

The Evolution of International Subsidy Rules

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June 1, 2012

Abstract

Imperfect competition gives rise to cross-border concerns that governments do not internalize when setting both trade policies and domestic policies. An open question is whether these international policy externalities matter for the design of the multilateral trading system. This paper considers the question in a monopolistically competitive environment in which countries can form agreements over import policies, export policies, and a domestic policy that singly determines the number of firms. In this setting, the GATT principal of reciprocity guides countries toward efficient trade policy choices, but there is inefficiency in the domestic policy choices. Hence, there is a fundamental problem for trade agreements arising from imperfect competition. The model can rationalize the existence and evolution of contracts over domestic policies (deep integration) in the multilateral trading system. Examples include the Agreement on Subsidies and Countervailing Measures in the 1995 World Trade Organization and competition policy coordination in the failed 1947 International Trade Organization. Deep integration on subsidies becomes desirable for politically-motivated governments only after countries achieve sufficient cooperation in restraining import tariffs.

JEL Classification: F12, F13, F15

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1 Introduction

When markets are imperfectly competitive, both trade policy and domestic policy choices by governments can create cross-border externalities that do not exist under perfect competition. Governments can use policy to shift profits to domestic firms from foreign firms or to shift firm locations from one country to another without internalizing the negative effect on their trading partners (Venables 1985, 1987). Though some GATT principles like reciprocity can reduce these externalities (Ossa 2011, Mrazova 2011), the prevailing view is that these imperfect competition externalities do not fundamentally matter for the design of the world trading system (Bagwell and Staiger 2010). The new imperfect competition externalities arising from trade policies disappear if countries can negotiate over both import and export policies, and the GATT principle of reciprocity serves only to eliminate the same terms-of-trade externality that arises under perfect competition (Bagwell and Staiger 2009, forthcoming b). Domestic policy externalities arising under imperfect competition can be addressed by GATT's market access preservation rules, which prevent countries from using domestic policies to upset the trade volumes anticipated at the time countries negotiate tariff reductions, so there is no need for direct contracting over domestic policies, also known as "deep integration" (Antras and Staiger 2012).

The success of GATT principles in existing models then begs the question, what explains departures from these principles? Countries have been directly contracting over domestic policies in the multilateral system for decades, although the nature of these rules has changed over time. This paper focuses on two examples detailed in Section 2. In the 1948 Havana Charter, negotiating countries agreed to international coordination of antitrust, although the deal was ultimately killed by the U.S. Congress. The WTO's Agreement on Subsidies and Countervailing Measures (SCM), in effect since 1995, created a consensus restriction on export subsidies and domestic subsidies. This paper argues that imperfect competition does fundamentally matter for the design of the world trading system and can explain the historical pattern of deep integration.

Section 3 details a tractable framework in which two symmetric countries (home and foreign) each have a domestic policy choice that singly determines the number of differentiated products produced by each country. Entry in the differentiated sector requires the employment of capital factor, while production requires labor in both the differentiated sector and a freely traded outside sector. Governments each choose the domestic policy and two border measures, an import policy and an export policy. Government maximize the sum of national income and an additional weight on the firm profits accruing to capital owners.

In section 4, we evaluate whether the domestic policy choice creates a problem distinct

from terms of trade that could pose a challenge for GATT principles. While prior work establishes that GATT principles are well-suited to handle pecuniary externalities, new product varieties arising from government domestic policy create cross-border externalities while having no effect on the prices of an individual product. We first consider whether these imperfect competition externalities persist at fully noncooperative trade and domestic policy choices. Trade policy inefficiency arises solely from countries' desire to manipulate their terms of trade, but there are additional cross-border externalities: foreign firm entry improves home consumer welfare, reduces home profits, and improves home import tariff revenue. Foreign firm entry exerts positive cross-border externalities provided that the weight on firm profits in government objectives is plausibly low, so there are externalities distinct from terms-of-trade manipulation. An additional check is whether the inefficiency in the domestic policy choices persists even if countries act as if they do not value their ability to manipulate their terms of trade, and we establish that such policy choices are always inefficient. A GATT market access preservation rule that forces foreign to preserve home's access to foreign's market does not ensure efficient policies either.

Having established that there is a fundamental problem for trade agreements to solve, we next explain the evolution of subsidy rules in the multilateral trading system (Section 5). Subsidy rules have long been a puzzle for the theory of trade agreements because export subsidies improve the terms of trade for importing countries and increase trade.¹ Limits on domestic subsidies can be harmful because domestic subsidies are the best instrument governments can use to address domestic distortions.² According to Bagwell and Staiger (2006), the WTO subsidy rules serve no purpose in plausible cases, even for politically motivated governments.³ Moreover, the rules could "completely undermine" the GATT, because countries could be forced to eliminate socially beneficial subsidies as a consequence of committing to low tariffs. For all these reasons, Mavroidis, Messerlin, and Wauters (2008) denounce the subsidy agreement as "one of the least economics-informed agreements in the WTO." But the model here can rationalize two historical facts: First, under the 1947 GATT, there was no direct regulation of subsidies, as only the Article XXIII nonviolation complaint could be used to prevent subsidies to import-competing industries that undermined the

¹For example, Janow and Staiger (2003) argue that the export subsidy prohibition runs against the GATT's fundamental purpose of increasing trade from inefficiently low levels.

²The theory of distortions and welfare dates back to Bhagwati and Ramaswami (1963). More recently, Stiglitz (2006) and Rodrik (2011) argue that the WTO subsidy rules are particularly damaging for developing countries where market imperfections are more prevalent.

³The one scenario in which Bagwell and Staiger (2006) find a justification for the WTO subsidy rules occurs when subsidy use is of minor importance on the efficiency frontier, but the authors consider this scenario to be inconsistent with the stated view of GATT members that some subsidy use is desirable. The inability of countries to impose domestic taxes and a cost for applying GATT rules are other conditions required for WTO rules to be beneficial in their paper.

benefits of tariff negotiations. Second, as countries achieved cooperation on import tariffs, countries also benefited from a consensus to limit subsidies on top of the prior GATT rules.

Regardless of the weight governments place on domestic profits, countries cannot benefit from the WTO's limits on subsidies when import tariffs are close to noncooperative levels, as when the GATT was formed. The foreign subsidy increases home import tariff revenue and it decreases the home price index, and both effects benefit home. Home values the price index decrease because when setting import tariffs, home always benefits from gaining tariff revenue on the inframarginal import volume. In equilibrium, home must balance this benefit by setting the price index higher than it would otherwise prefer. The absence of a rationale for subsidy limits at noncooperative trade policy choices is similar to prior work.⁴

A novel feature of this static model is that countries can achieve a global consensus to impose limits on both export subsidies and export-promoting domestic subsidies, as observed in the WTO. Consider foreign, choosing subsidies unilaterally, subject to the GATT constraint that ensures foreign's subsidies do not reduce the access home has to foreign's market.⁵ Despite the GATT constraint, foreign does not consider three effects of higher subsidies on home: a decrease in home's domestic profits, an increase in home's consumer surplus from the subsidized sector, and an increase in home's import tariff revenue. The net cross-border effect of the foreign subsidy on home can be negative, provided that home places a sufficiently large weight on profits in the subsidized sector and home's import tariffs are sufficiently small. A net negative cross-border effect implies that the two countries' unilateral subsidy choices are too high. When considering the effects of foreign policies on home consumption, home prefers changes that raise the home price index. A Pareto superior outcome for the two governments can be achieved by an agreement limiting subsidies.

Having established that there is a motivation to limit subsidies beyond the GATT market access constraint, the paper considers whether the ability of countries to respond to subsidies with temporary import tariffs, known as countervailing duties, either helps to promote efficiency or eliminates the need for subsidy rules. In the two-country case, countries can use countervailing duties as an alternative to enforcing subsidy limits. If countries impose countervailing duties to counter an undesired subsidy, then they are effectively insulated from the trade volume effects and they collect tariff revenue on the subsidy. The countervailing duty

⁴A similar argument explains why export subsidies must yield positive externalities in the model of Bagwell and Staiger (2006). When countries set import tariffs noncooperatively in such a two-good, perfectly competitive environment, they set the local price of imported goods higher than they would otherwise prefer, as proven in Bagwell and Staiger (1999) and Bagwell and Staiger (2002, p. 60-61, 192). When a country proceeds to import subsidized products, it benefits from both the local price decrease and an improvement in its terms of trade.

⁵The constraint is a consequence of Article XXIII in the GATT. Bagwell and Staiger (2001a, 2006) model the GATT in similar fashion.

can fail to be an effective remedy beyond the two-country case, if countries cannot coordinate countervailing duty action. The model can easily be extended to three symmetric countries, and we show that adding countries strengthens the case for using the multilateral subsidy limits rather than the unilateral countervailing duties.

Section 6 offers novel insight into the history of competition policy coordination in the world trading system.⁶ In 1948, countries negotiated and signed the Havana Charter, which included international coordination of competition policy. Though the WTO included other forms of deep integration like subsidy rules, there was no deep integration on competition policy. This section explains the distinction. When countries make their competition policy choices, they do not internalize the cross-border effect on consumer profits and foreign profits and tariff revenue. One country's lax competition policy (allowing less entry and competition) is good for foreign competitors but bad for foreign consumers. When trade barriers are high as in the 1940s, the executive supports global coordination toward stronger competition policy. The import tariff reductions following the 1940s can shift the executive's cross-border externalities from coordinating on stricter antitrust towards coordination on no antitrust or lax antitrust. The conclusion here mirrors that of Section 2.4 on subsidies: any eventual agreement on antitrust will result in lax antitrust that serves the interests of firms to reduce foreign competition, much like the WTO agreement on subsidies that actually occurred.

1.1 Relationship to Existing Literature

Two papers closely related to this paper are by Bagwell and Staiger (2001a), who found no reason for governments to constrain domestic policies beyond GATT rules, and Bagwell and Staiger (2009), who found that monopolistic competition did not give rise to any new externalities for a trade agreement to solve beyond the standard perfectly competitive case. The difference is that this paper considers a domestic policy that affects exported product variety and does not travel through local or world (offshore) prices. Such a policy that increases exported variety could then be considered a nonpecuniary externality.⁷ The creation of new products is the simplest example of a nonpecuniary externality arising through sub-

⁶Bagwell and Staiger (2002, Ch. 9) find no advantage to contracting directly over competition policy. Their results depend on the functioning of the GATT nonviolation complaint. Horn and Levinsohn (2001) consider whether supranational antitrust coordination is desirable in a Cournot framework with homogeneous products. Their focus is more normative than positive and they conclude that there are no general or intuitive results on supranational coordination. They do not consider the GATT nonviolation complaint and it is unclear what international externalities persist in the Cournot setting when the nonviolation complaint is effective.

⁷We could also classify firm entry as creating a pecuniary externality that causes a discrete drop in price from a prohibitive level. The classification is unimportant, because neither discrete price changes nor nonpecuniary externalities fit into the Bagwell and Staiger (2001a) framework.

sidization, but such a nonpecuniary externality could arise more generally from any subsidy that affects product characteristics. Bagwell and Staiger (2001a) acknowledge that a nonpecuniary externality could create additional problems in their framework, but the examples they consider involve consumers who care directly about foreign labor and environmental standards, and the authors suggest that these problems be handled outside of the WTO. They do not consider that subsidies could create nonpecuniary externalities, and subsidies have always been within the purview of the GATT and WTO. An additional distinction from Bagwell and Staiger (2009) is that they only consider trade policies, and all trade policy externalities go through price channels. The domestic policies here play a similar role to import tariffs in Ossa (2011), who observes that trade agreements must address imperfect competition externalities given that countries ban export subsidies. A difference between this paper and Ossa is that domestic policies create a fundamental problem for trade agreements, rather than one that arises as a consequence of other trade agreement restrictions. The WTO subsidy rules are one response to the fundamental problem.

A previous formal analysis of whether political motives can rationalize the WTO subsidy rules, Bagwell and Staiger (2006), found no rationale in an environment with costless application of the GATT rules.⁸ Countries do not have any reason to impose export-promoting subsidies, so there is also no role for countervailing duties in achieving or maintaining efficient policies.⁹ The same three cross-border effects of foreign subsidies in the current paper can exist in their perfectly competitive model, but a difference arises because subsidies to foreign's export sector influence all three effects solely through changes in terms of trade in their model. In their framework, the sum of the three effects is positive whenever two symmetric countries choose noncooperative import tariffs or pursue a symmetric liberalization path to lower efficient tariffs. At any point along such a symmetric liberalization path, the assumption that countries benefit from receiving a pure transfer in either good—equivalent to a terms-of-trade gain holding local prices fixed—ultimately implies that countries must benefit from a foreign subsidy that improves home's terms of trade.¹⁰ In the current pa-

⁸Other papers explain international subsidy limits but focus on subsidies to import-competing industries, which are restrained by GATT Article XXIII. Such papers include Horn, Maggi, and Staiger (2010) and Lee (2011). The current paper and Bagwell and Staiger (2006) take as given that Article XXIII is perfectly functional. Other papers look at dynamic issues involving subsidy rules, such as enforcement (Sauré 2010) and political commitment (Brou and Ruta 2009).

⁹The role for countervailing duties in the current paper is similar to the seminal results of Dixit (1984, 1988) on countervailing duties in Cournot oligopoly, but we distinctly focus on how countervailing duties complement other GATT/WTO rules and how the rules evolve.

¹⁰Along the liberalization path, countries benefit from a fall in the domestic price of the imported good, all else equal, as in Bagwell and Staiger (2002, p. 60-61). When a foreign subsidy increase improves home's terms-of-trade, home benefits from both the fall in domestic price and the direct effect of the terms-of-trade improvement.

per, countries benefit, all else equal, from a terms-of-trade gain—a pure transfer between treasuries in the outside good. But because foreign export subsidies influence home apart from changes in terms of trade, the sign of cross-border foreign subsidy effects along the liberalization path is not pinned down by the assumption that countries always benefit, all else equal, from a terms-of-trade gain.

The current paper provides a theory for a *consensus* restriction on export subsidies and domestic trade-promoting subsidies. While prior theory such as Brander and Spencer (1985) and Bagwell and Staiger (2001b) explain why common exporters would collude to limit their subsidies, this literature includes a third country that imports these goods and would not benefit from subsidy rules. As Bagwell and Staiger (forthcoming b) show, the globally efficient policy is for all countries to subsidize so that prices equal marginal costs, leaving no motive for subsidy constraints, and another essential feature of this paper’s argument for subsidy rules is that the imperfectly goods are consumed by the producing countries, and there is no way for countries to eliminate all monopoly distortions.¹¹ Bagwell and Staiger (2006) acknowledge but do not model the possibility that GATT subsidy disciplines could fail when two countries compete in third markets. They suggest that the GATT rules could be extended to three countries but do not offer any details on how this could be achieved. This paper interprets the WTO subsidy rules as an approach to dealing with third-market problems when countervailing duty action is difficult to coordinate.

Another closely related paper, Bagwell and Staiger (forthcoming a), provides an alternative explanation for the evolution of export subsidy rules using a model with linear Cournot competition. A unique property of international Cournot competition is that a foreign increase in export subsidy or reduction in export tariff gives home a terms-of-trade loss.¹² In their model, as in Venables (1985), nations would unilaterally deviate from an efficient, free-trade equilibrium using export subsidies, so export subsidy bans are desirable at free trade. Yet at the equilibrium where both import and export policies are chosen noncooperatively, countries choose both import and export taxes and countries benefit when they exchange small reductions in these taxes. An important difference between their paper and the current paper is theirs does not consider domestic subsidies. By providing a theory for the WTO’s limits on domestic subsidies, the current paper addresses a broader debate

¹¹To assume countries lack policy to eliminate imperfectly competitive distortions is typical of the trade policy literature, beginning with the seminal oligopolistic work of Dixit (1984), who believed such policies were unrealistic, as well as more recent work such as Ossa (2011) and Bagwell and Staiger (2009, forthcoming a, forthcoming b), whose countries have no domestic policies.

¹²In perfect competition (Bagwell and Staiger 1999), monopolistic competition (Bagwell and Staiger 2009), or Cournot competition without free entry (Bagwell and Staiger forthcoming b), the export subsidy at free trade worsens the terms of trade. The current paper shows that the rationale for export subsidy constraints need not depend on the Cournot framework.

over the appropriate scope of the WTO in regulating domestic policies.¹³ Moreover, the WTO's limits on domestic subsidies have not been made consistent with the theory that the GATT's fundamental purpose is to increase trade volumes from inefficiently low levels. By rationalizing these policies, the current paper implies that the WTO has addressed a wider range of international externalities than the standard theory, given the absence of alternative explanations.¹⁴

Profit-shifting and political economy motives in this paper are therefore important for the multilateral trading system's treatment of behind-the-border policies. This consequence contrasts with Antras and Staiger (2012, forthcoming), who argue that motives for deep integration did not arise until more recently, when offshoring emerged and bilateral bargaining determined more international prices. The current paper argues that international coordination problems other than terms-of-trade manipulation mattered back when the GATT was formed. Aside from the historical interest, profit-shifting and political economy motives expand the set of questions that matter for determining the future of the WTO in regulating non-tariff measures, as laid out in Staiger (2011).

2 Historical and Legal Background

This section details salient features in the evolution of multilateral discipline on subsidies, countervailing measures, and competition policy relevant for the theory in this paper. Histories that are more comprehensive but less focused on this paper's points of interest can be found in Sykes (2005), WTO (2006), and Wouters and Coppens (2010). The first subsection considers the GATT's history of regulating domestic subsidies, export subsidies, and countervailing duties. The next subsection considers evidence of the motives behind the Uruguay Round negotiations (1987-1995) that led to the WTO's Agreement on Subsidies and Countervailing Measures (SCM). The final subsection considers how well the model's focus on entry subsidies matches WTO practice.

¹³Examples include Bagwell, Mavroidis and Staiger (2002), Staiger and Sykes (2011), and Bagwell and Mavroidis (2010). Bhagwati (1996) defends the GATT's capability of handling labor and environmental issues. Bhagwati defends the GATT approach to domestic policies in his concluding remarks of a 2010 *Economist* debate on fair trade vs. free trade.

¹⁴Cross-border externalities that arise under imperfect competition can rationalize the GATT/WTO principles of reciprocity and nondiscrimination, as shown in Ossa (2011) and Mrazova (2011), but both principles can also be explained by the terms-of-trade theory of trade agreements. The current paper is distinct in explaining WTO rules that have not been explained by the terms-of-trade theory.

2.1 GATT Subsidy Rules

Negotiating parties for the GATT discussed subsidies but did not view them as an opportunistic policy that should be limited or eliminated. A 1946 UN Economics and Social Council meeting¹⁵ presented the following view:

One of the main features of the United States proposals on subsidies was that direct subsidies to producers would be permitted. The United States Delegation felt that subsidies were preferable to import restrictions or tariffs. Subsidies kept prices down and demand up. They were expansionist rather than contractionist measures.

The main provision constraining domestic policies under the GATT was the Article XXIII nonviolation complaint. The rule, first formally modeled by Bagwell and Staiger (2001a), "ensures that the level of market access commitments implied by tariff negotiations [in Article II] is not eroded by subsequent changes in domestic policies" (545). A 1955 GATT working party report¹⁶ explains that the contracting parties believed that domestic subsidy regulation of Article XXIII was sufficient to require no further strengthening of domestic policy provisions:

The Working Party considered many proposals for strengthening the present provisions of the Agreement with respect to the use of subsidies. So far as domestic subsidies are concerned, it was agreed that a contracting party which has negotiated a concession under Article II may be assumed, for the purpose of Article XXIII, to have a reasonable expectation, failing evidence to the contrary, that the value of the concession will not be nullified or impaired by the contracting party which granted the concession by the subsequent introduction of a domestic subsidy on the product concerned.

Based on the strong endorsement of Article XXIII, this paper takes as given that the Article XXIII nonviolation complaint was functional. When evaluating the WTO subsidy rules, we ask why additional rules—subsidy limits or countervailing duties—would be necessary in addition to Article XXIII.

The GATT had a longer history of limiting export subsidies than domestic subsidies, but a crucial difference from the GATT and WTO is the absence of a consensus to limit export subsidies. Manufacturing export subsidies were originally subject to a mere reporting

¹⁵E/FC/T/C.II/37, UN Economics and Social Council 31 October 46 meeting.

¹⁶GATT document L/334, 1 March 1955.

requirement in Article XVI. As Irwin, Mavroidis, and Sykes (2008) detail, there was some discussion of limiting export subsidies in the original GATT, but U.S. negotiators did not consider these proposals further because they did not have authority to limit export subsidies under the Reciprocal Trade Agreements Act (RTAA) of 1945, and the RTAA allowed the Truman Administration to implement GATT without Congressional approval. Beginning in 1962, thirteen developed countries began to limit manufacturing export subsidies while requiring no such rules for primary products (e.g. agriculture). Such an agreement matches well with the existing Brander and Spencer (1985) theory, in which manufacturing countries collude to limit subsidies at the expense of importers of manufactured goods. Indeed, the Australian delegation, a primary product exporter, was displeased with the plurilateral export subsidy agreement: "The Article was weak because of the glaring and invidious comparison between weak limitations on subsidies of primary products as compared with the ban on subsidies of manufacturing goods."¹⁷ Because existing theory is adequate to explain this 1962 subsidy agreement, this paper does not focus on it further, and instead focuses on explaining the consensus agreement to limit export subsidies that occurred in the WTO.

Countervailing duties (CVDs) existed in the GATT, but they were more a blatant form of protection by the United States than an efficiency-enhancing remedy. Because the 1897 U.S. CVD law predated the GATT, it was grandfathered in, and unlike other countries, the U.S. was permitted to countervail without demonstrating that its domestic industry had been injured by the subsidized imports, up until 1980 (Wouters and Coppens 2010). The U.S. was the primary user of CVDs under the GATT, accounting for 110 of 128 CVDs reported to the GATT Secretariat between 1980 and 1991 (Sykes 2005). Because the U.S. applied most CVDs and had limited standards in doing so, the GATT CVD best fits into this paper's framework as a conventional failure of import tariff cooperation, and the level of import tariff cooperation is exogenous on the model. This paper takes the position that CVDs played an efficiency-enhancing role only in the WTO.

2.2 WTO Subsidy Negotiating History

This subsection discusses evidence for what problems subsidy rule negotiators believed they were solving. A note from the GATT secretariat¹⁸ at the outset of the negotiations is most insightful:

A number of problems have arisen in the case of production subsidies. The General Agreement does not limit their use, and the requirement not to prejudice the

¹⁷GATT Document SR-9/41, 3 March 1955.

¹⁸MTN.GNG/NG10/W/4, 28 April 1987.

interests of other contracting parties is very vague. In particular it is unclear who has to make the determination of prejudice, how the prejudice should be assessed and whether the obligation to discuss the possibility of limiting the subsidization implies that the subsidizing contracting party must take action to limit the subsidy in question. The Agreement on Subsidies and Countervailing Measures has provided some disciplines as to the effects in the sense that signatories are obliged to seek to avoid causing, through the use of any subsidy, adverse effects to the interest of another signatory. It also established a procedure to determine the existence of adverse effects and to take a remedial action. To the extent that these effects have arisen in the domestic market of the importing country, they have been dealt with through the use of countervailing duties. As the importing country has an efficient deterrent against these effects, the problems result rather from possible abuse of this deterrent. However, regarding adverse effects arising in the domestic market of the subsidizing country or in the third country market, the obligations under the Agreement on Subsidies and Countervailing Measures to avoid causing such effects are hardly enforceable.

The theory in this paper matches the view of the secretariat that the purpose of the subsidy rules is to prevent subsidies from having adverse effects (cross-border externalities) in each other's markets and in the markets of third countries. Unlike Bagwell and Staiger (2006), countervailing duties are seen as playing an essential role in the agreement. Another contrast is that the text implies that the Article XXIII nonviolation complaint is no longer seen as effective at preventing "adverse effects arising in the domestic market of the subsidizing country."¹⁹ This paper nonetheless follows Bagwell and Staiger (2001, 2006) and assumes that Article XXIII handles adverse effects and looks to what other subsidy problems can emerge in the WTO.

2.3 Entry Subsidies and the GATT/WTO

A distinctive feature of this paper is its emphasis on problems created by subsidies that affect entry. The theory matches well with the seminal empirical countervailing duty study of Marvel and Ray (1995), who document that "many of the subsidies in question appear to have covered fixed costs." The authors interpret this stylized fact as evidence that countervailing duties are not used to address legitimate profit-shifting concerns, due to the absence of any theory of strategic motives for fixed cost subsidies. Grossman and Mavroidis (2001, 2003)

¹⁹See also Roessler and Gappah (2005) for a critique of the Article XXIII nonviolation complaint and a summary of its case history.

argue WTO panels have failed to follow the intentions of WTO founders in regulating these subsidies, hence their title choice, "Recurring Misunderstanding of Non-Recurring Subsidies. More recently, Baylis (2009) notes the need for theory on strategic motivations for fixed cost subsidies in her survey of the countervailing duty and strategic trade policy literature.

Among the most prominent examples of fixed cost subsidies in the WTO era is the Boeing-Airbus case, in which Boeing has challenged European Union "launch aid." The EU reduces Airbus' cost of financing the development of new aircraft varieties, which cut into Boeing's market share in several markets. Naturally, there are several complications of the aircraft industry not captured by model. Boeing and Airbus are multi-product duopolists who offshore and use complex supply chains. The model nonetheless captures the core feature of the dispute—subsidies leading to the expansion of varieties.

2.4 Competition Policy

This subsection argues that despite the ultimate failure of the ITO, the negotiation of the Havana Charter was an important example of domestic policy coordination. Negotiating the Havana Charter was a significant act between countries. It was proposed by John Maynard Keynes of the United Kingdom and signed by the U.S., and the U.K. and U.S. were the two major players in the trade negotiations at the time (Irwin, Mavroidis, and Sykes 2008). A guiding principle of the Havana Charter was that global integration required agreements covering more than traditional trade instruments. As Council of Foreign Relations economist William Diebold (1993-94) reflects,

The ITO was based on the conviction you could not maximize trade liberalization—or probably not achieve the objectives of the GATT—by means of traditional trade negotiations alone. . . [One] was to find some way of relating the rules of international trade to the domestic policies of a group of diverse countries.

The international coordination of competition policy (antitrust in the U.S.) was an important feature of the agreement, as negotiators believed it was the primary form of conflict between Congress and the Truman Administration. State department negotiator John M. Leddy says the ITO charter would have moved foreign antitrust closer to U.S. levels, which were the world's strongest:

"We considered ourselves a model how the restraint-of-trade problem should be handled. Cartels are to be outlawed, and the foreigners who sort of grew up in a cartel atmosphere anyhow—it was not their way of doing business to outlaw

cartels automatically.... It was a case-by-case procedure. The ITO Charter was a compromise on this."²⁰

The ITO had the strong support of the Truman Administration that negotiated the Charter, but the Charter faced so much resistance from Congress that it was never put up for a vote. The explanation with the strongest historical support is that Congress did not believe that competition policy coordination was going to result in stronger global antitrust, even though the Truman Administration insisted that was the case, based on the recollection of State Department economist Leroy Stinebower:

"[The charter] led the opposition in the Congress at least to believe that we were creating a supranational organization that could come into the United States and control both our social and our antitrust laws. And the funny thing is in part they saw it the other way around, These countries don't have any very tough antitrust laws and they'll water ours down to the level of theirs."²¹

This paper does not consider why Congress would not trust the executive's prognosis of the policy coordination outcome, and instead focuses on the decision of the executive to negotiate the charter.

3 The Model

The model builds on Section 7.3 of Helpman and Krugman (1989) by adding an export subsidy and a domestic entry subsidy, though we reinterpret this policy as a competition policy in Section 6²² We further simplify by assuming symmetric technology, endowments, and preferences across the two large countries, home and foreign. The economy has two sectors: a monopolistically competitive sector of symmetric firms producing differentiated products and a quasilinear freely traded numeraire good. There are two factors: a labor factor mobile between the two sectors and a specific factor necessary for entry in the differentiated sector. The factors are owned by consumers who take prices and government policies as given and maximize utility. Firms take government policy and the consumer price index as given

²⁰Oral History Interview with John M. Leddy by Richard D. McKenzie, 15 June 1973, available at <http://www.trumanlibrary.org/oralhist/leddyj.htm> (last visited 4 May 2012).

²¹Oral History Interview with Leroy Stinebower by Richard D. McKenzie, 9 June 1974, available at <http://www.trumanlibrary.org/oralhist/stinebow.htm> (last visited 4 May 2012).

²²Related contributions are Flan and Helpman (1987) and Venables (1987), who consider unilateral trade and domestic policies in two-country models with monopolistically competitive firms. Ossa (2011) and Bagwell and Staiger (2009) consider trade agreements under monopolistic competition, but do not consider domestic policies. All four papers use a single-factor model, while the current paper uses a two-factor model.

and maximize profits. Individual firms and consumers are too small to behave strategically. The focus of this paper is the strategic behavior between governments.

After laying out the model, this section determines the governments' objectives as a function of home and foreign policy choices. The objectives allow us to derive the *cross-border externalities* of government policies. Here externalities refer to the cross-border effects of policies that a government does not internalize when it chooses policies unilaterally.

3.1 Setup

Government: The home government chooses an ad valorem import tariff τ , an export subsidy s , and a subsidy to entry e . The foreign government chooses a corresponding set of policies τ^* , s^* , and e^* . A negative import tariff indicates an import subsidy, and a negative export subsidy indicates an export tax, but we will primarily focus on situations when governments choose import tariffs and export subsidies. Nondistortionary transfers between government and consumers balance any budget deficit or surplus.

Government objectives assign a weight 1 to consumer surplus and a weight α to the rents accruing to the specific factor (e.g. producer surplus) Microfoundations for such government objectives come from the Grossman and Helpman (1994) model of lobbying, and Chang (2005) extends the results to a framework with monopolistic competition.²³

For the existence of noncooperative and cooperative equilibria, we require $\alpha < \sigma$, where σ is the elasticity of substitution between differentiated products. If the political economy weight α were greater than σ , countries would give boundless export subsidies to their producers.

Consumption: Consumers in each country all have income large enough to ensure consumption Y of the numeraire good. The utility functions are

$$\begin{aligned} U &= \frac{1}{\theta}(D)^\theta + Y, \text{ and} \\ U^* &= \frac{1}{\theta}(D^*)^\theta + Y^*. \end{aligned} \tag{1}$$

The utility functions imply an elasticity of substitution $\varepsilon = \frac{1}{1-\theta}$ between sectors. D is a CES composite good over n_h symmetric home products and n_f symmetric foreign products. Imposing symmetry on the consumption of goods for each product, we have

²³The additional weight on producer profits is motivated by Hufbauer and Erb (1984, p. 8) and Baldwin (1980, p. 86), who argue that producers' sense of entitlement to their domestic markets has always been central to subsidy rules. Mavroidis, Messerlin, and Wauters (2008) observe the WTO subsidy rules are focused on producer interests.

$$\begin{aligned}
D &= \left(n_h c_h^{\frac{\sigma-1}{\sigma}} + n_f c_f^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \text{ and} \\
D^* &= \left(n_h c_h^{*\frac{\sigma-1}{\sigma}} + n_f c_f^{*\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}.
\end{aligned} \tag{2}$$

The elasticities of substitution satisfy $\sigma > \varepsilon > 1$. For consumption variables c , subscripts h and f denote location of origin, while the superscript "*" indicates location of consumption, so c_f is home imports and c_h^* is foreign imports.

Marginal Production: The good Y has a unit labor requirement and is freely traded between sectors. The differentiated products have marginal labor requirement m . To ship one unit abroad requires an iceberg trade cost, additional production of the good that "melts" in transit. The trade cost is $\phi \geq 0$.

Firm Entry: Countries each have a capital endowment K specific for entry into the differentiated sector. Some consumers own capital and some do not, ensuring a motive for capital lobbying. Governments can reduce the capital requirement with an entry subsidy. The government subsidizes entry in the differentiated sector by hiring labor to produce a public good specific to the differentiated sector. The capital requirement is given by the function $k(e)$, such that k is strictly decreasing in the government subsidy e . Firm profits accrue to the owners of the specific factor. The domestic entry subsidies e and e^* determine the number of firms n_h and n_f in each country:

$$n_h = \frac{K}{k(e)}, \text{ and } n_f = \frac{K}{k(e^*)}. \tag{3}$$

The function k can be inverted to express the cost to the government of having a given number of firms, as if governments were directly choosing the number of firms:

$$\begin{aligned}
e &= k^{-1}\left(\frac{K}{n_h}\right) \equiv f(n_h), \text{ and} \\
e^* &= k^{-1}\left(\frac{K}{n_f}\right) \equiv f(n_f).
\end{aligned} \tag{4}$$

A simple feasible functional form is $k(e) = \frac{K\beta}{e+\mu}$ for a scale parameter β and a shift parameter μ . Such a function $k(e)$ yields $f(n) = \beta n - \mu$ for $n \geq \frac{\mu}{\beta}$, and $\frac{\mu}{\beta}$ is the number of firms absent any entry subsidy. The model could conceivably admit a more general functional form for

k , provided that the government objectives are concave in the number firms chosen.²⁴ We require a restriction on the shift parameter μ that ensures countries offer positive entry subsidies at all equilibria under consideration.²⁵ The scale parameter for $k(e)$ is subject to an additional restriction to ensure there is a cooperative equilibrium with zero tariffs. Discussion of the restriction is postponed to Section 5.1.

The structure here allows us to consider, in a simple way, government ability to influence the extensive margin of firm entry, while at the same time not allowing free entry to eliminate any lobbying motive for firms, as would be the case in a single-factor model.²⁶ As discussed in Section 2.3, consideration of fixed cost subsidies is empirically justified. A richer model would allow owners of capital to hire more labor in response to profit opportunities. Such a model would fall in between the extremes of this paper's model and a single-factor free entry model. The simplification that government effectively chooses the number of firms has precedent in the international competition policy literature.²⁷ In the current paper, the approach offers tractability for studying interactions between domestic policy choices and trade policies, and such interactions have received little attention apart from Bagwell and Staiger (2001a, 2006).

3.2 Determining Government Objectives

To evaluate the government objectives, we find the equilibrium consumption and production taking government policies as given.

Freely mobile labor implies wages are equal across sectors, and profit maximization implies the wage equals the price of the homogeneous good. Free trade in the homogeneous good implies the prices of the homogeneous good and wages are equal across countries. The wage and price of the quasilinear good are defined to be the numeraire.

Utility maximization implies demand for the composite good $D = P^{-\varepsilon}$, where P is the price index for the composite good and PD is the total expenditure on differentiated products. Indirect utilities V and V^* are decreasing in own price index and increasing in

²⁴The elasticity of welfare with respect to firm entry, absent $f(n)$, is $\frac{\varepsilon-1}{\sigma-1}$, so at the very least we require $f(n)$ to be more convex than $n^{\frac{\varepsilon-1}{\sigma-1}}$, and a linear cost function meets this requirement since $\frac{\varepsilon-1}{\sigma-1} < 1$.

²⁵A decrease in μ lowers the number of firms with no entry subsidies. Being a constant in $f(n)$, μ has no effect on first-order conditions and second-order conditions that determine noncooperative and constrained choices of n_h and n_f .

²⁶The idea that such free entry can eliminate strategic trade motives has been well understood since Horstmann and Markusen (1986).

²⁷Dixit (1984), Horn and Levinsohn (2001), and Bagwell and Staiger (2002, Ch. 9) each consider a domestic competition policy (e.g. antitrust policy) that directly determines the number of domestic firms in a Cournot market. Only Bagwell and Staiger (2002, Ch. 9) consider whether there is an additional rationale for a domestic policy agreement beyond the GATT, and they conclude the answer is no.

income I :

$$\begin{aligned} V &= \frac{1}{\varepsilon - 1}PD + I = \frac{1}{\varepsilon - 1}P^{1-\varepsilon} + I, \text{ and} \\ V^* &= \frac{1}{\varepsilon - 1}P^*D^* + I^* = \frac{1}{\varepsilon - 1}P^{*1-\varepsilon} + I^*. \end{aligned} \quad (5)$$

The notation for prices p_h , p_f , p_h^* , and p_f^* matches the consumption variables c_h , c_f , c_h^* , and c_f^* . The price index P is standard following Dixit and Stiglitz (1977) under symmetric firms:

$$\begin{aligned} P &= (n_h p_h^{1-\sigma} + n_f p_f^{1-\sigma})^{\frac{1}{1-\sigma}} \equiv P(n_h, n_f, p_f), \text{ and} \\ P^* &= (n_f p_f^{*1-\sigma} + n_h p_h^{*1-\sigma})^{\frac{1}{1-\sigma}} \equiv P^*(n_h, n_f, p_h^*). \end{aligned} \quad (6)$$

Market demand x_h for a home product is the sum of domestic demand and foreign demand, plus the iceberg transport costs:

$$\begin{aligned} x_h &= c_h + (1 + \phi)c_h^*, \text{ and} \\ x_f &= c_f^* + (1 + \phi)c_f. \end{aligned} \quad (7)$$

Consumer maximization implies the total demands for individual products are

$$\begin{aligned} x_h &= p_h^{-\sigma} P^{\sigma-\varepsilon} + (1 + \phi)p_h^{*-\sigma} P^{*\sigma-\varepsilon}, \text{ and} \\ x_f &= p_f^{*-\sigma} P^{*\sigma-\varepsilon} + (1 + \phi)p_f^{-\sigma} P^{\sigma-\varepsilon}. \end{aligned} \quad (8)$$

Because markets are integrated, imports are marked up from domestic prices based on total net cross-border costs:

$$\begin{aligned} p_h^* &= (1 + \phi + \tau^* - s)p_h, \text{ and} \\ p_f &= (1 + \phi + \tau - s^*)p_f^*. \end{aligned} \quad (9)$$

Since demand functions have a constant price elasticity, profit-maximization implies a constant local price for domestic varieties p_h and p_f^* :

$$p_h = p_f^* = \frac{\sigma}{\sigma - 1} m \equiv p. \quad (10)$$

The prices do not depend on tariffs, as emphasized in Ossa (2011), or on firm entry, as emphasized here. World prices p_h^w and p_f^w are the prices of home and foreign exports between borders. They depend only on the export subsidy:

$$\begin{aligned} p_h^w &= (1 - s)p_h, \text{ and} \\ p_f^w &= (1 - s^*)p_f^*. \end{aligned} \quad (11)$$

The per unit markup $p - m = \frac{p}{\sigma}$ determines home and foreign domestic per firm profits π and total profits Π :

$$\begin{aligned} \pi_h &= \left(\frac{p}{\sigma}\right)x_h, \quad \pi_f = \left(\frac{p}{\sigma}\right)x_f, \\ \Pi_h &= n_h\pi_h, \text{ and } \Pi_f = n_f\pi_f. \end{aligned} \quad (12)$$

Home government objectives can be decomposed as follows:

- Profits (with political economy weight α) $\equiv \alpha\Pi_h$
 - Domestic profits $\equiv \alpha\left(\frac{p}{\sigma}\right)n_h c_h = \alpha\left(\frac{c_h}{x_h}\right)\Pi_h$
 - Export profits $\equiv \alpha\left(\frac{p}{\sigma}\right)(1 + \phi)n_h c_h^* = \alpha\left(1 - \frac{c_h}{x_h}\right)\Pi_h$
- Consumption
 - Consumer surplus $\equiv \frac{1}{\varepsilon - 1}PD$
 - Import tariff revenue $\equiv \tau p n_f c_f$
 - Export subsidy cost $\equiv -s p n_h c_h^*$
 - Entry subsidy cost $\equiv -f(n_h)$
 - Wage income $\equiv L$

A corresponding decomposition holds for foreign. The government objectives G and G^* are then

$$\begin{aligned}
G &= \alpha\Pi_h + \frac{1}{\varepsilon - 1}PD + \tau pn_f c_f - spn_h c_h^* - f(n_h) + L, \text{ and} \\
G^* &= \alpha\Pi_f + \frac{1}{\varepsilon - 1}P^*D^* + \tau^* p n_h c_h^* - s^* p n_f c_f - f(n_f) + L.
\end{aligned} \tag{13}$$

An important task is to separate the effects that go through prices and the number of firms. We write the home government objectives as a function of these, while noting that the price indices are also a function of firms and prices:

$$\begin{aligned}
G(n_h, n_f, p_f, p_h^*, p_f^w, p_h^w, P, P^*) &= \frac{1}{\varepsilon - 1}P^{1-\varepsilon} + n_h c_h(P) \left[\frac{\alpha p}{\sigma} \right] + n_f c_f(p_f, P) [p_f - \phi p_f^* - p^w] \\
&\quad + n_h c_h^*(p_h^*, P^*) \left[\frac{\alpha p(1 + \phi)}{\sigma} + (p^{*w} - p_h) \right] - f(n_h) + L
\end{aligned}$$

The world objectives is as follows:

$$\begin{aligned}
W(n_h, n_f, p_f, p_h^*, p_f^w, p_h^w, P, P^*) &= \frac{1}{\varepsilon - 1}(P^{1-\varepsilon} + P^{*1-\varepsilon}) + \frac{\alpha p}{\sigma} [n_h c_h(P) + n_f c_f(P^*)] \\
&\quad + n_f c_f(p_f, P) [p_f - (1 + \phi)p] + n_h c_h^*(p_h^*, P^*) [p_h^* - (1 + \phi)p] \\
&\quad - f(n_h) - f(n_f) + 2L.
\end{aligned}$$

The sum of the two objectives is justified here because we consider symmetric choices throughout. W can be written in terms of net trade taxes, which we define as $t_f \equiv (\tau - s^*)$ for foreign-produced goods and $t_h \equiv (\tau^* - s)$ for home-produced goods.

3.3 Import Tariff Results

This section considers noncooperative and cooperative tariffs. We introduce an unobjectionable assumption that ensures the standard result that countries' noncooperative import tariffs are larger than their cooperative import tariffs.

At the noncooperative equilibrium in trade policies, each country's import and export subsidy choice is unilaterally optimal. At the cooperative equilibrium, each country's total trade barriers are picked to maximize world welfare. The cooperative equilibrium depends only on total trade barriers because W only depends on total trade barriers.

We establish a first lemma that net trade taxes are higher at noncooperative trade policies than cooperative trade policies, so noncooperative trade policy choices result in too little trade. All lemmas are proven in Appendix A.2.

Lemma 1 Consider countries with symmetric policies \bar{e} , $\bar{\tau}^N$, and \bar{s}^N , such that $\frac{dG}{d\tau} = \frac{dG^*}{d\tau^*} = \frac{dG}{ds} = \frac{dG^*}{ds^*} = 0$. Consider an additional set of countries with total trade barriers \bar{t}^c such that $\frac{dW}{d\tau} = \frac{dW}{d\tau^*} = \frac{dW}{ds} = \frac{dW}{ds^*} = 0$. Then $\bar{\tau}^N$, \bar{s}^N , \bar{t}^c do not depend on \bar{e} , $\bar{\tau}^N > 0$, and $\bar{t}^N > \bar{t}^C$.

The lack of dependence of the noncooperative trade policies $\bar{\tau}^N$ and \bar{s}^N , and fully cooperative trade barriers \bar{t}^c on the level of entry subsidies (and hence the number of firms) is a consequence of CES preferences and the symmetry between countries. The policies maximizing the joint objective W involve subsidizing trade as a second-best attempt to correct the monopoly distortion, so countries would benefit when moving from noncooperative policies to policies with zero net trade taxes.²⁸

Many trade policy models suffer the difficulty that cooperative trade policies could arise from either reducing import tariffs or increasing export subsidies, while we observe GATT members reducing tariffs.²⁹ One typical way to avoid the problem is to assume away export subsidies, but such an approach is not feasible here because we want to study the motivation for the ban on export subsidies. Instead we build on the following lemma which argues that countries will unilaterally choose export subsidies below a certain bound.

Lemma 2 Consider arbitrary import tariff policies and entry subsidies, and export subsidy choices s and s^* satisfying $\frac{dG}{ds} = \frac{dG^*}{ds^*} = 0$. Then $s \leq \frac{\alpha}{\sigma}$ and $s^* \leq \frac{\alpha}{\sigma}$.

The $\frac{\alpha}{\sigma}$ is the value to governments of an additional unit of firm output. When subsidies are greater than $\frac{\alpha}{\sigma}$, the increase in subsidy costs cannot possibly be worth the increase in output.³⁰

Lemma 2 implies that countries would not choose export subsidies above these bounds unless either they were constrained to do so, or if choosing an export subsidy above $\frac{\alpha}{\sigma}$ allowed them to choose a more desirable import policy or entry subsidy policy against some constraint. We do not consider any such constraints in this paper, so throughout we assume $s \leq \frac{\alpha}{\sigma}$ and $s^* \leq \frac{\alpha}{\sigma}$. The assumption allows us to derive later results without concern for suboptimal subsidy choices.

Ruling out the possibility of high subsidies yields an empirically sensible result on import tariffs.

²⁸The joint objectives are also maximized with trade subsidies in the monopolistic competition model of Bagwell and Staiger (2009). Other trade policy models (e.g. Bagwell and Staiger 1999) allow the possibility that political preferences result in positive cooperative net trade barriers.

²⁹See Maggi and Rodriguez-Clare (2005) for more focus on this feature of trade policy models and an approach to resolving the issue.

³⁰The export subsidy increase consists of both an increase in the subsidy cost on the inframarginal export volume, and the total subsidy cost on the marginal export units. The former has a negative effect on the government objective. When the subsidy is greater than $\frac{\alpha}{\sigma}$, the latter more than offsets the value to governments of the marginal unit of output. The export subsidy has no effect on the domestic market. Consequently, countries cannot unilaterally benefit from subsidies greater than $\frac{\alpha}{\sigma}$.

Lemma 3 *Import tariffs always cause negative cross-border externalities on their trading partners ($\frac{dG^*}{d\tau} < 0$ and $\frac{dG}{d\tau^*} < 0$). If home and foreign choose noncooperative import tariffs to maximize their objectives, holding other policies fixed, then the noncooperative import tariffs are higher than the cooperative import tariffs that maximize W .*

A foreign import tariff raises the equilibrium price of home exports in the foreign market, and the higher price leads to lower exports for home. Provided that export subsidies do not violate the bound suggested by Lemma 2, such that the subsidy is larger than the government's valuation of export profits, then the import tariffs always exert negative cross-border externalities. The persistent negative externalities ensure that countries' unilateral tariff choices are too high.

3.4 Foreign Firm Entry Externalities

All policies create international externalities. We focus here on the externalities of a foreign entry subsidy policy on home and postpone the discussion of trade policy externalities. We show that foreign entry improves home differentiated sector consumption but worsens home domestic and foreign profits. Foreign entry improves home's net trade revenue when home uses import tariffs and export subsidies. The balance of concerns determines the effect of foreign entry on welfare.

Foreign entry lowers the price indices of the variety-loving consumers everywhere. An elasticity of substitution σ closer to 1 implies a larger effect. We express results as log derivatives: $\widehat{y} \equiv \frac{d \ln y}{d \ln x} = \frac{dy}{dx} \frac{x}{y}$, the elasticity of y with respect to x .

$$\text{Consumer surplus effect} \equiv -\frac{\widehat{P}}{\widehat{n}_f} = \frac{(1-S)}{(\sigma-1)} > 0. \quad (14)$$

Here $S \equiv \frac{n_h p c_h}{n_h p c_h + n_f p c_f}$, home's ratio of domestic expenditure on differentiated products to total expenditure on differentiated products. S^* is foreign's ratio. Since consumer surplus is inversely proportional to the price indices, the increase implies an increase in home consumer surplus from consuming differentiated products. The foreign price index increase is $\frac{\widehat{P}^*}{\widehat{n}_f} = \frac{-S^*}{(\sigma-1)} < 0$.

Foreign entry unambiguously lowers home total and per-firm profits, both domestically and abroad. A larger elasticity of substitution σ implies a larger business-stealing effect.

$$\text{Domestic profit effect} \equiv \frac{\alpha \widehat{\left(\frac{c_h}{x_h}\right)} \widehat{\Pi}_h}{\widehat{n}_f} = \frac{\widehat{c}_h}{\widehat{n}_f} = \frac{\widehat{P}}{\widehat{n}_f} (\sigma - \varepsilon) = -\frac{(1-S)}{(\sigma-1)} (\sigma - \varepsilon) < 0. \quad (15)$$

$$\text{Export profit effect} \equiv \frac{\alpha(1 - \frac{\widehat{c_h}}{x_h})\widehat{\Pi}_h}{\widehat{n}_f} = \frac{\widehat{c}_h^*}{\widehat{n}_f} = \frac{\widehat{P}^*}{\widehat{n}_f}(\sigma - \varepsilon) = -\frac{S^*}{(\sigma - 1)}(\sigma - \varepsilon) < 0. \quad (16)$$

Foreign entry increases the total home import volume (but decreases the imports per-firm). Foreign entry decreases the home export volume M^* and c_h^* . A larger elasticity of substitution implies a larger decrease in per firm volumes. Throughout when describing the effects, we assume $\tau > 0$ and $s > 0$.

$$\text{Import tariff revenue effect} \equiv \frac{\widehat{\tau p n_f c_f}}{\widehat{n}_f} = 1 + \frac{\widehat{c}_f}{\widehat{n}_f} = 1 - \frac{(\sigma - \varepsilon)}{(\sigma - 1)}(1 - S) > 0. \quad (17)$$

$$\text{Export subsidy cost effect} \equiv \frac{-\widehat{s p n_h c_h^*}}{\widehat{n}_f} = -\frac{\widehat{c}_h^*}{\widehat{n}_f} = \frac{(\sigma - \varepsilon)}{(\sigma - 1)}(S^*) > 0. \quad (18)$$

The foreign firm entry has no external effect on the home domestic entry subsidy costs and labor income.

To summarize, the signs of the various effects of foreign firm entry on the home government's objective are:

- Domestic profits decrease (−)
- Export profits decrease (−)
- Export subsidy costs decrease (+)
- Import tariff revenue increases (+)
- Consumer surplus increases (+)

The balance of the various externalities determines whether home benefits from foreign entry. Like the cross-border trade policy effects derived in Lemma 1, the sign of the various firm entry externalities do not depend on the entry subsidies and firm counts, provided that countries are symmetric. The desired international regulation of entry subsidy depends entirely on how parameters and trade policy choices affect the reaction curves for each country. The level of the noncooperative and efficient number of firms is irrelevant for determining the balance of the various externalities. Consequently, we do not need to specify a specific functional form for the firm count cost function $f(n)$ nor do we need to solve for the noncooperative or cooperative choices of n in determining whether subsidy rules are desirable.

4 Fundamental Trade Agreement Problems

Before using the framework developed in the previous question to evaluate multilateral trade institutions, we must first ask the question, what are the fundamental problems that trade agreements need to solve? In most static theoretical settings considered to date (Bagwell and Staiger 1999, 2001, 2009), the prisoner's dilemma created by countries desire to manipulate their terms of trade is the only problem for trade agreements to solve. Following this literature, we first consider whether other trade agreement problems persist at fully noncooperative policies. It is transparent that at the Nash equilibrium, all inefficiency in trade policy choices and some inefficiency in domestic policy choices is due to terms-of-trade manipulation, but other sources of inefficiency in domestic policies persist. We next consider a set of policies known as the political optimum,³¹ where countries choose policies as if they did not value their ability to manipulate their terms of trade. These policies are practically relevant in prior work because reciprocal trade policy negotiations guide countries toward these policies. Even in settings where countries have domestic policies and political economy (Bagwell and Staiger 2001) or imperfectly competitive markets (Bagwell and Staiger 2009), the political optimum is globally efficient. Here we find that the political optimum is indeed inefficient, as there are externalities through the choice in firms that persist even when countries do not evaluate their ability to manipulate their terms of trade.

Having determined that there is fundamental problem for trade agreements from the domestic policy, we next consider whether there is a fundamental need for deep integration—directly contracting over these domestic policies—or whether this problem can be solved by "shallow integration"—market access preservation rules that prevent countries from using domestic policies to alter the expectations of trade based on policies at the time of trade negotiations. We first consider a market access preservation rule akin to Bagwell and Staiger (2001a), where a foreign country's mix of trade and domestic policy choices are constrained to preserve foreign's import demand curve (i.e. home's access to foreign's market). A market access preservation rule that only preserves foreign's import demand will not prevent opportunistic use of domestic policies to influence behavior in home's domestic market. At the political optimum, foreign would cut its domestic subsidy and worsen home's terms of trade. We next consider a market access preservation rule such that foreign must preserve home's access to foreign's market. There are multiple potential rules to consider. First, we consider, as in Antras and Staiger (2012), that foreign preserves its trade volume exported to home, and we find this rule fails to maintain efficiency. An alternative rule is that foreign

³¹The term dates from Bagwell and Staiger (1999), who use it to distinguish the efficient points chosen when countries have political preferences from the conventional optimum when countries maximize national income (free trade in the two-good perfectly competitive model).

preserves domestic unit sales. This rule is equivalent to one preserving expenditure on foreign goods or one preserving the home price index. Under the alternative rule, which entails a larger subsidy than the constraint preserving the foreign trade volume, home's welfare is preserved. The loss in variety is precisely offset by the terms-of-trade gain.

The results from this section ultimately suggest that the GATT was ill-equipped to handle the international externalities from new product varieties arising in this model. Although a market access preservation rule that prevents the need for deep integration exists, the optimal rule was not seriously undertaken by the GATT. The Article XXIII nonviolation complaint, which preserves a country's market access, is the closest, but this rule does not preserve countries' sales within their own domestic markets. Lacking an optimal market access preservation rule, countries instead turned to countervailing duties and subsidy limits, which we evaluate in the following section.

4.1 Sources of Inefficiency

The Nash equilibrium conditions can be written as follows:

$$\begin{aligned} G_{p_f} + G_P \frac{dP}{dp_f} &= 0, & G_{p_f}^* + G_P^* \frac{dP}{dp_f} &= -G_{p_f}^{*w}, \\ G_{p_h}^* + G_{P^*} \frac{dP^*}{dp_h^*} &= -G_{p_h}^{*w}, & G_{p_h}^* + G_{P^*}^* \frac{dP^*}{dp_h^*} &= 0, \\ G_{n_h} + G_P \frac{dP}{dn_h} + G_{P^*} \frac{dP^*}{dn_h} &= 0, \text{ and } G_{n_f}^* + G_P^* \frac{dP}{dn_f} + G_{P^*}^* \frac{dP^*}{dn_f} &= 0. \end{aligned}$$

The first four conditions are for home and foreign's import and export policy choices, and we have divided out the derivative of trade policies on the local and world prices, which all are equal to p , as can be seen from equations (9) and (11). The last two conditions are for the domestic policy.

The conditions reflect convenient features of the model: only the export subsidy affects the offshore prices and prices of home's exports, while the import tariff affects only home's local price, as was also true in Bagwell and Staiger (2009). The new feature of the model is the entry subsidy.

Notice the interrelationship between the entry policy conditions and the price conditions—the Nash trade policy conditions do play a role in determining the effects of price indices on the government objectives, so there is still some possibility the trade policy choices could eliminate externalities that might exist in the choices in the entry policies.

The political optimal conditions are those for which countries do not value their ability

to manipulate terms of trade, so that they act as if $G_{p_h^w} = 0$ and $G_{p_f^w}^* = 0$. In the stylized environment here, only the export policy affects the terms of trade, while import tariffs and the domestic policy have no effect. The conditions for the political optimum are:

$$\begin{aligned}
G_{p_f} + G_P \frac{dP}{dp_f} &= 0, & G_{p_f}^* + G_P^* \frac{dP}{dp_f} &= 0, \\
G_{p_h^*} + G_{P^*} \frac{dP^*}{dp_h^*} &= 0, & G_{p_h^*}^* + G_{P^*}^* \frac{dP^*}{dp_h^*} &= 0, \\
G_{n_h} + G_P \frac{dP}{dn_h} + G_{P^*} \frac{dP^*}{dn_h} &= 0, \text{ and } G_{n_f} + G_P \frac{dP}{dn_f} + G_{P^*} \frac{dP^*}{dn_f} &= 0.
\end{aligned} \tag{19}$$

The global efficiency conditions are

$$\begin{aligned}
G_{p_f} + G_P \frac{dP}{dp_f} + G_{p_f}^* + G_P^* \frac{dP}{dp_f} &= 0, \\
G_{p_h^*} + G_{P^*} \frac{dP^*}{dp_h^*} + G_{p_h^*}^* + G_{P^*}^* \frac{dP^*}{dp_h^*} &= 0, \\
G_{n_h} + G_P \frac{dP}{dn_h} + G_{P^*} \frac{dP^*}{dn_h} + G_{n_h}^* + G_P^* \frac{dP}{dn_h} + G_{P^*}^* \frac{dP^*}{dn_h} &= 0, \text{ and} \\
G_{n_f} + G_P \frac{dP}{dn_f} + G_{P^*} \frac{dP^*}{dn_f} + G_{n_f}^* + G_P^* \frac{dP}{dn_f} + G_{P^*}^* \frac{dP^*}{dn_f} &= 0.
\end{aligned} \tag{20}$$

4.1.1 Trade Policy Inefficiency

At noncooperative policies, the efficiency conditions for the traded goods are nonzero, as in Bagwell and Staiger (2009), because governments value the ability to manipulate their terms of trade (that is, $G_{p_h^w}$ and $G_{p_f^w}^*$ are nonzero).

$$\begin{aligned}
G_{p_h^*} + G_{P^*} \frac{dP^*}{dp_h^*} + G_{p_h^*}^* + G_{P^*}^* \frac{dP^*}{dp_h^*} &= -G_{p_h^w} = -n_h c_h^* \neq 0, \text{ and} \\
G_{p_f} + G_P \frac{dP}{dp_f} + G_{p_f}^* + G_P^* \frac{dP}{dp_f} &= -G_{p_f^w}^* = -n_f c_f \neq 0.
\end{aligned}$$

Governments set export subsidies to be too low to improve their terms-of-trade. Even though import tariffs do not affect terms-of-trade, they nonetheless cause an externality because the trading partner's government has set export policy inefficiently due to terms-of-trade motives.

The politically optimal conditions (19), in contrast, imply the efficiency conditions for trade policies are satisfied. This result is consistent with Bagwell and Staiger (2009). Eliminated terms-of-trade manipulation leads to efficiency in trade policy choices.

We can easily solve for the politically optimal export policies. The politically optimal export policy condition (see Appendix A.1.1) can be written as

$$\frac{dG}{ds} = \frac{(s - \frac{\alpha}{\sigma})pn_h c_h^* \frac{\widehat{c}_h^*}{\widehat{p}_h^*}}{(1 + \phi + \tau^* - s)} = 0, \quad (21)$$

and the condition is satisfied when $s = \frac{\alpha}{\sigma}$. If countries did not value their terms of trade, they would set their export subsidies so that the cost in the change in trade volume (while disregarding the change in price), precisely offsets the gain in profits from additional units sold. The politically optimal subsidy choice illustrates how an imperfect competition externality can be eliminated by eliminating the terms-of-trade externality.

4.1.2 Entry Policy Inefficiency

For the entry policy, we have a contrast from the trade policy results—the inefficiency from foreign entry in foreign’s market is due solely to terms-of-trade manipulation, but there are other externalities that persist in the domestic market. We consider the effects of foreign firm entry on home without loss of generality since the countries are symmetric. Given that the Nash condition implies $G_{n_f}^* + G_P^* \frac{dP}{dn_f} + G_{P^*}^* \frac{dP^*}{dn_f} = 0$, for efficiency to hold we require that $\frac{dG}{dn_f} = G_{n_f} + G_P \frac{dP}{dn_f} + G_{P^*} \frac{dP^*}{dn_f} = 0$.

We split the effects of foreign firm entry into the effects on home’s activity in the domestic market ($G_{n_f} + G_P \frac{dP}{dn_f}$) and home’s activity in the foreign market ($G_{P^*} \frac{dP^*}{dn_f}$). We label the effects with interpretation from Section 3.4:

$$G_{n_f} + G_P \frac{dP}{dn_f} = \underbrace{-P^{-\varepsilon} \frac{dP}{dn_f}}_{\text{Consumer Surplus Effect}} + \alpha \left(\frac{p}{\sigma} \right) \left(\frac{n_h}{n_f} \right) c_h \frac{\widehat{c}_h}{\widehat{n}_f} + \underbrace{\tau p c_f \left(1 + \frac{\widehat{c}_f}{\widehat{n}_f} \right)}_{\text{Import Tariff Revenue Effect}},$$

$$\text{and } G_{P^*} \frac{dP^*}{dn_f} = \underbrace{\left[\frac{\alpha}{\sigma} - s \right] p \left(\frac{n_h}{n_f} \right) c_h^* \left(\frac{\widehat{c}_h^*}{\widehat{n}_f} \right)}_{\text{Export Profits and Subsidy Costs}}.$$

We can prove that at the noncooperative trade policies, $G_{n_f} + G_P \frac{dP}{dn_f} > 0$, that is, foreign firm entry gives a positive externality to the home market. First, $G_{n_f} = \tau p c_f >$

0 since the Nash import tariffs are positive, as established in Section 3.3. That G_P is negative is pinned down by the noncooperative import tariff condition: in particular, $G_P = -G_{p_f}/\frac{dP}{dp_f} = -D$. This restatement of the noncooperative import tariff condition reflects the tradeoff countries face when raising the import tariff: the tariff increase causes the price index to rise to the detriment of home, but it also leads to a gain in home's import tariff revenue on the inframarginal imports. Since $G_P < 0$ and $\tau p c_f > 0$ at the noncooperative import tariffs, and $\frac{dP}{dn_f} < 0$ always, we must have that $G_{n_f} + G_P \frac{dP}{dn_f} > 0$, in other words, the sum of the consumer surplus effect, domestic profit effect, and import tariff revenue effect at noncooperative policies is positive. None of these externalities are terms-of-trade externalities, as neither the import tariff nor the domestic policy affect the terms of trade.

While there is a distinct externality for home's activity in home's market, the inefficiency from foreign firm entry with respect to home's activity in the foreign market is due solely to terms-of-trade manipulation. As derived in the previous subsection, at the politically optimal policies $\frac{\alpha}{\sigma} = s$, so $G_{P^*} \frac{dP^*}{dn_f} = 0$. At the noncooperative policies, $s < \frac{\alpha}{\sigma}$, since countries recognize that the export subsidy worsens their terms of trade and so choose one less than the politically optimal level of $\frac{\alpha}{\sigma}$. So at the noncooperative policies, $G_{P^*} \frac{dP^*}{dn_f} < 0$, and the externality exists because of terms-of-trade manipulation.

At the politically optimal policies, $\frac{dG}{dn_f} > 0$, so countries will choose a level of variety that is below the globally efficient level. For the noncooperative policies, the question remains whether the positive externality from foreign firm entry for home in the domestic market is offset by the negative externality from foreign firm entry in the foreign market sales due to terms-of-trade manipulation. We establish in Appendix A.3 that for empirically plausible values of α , the positive effect of foreign firm entry also dominates at the noncooperative equilibrium. The condition required is that $\alpha < \frac{\varepsilon}{1-\varepsilon} \frac{1}{S^N}$, where S^N is the share of domestic production at the Nash equilibrium. The proposition implies subsidy limits can improve a GATT equilibrium given reasonable parameter values. If $\frac{\varepsilon}{\sigma} = \frac{1}{3}$, the ratio of elasticities of substitution between the highest and lowest categories of goods in Table IV of Broda and Weinstein (2006), and the share of differentiated consumption is 75%, then we require $a > 8$, which is much higher than any estimated in the empirical literature.³²

We summarize the results with the first proposition:

Proposition 1 *In the two-country model with monopolistic competition and firm entry singly determined by government domestic policy, noncooperative policies are inefficient, The only source of inefficiency for trade policies is terms-of-trade manipulation. For domestic*

³²For a formal estimation of government weights on profits, Mitra, Thomakos, and Ulubasoglu (2006) find close to equal weight on contributions and consumer welfare, while the earliest studies found little weight on contributions (Goldberg and Maggi 1999, Gawande and Bandyopadhyay 2000).

policies, an additional source of inefficiency is a net positive externality of firm entry, which improves consumer welfare and increases import tariff revenue, but reduces foreign profits. A negative externality from firm entry through foreign sales exists because of terms-of-trade manipulation, but it only partially undoes the positive externality, provided the political economy weight on profits in the government objective is sufficiently low.

4.2 Market Access Preservation Rules

This section considers the GATT rules that help countries maintain policies with desirable efficiency properties. Market access preservation rules can help countries stay at these policies without requiring countries to contract over specific domestic policies. Countries can instead contract on functions of multiple policies. We consider three potential forms such rules could take and how effective these rules are at both the Nash policies and the politically optimal policies.

4.2.1 Preserving Market Access for Exporters

The conventional form of market access rules in both the GATT negotiations of the 1940s and the economics literature (Bagwell and Staiger 2001a), is that countries can insist upon a rebalancing of commitments if the access to foreign markets implied by negotiated import tariff reductions is undermined by domestic policy choices.

Consider the effects of a reduction in the foreign entry subsidy and increase in foreign tariff, such that home has the same export volume as before. As we showed in the previous subsection, $G_{n_f} + G_P \frac{dP}{dn_f} > 0$ at either the Nash equilibrium or political optimum, so home is worse off from the reduction in the foreign domestic policy, while there are no external effects of foreign entry through home's foreign sales, which are constant.

Proposition 2 *A market access preservation rule that preserves the market access of exporters does not prevent countries from reducing entry subsidies to the detriment of trading partners.*

4.2.2 Preserving Access to One's Own Domestic Market

An extended market access preservation rule that has limited institutional history is one where a country that changes its domestic policies must not only preserve conditions for trading partners in its own market, but also must preserve trading conditions for trading partners in their domestic markets. Such a rule was considered by Antras and Staiger (2012). In their paper, when foreign imposes a domestic subsidy, foreign also must change

an export policy to preserve export volume to home. We find that such a rule still allows for opportunism from foreign, but a viable alternative exists.

An alternative is that foreign preserves domestic sales or expenditure on foreign goods or the home price index—all these rules are equivalent. Recall that home domestic sales are $n_h c_f = n_h p_h^{-\sigma} P^{\sigma-\varepsilon}$. Since home's policies are constant, n_h and p_h are constant, so P must also be constant. If P is constant, then total expenditure on differentiated goods $PD = P^{1-\varepsilon} = n_h p_h c_h + n_f p_f c_f$ is constant. Since $n_h p_h c_h$ is constant, then $n_f p_f c_f$ must also be constant.

At the political optimum, there are only two possible externalities—terms-of-trade externalities and entry externalities. We evaluate the balance of differential changes in each externality that leaves home unaffected. Consider a rise in firms (increase in n_f) and a fall in export subsidy (increase in p_f^w and p_f). Notice that $dp_f^w = dp_f = -p_f^* ds^*$. The impact of an increase in foreign price on home welfare is then $G_{p_f^w} dp_f^w = G_{p_f} dp_f = -n_f c_f dp_f$. The impact off an increase in entry on home welfare is $G_{n_f} = \frac{p_f c_f}{\sigma-1} dn_f$. Expressed in log derivatives, home welfare is unchanged if and only if $\frac{1}{\sigma-1} \hat{n}_f = \hat{p}_f$. But this is precisely the combination of changes in firms and prices that ensure that the home price index is constant.³³ Thus, the rule that ensures the price index is constant also preserves home welfare.

Proposition 3 *A market access preservation rule requiring that foreign preserves both home's export volume and home's domestic volume will maintain the home government's objective regardless of what mix of domestic policies and trade policies foreign might choose.*

According to the proposition, foreign can preserve home's objective by targeting the amount of domestic units home sells in each country. The preservation of the home government's objective is not immediately obvious, since in addition to the units sold, home's objective depends on the expenditure on foreign goods, and this expenditure matters for both home's consumption of differentiated goods and home's import tariff revenue. But pinning down home's domestic volume pins down the home price index and home's expenditure on foreign goods.

An immediate corollary of the previous proposition is that is not efficient to require foreign to maintain its export volume to home in lieu of requiring foreign to maintain home's domestic volume or home's expenditure on foreign goods. To see this, consider a foreign decrease in firms and increase in export subsidy that satisfies the rule so that the foreign's export volume to home $n_f c_f$ is unchanged. Since the subsidy increases, the price p_f falls and home's expenditure on foreign goods $p_f n_f c_f$ must have fallen. Since there has been no change in home policies, the resulting equilibrium consumption must involve a rise in

³³See Appendix A.1 for comparative statics.

consumption of home differentiated goods and a rise in the home price index P . The foreign subsidy chosen here is then too small to leave the home price index unchanged and preserve home's welfare.

5 Evolution of International Subsidy Rules

The previous section establishes that a domestic entry subsidy creates a fundamental problem for trade agreements, but the results seem counterfactual. The international problem at both the noncooperative policies and politically optimal policies is that entry subsidies are too low, and the result contrasts with the observation that the world trading system later pursued limits on subsidies—a remedy for when noncooperative subsidies are too high. This section establishes that the evolution of subsidy rules can derive from the evolution of import tariff reductions. The progression of import tariff reductions contrasts with the political optimum in the model, where countries expand trade by raising export subsidies rather than reducing import tariffs. We show that a GATT equilibrium at zero import tariffs is Pareto superior to the noncooperative equilibrium. We can then explore, within the context of the model, the subsidy rule consequences of an exogenous import tariff reduction, one that parallels the significant drop in import tariffs between the GATT and the WTO. This paper does not provide a theory explaining why countries progressed from noncooperative import tariffs in the 1940s to more cooperative levels in the 1990s, but there is already a large literature on theories of gradual tariff reductions.³⁴

To establish the desire for subsidy rules, we need to show that there is need for subsidy rules beyond the restrictions on domestic policies that existed in the GATT. Like Bagwell and Staiger (2001, 2006), this section formally models the Article XXIII nonviolation complaint, which prevents countries from benefiting from subsidies to import-competing industries to undermine import tariff reductions. We show that these GATT rules can be improved by adding subsidy limits once import tariffs are close to zero. Three characteristics that motivate subsidy limits are a high government weight on domestic profits, a high substitutability between home and foreign goods, and a large share of differentiated goods consumed domestically. When tariffs are close to noncooperative tariff levels, the agreement cannot be improved by adding subsidy limits. While the first two subsections establish the evolution results for the domestic subsidy policy, the third subsection extends the results to the export subsidy. The results link the evolution of subsidy rules to tariff reductions.

Establishing the benefit of subsidy rules here contrasts with the perfectly competitive environment of Bagwell and Staiger (2001, 2006), but it does not fully model the institution,

³⁴See Bagwell and Staiger (2002, p. 106-107) and Bagwell and Staiger (2010) for surveys.

because the analysis does not initially consider countervailing duties. The fourth subsection considers how countervailing duty laws can be used as a substitute for subsidy limits, and the result contrasts with Bagwell and Staiger (2006), in whose framework countervailing duties have no role. The final subsection argues that subsidy limits can be desirable over countervailing duties in a three-country extension, when countervailing duties are difficult to coordinate.

5.1 GATT Domestic Policy Rules

This subsection formalizes the GATT domestic policy rules and the question of whether further subsidy rules can offer an improvement. We consider whether the GATT approach to international regulation of domestic policies³⁵ succeeds in eliminating any domestic policy externalities derived in the previous subsection. We would expect the GATT approach to eliminate at least some domestic policy externalities, since the GATT eliminates all domestic cross-border externalities in Bagwell and Staiger (2001a). We generalize their stylized model of the GATT Article XXIII nonviolation complaint. As explained in Section 2.1, such a constraint prevents countries from using domestic policies to undermine the benefits implied by tariff negotiations. The nonviolation complaint enables home to demand a rebalancing of foreign's policies if foreign's domestic policy choices undermine the benefit of tariff reductions to home. Foreign would have to grant an additional tariff cut to home in order to abide by Article XXIII.

We use the following definition to model Article XXIII:

Definition 4 *A foreign policy mix (τ^*, s^*, e^*) is **market-access preserving** relative to baseline policies $(\bar{\tau}, \bar{s}, \bar{e}, \bar{\tau}^*, \bar{s}^*, \bar{e}^*)$ if and only if the new foreign policy mix yields equal or greater home export volume relative to the baseline policies.*

The definition must be different from Bagwell and Staiger (2001a) because theirs is not well-defined in our framework. When Bagwell and Staiger (2001a) formalize their market access constraint (p. 547), they require that foreign policies would preserve or increase home exports at a particular baseline world price. Their definition specifies nothing with respect to home's policies, because home's export volume does not depend on home's policies apart from the world price of home's exports, whereas in our framework the home export volume also depends on the home entry subsidy.³⁶ Foreign policies satisfying our definition do not

³⁵There are also other domestic policy rules in GATT that we abstract from, such as National Treatment, considered by Horn, Maggi, and Staiger (2010).

³⁶The home import tariff does not matter for home export volume, and the home export subsidy does not have any effect on home export volume apart from the world price.

erode home export volume, holding the home entry subsidy and both world prices fixed, so policies satisfying our definition satisfy their definition augmented by the requirement that the home entry subsidy is fixed at the baseline level.

Building on our definition of market-access preserving, we have our model of the GATT.

Definition 5 *Define a **GATT equilibrium** to be a set of policies $(\hat{\tau}, \hat{s}, \hat{e}, \hat{\tau}^*, \hat{s}^*, \hat{e}^*)$ such that each country is choosing unilaterally optimal policies subject to the **market access constraint** defined in the program below. The home and foreign constraints that imply a GATT equilibrium are known as a **GATT Agreement**. Formally, the foreign policies satisfy*

$$(\hat{\tau}^*, \hat{s}^*, \hat{e}^*) = \arg \max_{\tau^*, s^*, e^*} G^*(\hat{\tau}, \hat{s}, \hat{e}, \tau^*, s^*, e^*)$$

$$\text{subject to } c_h^*(\hat{\tau}, \hat{s}, \hat{e}, \tau^*, s^*, e^*) \geq c_h^*(\hat{\tau}, \hat{s}, \hat{e}, \hat{\tau}^*, \hat{s}^*, \hat{e}^*)$$

The set of GATT equilibria includes potential outcomes under GATT rules. For a given equilibrium, foreign cannot reduce home's exports. One GATT equilibrium is at the fully noncooperative trade policies. Tariff reductions under GATT are a movement between GATT equilibria.

To be consistent with reality, we need to ensure that if countries transition from one GATT equilibrium to a second GATT equilibrium with constraints requiring greater market access, then the second GATT equilibrium will have lower import tariffs than the first. In other words, countries will lower tariffs as part of granting each other greater market access. Countries could conceivably expand market access by reducing the entry subsidy and leaving tariffs fixed. In particular, we want to consider a GATT equilibrium with zero import tariffs, because we derive results at a zero-tariff GATT equilibrium in Section 5.2. We require the following lemma:

Lemma 6 *There exists a set B of scale parameters β for the function $k(e)$, such that there exists a GATT equilibrium at zero import tariffs when $\beta \in B$.*

We assume throughout that $\beta \in B$ so a zero-tariff GATT equilibrium exists. The assumption ensures that a sufficient expansion of market access under GATT rules eliminates import tariffs.

Our stylized model of GATT perfectly enforcing Article XXIII is unrealistic, but appropriate for our purposes. As discussed in Section 2.1, the early history of the GATT provides strong support for such a model, in the sense that countries understood that Article XXIII could be used to prevent nations from undermining the market access granted by tariff cuts. Later rounds of negotiations suggest that Article XXIII was not as successful as GATT

drafters originally had hoped, and the number of successful Article XXIII complaints was limited. When the Uruguay Round subsidy negotiations began in 1987, among the subsidies that were considered "hardly enforceable" were domestic subsidies to import-competing industries that Article XXIII could have addressed (GATT document W-4). The focus of the current section, however, is on why limits on subsidies were extended to trade-promoting subsidies not limited by Article XXIII, so we take an ideal version of Article XXIII as given.

With our definition of a GATT agreement, we can consider formally whether an agreement would benefit from further subsidy restrictions.

Definition 7 *Subsidy limits $e \leq \tilde{e}$ and $e^* \leq \tilde{e}^*$ or $s \leq \tilde{s}$ and $s^* \leq \tilde{s}^*$ improve a GATT equilibrium if Nash equilibrium government choices subject to both the market access constraints and subsidy limits yield a superior joint government outcome relative to Nash equilibrium choices subject only to the market access constraints.*

This definition only considers two possible forms of agreements, market access constraints and subsidy limits. Market access constraints alone can ensure efficiency in the two-good perfectly competitive framework of Bagwell and Staiger (2001a), who consider a generic domestic policy whose only cross-border effects travel through world prices. Subsidy limits would never improve an agreement in such an environment.³⁷

We next consider whether the GATT eliminates all domestic policy externalities. Consider a GATT equilibrium. The GATT market access constraint binds, because otherwise it would not prevent countries from choosing unilateral import tariffs. Subsidy limits improve the GATT equilibrium if there exists a combination of entry subsidy decreases and tariff increases along the market access constraint such that both countries are better off. Formally, such a combination exists when $\frac{dG}{dn_f}|_{dc_h^*=0} < 0$, such that an increase in foreign firms (dn_f) combined with a foreign tariff decrease keeps home exports constant ($dc_h^* = 0$).³⁸ Foreign's constrained maximization implies $\frac{dG^*}{dn_f}|_{dc_h^*=0} = 0$, so the change in the joint objective is $\frac{dW}{dn_f}|_{dc_h^*=0} < 0$.

Among the foreign firm entry externalities from Subsection 1.2.4, the first-order effect of foreign firm entry on home exports and export subsidy costs are zeroed out by the tariff change required to preserve home exports. GATT effectively eliminates the home export

³⁷The limits on contract type in the current paper differ from a literature that focuses on efficient points achieved when countries act as if they do not value their ability to manipulate their terms-of-trade. Bagwell and Staiger (2009) determine an efficient point in a monopolistically competitive framework that involves high export subsidies and noncooperative import tariffs. Such a point is an infeasible outcome in the current paper's contracting environment, because countries would unilaterally deviate by cutting their export subsidies. Contracting over a minimum export subsidy level would allow the point to be maintained, but no such policy exists in the GATT/WTO.

³⁸The foreign tariff decrease that keeps home export constant is $-d\tau \frac{dc_h^*/d\tau}{dc_h^*/dn_f}$.

effect and the export subsidy cost effect. Three other cross-border effects of foreign firm entry remain:

- Domestic profits (−)
- Consumer surplus (+)
- Import tariff revenue (+)

Which of the three effects above dominate depends on the parameters and trade policies in later sections. The complexity here contrasts with Bagwell and Staiger (2001a), where all three effects are a function of the terms-of-trade, and countries prefer terms-of-trade gains by assumption.

To interpret the result, notice that the foreign entry subsidy promotes both exports and import competition, the former trade-promoting and the latter trade-reducing. The GATT market access constraint eliminates the trade-reducing and import-competing effects of the subsidy and leaves only the trade-promoting effects. The remaining externalities are similar to the externalities of export subsidies.

Throughout this section, we will make heavy use of the following lemma:

Lemma 8 *Consider a set a constraints $X = 0$. Adding entry subsidy limits to the set of constraints improves a GATT equilibrium subject to the set of constraints $X = 0$ if $\frac{dG}{dn_f}|_{dX=0} < 0$. Adding export subsidy limits improves the GATT equilibrium if $\frac{dG}{ds^*}|_{dX=0} < 0$.*

To apply Lemma 8 to the GATT equilibrium with a market access constraint, we need to argue that the market access constraint binds. When market access is bound below the Nash level, then the market access constraint binds, because home wants to raise its tariff ($\frac{dG}{d\tau} > 0$ as shown in the proof of Lemma 3). At the Nash equilibrium, the market access constraint binds by definition.

Applying the Lemma 8, subsidy limits improve a GATT equilibrium subject to the market access constraint, if the sum of the domestic profit effect, the import tariff revenue effect, and the consumer surplus effect is negative.

5.2 Subsidy Limits at Zero Tariffs

This subsection first establishes the possibility that subsidy limits could improve a GATT equilibrium in the simplest case when import tariffs are zero. We then establish a more general set of parameters such that subsidy limits improve the GATT equilibrium.

Consider a GATT equilibrium such that the resulting policies are zero import tariffs $\hat{\tau} = \hat{\tau}^* = 0$. Such an agreement exists (Lemma 6). If a unilateral increase in entry subsidies and decrease in import tariffs, holding the trading partner's export volume fixed, still results in a negative net cross-border externality, then constraining subsidies would improve the GATT equilibrium. The negative net cross-border externality results if the negative effect on domestic profits outweighs the positive effect on consumers (Lemma 8), given that there is no tariff revenue. We evaluate the externality on home for the foreign policy change:

$$\frac{dG}{dn_f} \Big|_{\substack{dc_h^*=0 \\ \tau=\tau^*=0}} = \left(\overbrace{-PD \frac{\widehat{P}}{\widehat{n}_f}}^{\text{Consumer Surplus Effect}} + \overbrace{\alpha \left(\frac{p}{\sigma}\right) n_h c_h \frac{\widehat{c}_h}{\widehat{n}_f}}^{\text{Domestic Profit Effect}} \right) \frac{1}{n_f}. \quad (22)$$

Using our results from Section 3.4, we have

$$\begin{aligned} \frac{dG}{dn_f} \Big|_{\substack{dc_h^*=0 \\ \tau=\tau^*=0}} &= \left(-PD \frac{\widehat{P}}{\widehat{n}_f} + \alpha \left(\frac{p}{\sigma}\right) n_h c_h \frac{\widehat{P}}{\widehat{n}_f} (\sigma - \varepsilon) \right) \frac{1}{n_f} \\ &= \left(PD - \alpha \left(\frac{p}{\sigma}\right) n_h c_h (\sigma - \varepsilon) \right) \left(-\frac{\widehat{P}}{\widehat{n}_f} \right) \frac{1}{n_f} \\ &= \left[1 - \alpha S \left(1 - \frac{\varepsilon}{\sigma}\right) \right] \left(\frac{(1-S)}{(\sigma-1)} \right) \frac{PD}{n_f}. \end{aligned} \quad (23)$$

The sign of $\frac{dG}{dn_f} \Big|_{dc_h^*=0}$ is the same as the bracketed expression. Foreign entry decreases the home price index. The price index change leads to an increase in consumer surplus (with unit elasticity) and fall in domestic profits (with elasticity $(\sigma - \varepsilon)$). For a government maximizing national income with $\alpha = 1$, the home price index decrease from foreign home entry is always desirable. If government weighs domestic profits heavily (high α), the price index decrease is undesirable:

$$\alpha > \frac{1}{S} \left(\frac{1}{1 - \frac{\varepsilon}{\sigma}} \right) \implies \frac{dG}{dn_f} \Big|_{\substack{dc_h^*=0 \\ \tau=\tau^*=0}} < 0. \quad (24)$$

Though S is endogenous, for symmetric policies and zero tariffs the market share depends only on parameters: $S = \frac{c_h}{c_h + (1+\phi)c_f} = \frac{1}{1+(1+\phi)^{1-\sigma}}$. We then have an expression for the existence of trade-rules in terms of parameters. The first proposition then follows from (24) and Lemma 8:

Proposition 4 *For $\alpha > \frac{1+(1+\phi)^{1-\sigma}}{1-\frac{\varepsilon}{\sigma}}$ there exists a GATT equilibrium at sufficiently low im-*

port tariffs that can be improved by limits on domestic entry subsidies.

The theory implies three considerations that can motivate a GATT equilibrium limiting entry subsidies:

1. high political economy weight on profits (high α), which raises subsidies' cross-border externality on profits,
2. high domestic share of consumption (high S and high ϕ), which increases the relative importance of domestic profits compared to consumer surplus, and
3. high substitutability between differentiated goods relative to the outside good (low $\frac{\varepsilon}{\sigma}$), which increases the effects of competition from foreign entrants.

The proposition implies subsidy limits can improve a GATT equilibrium given reasonable parameter values. If $\frac{\varepsilon}{\sigma} = \frac{1}{3}$, the ratio of elasticities of substitution between the highest and lowest categories of goods in Table IV of Broda and Weinstein (2006), and the share of differentiated consumption is 75%, then we require $a > 2$, which implies governments give more weight to lobbying contributions than national welfare.

5.3 No Subsidy Limits at Higher Tariffs

This subsection establishes that when countries choose noncooperative tariffs, subsidy limits cannot improve a GATT equilibrium. At noncooperative tariffs, in contrast to the zero-tariff case, countries must benefit from a price index decrease. Since foreign firm entry decreases the price index and increases import tariff revenue, countries always benefit from foreign subsidies. The theory then provides a link between the import tariff reductions of the 1950s and 1960s under the GATT and the addition of subsidy limits on domestic trade-promoting subsidies under the WTO.³⁹

Recall from Section 4.1.2, the noncooperative equilibrium import tariff condition $\frac{dG}{d\tau} = 0$ can be written as

$$G_P(\tau^N) = -D.$$

This restatement of the noncooperative tariff condition reflects the tradeoff countries face when raising the import tariff. The tariff increase causes the price index to rise to the detriment of home, and it also leads to a gain in home's import tariff revenue on the inframarginal

³⁹The relevance of the result does not rest on the claim that the GATT actually represented a fall from noncooperative tariffs to zero import tariffs, since the respective results for zero and noncooperative import tariffs each hold for some neighborhood around the respective tariff choices.

imports. For the noncooperative import tariff condition to hold, $G_P(\tau^N) < 0$ must hold. In contrast, when we derived parameter conditions under which countries desired subsidy rules in the previous subsection, we required the equivalent of $G_P(0) > 0$, so home government actually prefers a price index increase. At the noncooperative import tariff the foreign firm entry externality and can be written as:

$$\left. \frac{dG}{dn_f} \right|_{\substack{dc_h^*=0 \\ \tau=\tau^*=\tau^N}} = G_P(\tau^N) \frac{dP}{dn_f} + \tau^N pc_f, \text{ and} \quad (25)$$

Since $G_P(\tau^N) < 0$ and $\tau^N pc_f > 0$ at the Nash import tariffs, and $\frac{dP}{dn_f} < 0$ always, we must have $\left. \frac{dG}{dn_f} \right|_{\tau=\tau^*=\tau^N} > 0$. An increase in foreign firm entry can be decomposed into two effects: a decrease in the price index and an increase in import tariff revenue. At the noncooperative import tariffs, import tariffs are positive and the home government prefers a marginal decrease in the price index, so the externality of foreign firm entry is positive. The positive sign of the foreign firm entry at noncooperative tariffs implies, by Lemma 8, the following proposition:

Proposition 5 *The GATT equilibrium at noncooperative tariffs cannot be improved by subsidy limits on domestic policies.*

The results here are similar to prior work on subsidy agreements at noncooperative tariffs. The Bagwell and Staiger (2006) study of subsidy rules uses a two-good perfectly competitive economy. In such an environment, Bagwell and Staiger (1999) have shown that a country sets the relative local price of its import good to its export good to be higher than it would otherwise prefer, because the import tariff improves its terms-of-trade. With standard preferences, this terms-of-trade improvement is reflected in higher tariff revenue on the inframarginal import volume, as in this section. When foreign then imposes an export subsidy at the Nash equilibrium, home benefits from both the decrease in price of the imported good, and the improvement in its terms of trade. A similar case occurs under monopolistic competition in Bagwell and Staiger (2009). In their analysis, import tariffs have no terms-of-trade effects, and at Nash import tariffs, countries do not value any change in their local price. When a foreign country imposes an export subsidy, there is no effect on home welfare through the change in local price, but home still benefits from the terms-of-trade gain. The foreign entry subsidy effects in this section are distinct from the prior work, because the foreign entry subsidy leads to a desirable decrease in the price index and no terms-of-trade effects, while Bagwell and Staiger (2006, 2009) model foreign subsidies that improve home's terms of trade. Yet the result is similar to prior work in that the Nash tariff condition pins down the partial effect of local prices on the government objective, and the local price effect

implies that countries benefit from a foreign subsidy.

5.4 Extending Results to Export Subsidies

This subsection extends the results of the previous two subsections on entry-promoting subsidies to export subsidies affecting marginal cost of production. We desire such an extension to explain why there was a consensus to limit both domestic policies and export subsidies in the WTO.

The effect of a foreign export subsidy increase on home can be written as

$$\frac{dG}{ds^*} = \left(\begin{array}{c} \text{Consumer Surplus Effect} \\ \overbrace{PD \frac{\widehat{P}}{\widehat{p}_f}} \\ \text{Domestic Profit Effect} \\ - \alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} \\ \text{Import Tariff Revenue Effect} \\ - \tau p n_f c_f \left(\frac{\widehat{c}_f}{\widehat{p}_f} \right) \end{array} \right) \frac{1}{1 + \phi + \tau + s^*}. \quad (26)$$

We do not require notation to indicate the effects of a GATT equilibrium because the GATT equilibrium does not constrain export subsidies. Because $\frac{dG}{ds} = 0$ at the GATT equilibrium, $\frac{dG}{ds^*} = \frac{dW}{ds^*}$, so it is sufficient to show that $\frac{dG}{ds^*} < 0$ to establish that export subsidies are inefficiently high and countries would benefit from export subsidy limits.

The condition for the domestic profit effect to dominate the consumer surplus here is equivalent to the condition for domestic entry subsidies at zero tariffs in Section 5.2. The conditions are equivalent because of the close relationship between foreign price effects and foreign firm entry effects: $(1 - \sigma) \frac{\widehat{P}}{n_f} = \frac{\widehat{P}}{p_f}$ and $\frac{\widehat{c}_h}{n_f} = (1 - \sigma) \frac{\widehat{c}_h}{p_f}$. Consequently, the motive for subsidy limits at zero tariffs holds for either kind of trade-promoting subsidy.

At Nash import tariffs, the import tariff revenue effect precisely offsets the domestic profit effect, and all that remains is the consumer surplus benefit for the falling foreign price. The result that $\frac{dG}{ds^*} \tau = \tau^* = \tau^N > 0$ at noncooperative import tariffs implies that international inefficiency results from too little subsidization at the noncooperative import tariffs:

$$\frac{dG}{ds^*} \tau = \tau^* = \tau^N = \left(PD \frac{\widehat{P}}{\widehat{p}_f} \right) \frac{1}{1 + \phi + \tau + s^*} > 0. \quad (27)$$

By Lemma 8, we can state the following:

Proposition 6 *Propositions 4 and 5 extend to export subsidies.*

Proposition 6 completes our explanation for why the rationale for subsidy limits and their evolution applies to both domestic entry subsidies and export subsidies.

5.5 Countervailing Duties

The previous subsections have considered how countries can improve upon GATT rules by bounding subsidies at cooperative levels. An alternative way to ensure efficient subsidies is by permitting a countervailing duty response to a subsidy. We show that if countries impose duties such that they eliminate the negative policy externalities of the subsidies, then the duties can ensure efficient subsidy choices. If α satisfies the conditions laid out in Proposition 4 so there is a problem with subsidies being too high in the absence of more rules, then countries can achieve efficient policies using countervailing duties instead of subsidy limits at the zero-tariff equilibrium. The evolution story described in the previous subsection still holds: since countries are already choosing their best response import tariffs when import tariffs chosen noncooperatively, countries obviously cannot achieve greater cooperation with countervailing duties.

To model these issues we introduce the following extension of our prior definition of the GATT equilibrium:

Definition 9 *Define a **GATT equilibrium with countervailing duties** to be a set of policies $(\hat{\tau}, \hat{s}, \hat{e}, \hat{\tau}^*, \hat{s}^*, \hat{e}^*)$ such that each country is choosing unilaterally optimal policies subject to the market access constraint defined in the program below, and such that any subsidy that undermines a trading partner's domestic sales is mechanically met with an import tariff ($\bar{\tau}$ for home) that restores domestic sales volume to the baseline level. The home and foreign constraints that imply a GATT equilibrium are known as a **GATT agreement with countervailing duties**. Formally, the foreign policies satisfy*

$$(\hat{\tau}^*, \hat{s}^*, \hat{e}^*) = \arg \max_{\tau^*, s^*, e^*} G^*(\bar{\tau}, \hat{s}, \hat{e}, \tau^*, s^*, e^*)$$

$$\text{subject to } c_h^*(\hat{\tau}, \hat{s}, \hat{e}, \tau^*, s^*, e^*) \geq c_h^*(\hat{\tau}, \hat{s}, \hat{e}, \hat{\tau}^*, \hat{s}^*, \hat{e}^*)$$

$$\text{and } c_h(\bar{\tau}, \hat{s}, \hat{e}, \tau^*, s^*, e^*) = c_h(\hat{\tau}, \hat{s}, \hat{e}, \hat{\tau}^*, \hat{s}^*, \hat{e}^*)$$

A GATT equilibrium with countervailing duties is one where countries would not deviate from a baseline level of subsidization given that a subsidy will be met with a countervailing duty response from the trading partner that preserves the trading partner's domestic sales, and as in the earlier GATT equilibrium definition, the subsidy also requires an import tariff reduction that preserves the trading partner's export volume. The maximum level of

countervailing duty implied by the definition is consistent with practice under the WTO. For an export subsidy, the countervailing duty ($\bar{\tau} - \hat{\tau}$, the tariff in excess of the baseline rate) that satisfies the second constraint above equals the amount of export subsidy beyond the baseline rate ($s^* - \hat{s}^*$). The laws for a countervailing duty of a nonrecurring subsidy are less straightforward. As Grossman and Mavroidis (2003) detail, one interpretation is that the countervailing duty should undo the effect of the undesirable subsidy, and such a requirement is met here.

We also introduce the following formalism that parallels Section 5.1:

Definition 10 *Subsidy limits $e \leq \tilde{e}$ and $e^* \leq \tilde{e}^*$ or $s \leq \tilde{s}$ and $s^* \leq \tilde{s}^*$ improve a GATT equilibrium with countervailing duties if Nash equilibrium government choices subject to both the market access constraints, the countervailing duties, and the subsidy limits yield a superior joint government outcome relative to Nash equilibrium choices subject only to the market access constraints and countervailing duties.*

We prove that the zero-tariff GATT equilibrium (which exists by Lemma 6) with countervailing duties cannot be improved by subsidy limits. Recall from Section 5.3 that the first-order effect of foreign firm entry on home welfare subject to the market access constraint is

$$\frac{dG}{dn_f} \Big|_{dc_h^*=0} = G_P(\tau) \frac{dP}{dn_f} + \tau p c_f. \quad (28)$$

Because a countervailing duty that preserves home domestic sales also preserves the home price index, we have $G_P \frac{dP}{dn_f}$ term is eliminated for any differential increase in the entry subsidy. It follows that $\frac{dG}{dn_f} \Big|_{dc_h^*=0, \frac{dP}{dP=0}} = 0$ for $\tau = 0$ and $\frac{dG}{dn_f} \Big|_{dc_h^*=0, \frac{dP}{dP=0}} > 0$ for $\tau > 0$. We can then decompose any discrete increase in foreign entry into an integral over such differential increases in the subsidies, and conclude that the discrete increase in foreign entry must have a nonnegative effect on home government welfare. We then have the following proposition by Lemma 8:

Proposition 7 *A GATT equilibrium with countervailing duties at non-negative import tariffs cannot be improved by subsidy limits.*

The success of countervailing duties then begs the question of why countries would ever have subsidy limits in addition to countervailing duties. One explanation, discussed in the next subsection, is the potential for subsidies to create problems for countries competing in third markets. Another answer we discuss here is that countervailing duties could deter efficient subsidization.

At the globally efficient level of subsidies (recall $W = G + G^*$), $\frac{dW}{dn_f} \Big|_{\substack{dc_h^*=0 \\ dP=0}} = 0$, $\frac{dG}{dn_f} \Big|_{\substack{dc_h^*=0 \\ dP=0}} > 0$, $\frac{dG^*}{dn_f} \Big|_{\substack{dc_h^*=0 \\ dP=0}} < 0$. By smooth concavity there must exist a level of subsidies within the neighborhood of globally efficient subsidies such that $\frac{dW}{dn_f} \Big|_{\substack{dc_h^*=0 \\ dP=0}} > 0$, and $\frac{dG^*}{dn_f} \Big|_{\substack{dc_h^*=0 \\ dP=0}} < 0$, in which case a country would be deterred from an efficient level of subsidization. The GATT equilibrium with subsidy limits does not suffer the same problem in theory. We can then state the following proposition:

Proposition 8 *If countries must transition from an inefficient level of subsidies to an efficient level of subsidies, then there exist points that can be obtained by the GATT equilibrium with subsidy limits that cannot be obtained by the GATT equilibrium with countervailing duties.*

5.6 Third Country Competition

As we discussed in Section 2.2, a reason why countries would favor using subsidy limits over countervailing duties is competition in third countries. The case for using subsidy limits in a three-country scenario in this model depends on the difficulty of countries coordinating countervailing duty action. The baseline model can easily be extended to a third symmetric country. Here we consider a scenario where home can impose a countervailing duty on foreign's entry subsidy, but the third country exogenously does not impose a countervailing duty on foreign. We denote the third country's production with subscript g and also use the superscript g to denote final destination and government choices of the third country. We already discussed in the previous subsection how at zero tariffs, there is no first-order effect of foreign subsidization on home, without considering the third country effects. The only effect of the foreign subsidy on home via the third country is through the change in the third country's price index, which affects home's export volume and home's export subsidy cost:

$$\frac{dG}{dn_f} \Big|_{\substack{dc_h^*=0 \\ dc_h^g=0 \\ dP=0 \\ \tau=\tau^*=\tau^g=0}} = G_{P^g} \frac{dP^g}{dn_f}$$

where $G_{P^g} \equiv \left(\frac{\alpha}{\sigma} - s\right)n_h \frac{dc_h^g}{dP^g}$.

We know $\frac{dc_h^g}{dP^g} > 0$ because an increase in the third-country price index is a decrease in foreign competition and improved exports, and by Lemma 2, and we know that $s < \frac{\alpha}{\sigma}$, because countries will never subsidize exports so much that they would prefer a decrease in export volume. Consequently, $G_{P^g} > 0$, so countries benefit from an increase in the

foreign price index. Since foreign firm entry decreases the third country's price index, we have $\frac{dP^g}{dn_f} < 0$. Intuitively, the home government is worse off in the third market because the increased foreign competition has an adverse effect on its exports.

The effect of foreign entry on the third country is equal to the effect of foreign entry on home derived in Equation (23). The third country suffers from the entry subsidy and does not impose the countervailing duty. There is no effect on the third country's exports to home because home's countervailing duty preserves home's price index.

The Lemma 8 result, that a negative externality implies countries benefit from subsidy rules, can easily be extended from two countries to the three-country setting. We have shown that both home and the third country suffer a negative effect from foreign firm entry. Subject to the market access and countervailing duty constraints, foreign sets its policy so there is no first-order effect of a change in entry subsidy. By setting a subsidy limit below the foreign level absent any such limit, home and the third country gain a first-order benefit and the world objective improves. We then have the following proposition:

Proposition 9 *In a three-country economy, a GATT equilibrium with home countervailing duties at zero import tariffs can be improved by subsidy limits.*

Having considered this result, we also need to verify that by including a third country, we have not overturned our previous result that subsidy rules are undesirable at the Nash policy choices. This result is a corollary to the noncooperative equilibrium result derived in Appendix A.3, since the external effects of foreign entry on home in the third market are the same as the external effects of foreign entry on home in foreign's market absent the nonviolation complaint.

Proposition 10 *In the three-country economy, home's welfare cannot be improved from the Nash equilibrium by subsidy limits if $\alpha < \frac{\varepsilon}{1-\varepsilon} \frac{1}{SN}$.*

This upper bound of α in Proposition 10 is greater than the lower bound of α in Proposition 4 that ensured countries desired subsidy limits, because $\varepsilon > 1$.

It is worth discussing why there are potentially some α where home would want subsidy agreements in the three-country case and not in the two-country case. When foreign subsidizes in the two-country case, the nonviolation complaint protects home from losing any exports to foreign, and home has set import tariffs sufficiently high so that home benefits from the price index decrease. In the three-country case, home is still worse off from the foreign subsidy decreasing the third country's price index, and political economy motives could allow the third-country effect to dominate in theory.

Using the parameter values from Section 5.2, the α upper bound is 8, far larger than any estimated in the published empirical literature, so the theory is still consistent with the stylized fact that there are no subsidy rules at noncooperative tariffs.

6 Evolution of Competition Policy Coordination

The subsidy rules are evidence of domestic policy coordination when import tariffs are low. The model also predicts countries would pursue coordination to increase entry when import tariffs are chosen noncooperatively. This section argues this is indeed the case for the 1948 Havana Charter which sought to coordinate competition policy.⁴⁰ The model can also explain why conditions for supranational coordination for competition policy have become less favorable in comparison to those for subsidies.

The model here re-interprets the domestic policy choice of the home country as being a competition policy rather than a subsidy to firm entry. The reduced-form government competition policy directly determines the competition policy at a cost $f(n)$. Stronger enforcement of competition policy is represented by more competition and more firms and a larger cost of enforcement. What encompasses the policy of no intervention is not crucial for our analysis, as our main focus is on whether government policy is relatively more pro-competitive or anti-competitive. The range of policies also encompasses policies of restrictive competition, so a policy of no government intervention is in the interior of the set of choices of n .

Modeling competition policy in such a reduced-form manner is a common feature of the international competition policy literature, such as Horn and Levinsohn (2001) and Ch. 9 of Bagwell and Staiger (2002). Since this prior work used Cournot competition, we must evaluate whether the model still makes sense in a monopolistically competitive setting.⁴¹

In our monopolistically competitive setting, reducing the number of firms reduces variety and has no effect on individual prices, but price indices rise, in contrast to the Cournot case, in which quantity falls and prices rise. But unlike Cournot, the anti-competitive behavior that arises here when government reduces the number of firms cannot be interpreted as looser merger policy. Unlike Cournot, monopolistic competition lacks a conflict between industry

⁴⁰The decision of Congress to reject the Havana Charter is not a focus of this section, but this decision is most easily explained by party differences, since the Democrats held the executive while the Republicans captured Congress in 1946. It was the Republicans who imposed the infamous Smoot-Hawley tariffs of 1930 and came close to blocking the 1945 renewal of the Reciprocal Trade Agreements Act (RTAA) of 1945 that enabled GATT to be implemented in 1947.

⁴¹But do notice that the original Dixit and Stiglitz (1977) model adapted here was an application to an industrial organization literature on efficient entry.

producer surplus and social surplus. In a homogeneous product Cournot setting, producer surplus is maximized by a monopolist, and social surplus is maximized as n approaches infinity. In our monopolistic competition model, both social surplus and industry profits increase as n approaches infinity.⁴² To resolve this issue, there could be additional costs that are borne privately by the firm that are either not considered by the government or are offset by positive externalities of entry, but such a change in the model would prevent us from extending our previous results that involve home industries lobbying government to increase entry and total industry profits.

Motives for anticompetitive behavioral can still arise at the level of any individual firm, since any individual firm's profit increases when the consumer price index increases. Government policy can be interpreted as addressing the potential conflicts that could arise between the individual capital owners within a country, who are then also capable of banding together and lobbying to limit competition from foreign firms.

6.1 Coordination on Stronger Competition Policy

The result that countries would want to coordinate on stronger competition policy at Nash equilibrium tariffs is a corollary of our result from Section 5 that countries would want never want to coordinate on restricting subsidies at Nash equilibrium tariffs.

We previously derived that the external effects of foreign entry consist of a consumer surplus effect, domestic profit effect, and an import tariff revenue effect. We are assuming that GATT rules can prevent any effect of foreign entry on home's exports.

$$\frac{dG}{dn_f} \Big|_{\substack{dc_h^*=0 \\ \tau=\tau^*=\tau^N}} = \left(\begin{array}{c} \text{Consumer Surplus Effect} \\ \underbrace{-PD \frac{\widehat{P}}{\widehat{n}_f}} \\ \text{Domestic Profit Effect} \\ + \alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\widehat{c}_h}{\widehat{n}_f} \\ \text{Import Tariff Revenue Effect} \\ + \tau^N p n_f c_f \left(1 + \frac{\widehat{c}_f}{\widehat{n}_f} \right) \end{array} \right) \frac{1}{n_f}. \quad (29)$$

Substituting in the form for Nash tariffs, we derived the effect of foreign entry on home government and proved that it was always positive.

$$\frac{dG}{dn_f} \Big|_{\substack{dc_h^*=0 \\ \tau=\tau^*=\tau^N}} = \left[1 - \frac{\alpha S^N (1 - \frac{\varepsilon}{\sigma})}{\sigma - (\sigma - \varepsilon)(1 - S^N)} \right] \left(\frac{(1 - S^N)}{(\sigma - 1)} \right) \frac{PD}{n_f} > 0 \quad (30)$$

Corollary 11 *The GATT equilibrium at noncooperative tariffs can be improved by coordinating on stronger competition policy.*

⁴²Though per firms sales are decreasing in n (n enters with exponent $\frac{\sigma-\varepsilon}{1-\sigma}$), the total industry profits are increasing in n (n enters with exponent $\frac{\varepsilon-1}{\sigma-1} > 0$). See the first appendix section on comparative statics.

Countries can then benefit from coordinating on stronger competition policy because the net cross-border externalities from strong competition policy are positive. The nature of the competition policy externality is that it boosts consumer surplus and tariff revenue by enough to outweigh the negative cross-border effect on firms' domestic profits. The externality is assured to be positive regardless of the strength of political economy because the political economy motive also leads countries to set higher import tariffs, which offset the stronger negative effects of firm profits on the government's objective.

The result here contrasts with both Bagwell and Staiger (2002) and Horn and Levinsohn (2001). In contrast to Bagwell and Staiger, there are externalities here from competition policy that are not transmitted through terms of trade, so GATT nonviolation rules do not eliminate competition policy. In contrast to Horn and Levinsohn (2001), this section gets a result on supranational coordination by considering the case of Nash tariffs, by considering the nonviolation complaint, and by assuming a specific form of demand.

6.2 Effects of Trade Liberalization

The contrasting histories of competition policy coordination and subsidy coordination are puzzling. The 1948 Havana Charter included provisions coordinating competition policy and not subsidies, while the WTO included provisions coordinating subsidies and not competition policy. The previous section covered the issues surrounding the evolution of subsidy rules. The same model can explain how competition policy would evolve from coordination on stronger competition policy to no coordination.

As we showed in equation (29), one of the effects determining the sign of the competition policy externality is the import tariff revenue effect. As import tariff revenues decrease, the externalities fall, and the incentive for coordination on stronger competition policy decreases. In the extreme case of zero import tariffs, the cross-border externality of foreign entry is

$$\left. \frac{dG}{dn_f} \right|_{\substack{dc_h^*=0 \\ \tau=\tau^*=0}} = \left[1 - \alpha S \left(1 - \frac{\varepsilon}{\sigma} \right) \right] \left(\frac{1-S}{\sigma-1} \right) \frac{PD}{n_f}.$$

and $\left. \frac{dG}{dn_f} \right|_{\substack{dc_h^*=0 \\ \tau=\tau^*=0}}$ can be negative when the political economy parameter α is sufficiently high.

Corollary 12 *Reducing import tariffs from noncooperative levels decreases the incentive to coordinate on stronger competition policy.*

The model yields the prediction that if international competition policy coordination were to take place, it would be on weaker competition policy. The historical period when coordination on stronger competition policy was most likely was back when import tariffs

were at high levels. Since coordination on stronger competition policy has not yet succeeded, it likely will never succeed.

This result that reciprocal tariff reductions lead towards coordination on weaker competition policy works against one of the main points of Horn and Levinsohn (2001): "We show that the intuition with which many informed economists approach the links between trade and merger policy may be misleading. The intuition is the following: trade liberalisation increases competition in the domestic market so liberalisation acts as a substitute for a stricter competition policy. Hence, as trade is liberalized... rationally acting countries will therefore pursue slacker policies than before liberalisation." Horn and Levinsohn only briefly consider supranational antitrust coordination and argue that there are no general conditions under which it makes sense. This section's contribution is that a particular type of competition policy coordination (weaker) becomes more preferable with trade liberalization, even though it remains ambiguous whether or not coordination itself becomes more preferable. Furthermore, the desirability of antitrust coordination is tied to the strength of the political economy parameter. Inferring that the political economy parameter is large because we observed coordination on subsidy limits narrows the set of possible outcomes from coordination. The link between subsidy agreements and competition policy coordination is another contribution of this section.

7 Conclusion

This paper has explored how a domestic policy creating new varieties leads to international externalities, which lead to new fundamental problems for trade agreements. The international externalities arising from imperfect competition can explain the pattern of deep integration through the history of the multilateral trading system. The government's domestic policy is modeled in a stylized fashion, but the paper's implications for externalities that do not travel through prices are potentially broader. Any domestic policy that leads to a new variety within a firm—a new product or service characteristic—could create an international externality that does not travel through prices and creates problems for the world trading system.

This paper counters the claim that the WTO subsidy rules have no economic rationale whatsoever. It resolves the puzzle of why countries would seek to constrain trade-reducing policies at the time of the GATT, yet implement barriers to trade-promoting policies 40 years later. It is important to provide a theory for understanding the WTO subsidy rules, when such a large body of literature argues the subsidy rules are nonsensical. Much of the trade literature argues that the GATT struck the right balance in regulating both trade policies

and domestic policies, but the current paper argues that the world trading system has faced problems that the GATT could not address.

The model provides a positive theory for the WTO subsidy rules. From the normative perspective that countries should maximize national income, the model does not provide a result distinct from prior work, since there is no motive for subsidy rules absent political economy motives. The positive theory is still valuable in explaining why countries form sub-optimal agreements. If there are additional reasons why governments should value domestic production outside the scope of the model, then this paper is a step towards a model of how such considerations would be important in motivating subsidy rules.

While we have mainly considered the history of domestic policies in manufacturing trade to validate the theory, the negotiations over services provide an additional potential application. As Francois and Hoekman (2010) observe, a puzzle in the services trade literature is that trade liberalization has tended to be unilateral and not driven by trade agreements—actual services policies are more liberal than negotiated policy bounds. The authors remark, "Much more work is also required to understand the political economy of services policies and reform. It is not clear that for international transactions that involve factor movement (i.e. trade in service) the standard explanations in the literature—first and foremost the terms of trade rationale—necessarily apply." Another defining feature of services trade is that domestic regulations rather than border measures are what matter for market access, so the framework developed here is promising for the analysis of such trade barriers. The theory can explain why services liberalization would be unilateral in some industries but require coordination in others.

This paper improves our positive understanding of the international coordination of subsidies, but the actual decision-making process to file subsidy disputes and countervailing duties is more complex than in the model. How does the political process map the winners and losers from subsidization into the actual decision-making? To what extent do bureaucrats have the necessary information to make appropriate decisions about subsidies? More research is necessary to understand how international coordination of subsidies could be improved, and whether international subsidy rules should be eliminated altogether, as Sykes (2010) proposes.

A Appendix

A.1 Comparative Statics

This appendix section derives comparative statics for government policies. Totally log-differentiating the price index equations and the demand equations yield all the comparative statics for prices and firms:

$$\begin{bmatrix} \hat{P} \\ \hat{P}^* \end{bmatrix} = \frac{1}{1-\sigma} \begin{bmatrix} S & 1-S \\ 1-S^* & S^* \end{bmatrix} \begin{bmatrix} \hat{n}_h \\ \hat{n}_f \end{bmatrix} + \begin{bmatrix} (1-S_h)\hat{p}_f \\ (1-S_f^*)\hat{p}_h^* \end{bmatrix}, \quad (31)$$

$$\begin{aligned} \hat{x}_h &= \frac{c_h}{x_h}\hat{c}_h + \left(1 - \frac{c_h}{x_h}\right)\hat{c}_h^*, \\ \hat{x}_f &= \left(1 - \frac{c_f}{x_f}\right)\hat{c}_f + \frac{c_f}{x_f}\hat{c}_f^*, \text{ and} \end{aligned} \quad (32)$$

$$\begin{bmatrix} \hat{x}_h \\ \hat{x}_f \end{bmatrix} = (\sigma - \varepsilon) \begin{bmatrix} \frac{c_h}{x_h} & 1 - \frac{c_h}{x_h} \\ \left(1 - \frac{c_f}{x_f}\right) & \frac{c_f}{x_f} \end{bmatrix} \begin{bmatrix} \hat{P} \\ \hat{P}^* \end{bmatrix} - \sigma \begin{bmatrix} \left(1 - \frac{c_h}{x_h}\right)\hat{p}_h^* \\ \left(1 - \frac{c_f}{x_f}\right)\hat{p}_f \end{bmatrix}. \quad (33)$$

Here $\hat{a} = d \log a = da/a$.

The entry subsidies e and e^* singly determine the firm counts n_h and n_f , respectively. The connection between the trade policy instruments and prices is that each trade policy instrument affects only one price. Totally differentiating the traded price equations yields

$$\begin{aligned} dp_f &= p(d\tau_h + d\tau_f), \text{ and} \\ dp_h^* &= p(d\tau_h^* + d\tau_f^*). \end{aligned} \quad (34)$$

To see a connection between the effects of foreign entry and foreign export subsidies, notice that log changes in one have proportional effects to log changes in the other, for the home price index, home domestic sales, and expenditure shares: $(1-\sigma)\frac{\hat{P}}{p_f} = \frac{\hat{P}}{p_f}$, $(1-\sigma)\frac{\hat{c}_h}{n_f} = \frac{\hat{c}_h}{p_f}$, and $(1-\sigma)\frac{\widehat{p_f n_f c_f}}{n_f} = \frac{\widehat{p_f n_f c_f}}{p_f}$.

Foreign price increases always raise home sales and lower foreign sales:

$$\begin{aligned} \frac{\hat{c}_h}{\widehat{p}_f} &= (\sigma - \varepsilon)(1 - S) > 0, \text{ and} \\ \frac{\hat{c}_f}{\widehat{p}_f} &= \sigma - (\sigma - \varepsilon)(1 - S) > 1. \end{aligned} \quad (35)$$

A.1.1 Trade Policy Comparative Statics

This subsection provides comparative statics for changes in home or foreign government policies on home welfare. Symmetric results hold for foreign.

The effect of a foreign tariff increase on home is

$$\frac{dG}{d\tau^*} = \frac{(\frac{\alpha}{\sigma} - s)pn_h c_h^* \frac{\widehat{c}_h^*}{\widehat{p}_h^*}}{(1 + \phi + \tau^* - s)}. \quad (36)$$

The effect of an increase in home's own export subsidy is

$$\frac{dG}{ds} = \frac{(s - \frac{\alpha}{\sigma})pn_h c_h^* \frac{\widehat{c}_h^*}{\widehat{p}_h^*} - p_h^* n_h c_h^*}{(1 + \phi + \tau^* - s)}. \quad (37)$$

The effect of an increase in foreign export subsidies on home is

$$\frac{dG}{ds^*} = \frac{p_f n_f c_f - \alpha(\frac{p}{\sigma})n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} - \tau p n_f c_f \frac{\widehat{c}_f}{\widehat{p}_f}}{(1 + \phi + \tau - s^*)}. \quad (38)$$

The effect of an increase in home's own tariff is

$$\frac{dG}{d\tau} = \frac{\alpha(\frac{p}{\sigma})n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} + \tau p n_f c_f \frac{\widehat{c}_f}{\widehat{p}_f}}{(1 + \phi + \tau - s^*)}. \quad (39)$$

The effect of an increase in trade barriers $t = \tau - s^* = \tau^* - s$ on world welfare is

$$\frac{(1 + t + \phi)}{2} \frac{dW}{dt} = \alpha \frac{p}{\sigma} n \left[c_h \left(\frac{\widehat{c}_h}{\widehat{p}_f} \right) + (1 + \phi) c_h^* \left(\frac{\widehat{c}_h^*}{\widehat{p}_h^*} \right) \right] + t p \bar{M} \left(\frac{\widehat{c}_h^*}{\widehat{p}_h^*} \right). \quad (40)$$

A.2 Lemma Proofs

Lemma 1 Consider countries with symmetric policies \bar{e} , $\bar{\tau}^N$, and \bar{s}^N , such that $\frac{dG}{d\tau} = \frac{dG^*}{d\tau^*} = \frac{dG}{ds} = \frac{dG^*}{ds^*} = 0$. Consider an additional set of countries with total trade barriers \bar{t}^C such that $\frac{dW}{d\tau} = \frac{dW}{d\tau^*} = \frac{dW}{ds} = \frac{dW}{ds^*} = 0$. Then $\bar{\tau}^N$, \bar{s}^N , \bar{t}^C do not depend on \bar{e} , $\bar{\tau}^N > 0$, and $\bar{t}^N > \bar{t}^C$.

Proof. $\bar{\tau}^N$, \bar{s}^N , and \bar{t}^C do not depend on \bar{e} because under symmetric policies, firm counts are the same, and drop out of all the first-order conditions.

$\bar{\tau}^N > 0$: Define $\bar{\tau}^N$ to be the Nash tariff and denote other symmetric policies similarly. $\bar{\tau}^N = -\frac{\alpha}{\sigma} \frac{c_h}{c_f} \frac{\widehat{c}_h}{\widehat{p}_f} / \frac{\widehat{c}_f}{\widehat{p}_f} > 0$, because $\frac{\widehat{c}_h}{\widehat{p}_f} > 0$ and $\frac{\widehat{c}_f}{\widehat{p}_f} < 0$ (a foreign price increase improves home's sales and lowers home's imports).

$\bar{t}^N > \bar{t}^C$: Substituting the Nash policy conditions ($\frac{dG}{ds} = 0$) and ($\frac{dG}{dt} = 0$) into the externality equations we get $\frac{dG}{ds^*} > 0$ and $\frac{dG}{d\tau^*} < 0$ (see Appendix Section A.1.1), which implies countries can benefit from cooperatively reducing trade barriers from Nash policies. ■

Lemma 2 *Consider arbitrary import tariff policies and entry subsidies, and export subsidy choices s and s^* satisfying $\frac{dG}{ds} = \frac{dG^*}{ds^*} = 0$. Then $s \leq \frac{\alpha}{\sigma}$ and $s^* \leq \frac{\alpha}{\sigma}$.*

Proof. The export subsidy first-order condition (setting equation 37 to 0) implies $\bar{s} = \frac{\alpha}{\sigma} + \frac{p_h^*}{p} / \frac{\widehat{c}_h^*}{p_h^*}$. Since $\frac{\widehat{c}_h^*}{p_h^*} < 0$, $\bar{s} < \frac{\alpha}{\sigma}$. ■

Lemma 3 *Import tariffs always cause negative cross-border externalities on their trading partners ($\frac{dG^*}{d\tau} < 0$ and $\frac{dG}{d\tau^*} < 0$). If home and foreign choose noncooperative import tariffs to maximize their objectives, holding other policies fixed, then the noncooperative import tariffs are higher than the cooperative import tariffs that maximize W .*

Proof. The import tariff externality expression (36) implies the externality has the same sign as $s - \frac{\alpha}{\sigma}$, but Lemma 2 implies $s < \frac{\alpha}{\sigma}$, and $\frac{dG^*}{d\tau} < 0$ and $\frac{dG}{d\tau^*} < 0$ follows. For the Nash policies to maximize W , it must also be true that $\frac{dG}{d\tau} + \frac{dG^*}{d\tau} = 0$, so $\frac{dG}{d\tau} > 0$. $\frac{dG}{d\tau} = 0$ at the Nash tariff, and $\text{sign}(\frac{dG}{d\tau}) = \text{sign}(\alpha(\frac{p}{\sigma})c_h \frac{\widehat{c}_h}{p_f} + \tau p c_f \frac{\widehat{c}_f}{p_f})$. $\alpha(\frac{p}{\sigma})c_h \frac{\widehat{c}_h}{p_f} > 0$ and $p c_f \frac{\widehat{c}_f}{p_f} < 0$, so a lower tariff than the Nash tariff is necessary to induce a positive $\frac{dG}{d\tau}$. ■

Lemma 6: *There exists a set B of scale parameters β for the function $k(e)$, such that there exists a GATT equilibrium at zero import tariffs when $\beta \in B$.*

Proof. Let $\bar{M} > \bar{M}^N$ be a symmetric export volume greater than the export volume at Nash policies. We show we can find a β such that there is a GATT equilibrium at zero import tariffs with export volume \bar{M} , and by varying \bar{M} , this maps out the set B of β values such that we know a zero-tariff GATT equilibrium exists. Let $\bar{\tau}$, \bar{s} , and \bar{e} be the policies countries choose at the GATT equilibrium with export volume \bar{M} . We can scale the function $k(e)$ so that countries choose zero import tariffs. Write $k(e) = \beta_k \kappa(e)$ for some $\beta_k > 0$ yet to be determined, and κ is a function that satisfies our restrictions for k from Subsection 2.2, and let κ have scale parameter β_κ . The condition for the constrained optimal choice of e can then be written as $F(\bar{\tau}, \bar{s}, \bar{e}) = \beta_k$, for some function $F(\bar{\tau}, \bar{s}, \bar{e})$, which is strictly positive because κ is positive, and both consumer welfare and total profits are increasing in the entry subsidy. The market access constraint gives us e as a function of $\bar{\tau}$ and the unilateral export condition gives us $\bar{s}(\bar{\tau}, \bar{e}(\bar{\tau}))$. If we choose $\beta_k = F(0, \bar{s}(0), \bar{e}(0))$, then the resulting function k has scale parameter $\beta = \beta_k \beta_\kappa$, the choices of s and e are optimal subject to the market constraint, and the policies $(0, \bar{s}(0), \bar{e}(0))$ determine a GATT equilibrium with zero tariffs. ■

Lemma 8: Consider a set a constraints $X = 0$. Adding entry subsidy limits to the

set of constraints improves a GATT equilibrium subject to the set of constraints $X = 0$ if $\frac{dG}{dn_f}|_{dX=0} < 0$. Adding export subsidy limits improves the GATT equilibrium if $\frac{dG}{ds^*}|_{dX=0} < 0$. **Proof.** At the GATT equilibrium with firms \hat{n}_f , $\frac{dG^*}{dn_f}|_{dX=0} = 0$. Since $\frac{dG}{dn_f}|_{dX=0} < 0$, $\frac{dW}{dn_f}|_{dX=0} < 0$. As discussed in Section 3.1, the reduced-form cost function $f(n)$ is such that G^* is concave in n_f . By concavity in n_f , there must exist $\bar{n}_f < \hat{n}_f$ in the neighborhood of \hat{n}_f such that at \bar{n}_f , $\frac{dW}{dn_f}|_{dX=0} < 0$, $\frac{dG}{dn_f}|_{dX=0} < 0$, and $\frac{dG^*}{dn_f}|_{dX=0} > 0$. As the foreign government objective is increasing and concave in n_f within the constraint set $n_f \leq \bar{n}_f$, the GATT equilibrium with constraint $n_f \leq \bar{n}_f$ must bind at $\bar{n}_f < \hat{n}_f$ and countries will achieve greater welfare since $\frac{dW}{dn_f}|_{dX=0} < 0$ within the interval (\bar{n}_f, \hat{n}_f) . A parallel proof applies for the home tariff choices, and a similar proof applies for the export subsidy choices. ■

A.3 Inefficiency at Noncooperative Tariffs

The combined effects of foreign firm entry, derived in Section 3.4, are

$$n_f \frac{dG}{dn_f} = p_f n_f c_f \frac{1}{\sigma - 1} + \left[\alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\hat{c}_h}{\hat{n}_f} + \tau p n_f c_f \left(1 + \frac{\hat{c}_f}{\hat{n}_f} \right) \right] + \left[\left(\alpha \left(\frac{p}{\sigma} \right) n_h c_h^* - s p n_h c_h^* \right) \frac{\hat{c}_h^*}{\hat{n}_f} \right].$$

The first term is the effect on consumer surplus, the first set of brackets contains the effects in the domestic market (home profits and tariff revenue), and the second set of brackets contains the effects in the third market (export profits and export policy costs). There are no effects in the foreign market due to Article XXIII.

We can express the foreign firm externality in log price changes using results from Appendix A.1:

$$n_f (\sigma - 1) \frac{dG}{dn_f} = p_f n_f c_f - \left[\alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\hat{c}_h}{\hat{p}_f} + \tau p n_f c_f \left(1 + \frac{\hat{c}_f}{\hat{p}_f} \right) \right] - \left[\left(\alpha \left(\frac{p}{\sigma} \right) n_h c_h^* - s p n_h c_h^* \right) \left(\frac{\hat{c}_h^*}{\hat{p}_f^*} \right) \right].$$

The first bracketed expression is comparable to the home unilateral import policy condition, while the second is comparable to the home unilateral export policy condition. Substituting in the noncooperative values of τ and s yields

$$\frac{dG}{dn_f} = \left(p_f n_f c_f + \left[\alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\hat{c}_h}{\hat{p}_f} / \frac{\hat{c}_f}{\hat{p}_f} \right] + \left[p_h^* n_h c_h^* \frac{\hat{c}_h^*}{\hat{p}_f^*} / \frac{\hat{c}_h^*}{\hat{p}_h^*} \right] \right) \frac{1}{n_f (\sigma - 1)}. \quad (41)$$

The first bracketed expression is negative. Home still loses domestic profits from foreign firm entry as in the zero-tariff case of the previous section, but the losses have been scaled down by

the price elasticities of import demand ($\frac{\widehat{c}_f}{\widehat{p}_f}$ and $\frac{\widehat{c}_h^*}{\widehat{p}_h^*}$) which both equal $-\sigma - (\sigma - \varepsilon)(1 - \bar{S}) < -1$.

To sign $\frac{dG}{dn_f}$, first compare the consumer gain $p_f n_f c_f$ to the second bracketed expression. For symmetric policies $p_f n_f c_f = p_h^* n_h c_h^g$. Because own price effects are stronger than cross-price effects, $-\frac{\widehat{c}_h^*}{\widehat{p}_f^*} / \frac{\widehat{c}_h^*}{\widehat{p}_h^*} < 1$, the consumer gain dominates. Further simplifying,⁴³

$$\frac{dG}{dn_f} = \left(p_f n_f c_f \varepsilon - \alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} \right) \frac{1}{\left(-\frac{\widehat{c}_f}{\widehat{p}_f} \right) n_f (\sigma - 1)}.$$

We can sign $\frac{dG}{dn_f}$ as follows:

$$\frac{dG}{dn_f} > 0 \iff \alpha < \frac{\varepsilon \sigma}{\sigma - \varepsilon} \frac{1}{\bar{S}^N}. \quad (42)$$

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⁴³We use the symmetry result that import price elasticities for each country are the same and we calculate that $1 + \frac{\widehat{c}_h^*}{\widehat{p}_f^*} / \frac{\widehat{c}_h^*}{\widehat{p}_h^*} = \varepsilon / \left(-\frac{\widehat{c}_h^*}{\widehat{p}_h^*} \right)$.

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