixed costs, both entry and VL can be unprofitable for the patent-holder even when its pricing is completely unconstrained by the South. Clearly, in such a situation, Southern consumers obtain no access to the product and the South's price control policy is rendered inconsequential. If only entry is profitable, it is optimal for the South to set the price control ($\bar{p}$) at a level that allows the patent-holder to just break even (i.e. cover its fixed cost of entry) – anything more stringent simply results in complete loss of access to the product. A price control set at the break-even price hurts the patent-holder by driving its net profit to zero but it increases Southern welfare.

When both modes of supply are profitable, a given price control ($\bar{p}$) is more binding under entry relative to VL since the optimal monopoly price under entry is higher due to the lower quality of production under VL (i.e. $p_E^* \geq p_L^*$ since $q_E \geq q_L$). When the break-even price under entry ($\overline{p}_E$) is lower than that under VL ($\overline{p}_L$), it is optimal for the South to set the price control at $\overline{p}_E$ since entry is doubly preferable to VL: it not only offers a higher quality product, it does so at a lower price than VL. However, when $\overline{p}_L \leq \overline{p}_E$, the South has to decide whether to set a price control that just allows the patent-holder to break-even under VL (i.e. set $\bar{p} = \overline{p}_L$) or to set a sufficiently lax price control at which the patent-holder prefers entry: even though profits are positive under both modes, the entry inducing price control $\widetilde{p}$ is such that entry is marginally more profitable for the patent-holder. Setting the price control $\bar{p} = \overline{p}_E$ is not optimal when $\overline{p}_E \geq \overline{p}_L$ since doing so induces the patent-holder to choose VL (under which it earns positive profit). From the patent-holder's viewpoint, the scenario where $\bar{p} > \overline{p}_E$

is necessarily better but the South also prefers it when the quality of production under VL is fairly low.

Our analysis shows that the option to use CL ensures that at least a lower quality version of the patented good is available locally if the patent-holder decides not to work its patent in the South. However, the very possibility of CL also makes it less likely that the patent-holder chooses to sell in the South. The threat of CL reduces the patent-holder's profits under VL by lowering the fee that the local licensee is willing to pay. Similarly, since the royalty payments under CL provide the patent-holder a return from the Southern market if it chooses to stay out, entry becomes relatively less attractive as well. When CL *replaces* entry, it can lower Southern welfare because it not only delivers a lower quality product to consumers, it does so with some *delay*.

Overall, our results show that the social value of CL is very much context dependent. When the fixed cost of entry is high relative to the size of the Southern market, CL plays a socially useful role that can be to the advantage of both the South and the patent-holder since the South obtains access while the patent-holder receives royalties from a market in which it would not have entered in the absence of CL. On the other hand, when fixed costs are of an intermediate level such that the patent-holder prefers to wait for CL rather than entering itself, the South is made worse off by the option of CL. Finally, when fixed costs are so small that the patent-holder chooses to enter regardless of whether the South has the option to issue CL or not, the threat of CL does not affect market outcomes and welfare.

The rest of the paper is organized as follows. Section 2 introduces the model of the patent-holder's choice between VL and entry and identifies the fixed cost/product quality trade-off between the two modes of supply. Section 3 analyzes the effect of price controls on the entry/licensing decision of the patent-holder and derives the South's optimal price control. Section 4 considers the alternative case under which the South does not use a price control, but has the ability to issue a compulsory license that is consistent with the relevant WTO rules. Here, we also compare the effects of price controls and CL on the patent-holder's decision and on the welfare of the two parties. Section 5 provides some concluding remarks.

## 2 Model

Since the basic purpose of the paper is to complete the analysis of the model of price controls and CL introduced in Bond and Saggi (2014), we begin by describing the basic structure of this model. Consider a Northern firm (referred to as the "patent-holder") that produces a good protected by a patent for $T$ periods. There are a continuum of Southern consumers of measure 1, each of whom buys (at most) one unit of the product. If a consumer buys the good at price $p$, its utility is $U = \theta q - p$ where $q$ measures quality and $\theta \geq 0$ is a taste parameter that captures the willingness to pay for quality. For simplicity, $\theta$ is assumed to be uniformly distributed over the interval [0,1]. Normalizing utility under no purchase to zero, the per-period demand in the South is $d(p, q) = 1 - p/q$.

If the patent-holder decides to enter the Southern market and produce the good itself then its quality level equals $q_E$. To be able to produce the good, the patent-holder has to incur the fixed entry cost $\varphi$. The parameter $\varphi$ captures the costs of obtaining any necessary approval from local authorities as well as the costs of establishing an effective marketing and distribution network.

The patent-holder can also sell its product in the South by licensing its technology to a local firm. For simplicity, we assume that there is only a single local firm with sufficient capability to be an effective licensee. Since the purpose of the model is to analyze the role of compulsory licensing (CL), we refer to the patent-holder choosing to license on its own terms as voluntary licensing (VL). Since VL allows the patent-holder to use the local licensee's existing distribution and retail network, the fixed cost of VL is assumed to be lower than that of direct entry and is denoted by $\alpha\varphi$ where $0 < \alpha < 1$.[5] The parameter $\alpha$ captures the fixed cost savings of VL relative to entry. The disadvantage of VL is that the quality of production under it ($q_L$) is lower than under entry: $q_L = \gamma q_E$ and $\gamma < 1$ captures the quality disadvantage of VL relative to entry.

Normalizing the cost of production under VL to zero, the monopoly price for the licensee equals $p_L^* = q_L/2$. The maximum gross profits accruing to the licensee over the life of the patent when facing the price control $\bar{p}$ are given by:

$$v_L(\bar{p}, q_L) = (1 + \Omega)\pi_L(\bar{p}, q_L) \text{ where } \pi_L(\bar{p}, q_L) \;\equiv \min[\bar{p}, p_L^*]\left(1 - \frac{\min[\bar{p}, p_L^*]}{q_L}\right) \qquad (1)$$

where $\Omega = \sum_{t=1}^{T} \beta^t$ converts future flow profits to present value and $0 < \beta \leq 1$ is the per period discount factor.[6]

[5] Chatterjee et. al. (2013) discuss how Novartis decided to license vildagliptin (an ant-diabetic drug) to a local Indian firm called USV in order to take advantage of its established presence and reach in the market. A similar strategy was used by Merck to sell sitagliptin in India. Thus, one advantage of VL is that it allows patent-holders to utilize the established marketing and distribution networks of their local licensees.

[6] The distinction between first period and subsequent returns plays an important role in the analysis of compulsory licensing in Section 4, since we interpret the first period as the waiting period required before a compulsory license can be imposed by the South. This period is intended to capture the time window granted by TRIPS for the patent-holder to have an adequate opportunity to work its patent in the South.

Assuming that the marginal cost of production under entry is the same as that under VL, the present value of the maximum gross profits the patent-holder earns by selling in the South via direct entry when facing the price control $\bar{p}$ equals

$$v_E(\bar{p}) = (1+\Omega)\pi_E(\bar{p}) \text{ where } \pi_E(\bar{p}) \equiv \min[\bar{p}, p_E^*]\left(1 - \frac{\min[\bar{p}, p_E^*]}{q_E}\right) \tag{2}$$

where $p_E^* = q_E/2 > p_L^*$ is the unconstrained monopoly price under entry. The absence of a price control is then equivalent to $\bar{p} \geq p_E^*$.

Southern welfare under VL equals

$$W_L(\bar{p}, q_L) = (1+\Omega)S(\min[\bar{p}, p_L^*], q_L) + \pi_L(\bar{p}, q_L)] - \alpha\varphi - f \tag{3}$$

where $f$ denotes the licensing fee paid to the patent-holder and $S(p, q_L) = (q_L/2)(1 - p/q_L)^2$ measures consumer surplus at price $p$ and quality $q_L$. Southern welfare under entry ($W_E$) consists (solely) of consumer surplus that accrues to the South over the life of the (higher quality) product sold by the patent-holder:

$$W_E(\bar{p}, q_E) = (1+\Omega)S(\min[\bar{p}, p_E^*], q_E) \tag{4}$$

Thus, while VL has the potential to provide the South some benefits in terms of the profits of the local firm (net of the license fee), these benefits come at the cost of having a lower quality product relative to entry. If the market is not served, the South receives a payoff of 0.[7]

We begin with the benchmark case where the only instrument available to the South for improving consumer access is the price control $\bar{p}$. Then, we allow the South to use CL in the event the patent-holder does not work its patent in the South.

# 3 Price controls and consumer access

In what follows, we first analyze interaction between the patent-holder and the Southern government (referred to as simply "the South" from hereon) in a two stage game in which the South does not have the option to use CL if the patent-holder refrains from selling locally.

[7] Our analysis implicitly assumes that once the patent expires, the product is supplied by competitive generic producers so that Southern welfare equals the consumer surplus associated with the generic version of the product. We assume that the payoff following the expiration of the patent is independent of whether the product is supplied to the South as well as of the mode (entry or VL) via which it is supplied during the period when it is still under patent. This assumption allows us to simplify exposition by dropping the welfare accrued after the expiration of the patent from the South's payoff function.

In the first stage of the game, the South chooses its price control $\bar{p}$. To avoid any hold-up problem, we assume that once the price control has been set, the South is committed to it for the remainder of the game. Given the price control set by the South, the patent-holder chooses between entry, VL, and not selling in the South. Under VL, the patent-holder makes a take it or leave it offer to the Southern firm. If the Southern firm accepts the offer, it acts as a licensee and transfers the present value of its product market profit stream to the patent-holder as the licensing fee $f_L(\bar{p})$. This is because if it rejects the offer, the Southern firm earns zero profits since it lacks the right to produce the patented product independently.

## 3.1 Patent-holder's decision

To determine how the patent-holder's choice between VL and entry depends upon the price control $\bar{p}$, first note that since $p_E^* > p_L^*$ a given price control either (i) binds under neither entry nor VL (i.e. $\bar{p} = p_E^*$); (ii) binds only under entry (i.e. $p_L^* \leq \bar{p} < p_E^*$); or (iii) binds under both modes (i.e. $\bar{p} < p_L^*$).

Denote the present value of the patent-holder's payoff under monopoly pricing by $v_Z^*$ where $Z = L$ or $E$. The present value differential between the two modes as a function of the price control $\bar{p}$ can be written as:

$$\Delta v(\bar{p}) \equiv v_E(\bar{p}) - v_L(\bar{p}) = \begin{cases} \Delta v^* = v_E^* - v_L^* = \frac{q_E(1+\Omega)(1-\gamma)}{4} & \bar{p} \geq p_E^* \\ \Delta v_1(\bar{p}) = (1+\Omega)\left[\bar{p}(1-\frac{\bar{p}}{q_E}) - \frac{q_L}{4}\right] & p_L^* \leq \bar{p} < p_E^* \\ \Delta v_2(\bar{p}) = (1+\Omega)\frac{\bar{p}^2}{q_E}\left(\frac{1-\gamma}{\gamma}\right) & \bar{p} < p_L^* \end{cases} \quad (5)$$

Direct calculations establish the following:

**Lemma 1**: *(i)* $\frac{\partial \Delta v(\bar{p})}{\partial \bar{p}} > 0$ *for* $p < p_E^*$*; (ii)* $\frac{\partial \Delta v^*}{\partial \bar{p}} = 0$; *(iii)* $\frac{\partial^2 \Delta v_1(\bar{p})}{\partial^2 \bar{p}} < 0$*; and (iv)* $\frac{\partial^2 \Delta v_2(\bar{p})}{\partial^2 \bar{p}} > 0$.

Part $(i)$ of Lemma 1 simply says that as the price control becomes less stringent, the present value differential between entry and VL increases for any price at which the control is binding for at least one mode of serving the market. For $\bar{p} \in (p_L^*, p_E^*)$, VL becomes relatively more attractive because the price control only binds under entry. For $\bar{p} < p_L^*$ a more stringent price control lowers profitability under both modes, but it is *more binding under entry* since $p_E^* > p_L^*$.

Part (*ii*) notes that if the price control lies above the optimal price under entry, the present value differential is independent of the price control since the patent-holder is free to charge its optimal price under both modes of supply. Parts (*iii*) and (*iv*) say that if the price control binds only under entry then the present value differential between entry and VL is concave in the level of the price control, whereas it is convex when it binds under both modes.

We now utilize the present value differential in (5) to derive the patent-holder's optimal decision. We begin with the case where the price control is so lax that the patent-holder can charge its optimal monopoly price under direct entry and VL (i.e. $\bar{p} \geq p_E^*$). The patent-holder prefers entry to VL iff $v_E^* - \varphi \geq f_L(p_L^*) = v_L^* - \alpha$ which implies that entry is preferred by the patent-holder iff

$$\varphi \leq \tilde{\varphi} \equiv \Delta v^*/(1-\alpha) \tag{6}$$

Furthermore, each mode of selling in the South is profitable iff the fixed cost of each mode lies below the present value of the respective profit stream:

$$\varphi \leq \varphi_E \equiv v_E^* \text{ and } \varphi \leq \varphi_L \equiv v_L^*/\alpha \tag{7}$$

The patent-holder's choice between entry and VL depends on the following trade-off. Though the fixed cost of VL is lower than that of entry (since $\alpha < 1$), the revenue earned by the licensee is smaller due to the lower quality of its product (i.e. $q_L = \gamma q_E$ where $\gamma < 1$). When $\gamma \leq \alpha$, the fixed cost saving under VL is dominated by the product quality advantage of entry and the break-even level of fixed cost for entry is lower than that for VL. Since the case where $\gamma > \alpha$ has been analyzed exhaustively in Bond and Saggi (2014), through-out the rest of the paper we assume that the cost advantage of licensing is dominated by its quality disadvantage:

**Assumption 1**: $\gamma \leq \alpha$.

Note that Assumption 1 implies that $\varphi_L \leq \varphi_E$ – i.e. VL is profitable over a smaller range of fixed costs than entry. In other words, whenever entry is unprofitable for the patent-holder so is VL. Using inequalities (6) and (7) we can show the following:

**Proposition 1**: *Given Assumption 1 ($\gamma \leq \alpha$), the patent-holder chooses to enter for all $\varphi \in [0, \varphi_E]$ whereas it does not work its patent in the South for all $\varphi > \varphi_E$.*

In other words, when the patent-holder is free to charge its optimal monopoly prices under both modes, VL does not occur in equilibrium. However, it is still interesting to analyze VL since, as we will see below, the use of a price control by the South tilts the patent-holder's choice between entry and VL in such a way that VL can arise in equilibrium due to the imposition of a price control.

We are now ready to consider the case where the South imposes a price control that binds on the patent-holder. It is useful to define the break-even price for entry $\overline{p}_E(\varphi)$ as the solution to $v_E(\bar{p}) = \varphi$. It is clear that $\overline{p}_E(\varphi)$ is continuous and increasing over $[0, v_E^*]$. Since there is no price at which the patent-holder can break even for $\varphi > v_E^*$, we set $\overline{p}_E(\varphi) = \infty$ for $\varphi > v_E^*$. Similarly the break-even price for VL is denoted by $\overline{p}_L(\varphi)$, which is continuous and increasing on $[0, v_L^*]$ and equal to $\infty$ for $\varphi > v_L^*$.

It is obvious that the patent-holder does not serve the Southern market if $\bar{p} < \min[\overline{p}_L(\varphi) < \overline{p}_E(\varphi)]$. If $\bar{p}_E(\varphi) \leq \bar{p}_L(\varphi)$, Lemma 1(i) ensures that entry is more profitable for the patent-holder than VL for all price controls for which it is profitable (i.e. $\bar{p} \geq \bar{p}_E(\varphi)$). If $\bar{p}_L(\varphi) < \bar{p}_E(\varphi)$, then entry is the more profitable mode if

$$\Delta v(\bar{p}) \geq (1-\alpha)\varphi \tag{8}$$

If $\bar{p}_L(\varphi) < \bar{p}_E(\varphi)$ and $\varphi \leq \tilde{\varphi}$, there exists a price $\widetilde{p}(\varphi)$ at which

$$\Delta v(\bar{p}) = (1-\alpha)\varphi = 0$$

We refer to $\widetilde{p}(\varphi)$ as the *entry-inducing* price, since the patent-holder prefers entry to VL if $\bar{p} \geq \widetilde{p}(\varphi)$.[8]

We can show the following:

**Proposition 2**: *For all price controls $\bar{p} \in [0, p_E^*)$, there exists a threshold level of fixed cost $\varphi_0 \in (0, \varphi_L]$ such that the following hold:*

*(i) For $\varphi \in (0, \varphi_0)$ we have $\overline{p}_L(\varphi) < \overline{p}_E(\varphi) < \tilde{p}(\varphi)$ and the patent-holder opts for VL if $\overline{p}_L(\varphi) \leq \bar{p} < \tilde{p}(\varphi)$; it enters if $\overline{p} \geq \widetilde{p}(\varphi)$; and does not serve the Southern market otherwise.*

*(ii) For $\varphi \in (\varphi_0, \varphi_L]$, we have $\overline{p}_E(\varphi) \leq \overline{p}_L(\varphi)$ and the patent-holder enters if $\bar{p} \geq \overline{p}_E(\varphi)$ whereas it does not serve the market otherwise.*

*(iii) The threshold value $\varphi_0$ has the property that $\frac{\partial \varphi_0}{\partial \alpha} < 0 < \frac{\partial \varphi_0}{\partial \gamma}$.*

The intuition underlying this result follows from Lemma 1$(i)$: as the price control $\bar{p}$ becomes more stringent, the profit advantage of entry over VL is reduced. Therefore, the fixed cost advantage of VL starts to become more important as $\bar{p}$ falls so that VL becomes a viable option over some range of fixed costs – i.e. for $\varphi \in (\varphi_0, \varphi_L]$ – when $\bar{p}$ is sufficiently low. The threshold value of the fixed cost $(\varphi_0)$ below which VL is a viable option is higher if the licensee enjoys a greater fixed cost advantage and a smaller quality disadvantage.

[8] Of course, if $\bar{p}_L(\varphi) < \bar{p}_E(\varphi)$ and $\varphi > \tilde{\varphi}$, no entry inducing price will exist. As with the break-even prices, we define $\tilde{p}(\varphi) = \infty$ in this case.

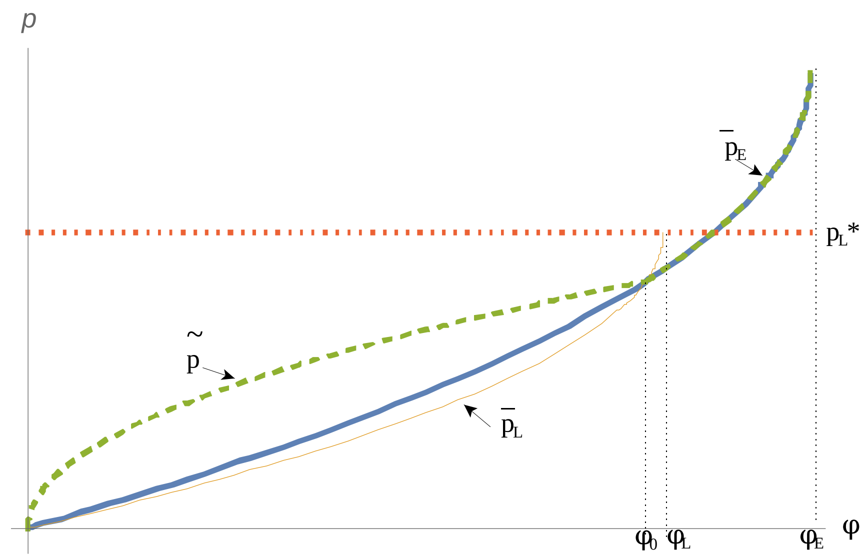


Figure 1: Price Control Thresholds

Figure 1 shows the relationship between the fixed cost parameter $\varphi$ and the relevant prices under the two modes for a specific example. For $\varphi > \varphi_E$, neither entry nor VL is profitable and the market is not served. When $\varphi \in (\varphi_L, \varphi_E)$, fixed costs are sufficiently high that VL is not profitable at any price. Entry is the only possible mode of serving the market over this interval and it is chosen by the patent-holder as long as the price control is no less than $\bar{p}_E(\varphi)$. The example in Figure 1 illustrates a case in which $\bar{p}_E(\varphi_L) < p_L^*$, so that there exists an interval of fixed costs $[\varphi_0, \varphi_L]$ for which $\bar{p}_E(\varphi) < \bar{p}_L(\varphi)$. Although there are prices at which both VL and entry are profitable over this interval, the patent-holder always earn higher profits under entry. For $\varphi \in [0, \varphi_0]$ both VL and entry are profitable and entry is chosen by the patent-holder iff the price control exceeds the entry inducing price $\tilde{p}(\varphi)$.[9]

An interesting insight provided by a comparison of Propositions 1 and 2 is that *the use of a price control by the South can make VL arise in equilibrium.* Given Assumption 1, in the absence of a price control, the patent-holder either chooses entry or stays out whereas in the presence of a price control, it chooses VL when $\varphi \in (0, \varphi_0)$ and $\bar{p} \in (\overline{p}_L(\varphi), \tilde{p}(\varphi)]$. The intuition for this result comes from Lemma 1: whereas a price control reduces profitability under both entry and VL, it is more binding under entry since $p_L^* < p_E^*$. As a result, when $\varphi \in (0, \varphi_0)$, for any price control $\bar{p} \in (\overline{p}_L(\varphi), \tilde{p}(\varphi)]$, the

[9]If $\bar{p}_E(\varphi_L) \geq p_L^*$, then $\varphi_0 = \varphi_L$ and the break-even price for VL is lower than that for entry for all $\varphi < \varphi_L$. The threshold level $\varphi_0$ decreases as the licensee's quality disadvantage increases compared to its fixed cost advantage. In either case, there can be only one such reversal of advantage in break-even prices for VL and entry.

patent-holder ends up choosing VL whereas it never does so when the South allows it to charge its optimal monopoly prices under the two modes.

### 3.2 Optimal price control

We now derive the South's optimal price control assuming its objective is to maximize local welfare. Since the patent-holder extracts all rents under VL, the comparison between entry and VL is determined solely by consumer surplus. It is obvious that if $\varphi > \varphi_E$ then the patent-holder finds neither entry nor VL worthwhile and the price control is irrelevant since the patent-holder stays out of the Southern market no matter what its level.

Next suppose $\varphi_L \leq \varphi < \varphi_E$. Since only entry is profitable over this range, the optimal policy calls for the South to set the price control equal to the break even entry price $\overline{p}_E$. Now consider the scenario where both modes of supply are profitable for the patent-holder i.e. $\varphi < \varphi_L$. Here, first suppose that $\overline{p}_E \leq \overline{p}_L$ – which happens when $\varphi \in (0, \varphi_0)$. Under this scenario, if the South were to set $\overline{p} = \overline{p}_E$ then the patent-holder would choose entry since VL does not break even at this price. Since quality is superior under entry and the price needed to induce entry is lower than that required for VL, the South's optimal policy is to set $\overline{p} = \overline{p}_E$ whenever $\overline{p}_E \leq \overline{p}_L$. Consider now the case where $\overline{p}_E > \overline{p}_L$. Here, to be able to induce entry, the South has to set the price control at the entry inducing price $\widetilde{p}$. Of course, it can alternatively set $\overline{p} = \overline{p}_L$(the break-even price under VL) thereby inducing VL. Thus, the trade-off facing the South is clear: entry offers a higher quality product but also requires a more lax price control. Thus, when $\overline{p}_E > \overline{p}_L$, the South prefers the entry inducing price $\widetilde{p}$ to the break-even VL price $\overline{p}_L$ iff

$$S(\widetilde{p}, q) \geq S(\overline{p}_L, \gamma q) \tag{9}$$

We summarize the optimal price control policy below:

**Proposition 3**: *The South's optimal price control policy is as follows:*
*(i) For $\varphi \in [\varphi_0, \varphi_E]$ the optimal price control equals the break-even entry price $\overline{p}_E$.*
*(ii) For $\varphi < \varphi_0$, the optimal price control equals the entry inducing price $\widetilde{p}$ if inequality (9) holds and the break even licensing price $\overline{p}_L$if it does not.*

When both modes of supply are profitable for the patent-holder and the break-even price for VL is higher, the South's choice between the two modes is clear cut: entry is strictly preferable to VL since it offers a better product at a lower price. However, when $\overline{p}_E > \overline{p}_L$whether entry is preferable to VL depends upon how large a price premium is required to induce it. Further insight into this trade-off can be gained by solving for the price at which $S(p, q) = S(\overline{p}_L, \gamma q)$. This equation yields the highest price $p_S(\gamma)$ that the

South is willing to pay to induce entry when VL can be induced at its break-even price. We have:

$$p_S = q_E(1-\sqrt{\gamma}) + \frac{\overline{p}_L(\gamma)}{\sqrt{\gamma}} \tag{10}$$

where $p_S \geq \overline{p}_L$ since $\gamma \leq 1$.

Differentiation of (10) establishes that

$$\frac{\partial p_S(\gamma)}{\partial \gamma} < 0$$

i.e. the maximum price that the South is willing to pay to induce entry declines as the quality disadvantage of licensing decreases. Indeed, as $\gamma \to 1$, $p_S \to \overline{p}_L$ so that the South becomes unwilling to offer any price premium for entry and the patent-holder ends up choosing VL. Further note that $p_S$ increases in $\alpha$, i.e., the Southern tolerance for a higher entry price increases when the cost advantage of VL declines.[10]

It is clear that the Southern price control necessarily makes the patent-holder worse off: for $\varphi_L \leq \varphi < \varphi_E$, its net payoff from entry is driven all the way to zero. For $\varphi < \varphi_L$, it does earn some positive profits when the South chooses to implement the entry inducing price $\widetilde{p}$ but these profits are always lower than what it earns in the absence of the price control since $\widetilde{p} < p_E^*$. As we will see below, unlike a price control, the use of CL does not always make the patent-holder worse off.

# 4 Compulsory licensing

We now examine how granting the South the option of using CL along the lines sanctioned by TRIPS affects the patent-holder and Southern consumers. We do so by considering the following game. In the first stage, the patent-holder chooses between VL and entry. Next, if the patent-holder neither enters nor grants a voluntary license to the local firm, the South issues a compulsory license to the local firm who produces the product for the duration of the patent. In return for the right to grant a compulsory license to the local firm, the South pays the per-period royalty $R$ to the patent-holder.

The TRIPS requirement that applicants for a compulsory license should have been unable to obtain a voluntary license on "reasonable commercial terms" is reflected in the assumption that the second stage of the game arises only if the patent-holder neither

[10] If the Southern government has the ability to set two different price controls (one for entry and another for VL), it does not have to pay a premium to induce entry since it can drive the patent-holder's net payoff under VL to zero by setting the price control under VL at $\overline{p}_L^C(\varphi, R)$. The abiltiy to set two different price controls makes entry more attractive to the South.

enters nor issues a voluntary license to the local firm at the first stage. The per-period royalty $R$ received by the patent-holder captures the TRIPS requirement of providing "adequate remuneration" to the patent-holder.

If the patent-holder does not sell in the South in the first period, the South must decide whether or not to grant a compulsory license. A compulsory license granted at stage two provides the licensee with the right to produce the good for $T-1$ periods and delays incurring the fixed cost by one period. We assume that the quality of the product produced by the Southern firm under CL is the same as that under VL, as is the required fixed cost. Thus, from a technological perspective, the two types of licensing are identical.[11] We allow the South to compensate the local licensee for any losses that it might suffer under CL. With these assumptions, the welfare of the South under CL equals:

$$W_{CL} = \Omega\left[S(p_L^*, q_L) + \pi_L(p_L^*, q_L) - R\right] - \alpha\beta\varphi \tag{11}$$

In order for CL to be a credible threat we need that $W_{CL} > 0$, which basically requires that the quality of production under CL not be so low that the total surplus generated in the South ends up being insufficient to cover the royalty payment made to the patent-holder.

We denote the maximum level of fixed costs at which CL is a credible threat as

$$\varphi_C^m(R) = \frac{\Omega\left[S(p_L^*, q_L) + \pi_L(p_L^*, q_L) - R\right]}{\alpha\beta}$$

## 4.1 Supply mode

Given that CL is a credible threat, we are now ready to consider the patent-holder's decision regarding whether and how to utilize its patent in the South. Under entry, the patent-holder earns a return of $v_E^* - \varphi$. Under VL, the patent-holder's payoff equals its licensing fee $f_L^C$ and it is determined as follows. We assume that the patent-holder makes a take it or leave it offer to the Southern firm. If Southern firm rejects the VL offer and the patent-holder does not enter directly then the Southern firm's outside option is no longer zero profits since the government grants it a compulsory license in the next period while paying the per period royalty $R$ to the patent-holder, the present value of which equals $\Omega R$. Under CL, the licensee earns a return with a present value of $\max[\Omega\pi_L(p_L^*, q_L) - \alpha\beta\varphi, 0]$.

The highest fee that the patent-holder can charge under VL is one that makes the Southern firm indifferent between agreeing to a VL in the first period and waiting for a

[11] Intuitively, we are assuming that the quality of production under either type of licensing reflects the technological capability of the local firm and that this capability is unaffected by whether the patent-holder grants a license voluntarily or is forced to do so by the South.

compulsory license in the next period, which yields:

$$f_L^C = v_L^* - \alpha\varphi - \max\left\{\Omega\pi_L(p_L^*, q_L) - \beta\alpha\varphi, 0\right\}. \qquad (12)$$

When $\Omega\pi_L(p_L^*, q_L) > \alpha\beta\varphi$, the possibility of CL induces "profit-shifting" from the patent-holder to the local licensee since it reduces the license fee the patent-holder can earn under VL. Note from above that $f_L^C \leq f_L(p_L^*)$: i.e. if production under CL is profitable for the local firm, the threat of CL lowers the patent-holder's payoff from VL; otherwise it does not affect it.

Given these payoffs, in the first period the patent-holder has to choose between the following options:
$(i)$ enter with a return of $v_E^* - \varphi$;
$(ii)$ issue a VL to collect the fee $f_L^C$; and
$(iii)$ not work its patent and wait for CL which yields royalties worth $\Omega R$.

Recall from Proposition 1 that due to Assumption 1, absent the threat of CL, the patent-holder necessarily prefers entry to VL. Note further that this conclusion remains unchanged when CL is an available option since the threat of CL *further lowers* the payoff from VL. This means that the only remaining question is whether the patent-holder prefers entry to CL or not. The patent-holder prefers entry to CL iff

$$v_E^* - \varphi \geq \Omega R$$

which yields:

**Proposition 4**: *The patent-holder chooses entry if* $\varphi \in [0, \varphi_E^C]$ *where* $\varphi_E^C \equiv v_E^* - \Omega R$ where $\varphi_E^C < \varphi_E$ *for all* $R > 0$; *it does not work its patent otherwise and the South resorts to CL in the second period.*

Figure 2 illustrates Proposition 4. A comparison of Propositions 1 and 4 shows that the possibility of CL causes two types of switches in the patent-holder's preferred mode of serving the Southern market. For $\varphi \in [\varphi_E^C, \varphi_E]$, the patent-holder switches from entry to not serving the market in order to obtain royalty payments under CL. This outcome represents a scenario where the patent-holder's return from entry is dominated by the present value of royalty payments it receives under CL. For $\varphi \in [\varphi_E, \varphi_C^m]$, CL results in the patented product being produced locally whereas the South would not have been served otherwise. As is clear from Figure 2, the threat of CL expands the range of parameters for which Southern consumers enjoy access to the patented good while *simultaneously* reducing the range of fixed costs for which the patent-holder chooses to enter the Southern market.

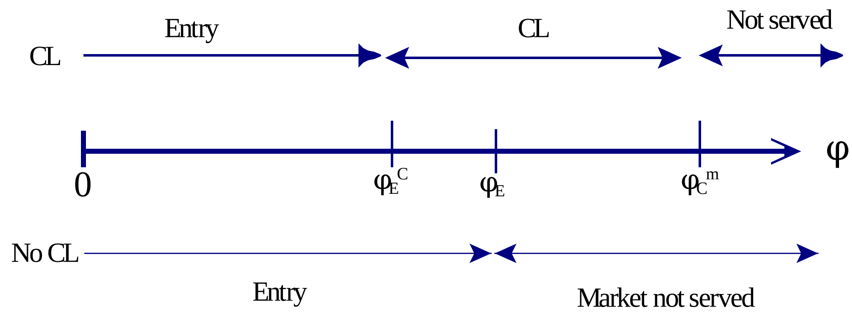


Figure 2: Effect of CL on Market Outcomes

Thus, CL is similar to a price control in the sense that *both instruments reduce the absolute attractiveness of entry* for the patent-holder. But the two instruments differ in two fundamental ways. One, unlike a price control, by reducing the fee paid to the patent-holder under VL the threat of *CL makes VL less attractive to the patent-holder relative to entry.*[12] Second, if the patent-holder chooses to stay out when facing a stringent price control it earns no return from the Southern market whereas it earns a strictly positive return when it decides to stay out and the South resorts to CL.

## 4.2 Welfare under CL

We now analyze the effect that the option to use CL has on Southern welfare and patent-holder. Figure 2 illustrates that three types of outcomes can obtain when CL is a credible threat: the patent-holder enters with or without CL for $\varphi \leq \varphi_E^C$, the patent-holder switches from entry to waiting for the occurrence of CL for $\varphi \in [\varphi_E^C, \varphi_E]$, and the Southern market is served by the local firm acting as a licensee under CL for $\varphi \in [\varphi_E, \varphi_C^m]$.

Clearly, neither party is unaffected by the threat of CL for $\varphi \leq \varphi_E^C$. Now consider $\varphi \in [\varphi_E^C, \varphi_E]$. For this range of fixed costs, the possibility of CL *induces* the patent-holder to not enter. As a result, Southern consumers experience a switch from consuming

[12] Beall and Kuhn (2012) provide an overview of international episodes of CL observed during 1995-2011. All in all, during this time period there were 24 episodes where CL was either publicly considered or actually implemented by governments of developing countries. VL was the end result in only 3 of these episodes; CL resulted in 12 of them; and the patent-holders agreed to sell their products at reduced prices in the other cases.

a product of quality $q_E$ at its monopoly price of $p_E^*$ to a lower quality product (of quality $\gamma q_E$) at the price $p_L^*$ (where $p_L^* = \gamma p_E^*$) with a delay of one period. These changes necessarily reduces the joint welfare of the two parties because not only is the quality of the product under CL lower than that under entry, it also becomes available after a one period delay. The switch from entry to CL necessarily raises the welfare of the patent-holder because the only reason it decides not to enter is that the royalty payments under CL offer a higher return than that which it can obtain under entry. Furthermore, since joint welfare decreases and the patent-holder gains from its decision to not enter and wait for CL, the South necessarily loses from this switch. Thus, the mere observance of CL does not imply that the country using it is better off relative to a scenario where it does not have the option to use CL.

When $\varphi \in [\varphi_E, \varphi_C^m]$, both the South and the patent-holder gain: here, CL grants access to a product that would otherwise not be sold in the South and the South gets consumer surplus and profits of the licensee while the patent-holder obtains royalty payments. Thus, over this range of fixed costs, the threat of CL yields a Pareto improving outcome – something that is not possible with a price control.

These results are summarized as:

**Proposition 5**: *The threat of CL affects equilibrium outcomes and welfare of each party as follows:*

*(i) For $\varphi \in [\varphi_E, \varphi_C^m]$ the Southern market is served by the local firm under CL whereas it would not be served without the threat of CL. As a result, the payoff to both the South and the patent-holder increase due to the option of CL.*

*(ii) For $\varphi \in [\varphi_E^C, \varphi_E]$, CL occurs whereas the Southern market would have been served by entry if CL were not possible. In this case, the South loses, the patent-holder gains, and joint welfare declines due to the option of CL.*

# 5 Conclusion

Both price controls and CL have been used to improve consumer access to patented pharmaceuticals in developing countries. In this paper, we have extended the analysis of Bond and Saggi (2014) to provide a comparison of the two instruments from the viewpoint of patent-holders as well as consumers in developing countries. While the TRIPS agreement of the WTO is silent on the subject of price controls, it does lay down some clear conditions that a country seeking to use CL must satisfy. Our model is designed to capture actual WTO rules pertaining to the use of CL quite closely. In particular, the South is allowed to use CL only if the patent-holder fails to work the patent locally via either entering directly or licensing its technology voluntarily to a local firm. It follows then that the patent-holder can preempt CL by choosing to license its product or by entering the Southern market itself.

The model provides four main insights. First, from the perspective of the patent-holder, the use of price controls increases the attractiveness of VL relative to entry because the optimal monopoly price under VL tends to be lower. Second, the optimal price control of the South needs to account for the fixed cost of the two modes as well as the quality difference between them: while the patent-holder's break-even price under VL tends to be lower relative to entry, so does the quality of production under it. Thus, it is sometimes worthwhile for the South to allow a higher price in order to ensure the patent-holder chooses entry over VL. The third insight provided by the model is that while the option of CL reduces the attractiveness of VL (by lowering the fee that the local licensee is willing to pay) relative to entry, it also makes staying out of the market more attractive to the patent-holder since it can collect royalties under CL that results from its decision to not work its patent in the South. Fourth, CL ensures that local consumers have access to (a lower quality version of) the product when the patent-holder finds it unprofitable to sell locally. Indeed, it is possible that both the patent-holder and the South are made better off by the option of CL. However, as we show in the paper, when the option of CL induces the patent-holder to not enter, the South loses while the patent-holder benefits.

# References


[1] Baron, David, 2008. "Compulsory Licensing, Thailand, and Abbott Laboratories." Stanford Graduate School of Business Case P-66.

[2] Beall, Reed and Randall Kuhn, 2012. "Trends in Compulsory Licensing of Pharmaceuticals Since the Doha Declaration: A Database Analysis." PLos Medicine 9(1),1-9.

[3] Bond, Eric and Kamal Saggi, 2014. "Compulsory Licensing, Price Controls, and Access to Patented Foreign Products." Journal of Development Economics 109: 217-228.

[4] Chatterjee, Chirantan, Kensuke Kobe, and Viswanath Pingali, 2013. "The Welfare Implications of Patent Protection, Pricing, and Licensing in the Indian Oral Anti-Diabetic Drug Market." Indian Institute of Management Working paper No. 408.

[5] Daemmrich, Arthur A., and Aldo Musacchio, 2011. "Brazil: Leading the BRICs." Harvard Business School Case 9-711-024.

[6] Dutta, Antara, 2011. "From Free Entry to Patent Protection: Welfare Implications for the Indian Pharmaceutical Industry." The Review of Economics and Statistics 93(1): 160-178.

[7] Goldberg, Pinelopi. K., 2010. "Intellectual Property Rights Protection in Developing Countries: the Case of Pharmaceuticals." Journal of the European Economic Association 8, 326-53.

[8] Kyle, Margaret, 2007. "Pharmaceutical Price Controls and Entry Strategies." The Review of Economics and Statistics 89(1): 88-99.

[9] Lanjouw, Jean, 2005. "Patents, Price Controls and Access to New Drugs: How Policy Affects Global Market Entry." NBER Working paper 11321, Cambridge, MA.

[10] Lybecker, Kristina M., and Elisabeth Fowler, 2009. "Compulsory Licensing in Canada and Thailand: Comparing Regimes to Ensure Legitimate Use of the WTO Rules." Journal of Law, Medicine & Ethics, Spring, 222-239.

[11] Saggi, Kamal, 2016. "Trade, Intellectual Property Rights, and the WTO," in the Handbook of Commercial Policy, edited by Kyle Bagwell and Robert W. Staiger, Elsevier.

# 6 Appendix

**Proof of Proposition 1**

The break-even price under VL is the solution to $\pi(p, \gamma q_E)(1+\Omega) - \alpha\varphi = 0$ which yields

$$\overline{p}_L(\varphi) = \frac{\gamma q_E}{2}\left(1 - \left(1 - \frac{\alpha\varphi}{v_L^*}\right)^{1/2}\right) \text{ for } \varphi \in \left[0, \frac{v_L^*}{\alpha}\right] \tag{13}$$

where $v_L^* \equiv \gamma q_E(1+\Omega)/4$. We set $\overline{p}_L(\varphi) = \infty$ for $\varphi > v_L^*$, since fixed costs exceed monopoly profits and the licensee cannot earn zero profits at any price. Under entry we have:

$$\overline{p}_E(\varphi) = \frac{q_E}{2}\left(1 - \left(1 - \frac{\varphi}{v_E^*}\right)^{1/2}\right) \text{ for } \varphi \in [0, v_E^*] \tag{14}$$

where $v_L^* = \gamma v_E^*$ and $\overline{p}_E(\varphi) = \infty$ for $\varphi > v_E^*$. It is straightforward to establish that the respective break-even prices are increasing and convex in $\varphi$, with $\overline{p}_L(\varphi) = \overline{p}_E(0) = 0$.

Since $\gamma \leq \alpha$, we have $v_L^*/\alpha \leq v_E^* \leq \Delta v^*/(1-\alpha)$. To prove Proposition 2(i), we show that there exists a unique $\varphi_0 \in (0, v_L^*/\alpha]$ such that $\overline{p}_L(\varphi) < \overline{p}_E(\varphi_0)$ for $\varphi \in (0, \varphi_0)$

and $\overline{p}_L(\varphi) \geq \overline{p}_E(\varphi_0)$ for $\varphi \in (\varphi_0, v_E^*]$. Differentiating (13) and (14) and evaluating at $\varphi = 0$ yields $\overline{p}'_E(\varphi) - \overline{p}'_L(\varphi) = (1-\alpha)/(1+\Omega)$, which ensures that $\overline{p}_L(\varphi) < \overline{p}_E$ in the neighborhood of $\varphi = 0$. Evaluating the break-even functions at $v_L^*/\alpha$ yields $\overline{p}_L(v_L^*/\alpha) > \overline{p}_E(v_L^*/\alpha)$ iff $\gamma < 2 - 1/\alpha$.

We then have two cases to consider (a) $\gamma < 2 - 1/\alpha$ and (b) $\gamma \geq 2 - 1/\alpha$. First consider case (a). If $\gamma < 2 - 1/\alpha$ then $H(\varphi) = \overline{p}_E(\varphi) - \overline{p}_L(\varphi)$ is a continuous and differentiable function for $\varphi \in [0, v_L^*/\alpha]$ with $H(0) = 0$, $H'(0) > 0$, and $H(v_L^*/\alpha) < 0$. By the continuity of $H(.)$, there exists a $\varphi_0 \in (0, v_L^*/\alpha]$ such that $\overline{p}_L(\varphi) = \overline{p}_E(\varphi)$. Solving this equation yields the unique solution

$$\varphi_0 = \frac{\gamma q(1-\gamma)(1-\alpha)(1+\Omega)}{(1-\alpha\gamma)^2} \in (0, v_L^*/\alpha) \text{ for } \gamma < 2 - 1/\alpha \tag{15}$$

For this range of parameter values, $\overline{p}_E(\varphi) > \overline{p}_L(\varphi)$ for $\varphi \in (0, \varphi_0)$ and $\overline{p}_E(\varphi) < \overline{p}_L(\varphi)$ for $\varphi \in (\varphi_0, v_L^*/\alpha)$. The fact that $v_L^*/\alpha < \Delta v^*/(1-\alpha)$ ensures that Lemma 1(iii) applies in the latter range.

Now consider case (b). For $\gamma \in [2 - 1/\alpha, \alpha]$, $H(v_L^*/\alpha) \geq 0$ and there is no solution for $H(\varphi) = 0$ on $(0, v_L^*/\alpha)$. Since $v_L^*/\alpha < \Delta v^*/(1-\alpha)$, Lemma 1(iii) applies and we have $\tilde{p}(\varphi) > \overline{p}_E(\varphi) > \overline{p}_L(\varphi)$ for $\varphi \in (0, v_L^*/\alpha)$. For $\varphi \in (v_L^*/\alpha, v_E^*]$, the licensee cannot break even at any price and Lemma 1(i) applies.

(iii) This result follows from straightforward differentiation of the expression for $\varphi_0$ in equation (15) with respect to $\alpha$ and $\gamma$ respectively.||

# Estimating a Model of Settlement Bargaining in the World Trade Organization*

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**Abstract**

Disputes that involve developed countries are more likely to result in litigation. Moreover, in a dispute between a developed and a developing country, litigation is more likely if the developing country is the complaining party. We modify canonical models of settlement bargaining under asymmetric information by assuming that governments are restricted to use policy adjustment, rather than cash payments, as a means of compensation in their settlement negotiations. A key theoretical prediction of the modified models is that the likelihood of settlement is more sensitive to the defendant's litigation costs than to the complainant's litigation costs. This theoretical prediction combined with the assumption that developing countries face higher costs of litigation explains the divergent behavior of developing and developed countries in the dispute settlement process. Empirical evidence from the WTO supports our theoretical findings. Moreover, we show that the introduction of subsidized legal help for poor

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countries by the Advisory Centre on WTO Law has changed the litigation patterns in a way that is consistent with the predictions of the model.

# 1 Introduction

The establishment of a legalized Dispute Settlement Process (DSP) was one of the most important reforms introduced to the old GATT system in its transition to the World Trade Organization (WTO). Under GATT, dispute settlement was merely a political process for the negotiation and rebalancing of reciprocal state-to-state trade concessions (Shaffer, 2003). In contrast, the DSP under the WTO is quite similar to a domestic legal system in that it involves dispute panels that act as a court of law and an Appellate Body that reviews the rulings of the panels. There is an ongoing debate on whether a "legalized" dispute settlement process creates a more level playing field that favors the less powerful members, or whether this process is used as an instrument by powerful members to put pressure on developing countries to fulfill their liberalization promises.

One of the concerns about a legalized process of dispute settlement is its high cost that may have an adverse effect on the bargaining position of developing countries against developed countries.[1] For example, in a recent survey the WTO delegations from developing countries have cited the high cost of litigation as one of the main reasons for not pursuing a complaint (Busch et al., 2008).

Developing and developed countries show divergent behavior in the dispute settlement process. More than half of all initiated disputes are resolved without litigation, i.e. without the establishment of a dispute panel, which may reflect the parties' desire to avoid high costs of litigation in the WTO.[2] Disputes that involve developed countries, however, are more

[1] We use the commonly used keywords, developing and developed *countries* to refer to all WTO members, although some members, such as European Union, are not countries.

[2] The main stages of the DSP are Consultation (pre-trial negotiations between disputants), Dispute Panel, and Appellate Body. See Beshkar and Bond (2008) for a summary of the DSP.

likely to result in litigation. To show this, we divide countries into developing and developed. Countries whose GDP per capita (in 2005 dollars) is larger than $10,000 are categorized as developed and those below this threshold as developing.[3] Using $7,000, $12,000, or even $15,000 as the threshold does not change the results.[4] As demonstrated in Table 1, being a developed country, as opposed to a developing country, as the defending party, decreases the likelihood of pre-trial settlement by 24 percentage points (i.e., from 69% to 45%; the right column of the table). Similarly, a developed defendant decreases the likelihood of settlement by 9 percentage points (i.e. from 60% to 51%; the bottom row of the table).

A more curious pattern is that in a dispute between a developed and a developing country, litigation is more likely if the developed country is the defending party. As is shown in Table 1, 62 percent of disputes in which a developed country presses charges against a developing country are settled without establishing a dispute panel. In contrast, only 44 percent of disputes are settled without establishing a dispute panel if a developing country disputes against a developed country.

In this paper, we provide a model of dispute settlement in the WTO that explains the above patterns. The model is a modification of the classic models of dispute settlement, namely, Bebchuk (1984) and Reinganum and Wilde (1986). The point of departure from this tradition is the assumption that disputing parties are restricted to use policy adjustment as a means of compensation in their settlement negotiations. In disputes between private parties, a settlement normally involves a cash transfer from the defending party to the complaining party. However, cash transfer has rarely been used in the WTO to settle a trade dispute.[5]

[3]Income is measured in 2005 US dollars. The $10,000 threshold for classifying developed and developing countries is comparable to the World Bank threshold of high income countries in 2005 dollars, i.e. $10,725 (GNI per capita). Moreover, using the World Bank threshold and GNI per capita leads to (almost) identical results. List of developed and developing countries can be found in Tables A1 and A2, respectively. For more information on the World Bank threshold, see "How are the income group thresholds determined?" on World Bank website (`https://datahelpdesk.worldbank.org/knowledgebase/articles/378833-how-are-the-income-group-thresholds-determined`).

[4]$7000, $12,000, and $15,000 are chosen to check the robustness of the results if one digresses from the World Bank definition of high income countries.

[5]See Limão and Saggi (2008) for a discussion of why cash compensation is rarely used as a means of

Instead, a complaining country is usually compensated through policy adjustments, such as a reduction in import tariffs in the defending country. The type of available compensation mechanisms determines the payoff structure in the bargaining process, which may also affect the outcome of the process. In particular, while cash transfer is a zero-sum transaction, a policy adjustment is not necessarily zero-sum. For example, as is well-known in the trade literature, a reduction in import tariffs in an importing country generates more gains for the exporting country than losses to the importing country.

The paper shows that due to differences in methods of compensation in private and inter-governmental disputes, classic models of settlement bargaining cannot correctly explain the settlement pattern in the WTO. To show this, we extend those models to study the determinants of out-of-court settlement under situations where the available compensation mechanism features a positive-sum transaction. This added feature alters some of the important predictions of the classic models. In particular, the models of Bebchuk (1984) and Reinganum and Wilde (1986) imply that the allocation of litigation costs between disputants has no bearing on the likelihood of settlement. In contrast, we show that under a positive-sum compensation mechanism, the likelihood of settlement is more sensitive to the defendant's litigation costs than to the complainant's litigation costs. This analysis has important policy implications, as it suggests that allocating the burden of proof to the defending party should lead to a higher settlement rate.[6]

This study provides a novel explanation for the divergent settlement behavior of developing and developed countries, which is based on relative litigation costs of these countries. We construct a measure of litigation costs based on the assumption that the cost of pursuing a dispute in the DSP is greater for poorer and smaller countries. It is a widely held view among observers of the WTO that less developed countries have higher costs of legal work

settling disputes among WTO members.

[6]The DSP can influence the allocation of litigation costs by adopting appropriate rules about the allocation of the burden of proof, for example.

in the dispute settlement process. For example, Shaffer (2003) points out that "lack of legal expertise in WTO law and the capacity to organize information concerning trade barriers and opportunities to challenge them [... and] lack of financial resources, including for the hiring of outside legal counsel," are challenges faced by the developing countries in using the WTO legal system effectively.[7] In fact, to address this issue, in 2001, Advisory Centre on WTO Law (ACWL) was established to provide subsidized legal counselling to developing countries.

In addition to whether the dispute had multiple complainants or third parties, we use the following measures of real value of trade one year before the violation to capture "stakes at dispute": 1) the real value of the defending country's import from the complaining country in the disputed sector, and 2) the real value of the defending country's import from the rest of the world. Real value of total export of defending country to the complaining country in the year of the dispute is used as a measure of retaliation capacity of the complaining country. We show that controlling for these measures the probability of settlement is positively correlated with the litigation costs of the disputants and statistically significant for the defending party, prior to 2001. It is also empirically verified that before 2001, the litigation costs of the defending party has a significantly larger effect on the likelihood of settlement than the litigation costs of the complaining party. While consistent with the prediction of our model, this latter observation is at odds with the prediction of the classical settlement bargaining models, where the total litigation costs of the disputants – not the distribution of costs – is what matters for the likelihood of settlement.

The fact that these results hold for pre-2001 sample, further strengthens our hypothesis that litigation costs of parties play a critical role in the settlement process. This is because

[7]For developing countries, the absolute marginal cost of pursuing a dispute – not just the relative marginal cost, for example, as a share of GDP – is larger than the developed countries. For instance, developed countries have a large mission at WTO that is available to litigate the disputes when they happen. But, developing countries have small missions that are insufficient or would be overwhelmed by the litigation at the margin. Therefore, their marginal costs of litigation are larger than developed countries in absolute terms.

if litigation costs are the key, they should not matter (or matter less) after the establishment of ACWL in 2001, which offered subsidized legal expertise to developing countries to help them overcome the challenges of the dispute settlement process.

We also show that the larger is the defending party's imports from the complaining party in the disputed sector (i.e. the more is the stakes at dispute), the lower is the likelihood of a pre-trial settlement. The defending country's import in the disputed sector from third parties (rest of the world), however, has no statistically significant effect on the likelihood of pre-trial settlement. Multiplicity of complainants in the bargaining process and the existence of third parties in the dispute, however, reduce the chance of pre-trial settlement. But, the retaliatory capacity of the complaining party, measured by total export of defendant to complainant, has no statistically significant relation with the probability of settlement.

In the past decade, there has been a growing number of empirical studies of the dispute settlement process of GATT and the WTO.[8] Guzman and Simmons (2002) consider the relationship between the nature of the dispute and likelihood of an early settlement. They hypothesize that if the subject matter of the dispute has an all-or-nothing character and leaves little room for compromise (for example, health and safety regulations), the parties' ability to reach an agreement is limited and a higher rate of litigation is expected for such disputes. They find empirical support for their hypothesis only among democratic states. Busch and Reinhardt (2003) consider the success of developing countries as complainants in this process by investigating the level of concessions that they have been able to induce from defending countries. In particular, they find that the introduction of a more legalized system of dispute settlement under the WTO has exaggerated the gap between developed and developing country complainants with respect to their ability to get defendants to liberalize disputed policies. Nevertheless, Bown (2004) provides evidence that developing country complainants have had more economic success in resolving trade disputes under the WTO

[8]Busch and Reinhardt (2003) provide a survey of this literature.

than was the case under the GATT.

A number of papers study the determinants of the decision to initiate a formal dispute. Bown (2005) investigates the determinants of participation in the DSP and examines whether the new regulations of the DSP under the WTO discourages active engagement by developing countries. He finds that the size of exports at stake and legal capacity are important factors in deciding whether to initiate a dispute. Wilckens (2009) also finds that a country is more likely to file a complaint if its retaliatory capacity is large. Horn et al. (1999), however, argue that the bias in the pattern of disputes that have been initiated under the WTO is due to the fact that developed countries have a larger diversity of imports and exports that naturally leads to more disputable trade policies and a more frequent use of the DSP by the developed countries.

In a more recent study, Kuenzel (2017) finds a relationship between the likelihood of a dispute and the degree of unilateral policy flexibility that a country has in any particular sector. As documented by Beshkar et al. (2015), Beshkar and Bond (2017), and Beshkar and Lee (2018), in a substantial fraction of sectors worldwide, the negotiated tariff bindings are above the tariffs applied by the government. The difference between applied tariffs and the negotiated bindings, known as tariff overhang, provides governments with a degree of flexibility to adjust their tariffs unilaterally. Kuenzel (2017) shows that a WTO dispute is more likely to arise in sectors with lower tariff overhangs. While we focus on the determinants of early, i.e. pre-trial, settlements, many interesting questions regarding the later stages of the dispute settlement process, namely the WTO trial and post-trial negotiation, remain unexplored in this study. Moreover, in this paper we do not explicitly model tariff adjustments in the dispute settlement process. These issues are studied in various papers including Park (2011), Beshkar and Park (2017), Maggi and Staiger (2011; 2015a; 2017; 2018), and Beshkar (2010; 2016). Park (2016) provides a comprehensive review of this literature.

In Sections 2 to 4 of this paper, we focus on disputes under the allegation of direct breach.

In Section 2, we introduce our assumptions regarding the costs and benefits of settlement to the disputing parties. In Section 3, we set out a screening model of pre-trial bargaining, which is a modified version of the Bebchuk (1984) model. Similarly, in Section 4, we follow Reinganum and Wilde (1986) approach to model the pre-trial settlement bargaining in the WTO as a signaling game. We turn our attention to non-violation cases in Section 5 and show that the effect of litigation costs and the stake at dispute on the settlement outcome are similar in violation and non-violation cases. Section 6 provides a brief discussion of the data sets and explanatory variables. The empirical models and results are presented and discussed in Section 7. Section 8 concludes.

## 2 Basic Setup

In this and the two subsequent sections, we focus on the case of direct breach. In a direct breach, the dispute is on the nature of the prevailing contingency. If such a case is litigated, the court issues its opinion on the nature of the contingency and rules whether the defendant is in violation of its obligation or not. If ruling is against the defendant, the defendant is supposed to reduce its tariff rate to a lower level (possibly the agreed-upon level) as specified by the court. Similarly, a settlement schedule is a tariff rate (lower than the disputed tariff rate) offered by one of the two parties.

The defendant's tariff rate on the imports from the complainant at the time of the dispute is denoted by $\tau^d$, while $\tau^a$ $\left(\leq \tau^d\right)$ denotes the tariff rate that the defendant should adopt in order to be in compliance with its obligations. When a dispute arises, *renegotiation* takes place in order to find a "mutually agreed solution". A settlement proposal is characterized by a new tariff rate, $\tau$ $\left(< \tau^d\right)$, to be adopted by the defending country. If a mutually agreed solution is not achieved, the case will escalate to the dispute panel. If at the panel stage the defendant is found in violation of its obligations, it should reduce its tariff from $\tau^d$ to $\tau^a$.

Otherwise, the defending party can continue to adopt the disputed tariff rate, $\tau^d$.

Let $W_D(\tau)$ and $W_C(\tau)$ denote the welfare of the defendant and the complainant, respectively, as functions of the defendant's tariff rate, where $W'_D(\tau) > 0$ and $W'_C(\tau) < 0$. Then the defendant's welfare loss from lowering its tariff from the disputed level (i.e., $\tau^d$) to $\tau$ is given by

$$\Omega(\tau) \equiv W_D\left(\tau^d\right) - W_D(\tau).$$

Similarly, the complainant's benefits from this policy adjustment is given by

$$\Delta(\tau) \equiv W_C(\tau) - W_C\left(\tau^d\right).$$

Assuming there are gains from trade, an increase in tariff rates by one party would decrease the two parties' aggregate payoff.[9] Therefore, if deviation from the agreement benefits one party it should hurt the other party to a larger extent. Similarly, the defendant's loss from reducing its tariff rate is smaller than the complainant's benefits from this policy adjustment, i.e. $\Omega(\tau) < \Delta(\tau)$. For the sake of the tractability of the model, we impose more restrictions on the functions $\Omega$ and $\Delta$ as follows:

**Assumption 1**: $\Omega(\tau) = \alpha\Delta(\tau)$ *for all* $0 \leq \tau \leq \tau^d$, *where* $\alpha < 1$.

As will be seen in the subsequent sections, modifying the classical models of settlement bargaining (e.g., Bebchuk 1984 and Reinganum and Wilde 1986) reveals some interesting features of the settlement bargaining in the WTO.

[9] This assumption is consistent with various trade models but it may fail if there is a shock to the preferences of the parties that changes the jointly optimal tariff rate. In the framework of our paper, this assumption always holds as we assume away shocks to preferences. For models of dispute settlement that consider preference shocks, see Beshkar (2010, Forthcoming) and Maggi and Staiger (2015b, 2018, 2011).

# 3 A Screening Model

Consider a case in which the defendant has better information about the dispute case. In the case of implementing safeguard measures, for example, the defendant is better informed about the economic conditions surrounding its import-competing industries. Therefore, the defendant can make a better prediction about the ruling of the dispute panel in case of litigation. On this basis, we assume that the probability of an adverse ruling against the defendant, $p$, is private knowledge of the defendant, while the complainant knows only that $p$ is distributed over interval $\left[\underline{p}, \overline{p}\right]$ by a distribution function $F(.)$. Here, $p$ is interpreted as the defendant's type.

Bebchuk's (1984) framework can be easily adapted to this situation. Suppose that the complainant demands that the defendant adopts $\tau^s$ rather than $\tau^d$. If the defendant fulfills this demand the case is settled, the complainant earns $\Delta(\tau^s)$ and the defendant incurs a cost of $\Omega(\tau^s)$. On the other hand, if the defendant does not accept this offer, the parties bring the case before the dispute panel, in which case each of them should pay their respective legal fees, namely, $c_D$ and $c_C$.

Assuming that the panel ruling is enforceable, the defendant accepts $\tau^S$ if and only if:

$$\Omega(\tau^s) \leq (1-p) \times 0 + p\Omega(\tau^a) + c_D, \tag{1}$$

or, equivalently, if and only if:

$$p \geq \frac{\Omega(\tau^s) - c_D}{\Omega(\tau^a)}. \tag{2}$$

Hence, the defendant will accept $\tau^s$ if and only if its type $p$ is equal to or higher than $q(\tau^s)$, where $q(\tau^s)$ is the marginal defendant type defined by

$$q(\tau^s) = \frac{\Omega(\tau^s) - c_D}{\Omega(\tau^a)}.$$

On the other hand, the complainant's expected payoff from demanding $\tau^s$ is given by

$$\begin{aligned} A\left(\tau^s\right) &= \left\{1-F\left[q\left(\tau^s\right)\right]\right\}\Delta\left(\tau^s\right) \\ &\quad +F\left[q\left(\tau^s\right)\right]\left\{-c_C+\frac{\Delta\left(\tau^a\right)\int_{\underline{p}}^{q\left(\tau^s\right)}pf\left(p\right)dp}{F\left[q\left(\tau^s\right)\right]}\right\}. \end{aligned}$$

Therefore, the FOC is given by $A'\left(\tau^S\right)=0$, where

$$\begin{aligned} A'\left(\tau^s\right) &= -f\left[q\left(\tau^s\right)\right]q'\left(\tau^s\right)\Delta\left(\tau^s\right)+\left\{1-F\left[q\left(\tau^s\right)\right]\right\}\Delta'\left(\tau^s\right) \\ &\quad -f\left[q\left(\tau^s\right)\right]q'\left(\tau^s\right)c_C+\Delta\left(\tau^a\right)q\left(\tau^s\right)f\left(q\left(\tau^s\right)\right)q'\left(\tau^s\right) \\ &= \left\{1-F\left[q\left(\tau^s\right)\right]\right\}\Delta'\left(\tau^s\right)-f\left[q\left(\tau^s\right)\right]q'\left(\tau^s\right)\left[\Delta\left(\tau^s\right)+c_C-\Delta\left(\tau^a\right)q\left(\tau^s\right)\right]. \end{aligned}$$

Substituting $q\left(\tau^s\right)=\frac{\Omega(\tau^s)-c_D}{\Omega(\tau^a)}$, and $q'\left(\tau^s\right)=\frac{\Omega'(\tau^s)}{\Omega(\tau^a)}$ in this equation and then applying Assumption 1, i.e. $\Omega\left(\tau\right)\equiv\alpha\Delta\left(\tau\right)$, yield:

$$A'\left(\tau^s\right)=\left\{\left\{1-F\left[q\left(\tau^s\right)\right]\right\}-f\left[q\left(\tau^s\right)\right]\frac{c_C+\frac{c_D}{\alpha}}{\Delta\left(\tau^a\right)}\right\}\Delta'\left(\tau^s\right).$$

Thus, the FOC can be written as:

$$\frac{f\left[q\left(\tau^s\right)\right]}{1-F\left[q\left(\tau^s\right)\right]}=\frac{\Delta\left(\tau^a\right)}{c_C+\frac{c_D}{\alpha}}. \tag{3}$$

Moreover,

$$\begin{aligned} A''\left(\tau^s\right) &= -\left\{f\left[q\left(\tau^S\right)\right]+f'\left[q\left(\tau^S\right)\right]\frac{c_C+\frac{c_D}{\alpha}}{\Delta\left(\tau^A\right)}\right\}q'\left(\tau^S\right)\Delta'\left(\tau^S\right) \\ &= -\left\{f\left[q\left(\tau^S\right)\right]+f'\left[q\left(\tau^S\right)\right]\frac{c_C+\frac{c_D}{\alpha}}{\Delta\left(\tau^A\right)}\right\}\frac{\left[\Delta'\left(\tau^S\right)\right]^2}{\Delta\left(\tau^A\right)}. \end{aligned}$$

Therefore, the SOC, $A''(S) < 0$, is given by:

$$f\left[q\left(\tau^s\right)\right] + f'\left[q\left(\tau^s\right)\right] \frac{c_C + \frac{c_D}{\alpha}}{\Delta\left(\tau^a\right)} > 0. \tag{4}$$

Assuming a monotonic and increasing hazard function for the distribution function, $F$, the SOC will be always satisfied and the First-Order condition given in (3) yields a unique equilibrium.

## 3.1 Litigation costs and the likelihood of settlement

Under the baseline model of Bebchuk (i.e., when $\alpha = 1$ in this setting), settlement rate is equally sensitive to the changes of the litigation costs of either party. However, under the current model (i.e., when $\alpha < 1$), settlement rate is more responsive to changes in the defendant's costs than to changes in the complainant's costs. To see this, denote the equilibrium value of $q\left(\tau^s\right)$ by $q^*$ and rewrite the first-order condition (3) as follows

$$\frac{f\left(q^*\right)}{1 - F\left(q^*\right)} = \frac{\Delta\left(\tau^A\right)}{\frac{c_D}{\alpha} + c_C}. \tag{5}$$

Since we assume a monotonically increasing hazard function, an increase in the RHS of this equation results in a higher equilibrium value for $q^*$, or equivalently, a lower equilibrium settlement rate. Therefore,

**Proposition 1** *The equilibrium settlement rate is increasing in the litigation costs of either party and decreasing in the stake at dispute.*

Moreover, since $\alpha < 1$, a reduction in the defendant's litigation costs reduces the likelihood of settlement to a greater extent than does a reduction in the complainant's costs. Formally,

**Proposition 2** *The equilibrium settlement rate is more sensitive to changes in the defendant's costs than to changes in the complainant's costs.*

To obtain an intuition for this result, consider the relative cost of litigation to concessions for each party. Due to gains from trade (Assumption 1), a marginal change in tariffs has a greater impact on the welfare of the complaining country than the welfare of the defending country. Therefore, the opportunity cost of litigation is relatively higher for the defending party.

Denoting the equilibrium settlement rate by $R^*$, Propositions 1 and 2 imply:

$$\frac{dR^*}{dc_D} > \frac{dR^*}{dc_C} > 0.$$

**Example 3** *Suppose that* $p$ *is distributed according to Beta distribution with shape parameters given by* $(2,2)$, *i.e.,*

$$f(p) = \frac{\Gamma(4)}{\Gamma(2)\Gamma(2)} p(1-p),$$

*where* $p \in [0,1]$ *and* $\Gamma$ *is the gamma function. The hazard function of this probability distribution is given by*

$$\frac{\frac{\Gamma(4)}{\Gamma(2)\Gamma(2)} p(1-p)}{1 - \frac{\Gamma(4)}{\Gamma(2)\Gamma(2)} \int_0^p t(1-t)\,dt} = \frac{6p}{1+p-2p^2}.$$

*Using this hazard function, the equilibrium condition* $(5)$ *can be written as*

$$\frac{6q^*}{1+q^*-2q^{*2}} = \frac{\Delta\left(\tau^A\right)}{\frac{c_D}{\alpha} + c_C}.$$

*Solving for* $q^*$ *yields:*

$$q^* = \frac{\Phi - 6 + \sqrt{-12\Phi + 9\Phi^2 + 36}}{4\Phi},$$

*where,* $\Phi$ *is equal to the right-hand side of* $(5)$. *Thus, the likelihood of settlement,* $R^* =$

$1-F(q^*)$, *is given by*

$$\begin{aligned} R^* &= 1-\frac{\Gamma(4)}{\Gamma(2)\Gamma(2)}\int_0^{q^*} t(1-t)\,dt \\ &= 1-\frac{3}{16\Phi^2}\left(\Phi-6+\sqrt{9\Phi^2-12\Phi+36}\right)^2+\frac{1}{32\Phi^3}\left(\Phi-6+\sqrt{9\Phi^2-12\Phi+36}\right)^3 \end{aligned}$$

*As is depicted in Figure 1,* $R^*$ *is a decreasing function of* $\Phi \equiv \frac{\Delta(\tau^A)}{\frac{c_D}{\alpha}+c_C}$, *and Propositions 1 and 2 are verified.*

# 4 A Signaling Model

In the previous section, we assumed that in the settlement bargaining game the uninformed party offers a settlement proposal and the informed party decides whether to accept or reject this proposal. In contrast, in this section, we assume that the informed party is the one that offers a settlement and the uninformed party may accept or reject the offer.

The model presented in this section is a modification of the signaling model of Reinganum and Wilde (1986). As in the previous section, we assume that the defendant has private information about its probability of losing the case in the court, denoted by $p$. The signaling game is as follows. The defendant offers a reduction in its import tariff from $\tau^d$ to $\tau^s$. The complainant's strategy, on the other hand, is a function, $r(\tau^s)$, which specifies the probability that it rejects the defendant's policy adjustment proposal. The expected payoffs of the complainant, if she chooses a rejection probability of $\rho$, is given by

$$\Pi_C(\tau^s,\rho;b) = [1-\rho]\,\Delta(\tau^s)+\rho\,[b(\tau^s)\,\Delta(\tau^a)-c_C]\,. \tag{6}$$

where, $b(\tau^s)$ represents the complainant's belief about $p$ given the defendant's offer, $\tau^s$.

Given function $r(.)$, the expected payoff of the defendant from offering $\tau^s$ is

$$\Pi_D\left(\tau^s; r\left(.\right)\right) = -\left[1 - r\left(\tau^s\right)\right]\alpha\Delta\left(\tau^s\right) - r\left(\tau^s\right)\left[p\alpha\Delta\left(\tau^a\right) + c_D\right]. \tag{7}$$

An equilibrium for this problem is characterized by a triple $(b^*, r^*, \tau^{s*})$. An interior solution for the complainant's problem requires:

$$\frac{\partial \Pi_C}{\partial \rho} = -\Delta\left(\tau^s\right) + b\left(\tau^s\right)\Delta\left(\tau^a\right) - c_C = 0. \tag{8}$$

Moreover, consistency requires $b\left(\tau^s\right) = p$. Therefore, (8) implies:

$$\Delta\left(\tau^{s*}\right) = p\Delta\left(\tau^a\right) - c_C \tag{9}$$

Furthermore, $\tau^{s*}$ must maximize the defendant's expected payoff, given $r^*\left(\cdot\right)$. That is, it should satisfy the defendant's first-order condition:

$$r'\left(\tau^{s*}\right)\alpha\Delta\left(\tau^{s*}\right) - \left[1 - r\left(\tau^{s*}\right)\right]\alpha\Delta'\left(\tau^{s*}\right) - r'\left(\tau^{s*}\right)\left[p\alpha\Delta\left(\tau^a\right) + c_D\right] = 0$$

or, equivalently,

$$-\alpha\Delta'\left(\tau^{s*}\right) + \alpha\Delta'\left(\tau^{s*}\right)r\left(\tau^{s*}\right) - \left[\alpha c_C + c_D\right]r'\left(\tau^{s*}\right) = 0 \tag{10}$$

Equation (10) has a one-parameter family of solutions $r^*\left(\Delta'\left(\tau^s\right)\right) = 1 + \lambda \exp\left\{-\frac{\Delta'\left(\tau^s\right)}{\alpha c_C + c_D}\right\}$. The appropriate boundary condition is $r^*\left(\Delta'\left(\underline{\tau}^s\right)\right) = 0$, where $\Delta'\left(\underline{\tau}^s\right) = \overline{p}\Delta'\left(\tau^a\right) - c_C$.[10] This implies that

$$\lambda = -\exp\left\{\frac{\overline{p}\Delta'\left(\tau^a\right) - c_C}{\alpha c_C + c_D}\right\}.$$

[10]For a discussion of this boundary condition, see Reinganum and Wilde (1986).

Therefore, the equilibrium probability of rejection as a function of $\tau^s$ will be given by:

$$\begin{aligned} r^*\left(\tau^s\right) &= 1-\exp\left\{\frac{\overline{p}\Delta'\left(\tau^a\right)-c_C}{\alpha c_C+c_D}\right\}\exp\left\{-\frac{\Delta'\left(\tau^s\right)}{\alpha c_C+c_D}\right\} && (11)\\ &= 1-\exp\left\{\frac{\overline{p}\Delta'\left(\tau^a\right)-\Delta'\left(\tau^s\right)-c_C}{\alpha c_C+c_D}\right\}. && (12)\end{aligned}$$

Finally, for a particular value of $p$, the equilibrium settlement rate, $R^* = 1 - r^*$, can be obtained by substituting $\Delta\left(\tau^{s*}\right)$ from (9) into (11), namely:

$$R^* = \exp\left\{\frac{\overline{p}-p}{\alpha c_C+c_D}\Delta'\left(\tau^a\right)\right\}. \tag{13}$$

In contrast with the Reinganum and Wilde (1986) original model, in the present formulation the probability of trial depends on the allocation of litigation costs. In particular, probability of trial is more responsive to changes in the defendant's litigation costs than to the complainant's litigation costs. Therefore, Propositions 1 and 2 hold under the signaling model as well.

# 5 Settlement Bargaining under the Allegation of Indirect Breach

In this section, we consider disagreements over policies that are not explicitly restricted by the trade agreement but can potentially nullify or impair the benefits of a contracting party that were intended under the agreement. Such actions, if proved to nullify the effect of the agreement, may be categorized as indirect breach of the contract. In an indirect breach, while keeping its tariff rates fixed at the agreed-upon levels, the defendant adopts a policy, such as subsidies, etc, that potentially nullifies/impairs the benefits of the complainant from the agreement. If such a case is litigated, the court determines the extent to which the defendant's policy has nullified the complainant's gains from the agreement. If the court's ruling is against the defendant, the defendant is supposed to take mitigating actions that restore the benefits of the complainant from the agreement.

In this type of disagreement, the dispute is over the extent of damages imposed on the complaining party. Such disagreements may arise due to asymmetric information of the disputing parties about the size of the compensation, denoted by $\Delta$, that the dispute panel would award to the complainant in case of litigation. We assume that $\Delta$ is the private information of the complaining party, while the defending party only knows that $\Delta$ is distributed according to $G(\cdot)$ on the interval $\left(\underline{\Delta}, \overline{\Delta}\right)$. We also maintain Assumption 1, which implies that the cost to the defendant of conforming to an adverse ruling by the panel is given by $\alpha\Delta$, where $0 < \alpha < 1$.

Once again, we employ the signaling model of Reinganum and Wilde (1986) to analyze the settlement bargaining problem. More specifically, we consider a bargaining process in which the informed party, i.e., the complainant, demands a policy adjustment on behalf of the defendant in exchange for settlement. Let $S$ denote the benefit of the proposed policy adjustment to the complaining party. We continue to maintain Assumption 1, which implies that the cost of this policy adjustment to the defending party is given by $\alpha S$.

The complainant's strategy is to demand $S$ to maximize its expected payoff. The defendant's strategy, on the other hand, is a function, $r(S)$, which specifies the probability that it rejects the complainant's policy adjustment proposal. The expected payoffs of a defendant who has received a settlement demand $S$ and has a rejection probability of $\rho$, is given by

$$\Pi_D(S, \rho; b) = -[1-\rho]\,\alpha S - \rho\left[\alpha b(S) + c_D\right], \tag{14}$$

where, $b(S)$ represents the defendant's belief about $\Delta$ given the complainant's demand, $S$.

Expected payoffs of a complainant who would receive an award of the size $\Delta$ by the dispute panel, demands $S$ to settle, and takes as given the strategy $r(S)$ of the defendant, is given by

$$\Pi_C(S;r) = [1 - r(S)]\,S + r(S)\,[\Delta - c_C]\,. \tag{15}$$

An equilibrium for this problem is characterized by a triple $(b^*, r^*, S^*)$. An interior solution for the defendant's problem requires:

$$\frac{\partial \Pi_D}{\partial \rho} = \alpha S - \alpha b(S) - c_D = 0. \tag{16}$$

Moreover, consistency requires $b(S) = \Delta$. Therefore, (16) implies:

$$S^* = \Delta + \frac{c_D}{\alpha}. \tag{17}$$

Furthermore, $S^*$ must maximize the complainant's expected payoff, given $r^*(\cdot)$. That is, it should satisfy the complainant's FOC:

$$[1 - r(S^*)] + [1 - r'(S^*)]\,S^* + r'(S^*)\,[\Delta - c_C] = 0,$$

or, equivalently,

$$1 + S^* - r(S^*) - \left(c_C + \frac{c_D}{\alpha}\right) r'(S^*) = 0. \tag{18}$$

Equation (18) has a one-parameter family of solutions $r^*(S) = 1 + \lambda \exp\left\{-\frac{S}{c_C + \frac{c_D}{\alpha}}\right\}$. Applying appropriate boundary conditions, the equilibrium probability of rejection as a function of $S$ will be given by:

$$r^*(S) = 1 - \exp\left\{-\frac{S - \underline{\Delta} - \frac{c_D}{\alpha}}{c_C + \frac{c_D}{\alpha}}\right\}. \tag{19}$$

Finally, for a particular value of $\Delta$, the equilibrium settlement rate, $R^* = 1 - r^*$, can be obtained by substituting $S^*$ from (17) into (19), namely:

$$R^* = \exp\left\{-\frac{\Delta - \underline{\Delta}}{\frac{c_D}{\alpha} + c_C}\right\}. \tag{20}$$

Note the similarity between this result and equation (13), which is the equilibrium settlement rate in the signaling model of Section 4. In both cases the equilibrium settlement rate is more responsive to changes in the defendant's litigation costs than to the complainant's litigation costs and Propositions 1 and 2 continue to hold.

# 6 Data

The data set used in this study is from Bown and Reynolds (2014). It contains 427 disputes from 1995 to 2011. For each case, the respondents, complainants, dispute initiation date, whether dispute was over import or export, and the dates as well as nature of violations are reported. Out of all the disputes, 308 cases target import of specific products. The innovation of this data set is the inclusion of bilateral trade volumes and values at the time of violation as well as the time of implementation of these disputes. Moreover, these trade data are included for two years before and after those dates.[11]

Note that some of these 308 cases are multiple filings of same disputes.[12] These multiple filings are marked in the data set with a variable that gives them the same dispute number. This helps us to combine these multiple filings into single disputes. But, since disputed product codes between a pair of countries might have been repeated across these multiple filings, one needs to eliminate these duplicate observations so that trade values are not double-counted in these combined disputes.

[11] See Bown and Reynolds (2014) for more information on the data set.

[12] One example is when the same dispute between a pair of member countries is filed multiple times. Another is when several parties have similar complaints against a defending party, they may file a single complaint as co-complainants or they may file separate complaints. In either case, similar complaints are addressed as a single case by the DSP.

- *Measure of settlement*

Settlement can happen before or after the panel establishment. We call settlements that take place before panel establishment 'early settlements' and those after it as 'late settlements.' We only consider early settlement for this study. Cases for which panels were not established, i.e. the date of panel establishment is missing in their data, are considered as settled early. The data on the dates of panel establishment are taken from the WTO dispute settlment data set (Horn and Mavroidis, 2008).

- *Measure of litigation costs*

It is a widely held view among the observers of the WTO that less developed countries have relatively higher costs of legal work in the dispute settlement process. For example, Shaffer (2003) points out that little expertise in the WTO law and the opportunities it offers coupled with financial constraints in obtaining legal expertise from outside are challenges faced by the developing countries in using the WTO legal system effectively.[13] In fact, in response to concerns about the relatively high costs of legal works for poorer countries, the Advisory Centre on WTO Law (ACWL) was established in 2001 to provide developing countries with subsidized legal aid for participation in the DSP.[14]

On this basis, we divide countries into high cost and low cost based on their GDP per capita. All countries whose GDP per capita is beyond a threshold are considered low cost and those below the threshold are high cost. $10,000 is chosen as the threshold. But, the results do not change when we use $7,000, $12,000, or even $15,000 as the threshold.[15] Tables A1 and A2 rank countries based on their GDP per capita and reports share of times they

[13] See the quote from Shaffer (2003) in Section 1.

[14] Developing countries can access legal aid through ACWL for an hourly charge that ranges from $25 for the least developed countries to $200 for the highest income developing countries (see www.ACWL.ch).

[15] Some may argue that even though China, India, and Brazil are developing countries with low income levels, they have a similar capacity as the developed countries to litigate in WTO. This may be apparent from the fact that they are strong and active members of WTO. Including these countries among the low cost countries does not change the result qualitatively.

settled their disputes as a defendant or a complainant. For the defendants a dummy is defined that is equal to one if the defendant belongs to the high cost countries and zero otherwise. A similar dummy is defined for the richest complainant in a dispute. This measure only depends on the disputing party's GDP per capita and not on the characteristics of the case, e.g., the complexity of the legal issues involved. While it would be interesting to include case-specific factors in the construction of this measure, it has been pointed out by observers that litigation costs are more or less independent of the commercial stakes involved in a dispute (Shaffer, 2003).

- *Measure of the stake at dispute*

Stake at dispute affects the chance of settlement negatively and should be included in any regression of dispute settlement. We use the value of defendant's import of the disputed products from the complainants one year before the violation, as one measure of stakes at dispute. Products are measured at six-digit level HS codes. The stake at dispute may be also affected by the defending country's size of imports from third countries. In a three-country model of trade where the defending party imports from the complaining party as well as the rest of the world, it can be shown that the stake at dispute for the defending party is decreasing in its import value from the rest of the world. To account for this effect, we also include value of import in the disputed sector from the rest of the world one year prior to violation, in the regression.[16]

- *Measure of retaliation capacity of the complainants*

The complainants in a dispute may want to retaliate by raising their tariff rates on imports from the defendant. The size of this threat may affect the likelihood of the settlement. Therefore, we control for the total value of exports from the defendant to all complainant.

[16]Bown and Reynolds (2014) data set has the size of defendant's import from all countries. So the import from the complainants and from the rest of the world are calculated based on these data. Moreover, when the complainant is European Union, we calculate the size of the defendant's import by adding the size of import from countries that were in the European Union in the year the dispute was initiated.

- *Other control variables*

Some disputes involve multiple complaining parties that join the dispute as interested parties. In some instances also, third parties join the dispute. The existence of multiple parties as well as the existence of third parties, who joined before the panel was established, can affect the settlement of a dispute. Therefore, we define and include two dummies in the regressions: 1) a multiple complainants dummy that is one if the dispute has multiple complainants and zero otherwise, and 2) a third-party complainants dummy that is one if at least one of the third parties joined the dispute before the panel was established and zero if there was no third party or all of them joined after the panel was established. The third-party complainants dummy is defined this way - which is different from the third-party variable already in the data set - because not all parties that join a dispute can be considered as a third party. Most third parties join a dispute after pre-trial negotiations break down. Therefore, one can argue that it is the breakdown of pre-trial negotiations that attracts third parties to join the dispute, and not the other way around. Hence, only third parties that joined before the panel establishment should be considered.

Summary statistics of all variables are reported in Table 2.

# 7 Empirical Results

In this section, we evaluate the following hypotheses that are derived from Propositions 1 and 2:

*Hypothesis 1A:* Settlement rate is positively correlated with the measures of litigation costs.

*Hypothesis 1B:* Settlement rate is negatively correlated with the trade volume between the disputing parties in the disputed sector prior to violation.

*Hypothesis 2:* Settlement rate is more sensitive to changes in the litigation costs of the defending party than to changes in the litigation costs of the complaining party.

Hypotheses 1A and 1B correspond to Proposition 1 and Hypothesis 2 refers to Proposition 2. In addition to these hypotheses, we will also be able to discuss other factors that may influence the outcome of settlement negotiations, including the retaliation capacity and the existence of co-complainants.

Table 3 reports the probit estimates for the likelihood of settlement in a dispute. Similar results are obtained from linear probability model, logit model, and maximum likelihood estimation assuming beta distribution. The dependent variable is a dummy that is equal to one if the panel is not established, i.e. the dispute is settled prior to panel establishment. Column (1) has the probit estimation for all disputes regardless of whether they are on imports, exports, goods, or services. It contains 349 disputes. Columns (2) to (6) restrict the results to those disputes that are about import of goods in a specific disputed sector for which import data is available. They have 252 disputes.

Estimations for the whole data (Column(1)) and all import cases (Columns (2) and (3)) support Hypothesis 1A which states the likelihood of settlement is positively correlated with the litigation costs of each party. The coefficient of defendant cost is statistically significant in all of them. But, the coefficient of the richest complainant cost, although positive, is not statistically significant. The results are robust when we control for different variables, that are potentially related to settlement, in Column (3). The last row in the table reports the p-value for testing the null hypothesis of whether the coefficient of 'Defendant is high cost' is smaller than the coefficient of the 'Richest complainant is high cost'. The results in Columns (1) through (3) reject the null and therefore, support Hypothesis 2.

Column (4) reports the results for only disputes prior to 2001 and Column (5) depicts them for disputes filed in and after 2001. In 2001, the Advisory Centre on WTO Law (ACWL) that subsidizes the cost of litigation for the developing countries was established. As a result, it became easier for these countries to press charges against their trade partners, especially the developed countries, and defend their cases in the DSP. As Figure 2 shows the share of disputes in which a developing country is a complainant substantially increased after 2001. This share was about 30% between 1995 and 2000 and increased to about 50% between 2001 and 2011. Hence, based on the model presented in this study, one may expect that the estimated results would only hold (or would be stronger) for disputes prior to 2001. The estimates in Columns (4) and (5) are in line with this conjecture and show that Hypotheses 1A and 2 are only supported by data prior to 2001. In other words, with the advent of ACWL and subsidization of litigation costs of developing countries, being a developing country is not correlated with the likelihood of settlement anymore. This further supports the theoretical model of the paper that the litigation cost of developing countries is an important predictor of settlement.

The estimates for the pre-2001 period are similar to those for the whole sample. The coefficient of litigation costs for both defendant and the richest complainant increases. But, similar to Columns (1) through (3), it is only statistically significant for the defendant. The test rejects that the correlation for the cost of defendant is smaller than the complainant which confirms Hypothesis 2 (for pre-2001 sample).

- *Stake at dispute, retaliation capacity, and co-complainants*

The value of defendant's imports from the complainants in the disputed sector one year prior to violation is a measure of stake at dispute. As shown in Columns (3) through (6), the likelihood of settlement is negatively correlated with this variable. The coefficient remains statistically significant even after 2001. This supports Hypothesis 1B that the larger the trade value, the greater the stake at dispute, and the harder the settlement. The value of defendant's import from the rest of the world, however, has no statistical correlation with the probability of settlement.

The Dispute Settlement Process of the WTO does not provide any external enforcement of the agreement. Instead, the system relies on the retaliatory power of the injured countries against the offending countries to enforce trade agreements. Therefore, the retaliatory capacity of the complaining parties may influence the outcome of the pre-trial negotiations. Retaliatory actions are normally in the form of import restrictions in the injured country against the products from the offending country. Thus, the volume of export from the defending country to the complaining countries can be used as a measure of the complainants' retaliation capacity. Our empirical observation suggests that total value of exports from the defending country to the complaining countries has no correlation with the likelihood of settlement controlling for the size of imports.

Having multiple complainants, on the other hand, is negatively correlated with the probability of settlement and the correlation is statistically significant. Columns (4) and (5) show that this negative correlation is only pronounced prior to 2001. Hence, in that period, the existence of multiple complainants may have reduced the likelihood of settlement by increasing the stake at dispute. This result is robust even if we control for measures of the stake at dispute such as the disputed trade values between the defendant and the complaining parties.

Busch and Reinhardt (2006) hypothesize that third parties undermine pre-trial negotiations by increasing the negotiation costs. In fact, as they point out, "61 percent of disputes with no third parties ended in early settlement, in contrast to 26 percent of disputes with third parties. Likewise, nine percent of disputes without third parties ended in a ruling, whereas fully 45 percent of disputes with third parties went the legal distance." But, it is important to note that most third parties join a dispute after pre-trial negotiations break down. Therefore, one can argue that this is the breakdown of pre-trial negotiations that attracts third parties to join the dispute, and not the other way around. To analyze the effect of third parties on the pre-trial negotiations, we define third-party complainants as a dummy variable that is equal to one if at least one third party joined the negotiations *prior* to the establishment of a WTO dispute panel. The coefficient of third-party complainants support Busch and Reinhardt (2006) hypothesis at least prior to 2001.

# 8 Conclusion

Our objective in this paper was to highlight the effect of the compensation mechanism that is available to disputing parties on the outcome of pre-trial negotiations. In particular, we considered trade disputes among the WTO members in which trade policy adjustments, rather than cash payments, are used to transfer wealth among the member countries. As opposed to cash payments, policy adjustments are not zero-sum transactions, in the sense that the payee receives a different amount than is paid by the payer. The classical settlement bargaining models, which consider cash payments as the method of compensation, is modified to study settlement bargaining in an environment where compensations are implemented through policy adjustment.

We showed that when policy adjustment is the only compensation mechanism, the litigation costs of the defending party has a pronounced effect on the likelihood of pre-trial settlement. Thus, the classic result regarding the independence of the settlement likelihood and the allocation of litigation costs does not follow under this alternative compensation mechanism. This result suggests that legal procedures that allocate a larger fraction of the burden of proof on the defending party should result in a higher settlement rate.

This theory can explain some stark differences between the behavior of these developed and developing countries in the dispute settlement process of the WTO. In a dispute between a developed and a developing country, the likelihood of settlement is significantly lower when the developed country is named as the defending party. Assuming that developing countries in the data set have higher litigation costs, this observation can be interpreted as an indication of the pronounced effect of the defending countries' litigation costs in pre-trial negotiations.

# References

Bebchuk, L. (1984). Litigation and Settlement under Imperfect Information. *Rand Journal of Economics 15*(3), 404–415.

Beshkar, M. (2010). Trade Skirmishes and Safeguards: A Theory of the WTO Dispute Settlement Process. *Journal of International Economics 82*(1), 35 – 48.

Beshkar, M. (2016). Arbitration and Renegotiation in Trade Agreements. *Journal of Law, Economics, and Organization 32*.

Beshkar, M. and E. Bond (2017). Cap and Escape in Trade Agreements. *American Economic Journal-Microeconomics*.

Beshkar, M., E. Bond, and Y. Rho (2015). Tariff Binding and Overhang: Theory and Evidence. *Journal of International Economics 97*(1), 1–13.

Beshkar, M. and E. W. Bond (2008). The Theory of Dispute Resolution with Application to Intellectual Property Rights. In K. Maskus (Ed.), *Intellectual Property, Growth and Trade*. Elsevier B.V.

Beshkar, M. and R. Lee (2018). How do terms-of-trade effects matter for trade agreements?

Beshkar, M. and J. Park (2017). Dispute Settlement with Second-Order Uncertainty: The Case of International Trade Disputes. *Working Paper*.

Bown, C. (2005). Participation in WTO dispute settlement: Complainants, interested parties, and free riders. *The World Bank Economic Review 19*(2), 287.

Bown, C. P. (2004). Developing countries as plaintiffs and defendants in GATT/WTO trade disputes. *The World Economy 27*(1), 50–80.

Bown, C. P. and K. M. Reynolds (2014). Trade flows and trade disputes. World Bank Policy Research Working Paper 6979.

Busch, M. and E. Reinhardt (2003). Developing countries and general agreement on tariffs and trade/world trade organization dispute settlement. *Journal of World Trade 37*(4), 719–735.

Busch, M. and E. Reinhardt (2006). Three's a crowd: Third parties and WTO dispute settlement. *World Politics 58*(3), 446–477.

Busch, M. L., E. Reinhardt, and G. Shaffer (2008). Does legal capacity matter? explaining patterns of protectionism in the shadow of WTO litigation. Working paper.

Guzman, A. and B. A. Simmons (2002). To settle or empanel? an empirical analysis of litigation and settlement at the world trade organization. *Journal of Legal Studies XXXI*, 205–235.

Horn, H. and P. C. Mavroidis (2008). The WTO Dispute Settlment Data Set 1995-2006: User's Guide. Version 2.0.

Horn, H., P. C. Mavroidis, and H. Nordström (1999). Is the use of the WTO dispute settlment system biased? Discussion Paper Series- Center for Economic Policy Research.

Kuenzel, D. J. (2017). WTO dispute determinants. *European Economic Review 91*, 157–179.

Limão, N. and K. Saggi (2008). Tariff retaliation versus financial compensation in the enforcement of international trade agreements. *Journal of International Economics 76*(1), 48–60.

Maggi, G. and R. Staiger (2011). The role of dispute settlement procedures in international trade agreements. *The Quarterly Journal of Economics 126*(1), 475–515.

Maggi, G. and R. W. Staiger (2015a). Optimal design of trade agreements in the presence of renegotiation. *American Economic Journal: Microeconomics 7*(1), 109–143.

Maggi, G. and R. W. Staiger (2015b). Optimal design of trade agreements in the presence of renegotiation. *American Economic Journal: Microeconomics 7*(1), 109–143.

Maggi, G. and R. W. Staiger (2017). Learning by ruling and trade disputes. Technical report, National Bureau of Economic Research.

Maggi, G. and R. W. Staiger (2018). Trade disputes and settlement. *International Economic Review 59*(1), 19–50.

Park, J. (2011). Enforcing international trade agreements with imperfect private monitoring. *The Review of Economic Studies 78*(3), 1102–1134.

Park, J.-H. (2016). Enforcement and dispute settlement. In K. Bagwell and R. W. Staiger (Eds.), *Handbook of Commercial Policy*, Volume B1, pp. 3–67. Elsevier.

Reinganum, J. and L. Wilde (1986). Settlement, litigation, and the allocation of litigation costs. *Rand Journal of Economics 17*(4), 557–566.

Shaffer, G. (2003). How to Make the WTO Dispute Settlement System Work for Developing Countries: Some Proactive Developing Country Strategies. *ICTSD Resource Paper*.

Wilckens, S. (2009). The usage of the WTO dispute settlement system: Do power considerations matter? In J. C. Hartigan (Ed.), *Trade Disputes and the Dispute Settlement Understanding of the WTO: An Interdisciplinary Assessment*, pp. 213–241. Emerald Group Pub Ltd.

# Figures

Figure 1: Equilibrium settlement rate, $R^*$, as a function of $\Phi \equiv \frac{\Delta(\tau^A)}{\frac{c_D}{\alpha}+c_C}$.

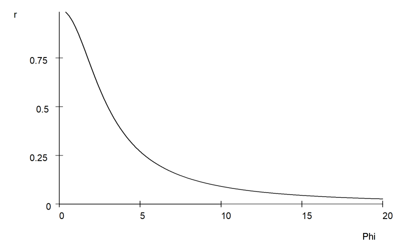
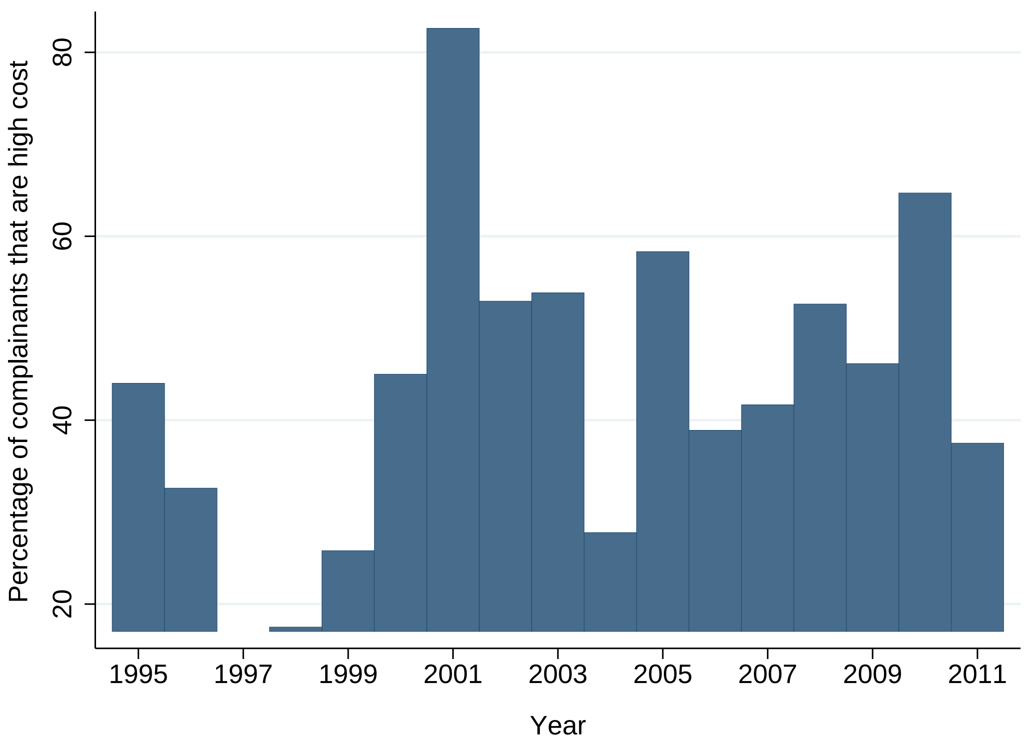



Figure 2: Percentage of complainants that are high cost over time



# Tables

Table 1: Settlement rate and the size of the defending and complaining parties

| Defendant Economy | Complainant Economy | | |
|---|---|---|---|
| | Developing | Developed | All |
| Developing | 75%$^{\dagger}$ (69) | 62%$^{\ddagger}$ (71) | 69% (140) |
| Developed | 44% (66) | 45% (142) | 45% (208) |
| All | 60% (135) | 51% (213) | 54% (348) |

Note: The numbers in parentheses show the number of disputes. Disputes that were the same and filed multiple times are combined. *Developing* includes all countries with GDP per capita≤\$10,000 and *Developed* contains all countries with GDP per capita above \$10,000. For more information, please see Tables A1 and A2. Using \$7,000, \$12,000, or even \$15,000 as the threshold does not change the results.

† This is statistically significantly different than 50% (the average settlement rate for when the defendant is developed and complainant is developing (P-value<0.01).)

‡ This is statistically significantly different than 46% (the average settlement rate for when the defendant and complainant are both developed (P-value<0.01).) It is also statistically significantly different than 50% (when the defendant is developed and the complainant is developing (P-value<0.02).)

Table 2: Summary statistics of variables

| | Observations | Mean | St. dev. | Min | Max |
|---|---|---|---|---|---|
| Settlement prior to panel establishment | 252 | 0.54 | 0.50 | 0 | 1 |
| Defendant is high cost | 252 | 0.44 | 0.50 | 0 | 1 |
| Richest complainant is high cost | 252 | 0.46 | 0.50 | 0 | 1 |
| ln(import from complainants in disputed sectors) | 252 | 3.24 | 2.86 | 0 | 10.25 |
| ln(import from the rest of the world in disputed sectors) | 252 | 5.52 | 2.98 | 0 | 11.48 |
| ln(total export to all complainants) | 252 | 16.15 | 2.94 | 9.00 | 20.95 |
| Multiple complainants | 252 | 0.11 | 0.31 | 0 | 1 |
| Third-party complainants | 252 | 0.61 | 0.49 | 0 | 1 |

Note: 'Settlement prior to panel establishment' is a dummy that is one if the dispute is settled before the panel is established. Import variables have the real value of import of the defendant from the complainants and from the rest of the world one year before the violation. 'Real import from the complainants' only includes import from complainants who filed the dispute and is in the year before the violation. 'Total export to all complainants' is export from the defendant to all complainants in the year the dispute is filed. 'Multiple complainants' is equal to one if more than one complainant filed the dispute. 'Third-party complainants' is a dummy that is equal to one if at least one third party joined the dispute before the panel is established and zero otherwise.

Table 3: Probit Estimation of the Settlement Likelihood

| | | | | Pre-2001 | Post-2001 | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Defendant is high cost | 0.609*** | 0.619*** | 0.740*** | 1.591** | 0.376 | |
| | (0.143) | (0.165) | (0.274) | (0.664) | (0.288) | |
| Richest complainant is high cost | 0.156 | 0.162 | 0.309 | 0.458 | 0.046 | |
| | (0.143) | (0.164) | (0.262) | (0.610) | (0.331) | |
| ln(import from complainants in disputed sectors) | | | -0.131*** | -0.150* | -0.150*** | -0.123*** |
| | | | (0.042) | (0.081) | (0.051) | (0.042) |
| ln(import from the rest of the world in disputed sectors) | | | 0.065 | 0.151 | 0.045 | 0.028 |
| | | | (0.047) | (0.112) | (0.056) | (0.044) |
| ln(total export to all complainants) | | | 0.058 | 0.175 | -0.060 | -0.015 |
| | | | (0.055) | (0.116) | (0.063) | (0.043) |
| Multiple complainants | | | -0.773* | -2.763** | -0.083 | -0.701* |
| | | | (0.448) | (1.099) | (0.496) | (0.413) |
| Third-party complainants | | | -2.726*** | -4.019*** | | -2.625*** |
| | | | (0.290) | (0.468) | | (0.267) |
| Constant | -0.200** | -0.251** | 0.808 | -1.485 | 1.160 | 2.550*** |
| | (0.099) | (0.125) | (0.993) | (2.049) | (1.199) | (0.632) |
| Observations | 349 | 252 | 252 | 114 | 138 | 252 |
| P-value for $H_0 : \beta_{Def.} \leq \beta_{Comp.}$ † | 0.019 | 0.034 | 0.102 | 0.065 | 0.180 | |

Note: For the definition of variables see notes in Table 2. The dependent variable is 'Settlement prior to panel establishment'. 'Third-party complainants' is dropped from Column (5) as it predicted success of probit perfectly.

† This row reports the p-value of testing whether the coefficient of 'Defendant is high cost' is smaller than the coefficient of the 'Richest complainant is high cost'.

* p<0.10, ** p<0.05, *** p<0.01

# Appendix

Table A1: Settlement Rate and the Size of the Defending and Complaining Parties with Low Litigation Costs

| Country | No. of Settled/All Disputes as a | |
|---|---|---|
| (from richest to poorest) | Defendant | Complainant |
| Norway | | 1/2 |
| Switzerland | | 2/3 |
| Denmark | 1/1 | |
| United States | 33/94 | 50/88 |
| United Kingdom | 0/1 | |
| Netherlands | 1/1 | |
| Japan | 6/12 | 2/10 |
| Ireland | 2/2 | |
| Belgium | 2/3 | |
| Canada | 5/15 | 11/23 |
| Sweden | 1/1 | |
| France | 2/2 | |
| Australia | 6/10 | 1/6 |
| New Zealand | | 1/6 |
| European Union | 22/49 | 41/79 |
| Singapore | | 1/1 |
| Hong Kong | | 1/1 |
| Greece | 2/2 | |
| Portogul | 1/1 | |
| Korea | 5/12 | 4/14 |
| Antigua and Barbuda | | 0/1 |

Table A2: Settlement Rate and the Size of the Defending and Complaining Parties with High Litigation Costs

| Country | No. of Settled/All Disputes as a | |
|---|---|---|
| (from richest to poorest) | Defendant | Complainant |
| Czech Republic | 2/2 | 1/1 |
| Croatia | 1/1 | |
| Hungary | 2/2 | 5/5 |
| Slovakia | 3/3 | |
| Trinidad and Tobago | 1/1 | |
| Mexico | 8/14 | 6/15 |
| Poland | 1/1 | 2/3 |
| Chile | 7/10 | 6/10 |
| Turkey | 5/7 | 1/2 |
| Venezuela | 2/2 | 0/1 |
| Argentina | 9/16 | 9/13 |
| South Africa | 3/3 | |
| Panama | 1/1 | 1/3 |
| Malaysia | 1/1 | 0/1 |
| Uruguay | 0/1 | 1/1 |
| Brazil | 7/11 | 11/22 |
| Costa Rica | | 2/3 |
| Dominican Republic | 2/4 | |
| Romania | 2/2 | |
| Colombia | 2/3 | 5/5 |
| Ecuador | | 1/3 |
| China | 10/15 | 2/7 |
| Peru | 4/4 | 1/3 |
| Thailand | 1/3 | 6/13 |
| Guatemala | 0/2 | 3/5 |
| Ukraine | 1/1 | 2/2 |
| Armania | 1/1 | |
| Indonesia | 0/1 | 1/4 |
| Honduras | | 2/5 |
| Egypt | 3/4 | |
| Philippines | 3/4 | 2/4 |
| Nicaragua | 2/2 | 1/1 |
| Moldova | 1/1 | 1/1 |
| Vietnam | | 0/1 |
| Sri Lanka | | 1/1 |
| India | 8/13 | 8/18 |
| Pakistan | 2/2 | 1/3 |
| Bangladesh | | 1/1 |