

Essays on International Trade Agreements Under Monopolistic Competition

David R. DeRemer

Submitted in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy
in the Graduate School of Arts and Sciences

COLUMBIA UNIVERSITY

2012

© 2012

David R. DeRemer

All Rights Reserved

ABSTRACT

Essays on International Trade Agreements Under Monopolistic Competition

David R. DeRemer

This dissertation consists of three essays exploring how trade models with monopolistic competition can help us understand and evaluate the history of domestic policy coordination in the multilateral trading system. Relative to perfect competition, imperfect competition gives rise to new cross-border concerns that governments do not internalize when setting both trade policy and domestic policy. An open question is whether these international policy externalities matter for the design of the multilateral trading system.

The first chapter develops the workhorse model for the dissertation and applies it to the evolution of subsidy rules in the multilateral trading system. Why did countries achieve a consensus to impose explicit restrictions on trade-distorting subsidies when the WTO was formed in 1995, but not decades earlier under the GATT? This chapter rationalizes the historical pattern of subsidy rules. Politically-motivated governments benefit from international subsidy restraints only after achieving sufficient cooperation in restraining tariffs. Once tariffs fall, as they did in the 1950s and 1960s, governments prefer to protect domestic sales through international subsidy restraints and countervailing duties rather than to allow consumers to benefit from unfettered subsidization.

The second chapter applies the same model to the international coordination of competition policy (antitrust in the United States). In 1948, 53 nations signed the Havana Charter which would have led to the creation of the International Trade Organization and international coordination of competition policy, if the charter had been ratified by the U.S. Congress. Decades later, there is no direct international coordination of competition policy, despite direct coordination in other domestic policies. The theory argues that when

countries have noncooperative policies, international coordination toward stronger competition policy can lead to increased consumer welfare. As countries reduce import tariffs, they tend away from coordination on stronger competition policy and toward no coordination or weaker competition policy. The model predicts that if countries were ever to coordinate on competition policy, it would be toward weaker competition policy.

The first two chapters each argue that externalities arising under imperfect competition can explain the history of domestic policy coordination, given the actual path of trade liberalization. In contrast, the final chapter evaluates whether the world trading system could have chosen rules that eliminate these externalities. If these externalities could have been eliminated, then monopolistic competition does not create any new fundamental problem for trade agreements to solve. We re-evaluate two claims about international externalities that hold true under perfect competition and are also consistent with the rules and norms of the 1947 GATT: (1) reciprocal trade negotiations can guide countries toward globally efficient policies, such that countries act as if they do not value their ability to manipulate their terms of trade, and (2) globally efficient policies can be preserved by rules that prevent countries from using domestic policies to undermine the market access implied by tariff negotiations. This chapter shows that both claims fail to hold when countries have subsidies for the marginal cost of production and subsidies for firm entry. The source of inefficiency is countries free-riding off of each other's entry subsidies. A market access rule that preserves both a trading partner's home volume and export volume can prevent opportunism in domestic policy choices. The results suggest that the rise of trade in imperfect competition was a factor in limiting the effectiveness of the 1947 GATT rules, long before other challenges for the world trading system like offshoring became predominant.

Contents

Acknowledgements	iii
Dedication	vi
Chapter 1. The Evolution of International Subsidy Rules	1
1.1. Introduction	1
1.2. Historical and Legal Background	8
1.3. The Model: Government Objectives and Externalities	14
1.4. Model of Subsidy Rule Evolution	31
1.5. Conclusion	45
Chapter 2. International Competition Policy and the 1948 Havana Charter	47
2.1. Introduction	47
2.2. Historical Background	50
2.3. Modeling Competition Policy	52
2.4. Coordination on Stronger Competition Policy	54
2.5. Effects of Trade Liberalization on Competition Policy Coordination	55
2.6. Conclusion	56
Chapter 3. Fundamental Trade Agreement Problems in Monopolistic Competition	58
3.1. Introduction	58
3.2. Trade Policy Model with Two Domestic Policy Choices	62
3.3. Nash Equilibrium and Unrestrained Entry Political Optimum	64
3.4. Market Access Preservation Rules	70

3.5. Conclusion	73
References	75
Appendix A. Comparative Statics	80
A.1. Trade Policy Comparative Statics	81
A.2. Firm Entry Externalities Compared to Export Subsidy Externalities	82
Appendix B. Existence of Efficient Policies	84
Appendix C. Lemma Proofs	87
Appendix D. Proof of Proposition 17	90
Appendix E. Income Effects, Imperfect Competition, and Trade Agreements	92
E.1. The Model	93
E.2. Results	97
E.3. Proofs	102
Appendix F. Extensions	105
F.1. Model with No Domestic Consumers	105
F.2. Mirror Image Economy	105
F.3. Single Factor Economy	108
F.4. Single Sector Economy	109

Acknowledgements

Many special people and organizations made this dissertation possible. I thank first and foremost my main advisors. My primary advisor Kyle Bagwell sparked my initial interest in the economics of the WTO. He kindly encouraged me and provided expert feedback along every step of my dissertation process. When he told me his intention to leave Columbia after my second year of graduate school, he made it clear he would still be enthusiastic about advising me. He has always made time for me, whether I was at Columbia or visiting him at Stanford. He made the special effort to travel across the country to attend my Columbia dissertation defense and provided detailed feedback down to the last hours of my dissertation deadline. My Columbia dissertation sponsor Donald Davis was my first graduate international trade professor. His teaching drew me to the field, and his first-week assigned readings by Paul Romer and David Weinstein on the welfare gains of new varieties inspired me to consider the implications of such gains for trade agreements. His advice helped me to identify an appropriate dissertation topic, to make my work appeal to a wider audience, and to connect the logic in every step of my work. I give special thanks to Jonathan Vogel. Jon was always able to recognize immediately the promise or the failure in my work. His advice kept me focused whenever I got off track. His efforts to improve my presentation and my writing have made a much better economist. I thank my committee members Michael Riordan and David Weinstein. Mike provided me with years of research assistantship support, and he offered another excellent theorist's perspective on my work. His effort as department chair during the last three years made Columbia a much more pleasant place to work. I thank Eric Verhoogen and Katherine Ho, who each had a significant impact

on my Columbia graduate education. I also thank Dominic Coppens and Petros Mavroidis, who each provided a valuable perspective on my work from Columbia Law School.

The NSF-IGERT International Globalization and Development Program provided financial support during my fourth year of graduate education, and I thank Akbar Noman, Eva Kaplan, Jose Antonio Ocampo, and Joseph Stiglitz for making this support possible.

I spent six months during my fifth year of graduate school as an exchange scholar at Stanford University. I thank Bob Staiger, Kalina Manova, Kyle Handley, and Arghya Ghosh and all participants at the Stanford Trade Lunch for their helpful comments during my time there. I give special thanks to Greg Rosston for allowing me to be a SIEPR visitor, and to Assaf Zimring and Alejandro Molnar for helping to integrate me into the graduate student experience at Stanford.

My dissertation benefited from my presentations at the 2009 Congress of the European Economic Association, the 2010 Advanced Graduate Workshop at the Manchester/Brooks World Poverty Institute, the 2010 Princeton University EconCon, the Midwest International Economics Group Fall 2011 Meeting, and the Fifth Conference on the Political Economy of International Organizations. I also benefited from attending a 2010 SITE conference and a 2012 SCID conference on the WTO. I thank Mostafa Beshkar, Eric Bond, Chad Bown, Paola Conconi, Ana Espínola-Arredondo, Ralph Ossa, and Kamal Saggi for helpful discussions at these events.

I benefited from excellent graduate student peers at Columbia. I could not ask for better colleagues in my field than Jonathan Dingel, Jessie Handbury, Walker Hanlon, Alex McQuoid, Guru Sethupathy, and Yoichi Sugita. I thank them all for their kindness and invaluable feedback on my work inside and outside Columbia's International Trade Colloquium. My colleagues Alejo Czerwonko, Mariesa Hermann, Donald Ngwe, Maria-Jose Prados, and Patrick Sun all provided excellent help and feedback along the way. I give special thanks to Ryan Chahrour, who helped me pull together my work before the job market. We were

Boston Fed co-workers and roommates before attending Columbia, and he has remained a dedicated friend to me over the last eight years through so many life changes.

I thank everyone else who made my life enjoyable over the last six years. Most of all, I thank Marie Triboulet for her care and support.

Last but not least, I thank my family: my parents, James and Jennifer, and my brother and sister-in-law, Matt and Magda, provided constant love and support throughout my graduate school process. I thank my Aunt Florence for her love, may she rest in peace.

Dedication

For my parents.

CHAPTER 1

The Evolution of International Subsidy Rules**1.1. Introduction**

The expanded restrictions on manufacturing subsidies in the World Trade Organization (WTO) since 1995 are a significant departure from the 1947 General Agreement on Tariffs and Trade.¹ Export subsidies are prohibited in the WTO, and domestic subsidies that increase exports can be disputed. Countervailing duties, unilateral tariffs contingent on subsidies, became a more entrenched part of the WTO. Government consternation over export subsidies puzzles trade lawyers and economists because export subsidies improve the terms of trade for importing countries and increase trade.² When the only cross-border effect of export subsidies is the terms-of-trade improvement of the importing country, then the export subsidies are like a gift from abroad, and there is no reason for countries to restrict each other from using them. Limits on domestic subsidies can be harmful because domestic subsidies are the best instrument governments can use to address domestic distortions.³ According to Bagwell and Staiger (2006), the WTO subsidy rules serve no purpose in plausible cases, even for politically motivated governments.⁴ 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

¹Section 1.2 provides detailed historical background.

²For 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.

³The 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.

⁴The 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.

Wauters (2008) denounce the subsidy agreement as "one of the least economics-informed agreements in the WTO." The potential drawbacks of the WTO subsidy rules call for a better understanding of why the rules were adopted. Why were the WTO subsidy rules adopted? Why were they not implemented sooner?

To address these questions, this chapter proposes the following model. There are two governments who each choose a domestic subsidy, an ad valorem import tariff and an ad valorem export subsidy. The two symmetric countries each have two sectors: a freely traded outside sector and a monopolistically-competitive, differentiated sector with costly trade. Firm entry in the differentiated sector requires the employment of capital factor while production requires labor in each sector. The government's domestic subsidy reduces the cost of firm entry and fully determines the number of firms in each country. Firm profits accrue to capital owners and government objectives give greater weight to profits than to other forms of national income.

This chapter establishes the novel result that countries could achieve a global consensus to impose limits on both export subsidies and export-promoting domestic subsidies, as in the WTO.⁵ Consider a country, foreign, choosing subsidies unilaterally, subject to the GATT constraint that ensures foreign's subsidies do not reduce the access another country, home, has to foreign's market.⁶ 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

⁵The consensus distinguishes the theory from prior work. Brander and Spencer (1985) and Bagwell and Staiger (2001b) each provide theories of why two countries would limit export subsidies at the expense of a third country who only imports.

⁶The constraint is a consequence of Article XXIII in the GATT. Bagwell and Staiger (2001a, 2006) model the GATT in similar fashion.

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.

The chapter further shows that 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 net effect of a foreign subsidy on home welfare must be positive at unilateral tariff choices. The foreign subsidy increases home import tariff revenue and it decreases the home price index, and both effects benefit home. In contrast to the zero-tariff case in which home values a price index increase under strong political motives, home always values a price index decrease at the noncooperative import tariffs. Home values the price index decrease because when setting import tariffs, home always benefits from gaining tariff revenue on the inframarginal import volume, and in equilibrium, home must balance this benefit by setting the price index higher than it would otherwise prefer.⁷ Absent a model, one might have speculated that sufficiently strong political economy effects could also motivate a subsidy limit agreement at noncooperative import tariffs. But the same political economy concerns that motivate subsidy rules also motivate higher unilateral import tariffs, and the noncooperative equilibrium conditions guarantee that subsidies lead to positive cross-border externalities. Imposing limits on subsidies cannot be Pareto-improving until governments achieve sufficient cooperation in reducing tariffs. Hence, the second main result of the chapter is that the WTO's subsidy rules were desirable only after several successive rounds of tariff reductions under the GATT.

⁷A 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.

Having considered the motivation to limit subsidies beyond the GATT market access constraint, the chapter next turns to the subject of countervailing duties. 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 can fail to be an effective remedy when we move beyond the two-country case. 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.

Two papers closely related to this chapter 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 chapter 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.⁸ The creation of new products is the simplest example of a nonpecuniary externality arising through subsidization, 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

⁸We 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.

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 chapter 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.⁹ 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.¹⁰ 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.¹¹ The same three cross-border effects of foreign subsidies in the current chapter 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

⁹The third chapter of this dissertation focuses more on this claim.

¹⁰Many other 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), Brou and Ruta (2009), Sauré (2010), and Lee (2011). The current paper and Bagwell and Staiger (2006) take as given that Article XXIII is perfectly functional.

¹¹The role for countervailing duties in the current chapter 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.

benefit from a foreign subsidy that improves home's terms of trade.¹² In the current chapter, 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 countries¹³, and there is no way for countries to eliminate all monopoly distortions.¹⁴ 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 chapter interprets the WTO subsidy rules as an approach to dealing with third-market problems when countervailing duty action is difficult to coordinate. An advantage of the current chapter's framework is that it can easily be extended to multiple symmetric countries.

¹²Along 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.

¹³Appendix section F.1 shows that no motive would exist for subsidy rules if the countries exported differentiated goods to a third market and did not consume them themselves.

¹⁴To 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.

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.¹⁵ In their model, nations would unilaterally deviate from an efficient, free-trade equilibrium using export subsidies, so export subsidy bans are desirable at free trade.¹⁶ 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 chapter is theirs does not consider domestic subsidies. By providing a theory for the WTO's limits on domestic subsidies, the current chapter addresses a broader debate over the appropriate scope of the WTO in regulating domestic policies.¹⁷ 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 chapter implies that the WTO has addressed a wider range of international externalities than the standard theory, given the absence of alternative explanations.¹⁸

¹⁵In 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.

¹⁶Venables (1985) was the first to identify that a country would unilaterally deviate from free trade with an export subsidy in such a Cournot trade model.

¹⁷Examples 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.

¹⁸Cross-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.

1.2. Historical and Legal Background

This chapter details salient features in the evolution of multilateral discipline on subsidies and countervailing measures. These features are what discipline the theory of this chapter. Histories that are more comprehensive but less focused on this chapter's points of interest can be found in Sykes (2005), WTO (2006), and Wouter 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.

1.2.1. GATT Rules

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 report¹⁹ 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.

¹⁹GATT document L/334, 1 March 1955.

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 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."²⁰ Because existing theory is adequate to explain this 1962 subsidy agreement, this chapter 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.

²⁰GATT document SR-9/41, 3 March 1955.

was permitted to countervail without demonstrating that its domestic industry had been injured by the subsidized imports, up until 1980 (Wouters and Coppen 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 chapter's framework as a conventional failure of import tariff cooperation, and the level of import tariff cooperation is exogenous on the model. The chapter takes the position that CVDs played an efficiency-enhancing role only in the WTO.

1.2.2. WTO Negotiating History

A recurring question in the trade agreement literature is whether international trade agreements are a means to eliminate cross-border externalities through cooperation, or a commitment device for avoiding domestic political pressures. While this chapter and most literature on the WTO has taken the former view, Maggi and Rodriguez-Clare (2007) take the latter view, and Brou and Ruta (2009) construct a theory of the WTO subsidy rules as solving a commitment problem. This subsection discusses evidence for what problems subsidy rule negotiators believed they were solving.

A note from the GATT secretariat²¹ 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 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

²¹GATT document MTN.GNG/NG10/W/4, 28 April 1987.

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 importance of competition in third markets is echoed by Sykes (2005):

The opportunity to challenge such subsidies as violations of WTO law is an important step forward.... Under prior law, domestic subsidies that harmed import-competing industries abroad could merely be countervailed by the importing nation, which is an inferior option.... Countervailing duties do not necessarily discourage undesirable subsidization, and may simply divert subsidized goods to other markets.

The theory in this chapter matches the view of the secretariat and Sykes 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."²² This chapter 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.

The secretariat's note works against the view that subsidies were an undesirable that governments needed to tie their hands from, though these views are not necessarily stable over time. Dating back to the GATT negotiations, a 1946 UN Economics and Social Council meeting²³ presents a favorable view towards subsidies:

One of the main features of the United States proposals on subsidies was that direct subsidies to producers would be permitted. The United States

²²See also Roessler and Gappah (2005) for a critique of the Article XXIII nonviolation complaint and a summary of its case history.

²³E/FC/T/C.II/37, UN Economics and Social Council 31 October 46 meeting.

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.

Bagwell and Staiger (2006) also argue that GATT members believed subsidies were necessary to achieve efficient policies.

Other scholars have argued that the WTO SCM was a consequence of market fundamentalism. For example, Qin (2008) argues, "The SCM was negotiated in the late 80's and early 90's when the world was moving towards embracing free market and privatization. It is therefore not surprising to find that the SCM Agreement imposes very strict disciplines and contains no general exceptions."²⁴ The negotiating history of the Uruguay Round offers evidence in support of this claim, despite the initial note from the secretariat. The negotiating postures of the United States in this regard changed rather abruptly, as can be seen in the statements surrounding its views on allowing developing countries to be exempt from subsidy restrictions. In May 1987, the U.S. is permissive toward the developing country exceptions in GATT Article XIV:²⁵

The United States believes that it would be useful to review the application of Article 14 in the context of the more advanced developing countries. The United States also believes that it would be useful to examine the application of Article 14 to economic sectors in which an industry in a developing country is internationally competitive and, as a result, the need for subsidies to facilitate the economic development program of that country is not readily apparent.

But 13 months later, the U.S. is taking the opposite position, and taking a negative view of subsidies more in line with the commitment theory:²⁶

National policies providing subsidies which directly or indirectly affect trade create false incentives to producers, isolating them from the signals of the market. This has led to inefficient use of resources and costly budgetary outlays. In the view of the United States, the elimination of export subsidies

²⁴International Economic Law and Policy Blog, available at <http://worldtradelaw.typepad.com/ielpblog/2008/12/rethinking-wto-subsidy-rules-should-the-scm-have-an-escape-clause.html>

²⁵GATT document MTN.GNG/NG10/W/1.

²⁶GATT document MTN.GNG/NG10/W/20.

and greater adherence to GATT rules and disciplines regarding domestic subsidies would lead to more efficient use of resources, improved market access, and greater economic growth.

There is evidence for both the current theory and the commitment theory during the Uruguay Round, and the two theories can complement each other, as in other aspects of the trade agreement literature. The current theory provides an explanation for why countries encouraged subsidies in the 1940s and for the motives laid out by the secretariat at the outset of the Uruguay Round, and the commitment theory matches well with motives that emerged later in the round.

1.2.3. Entry Subsidies and the GATT/WTO

A distinctive feature of this chapter 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) 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.

1.3. The Model: Government Objectives and Externalities

The model builds on Section 7.3 of Helpman and Krugman (1989) by adding an export subsidy and a domestic entry subsidy.²⁷ 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 and maximize profits. Individual firms and consumers are too small to behave strategically. The remainder of the chapter focuses on the strategic behavior between the two 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. We formally model the GATT rules, and we define what it means to improve upon the GATT. The GATT rules can manage some cross-border effects, but not all of them. The third section of the chapter focuses on the balance of the remaining externalities.

²⁷Related 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.

1.3.1. Baseline Model

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.²⁸

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

$$(1.1) \quad \begin{aligned} U &= \frac{1}{\theta}(D)^\theta + Y, \text{ and} \\ U^* &= \frac{1}{\theta}(D^*)^\theta + Y^*. \end{aligned}$$

²⁸The 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.

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

$$(1.2) \quad \begin{aligned} D &= \left(n_h c_h^{\frac{\sigma-1}{\sigma}} + n_f c_f^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \text{ and} \\ D^* &= \left(n_h c_h^{*\frac{\sigma-1}{\sigma}} + n_f c_f^{*\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}. \end{aligned}$$

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:

$$(1.3) \quad n_h = \frac{K}{k(e)}, \text{ and } n_f = \frac{K}{k(e^*)}.$$

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:

$$(1.4) \quad \begin{aligned} e &= k^{-1}\left(\frac{K}{n_h}\right) \equiv f(n_h), \text{ and} \\ e^* &= k^{-1}\left(\frac{K}{n_f}\right) \equiv f(n_f). \end{aligned}$$

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.²⁹ We require a restriction on the shift parameter μ that ensures countries offer positive entry subsidies at all equilibria under consideration.³⁰ 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 1.3.5.

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.³¹ As discussed in Section 1.2.3, 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 chapter's model and a single-factor free entry model. The simplification that government effectively chooses the number of firms has

²⁹The 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 $n^{\left(\frac{\varepsilon-1}{\sigma-1}\right)}$, and a linear cost function meets this requirement since $\frac{\varepsilon-1}{\sigma-1} < 1$.

³⁰A 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 .

³¹Models with single-factor free entry are derived in Appendix F. The idea that such free entry can eliminate strategic trade motives has been well understood since Horstmann and Markusen (1986).

precedent in the international competition policy literature.³² In the current chapter, 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).

1.3.2. 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 income I :

$$(1.5) \quad \begin{aligned} V &= \frac{1}{\varepsilon - 1} PD + I = \frac{1}{\varepsilon - 1} P^{1-\varepsilon} + I, \text{ and} \\ V^* &= \frac{1}{\varepsilon - 1} P^* D^* + I^* = \frac{1}{\varepsilon - 1} P^{*1-\varepsilon} + I^*. \end{aligned}$$

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:

³²Dixit (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.

$$(1.6) \quad \begin{aligned} P &= (n_h p_h^{1-\sigma} + n_f p_f^{1-\sigma})^{\frac{1}{1-\sigma}}, \text{ and} \\ P^* &= (n_f p_f^{*1-\sigma} + n_h p_h^{*1-\sigma})^{\frac{1}{1-\sigma}}. \end{aligned}$$

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

$$(1.7) \quad \begin{aligned} x_h &= c_h + (1 + \phi)c_h^*, \text{ and} \\ x_f &= c_f^* + (1 + \phi)c_f. \end{aligned}$$

Consumer maximization implies the total demands for individual products are

$$(1.8) \quad \begin{aligned} x_h &= p_h^{-\sigma} P^{\sigma-\varepsilon} + (1 + \phi)p_h^{*-\sigma} P^{*\sigma-\varepsilon}, \text{ and} \\ x_f &= p_f^{*-\sigma} P^{*\sigma-\varepsilon} + (1 + \phi)p_f^{-\sigma} P^{\sigma-\varepsilon}. \end{aligned}$$

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

$$(1.9) \quad \begin{aligned} p_h^* &= (1 + \phi + \tau^* - s)p_h, \text{ and} \\ p_f &= (1 + \phi + \tau - s^*)p_f^*. \end{aligned}$$

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

$$(1.10) \quad p_h = p_f^* = \frac{\sigma}{\sigma - 1} m \equiv p.$$

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:

$$(1.11) \quad \begin{aligned} p_h^w &= (1 - s)p_h, \text{ and} \\ p_f^w &= (1 - s^*)p_f^*. \end{aligned}$$

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

$$(1.12) \quad \begin{aligned} \pi_h &= \left(\frac{p}{\sigma}\right)x_h, \quad \pi_f = \left(\frac{p}{\sigma}\right)x_f, \\ \Pi_h &= n_h\pi_h, \text{ and } \Pi_f = n_f\pi_f. \end{aligned}$$

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

$$(1.13) \quad \begin{aligned} G &= \alpha\Pi_h + \frac{1}{\varepsilon - 1}PD + \tau pn_f c_f - spn_h c_h^* - f(n_h) + L, \text{ and} \\ G^* &= \alpha\Pi_f + \frac{1}{\varepsilon - 1}P^*D^* + \tau^* pn_h c_h^* - s^* pn_f c_f - f(n_f) + L. \end{aligned}$$

For cooperative policies, the government joint objective $W \equiv G + G^*$, and

$$(1.14) \quad W = \alpha(\Pi_h + \Pi_f) + \frac{1}{\varepsilon - 1}(PD + P^*D^*) + (\tau - s^*)pn_f c_f + (\tau^* - s)pn_h c_h^* - f(n_h) - f(n_f) + 2L.$$

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.

1.3.3. 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. Existence of the cooperative equilibrium in trade policies is established in Appendix B.

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 C.

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.³³

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.³⁴ 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 $s^* \leq \frac{\alpha}{\sigma}$.*

³³The 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. Appendix Section F.2 considers an extension with two differentiated sectors that can generate positive net trade barriers due to a distributional conflict.

³⁴See Maggi and Rodriguez-Clare (2005) for more focus on this feature of trade policy models and an approach to resolving the issue.

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.³⁵

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 chapter, 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.

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.

³⁵The 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 $\frac{\alpha}{\sigma}$.

1.3.4. 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: $\frac{\widehat{y}}{\widehat{x}} \equiv \frac{d \ln y}{d \ln x} = \frac{dy}{dx} \frac{x}{y}$, the elasticity of y with respect to x .

$$(1.15) \quad \text{Consumer surplus effect} \equiv -\frac{\widehat{P}}{\widehat{n}_f} = \frac{(1-S)}{(\sigma-1)} > 0.$$

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.

$$(1.16) \quad \text{Domestic profit effect} \equiv \frac{\alpha \widehat{\left(\frac{c_h}{x_h}\right)} \Pi_h}{\widehat{n}_f} = \frac{\widehat{c}_h}{\widehat{n}_f} = \frac{\widehat{P}}{\widehat{n}_f} (\sigma - \varepsilon) = -\frac{(1-S)}{(\sigma-1)} (\sigma - \varepsilon) < 0.$$

$$(1.17) \quad \text{Export profit effect} \equiv \frac{\alpha \widehat{\left(1 - \frac{c_h}{x_h}\right)} \Pi_h}{\widehat{n}_f} = \frac{\widehat{c}_h^*}{\widehat{n}_f} = \frac{\widehat{P}^*}{\widehat{n}_f} (\sigma - \varepsilon) = -\frac{S^*}{(\sigma-1)} (\sigma - \varepsilon) < 0.$$

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 $s > 0$.

$$(1.18) \quad \text{Import tariff revenue effect} \equiv \frac{\widehat{\tau p n_f c_f}}{\widehat{n_f}} = 1 + \frac{\widehat{c_f}}{\widehat{n_f}} = 1 - \frac{(\sigma - \varepsilon)}{(\sigma - 1)}(1 - S) > 0.$$

$$(1.19) \quad \text{Export subsidy cost effect} \equiv \frac{-\widehat{s p n_h c_h^*}}{\widehat{n_f}} = -\frac{\widehat{c_h^*}}{\widehat{n_f}} = \frac{(\sigma - \varepsilon)}{(\sigma - 1)}(S^*) > 0.$$

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, and we will show in the next subsection that the sign is what matters for whether countries would benefit from subsidy rules. 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.

1.3.5. 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 policies³⁶ 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 1.2.1, 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

³⁶There are also other domestic policy rules in GATT that we abstract from, such as National Treatment, considered by Horn, Maggi, and Staiger (2010).

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.³⁷ Foreign policies satisfying our definition do not 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.

³⁷The 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.

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 1.4.1. 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 1.2.1, 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 chapter, 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.³⁸

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 ($dc_h^* = 0$).³⁹ 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 effect and the export subsidy cost effect. Three other cross-border effects of foreign firm entry remain:

³⁸The 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.

³⁹The foreign tariff decrease that keeps home export constant is $-d\tau \frac{dc_h^*/d\tau}{dc_h^*/dn_f}$.

- 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 chapter, 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.

1.4. Model of Subsidy Rule Evolution

This section models subsidy rule evolution by applying the two-country framework introduced in the previous section. At a GATT equilibrium (defined in Definition 5), then the equilibrium could be improved by adding subsidy limits (Definition 7) when 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. The fourth subsection considers how countervailing duty laws can be used as a substitute for subsidy limits in some cases, and the final subsection argues that in a three-country extension, subsidy limits can be valuable when countervailing duties are difficult to coordinate.

This section takes the choice among the GATT equilibria to be exogenous. We have shown in Lemmas 3 and 6 that a GATT equilibrium at zero import tariffs exists that 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 dissertation does not provide a theory explaining why countries chose a GATT equilibrium with higher tariffs in the 1940s and progressed to Pareto superior GATT equilibria with lower tariffs, but there is already a large literature on theories of gradual tariff reductions.⁴⁰

⁴⁰See Bagwell and Staiger (2002, p. 106-107) and Bagwell and Staiger (2010) for surveys.

1.4.1. 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:

$$(1.20) \quad \frac{dG}{dn_f} \Big|_{\substack{dc_h^*=0 \\ \tau=\tau^*=0}} = \left(\overbrace{-PD \frac{\widehat{P}}{\widehat{n}_f}}^{\text{Consumer Surplus Effect}} + \overbrace{\alpha \left(\frac{p}{\sigma}\right) n_h c_h \frac{\widehat{c}_h}{\widehat{n}_f}}^{\text{Domestic Profit Effect}} \right) \frac{1}{n_f}.$$

Using our results from Section 1.3.4, we have

$$(1.21) \quad \begin{aligned} \frac{dG}{dn_f} \Big|_{\substack{dc_h^*=0 \\ \tau=\tau^*=0}} &= \left(-PD \frac{\widehat{P}}{\widehat{n}_f} + \alpha \left(\frac{p}{\sigma}\right) n_h c_h \frac{\widehat{P}}{\widehat{n}_f} (\sigma - \varepsilon) \right) \frac{1}{n_f} \\ &= \left(PD - \alpha \left(\frac{p}{\sigma}\right) n_h c_h (\sigma - \varepsilon) \right) \left(-\frac{\widehat{P}}{\widehat{n}_f} \right) \frac{1}{n_f} \\ &= \left[1 - \alpha S \left(1 - \frac{\varepsilon}{\sigma}\right) \right] \left(\frac{(1-S)}{(\sigma-1)} \right) \frac{PD}{n_f}. \end{aligned}$$

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:

$$(1.22) \quad \alpha > \frac{1}{S} \left(\frac{1}{1 - \frac{\varepsilon}{\sigma}} \right) \implies \frac{dG}{dn_f} \Big|_{\substack{dc_h^*=0 \\ \tau=\tau^*=0}} < 0.$$

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 (1.22) and Lemma 8:

Proposition 9. *For $\alpha > \frac{1+(1+\phi)^{1-\sigma}}{1-\frac{\varepsilon}{\sigma}}$ there exists a GATT equilibrium at sufficiently low import 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.⁴¹

1.4.2. No Subsidy Limits at Higher Tariffs

This subsection establishes that when countries choose noncooperative tariffs, subsidy limits cannot improve a GATT equilibrium. We show that 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.⁴² To derive these results, a helpful form of notation to introduce is the partial effect of the home price index on government welfare, as function of the home tariff τ . The notation has suppressed the dependence of G_P on the other policies:

$$G_P(\tau) \equiv -D + \alpha \left(\frac{p}{\sigma} \right) n_h \frac{dc_h}{dP} + \tau p n_f \frac{dc_f}{dP}.$$

The Nash 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, but it also leads to a gain in home's import tariff revenue on the inframarginal

⁴¹For 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). The estimates are for a different model (Grossman and Helpman 1994) with perfectly competitive sectors.

⁴²The 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 Nash 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 Nash equilibrium, the foreign firm entry externality and can be written as:

$$(1.23) \quad \left. \frac{dG}{dn_f} \right|_{\substack{dc_h^*=0 \\ \tau=\tau^*=\tau^N}} = G_P(\tau^N) \frac{dP}{dn_f} + \tau^N pc_f, \text{ and}$$

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 $\left. \frac{dG}{dn_f} \right|_{\substack{dc_h^*=0 \\ \tau=\tau^*=\tau^N}} > 0$. 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 Nash equilibrium, 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 Nash tariffs implies, by Lemma 8, the following proposition:

Proposition 10. *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 chapter. 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 chapter 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.

Though this chapter matches prior work on the lack of motive for subsidy rules at non-cooperative import policies, the chapter is still distinct in showing that political economy motives can motivate subsidy rules away from the Nash tariffs. It is interesting to consider further why the claim that higher α can motivate subsidy rules does not continue to apply at noncooperative import policies, as we have already proven in Proposition 10.

We decompose the foreign firm entry effects for general positive tariffs:

$$(1.24) \quad \frac{dG}{dn_f} \Big|_{dc_h^*=0} = \left(\begin{array}{c} \text{Consumer Surplus Effect} \\ \underbrace{-PD}_{\widehat{P}} \\ \underbrace{\widehat{P}}_{\widehat{n}_f} \end{array} + \begin{array}{c} \text{Domestic Profit Effect} \\ \alpha \left(\frac{p}{\sigma} \right) n_h c_h \underbrace{\widehat{c}_h}_{\widehat{n}_f} \end{array} + \begin{array}{c} \text{Import Tariff Revenue Effect} \\ \tau p n_f c_f \left(1 + \frac{\widehat{c}_f}{\widehat{n}_f} \right) \end{array} \right) \frac{1}{n_f}.$$

The connection between the motive to limit subsidies and the motive to raise tariffs is evident when comparing the external effects of foreign firm entry to home's Nash tariff condition,

$$\frac{dG}{d\tau} = 0:$$

$$(1.25) \quad \alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} + \tau^N p n_f c_f \frac{\widehat{c}_f}{\widehat{p}_f} = 0.$$

Hidden within the unilateral tariff condition is the result that the fall in consumer surplus from an increased tariff is perfectly offset by the first-order increase in tariff revenue. Unilateral tariffs are always positive: a foreign price increase raises home per firm sales ($\widehat{\frac{c_f}{p_f}} > 0$) and lowers foreign import sales ($\widehat{\frac{c_f}{p_f}} < 0$). A higher political economy motivation (higher α) motives higher import tariffs. Those larger import tariffs are sufficiently large so that the import tariff revenue effect and consumer surplus effect always dominate the domestic profit effect. The following is then an alternative Proposition 10 proof, which unpacks the various effects that operate through the home price index.

To connect the unilateral import tariff equation to the cross-border externality expression, we require a relationship between the effect of foreign prices on domestic consumption and the effect of foreign entry on domestic consumption. Log differentiating the demand equation (1.8) and price index equation (1.6) establishes the relationship. A one percent foreign price increase has the same impact on home's price index as a $(\sigma - 1)$ percent decrease in foreign firms: $(1 - \sigma)\widehat{\frac{P}{n_f}} = \widehat{\frac{P}{p_f}}$. Consequently, the impact of a one percent foreign firm increase on expenditure of either home or foreign goods is the same as the impact of a $(\sigma - 1)$ percent decrease in foreign firms: $\widehat{\frac{n_f p_f c_f}{n_f}} = (1 - \sigma)\widehat{\frac{n_f p_f c_f}{p_f}}$ and $\widehat{\frac{n_h p c_h}{n_f}} = (1 - \sigma)\widehat{\frac{n_h p c_h}{p_f}}$. The expressions can equivalently be written as $\widehat{\frac{c_h}{n_f}} = (1 - \sigma)\widehat{\frac{c_h}{p_f}}$ and $\left(1 + \frac{\widehat{c_f}}{n_f}\right) = (1 - \sigma)\left(1 + \frac{\widehat{c_f}}{p_f}\right)$.

We can then substitute the Nash tariff condition into the foreign firm externality equation. Using a similar derivation as (1.21), we have.

$$(1.26) \quad \left. \frac{dG}{dn_f} \right|_{\substack{dc_h^*=0 \\ \tau=\tau^*=\tau^N}} = \left[1 - \frac{\alpha S^N (1 - \frac{\varepsilon}{\sigma})}{\sigma - (\sigma - \varepsilon)(1 - S^N)} \right] \left(\frac{(1 - S^N)}{(\sigma - 1)} \right) \frac{PD}{n_f} > 0.$$

where S^N is home's import share at the Nash equilibrium. For the foreign firm entry externality to be negative, and the subsidy limits to be desirable, the bracketed expression must be negative. Solving the inequality for α we have

$$(1.27) \quad \left. \frac{dG}{dn_f} \right|_{\substack{dc_h^*=0 \\ \tau=\tau^*=\tau^N}} < 0 \implies \alpha > \sigma \left(1 + \frac{\varepsilon}{(\sigma - \varepsilon)SN} \right) > \sigma.$$

But our parameter restriction requires $\alpha < \sigma$. The parameter restriction was necessary because without it, governments would achieve an arbitrarily high joint objective by providing boundless export subsidies to their firms. The import tariff effect is strong enough to remove any motive to constrain the entry subsidies.

1.4.3. 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

$$(1.28) \quad \frac{dG}{ds^*} = \left(\begin{array}{c} \text{Consumer Surplus Effect} \\ \overbrace{PD \frac{\widehat{P}}{\widehat{p}_f}} \\ \text{Domestic Profit Effect} \\ - \alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} \\ \text{Import Tariff Revenue Effect} \\ - \tau p n_f c_f \left(\frac{\widehat{c}_f}{\widehat{p}_f} \right) \end{array} \right) \frac{1}{1 + \phi + \tau + s^*}.$$

Notice the similarities between the expression, (1.20), and (1.24). 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 1.4.1. The

conditions are equivalent because of the close relationship between foreign price effects and foreign firm entry effects: $(1 - \sigma) \frac{\widehat{P}}{\widehat{n}_f} = \frac{\widehat{P}}{\widehat{p}_f}$ and $\frac{\widehat{c}_h}{\widehat{n}_f} = (1 - \sigma) \frac{\widehat{c}_h}{\widehat{p}_f}$. 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, as evident from (1.25), 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 the Nash equilibrium implies that international inefficiency results from too little subsidization at the Nash equilibrium:

$$(1.29) \quad \frac{dG}{ds^*}_{\tau=\tau^*=\tau^N} = \left(PD \frac{\widehat{P}}{\widehat{p}_f} \right) \frac{1}{1 + \phi + \tau + s^*} > 0.$$

By Lemma 8, we can state the following:

Proposition 11. *Propositions 9 and 10 extend to export subsidies.*

Proposition 11 completes our explanation for why the rationale for subsidy limits and their evolution applies to both domestic entry subsidies and export subsidies.

1.4.4. 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 9 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 at the

Nash equilibrium, countries obviously cannot achieve greater cooperation with countervailing duties at the Nash equilibrium.

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

Definition 12. *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 1.3.5:

Definition 13. *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 1.4.2 that the first-order effect of foreign firm entry on home welfare subject to the market access constraint is

$$(1.30) \quad \frac{dG}{dn_f} \Big|_{dc_h^*=0} = G_P(\tau) \frac{dP}{dn_f} + \tau p c_f.$$

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 $\frac{dG}{dn_f} \Big|_{dc_h^*=0} = 0$ for $\tau = 0$ and $\frac{dG}{dn_f} \Big|_{dc_h^*=0} > 0$ 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 14. *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 $W = G + G^*$), $\frac{dW}{dn_f} \Big|_{dc_h^*=0} = 0$, $\frac{dG}{dn_f} \Big|_{dc_h^*=0} > 0$, $\frac{dG^*}{dn_f} \Big|_{dc_h^*=0} < 0$. By smooth concavity there must exist a level of subsidies within the neighborhood of globally efficient subsidies such that $\frac{dW}{dn_f} \Big|_{dc_h^*=0} > 0$, and $\frac{dG^*}{dn_f} \Big|_{dc_h^*=0} < 0$, 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 15. *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.*

1.4.5. Third Country Competition

As we discussed in Section 1.2.2, 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 (1.21). 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 16. *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, which we leave to Appendix D, is that subsidy rules are desirable when political economy incentives are sufficiently weak:

Proposition 17. *In the three-country economy, home's welfare cannot be improved from the Nash equilibrium by subsidy limits if $\alpha < \frac{\varepsilon}{1-\varepsilon} \frac{1}{S^N}$.*

This upper bound of α in Proposition 17 is greater than the lower bound of α in Proposition 9 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 1.4.1, 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.

1.5. Conclusion

This chapter 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. The model is highly stylized, but it is important to provide a simple 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 chapter 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 chapter 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 chapter 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.

CHAPTER 2

International Competition Policy and the 1948 Havana Charter

2.1. Introduction

An important question in the economics of the multilateral trading system is whether countries should negotiate directly over specific behind-the-border domestic policies, i.e. achieve "deep" integration. Beginning in 1947, the world trading system was governed by the General Agreement on Tariffs and Trade (GATT), which achieved only "shallow" integration. Domestic policies were constrained only to the extent that they undermined the benefits of negotiated tariff commitments. This GATT treatment of domestic policies is consistent with the terms-of-trade theory of trade agreements. The theory establishes that if the only motive for a trade agreement is to prevent countries from using policy choices to manipulate their terms of trade, then shallow integration is sufficient to achieve an efficient trade agreement (Bagwell and Staiger 2001a). Although the terms-of-trade theory is consistent with the GATT's shallow integration, progress towards deep integration should not be necessary under the terms-of-trade theory. In 1948, 53 nations signed the Havana Charter intending to create the International Trade Organization (ITO), which was to be the third pillar of the global economic order along with the World Bank and International Monetary Fund (IMF). A guiding principle of the Havana Charter was that global integration required agreements covering more than traditional trade instruments. The ITO had the 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 history of international coordination in competition policy raises a number of questions. Why did countries agree to support the 1948 Havana Charter that included international coordination of competition policy? Why did the WTO not include any competition policy even though it included other forms of deep integration like the subsidy rules? How is trade liberalization likely to affect future coordination of competition policy? These questions are important to our understanding of agreements over behind-the-border domestic policies.

This chapter proposes a model of competition policy coordination with symmetric countries. The executive has preferences in the reduced form of Baldwin (1987) and Grossman and Helpman (1994) such that firm profits receive more weight than consumer welfare due to political motives. The competition policy is modeled as governments directly choosing the number of firms in a monopolistically competitive environment. Having governments choose firms is standard practice in the international competition policy literature (Horn and Levinsohn 2001, Ch. 9 of Bagwell and Staiger 2002), but usually in the context of Cournot mergers. An advantage over the Cournot framework for the current exposition is that the competition policies have no effect on prices and create international problems distinct from terms-of-trade problems.¹

This chapter's main result is that when trade barriers are high as in the 1940s, the executive supports global coordination toward stronger competition policy. 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. The decision of Congress to reject the charter is not a focus of this chapter, 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

¹Intuitively the lack of price effects means these results cannot be given a terms-of-trade interpretation. A full argument requires we consider a larger set of policies and is not worked out until the third chapter.

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.

The chapter next considers the competition policy implications of the cooperation in import tariff reduction since the 1940s. Since a cross-border effect of strict competition policy is to increase international trade subject to tariffs, the tariff reductions can shift the executive's cross-border externalities from coordinating on stricter antitrust towards coordination on no antitrust or lax antitrust, such that Congress will be even further in favor of lax antitrust. The conclusion here mirrors that of the first chapter of this dissertation 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.

The results here contrast with a wide body of work that argues terms-of-trade manipulation was the only relevant motive for a trade agreement in the first decades of the GATT and that no further agreements over domestic policies, including competition policies, should be required. Irwin, Mavroidis, and Sykes (2008) find the strongest support for the terms-of-trade theory in explaining the negotiations that led to the GATT. Looking at a theory of competition policy, Bagwell and Staiger (2002, Ch. 9) find no advantage to contracting directly over competition policy. Their results depend on the functioning of the GATT non-violation complaint, which prevents countries from any change in the mix of competition policy and tariffs that undermines the market access commitments implied by import tariff reductions. Just as in this dissertation's first chapter, international externalities persist here despite a functional GATT nonviolation complaint. There are still externalities from home's competition policy choices in the foreign country's domestic market, even if GATT rules preserve the foreign country's market access to home.

Profit-shifting and political economy motives in this chapter 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 chapter 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 domestic policies, as laid out in Staiger (2011).

The work most closely related to this chapter is Horn and Levinsohn (2001), which considers whether supranational antitrust coordination is desirable in a Cournot framework with homogeneous products. Their paper's focus is more normative than positive and they conclude that there are no general or intuitive results on supranational coordination. Horn and Levinsohn 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.

2.2. Historical Background

This section 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."²

The 1940s are likely as good time as any to apply a standard neoclassical trade policy model to government decision making, given the values of the U.S. State Department following Cordell Hull.

Having been chosen by Roosevelt to serve as Secretary of State, Hull was uniquely positioned to pursue his belief that freer trade might lead to economic and political conditions that would be more favorable to peace. Hull fought a long and hard bureaucratic battle to ensure that the official U.S. government position on international-trade policy was his State Department's vision of a world more open to trade and free from discriminatory commercial policies.... Although Hull retired as Secretary of State in November 1944 and was not directly involved in the GATT [ITO] negotiations, he gave the State Department a strong and lasting intellectual direction. As America's longest-serving secretary of state and imbued with a deep ideological attachment to the reduction of trade barriers, Hull shaped the State Department's approach to trade policy long after his departure.

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

²Oral 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).

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."³

This chapter does not have a model for why Congress would not trust the executive's prognosis of the policy coordination outcome. The chapter instead focuses on the decision of the executive to negotiate the charter. Modelling the executive's decision is a better fit for the framework we have already developed in the previous chapter.

2.3. Modeling Competition Policy

The model here follows the two-country, two factor model of the first chapter, but we re-interpret 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

³Oral 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).

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.⁴

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 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.⁵ 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 results from the first chapter 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.

⁴But do notice that the original Dixit and Stiglitz (1977) model adapted here was an application to an industrial organization literature on efficient entry.

⁵Though 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.

2.4. 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 the first chapter that countries would want never want to coordinate on restricting subsidies at Nash equilibrium tariffs.

In the first chapter, we derived equation (1.24), which says 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.

$$(2.1) \quad \left. \frac{dG}{dn_f} \right|_{\substack{dc_h^*=0 \\ \tau=\tau^*=\tau^N}} = \left(\begin{array}{c} \text{Consumer Surplus Effect} \\ \underbrace{-PD \frac{\widehat{P}}{n_f}} \\ \text{Domestic Profit Effect} \\ + \alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\widehat{c}_h}{n_f} \\ \text{Import Tariff Revenue Effect} \\ + \tau^N p n_f c_f \left(1 + \frac{\widehat{c}_f}{n_f} \right) \end{array} \right) \frac{1}{n_f}.$$

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

$$(2.2) \quad \left. \frac{dG}{dn_f} \right|_{\tau=\tau^*=\tau^N} = \left[1 - \frac{\alpha S^N (1 - \frac{\varepsilon}{\sigma})}{\sigma - (\sigma - \varepsilon)(1 - S^N)} \right] \left(\frac{(1 - S^N)}{(\sigma - 1)} \right) \frac{PD}{n_f} > 0$$

Corollary 18. *The GATT equilibrium at noncooperative tariffs can be improved by coordinating on stronger competition policy.*

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 chapter 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.

2.5. Effects of Trade Liberalization on Competition Policy Coordination

Absent a model, 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 chapter 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 (2.1), 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 19. *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 chapter'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 chapter.

2.6. Conclusion

This chapter has argued that our monopolistic competition model of trade and domestic policies can be applied to competition policy coordination in addition to subsidy rules. We have argued that trade liberalization leads countries away from coordination that strengthens

competition policy. The common thread between subsidy coordination and competition policy coordination is that externalities arise from entry and that trade liberalization can lead to anti-competitive forms of coordination when political economy preferences are strong.

We have so far continued to assume that governments are symmetric, though significant differences existed in negotiations between the U.S. and U.K. in the 1940s and the U.S. and European Union later on, so we have abstracted from any result that explains why the U.S. and E.U. had different competition policies to begin with. The symmetric model allows for simpler derivations, though it is not clear why going to an anti-symmetric case would significantly alter the main intuition of the results on the existence and evolution of competition policy coordination.

CHAPTER 3

Fundamental Trade Agreement Problems in Monopolistic Competition

3.1. Introduction

When markets are imperfectly competitive, both trade policy and domestic policy choices by governments can create cross-border externalities. Governments can use policy to shift profits to domestic firms from foreign firms or to shift firm locations from one country to another (Venables 1985, 1987). Whether these cross-border externalities fundamentally matter for the design of international institutions is an important unresolved question.¹ Although certain GATT and WTO rules can be interpreted as addressing externalities that arise under imperfect competition,² a recent literature has argued that these externalities are not a fundamental concern that the world trading system needs to address (Bagwell and Staiger 2009, forthcoming b, Antras and Staiger 2012). The authors show that the only relevant externality under imperfect competition is the terms-of-trade externality, the same one that arises under perfect competition when countries use policy to raise relative prices of their exports (or lower relative prices of their imports) in world markets at the expense of their trading partners. Terms-of-trade manipulation is the only source of inefficiency when countries choose tariffs noncooperatively. When countries follow the rules and principles

¹See Bagwell and Staiger (2010) for a survey on what constitutes a fundamental problem for a trade agreement to solve. The authors argue, for example, that the Ossa (2011) theory of the GATT in monopolistic competition does not describe a new fundamental problem because the trade policy externalities that motivate trade agreements in his setting disappear when countries negotiate over both import policies and export policies.

²Aside from the first two chapters, Ossa (2011) and Mrazova (2011) argue that the GATT principles of reciprocity and nondiscrimination can guide countries to an escape from externalities that arise under imperfect competition.

associated with the 1947 GATT, the terms-of-trade externality is eliminated and policy choices are efficient.

The claim that cross-border externalities arising under imperfect competition matter only when countries deviate from 1947 GATT rules and principles leads to a puzzling observation: the world trading system has deviated from 1947 GATT rules and principles. The path to efficiency suggested by Bagwell and Staiger (forthcoming b, 2009) is for countries to *reciprocally reduce net trade barriers over both import and export policies*, but the actual world trading system began to ban export subsidies in the 1960s among a few developed countries and then banned them almost entirely upon the creation of the WTO in 1995.³ Another theoretically appealing GATT feature is the *market access preservation rule*. The rule prevents countries from using domestic policies to upset the trade volumes anticipated at the time countries negotiate tariff reductions. The rule allows countries to achieve efficient policies without resorting to contracts over specific domestic policies in trade agreements, also known as "deep integration" (Antras and Staiger 2012). Although the GATT's drafters understood that GATT Article XXIII could be used in lieu of subsidy rules, that seems to have been forgotten during negotiations for the WTO subsidy rules.⁴

This chapter considers a trade model such that international externalities other than terms of trade do indeed persist. The conventionally successful rules and principles of the GATT fail to hold, and so the model offers an explanation for why the world trading system deviated from the GATT. The model considers trade between symmetric countries, home and foreign, with a monopolistically competitive differentiated sector and a freely traded outside sector. Governments each choose two border measures (an import policy and export policy) and two domestic policies (a conventional marginal cost subsidy and the number of monopolistically competitive firms in each country). A distinct feature of this model from

³Bagwell and Staiger (forthcoming a) have shown that an export subsidy ban becomes defensible following trade liberalization in a linear Cournot framework, but Bagwell and Staiger (2009) find no rationale to ban export subsidies in a monopolistically competitive framework.

⁴See Section 1.2.2.

the prior literature is that the governments' firm choices are a domestic policy that has cross-border externalities without having any effect on the prices of any individual product. The study of two domestic policy choices is also an important distinction. Countries can, in theory, set trade policies to nullify the externalities associated with one domestic policy—this is indeed the case in the first two chapters of this dissertation—but countries cannot generally do this with more than one domestic policy choice.

The chapter's first result is that a cross-border free-rider externality in firm choice persists even if countries act as if they do not value their ability to manipulate their terms of trade. These policy choices define what is known in prior work as the *political optimum*,⁵ and they are efficient when terms-of-trade is the only relevant international externality. In this context, we will refer to the full set of policies as the *unrestrained entry political optimum*. Since the entry policies cannot be used to manipulate world prices, so the politically optimal condition for entry subsidies is the same as the noncooperative condition. To understand why entry policy choices are inefficient, first consider countries' choices of trade policies and marginal cost subsidies. The conditions do not depend on the number of firms, a consequence of the simple CES demand setting. At the unrestrained entry political optimum, policies are set so that price equals marginal cost for all products, and there are no cross-border externalities from shifting imperfectly competitive rents. When countries set their number of firms, there is a positive cross-border externality as consumers gain from variety. There is a free-rider effect that implies countries choose variety below the internationally efficient level. There does exist a set of efficient policies, which we denote as the *efficient entry political optimum*, such that the trade policies and marginal cost subsidy satisfy the political optimum conditions, while the firm counts satisfy the efficiency condition.

⁵The 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).

The chapter next considers 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 special feature of monopolistic competition with a quasilinear outside good numeraire, noted by Bagwell and Staiger (2009), is that the country has no ability to influence the offshore price of its imports, but a country's domestic and export subsidies are fully passed through to the offshore price of its exports.⁶ 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 unrestrained entry political optimum, foreign would cut its domestic subsidy and worsen home's terms of trade. At the efficient entry political optimum, foreign would also attempt to cut its number of firms to the detriment of home.

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. Consider a foreign decrease in firms and increase in export subsidy. Home's expenditure on foreign goods then falls, since home is paying a lower price for the same volume of goods with less variety. Home then has more domestic consumption, a higher price index, and a lower overall objective. An alternative rule is that foreign 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 here are closely linked to the first two chapters of this dissertation. The first two chapters attempt to rationalize the 1995 WTO subsidy rules and the 1948 Havana

⁶Another difference between Bagwell and Staiger (2009) and Ossa (2011) is that Ossa considers the possibility of income effects, so one might consider that income effects creates additional problems for trade agreements in his framework. Appendix E argues that allowing for income effects creates no new problems for trade agreements in an environment where countries home import and export policy choices.

Charter using similar models, though with a smaller set of policies. These models considered countries' progress towards efficient policies distinct from the politically optimal policies, which are a unique set of efficient policies that are consistent with GATT rules and principles. This chapter complements the other two chapters by arguing how pursuit of the politically optimal policies under GATT rules and principles could fail to lead to globally efficient policies.

3.2. Trade Policy Model with Two Domestic Policy Choices

The model follows the first chapter of the dissertation, except countries can now set domestic marginal cost subsidies ψ and ψ^* and we no longer consider political economy weights in this section ($\alpha = 1$). This is the simplest setup that can illustrate how usual GATT principles and rules will fail to yield and maintain efficient policies. Adding the marginal cost subsidy plays two roles: first, it simplifies the analysis because it yields simple optimal policies. The net trade barriers are zero and the optimal marginal cost subsidy sets prices equal to marginal costs. Without the marginal cost subsidy, the efficient net trade barriers cannot be solved for explicitly. Second, by having two domestic subsidies, we prevent the possibility that countries could use the trade policies to eliminate externalities from the domestic marginal cost subsidy. As we will show, the politically optimal policies are those that eliminate externalities of the marginal cost subsidy, but they do not eliminate the externalities associated with the entry subsidy.

In the model augmented with the domestic marginal cost subsidy, the local prices are the subsidized cost with the usual CES markup:

$$(3.1) \quad \begin{aligned} p_h &= \frac{\sigma}{\sigma - 1}(m - \psi), \text{ and} \\ p_f &= \frac{\sigma}{\sigma - 1}(m - \psi^*). \end{aligned}$$

The resulting government objectives are then the same as in the first chapter (equations 1.13) , except the subsidized prices carry through the rest of the derivation, and governments must consider the costs of the domestic marginal cost subsidy.

$$(3.2) \quad \begin{aligned} G &= \Pi_h + \frac{1}{\varepsilon - 1}PD + \tau p_f^* n_f c_f - s p_h n_h c_h^* - \psi x_h n_h - f(n_h) + L, \text{ and} \\ G^* &= \Pi_f + \frac{1}{\varepsilon - 1}P^*D^* + \tau^* p_h n_h c_h^* - s^* p_f^* n_f c_f - \psi x_f n_f - f(n_f) + L. \end{aligned}$$

As in Bagwell and Staiger (2009), we can re-express the policy choices as local and offshore prices and parameters, so we can decompose the impact of policy by the policies' impact on each price. Recall the prices are denoted by subscripts indicating origin, and the offshore prices are

$$(3.3) \quad \begin{aligned} p_h^w &= (1 - s)p_h, \text{ and} \\ p_f^w &= (1 - s^*)p_f^*. \end{aligned}$$

The welfares take the forms

$$(3.4) \quad \begin{aligned} G &= \Pi_h + \frac{1}{\varepsilon - 1}PD + (p_f - \phi p_f^* - p_f^w)n_f c_f - (p_h^w - p_h)n_h c_h^* \\ &\quad - \left(\frac{\sigma - 1}{\sigma}p_h - m\right)x_h n_h - f(n_h) + L, \text{ and} \\ G^* &= \Pi_f + \frac{1}{\varepsilon - 1}P^*D^* + (p_h^* - \phi p_h - p_h^w)n_h c_h^* - (p_f^w - p_f^*)n_f c_f \\ &\quad - \left(\frac{\sigma - 1}{\sigma}p_f^* - m\right)x_f n_f - f(n_f) + L. \end{aligned}$$

Profits, output, and consumption can all be written as functions of onshore prices and firm counts, so we can express G and G^* as functions of onshore prices, offshore prices, and firm counts, each of which are a function of the policy choices.

The global welfare objective, $W = G + G^*$, is

$$(3.5) \quad \begin{aligned} W = & (\Pi_h + \Pi_f) + \frac{1}{\varepsilon - 1}(PD + P^*D^*) + (p_f - \phi p_f^* - p_f^*)n_f c_f + (p_h^* - \phi p_h - p_h)n_h c_h^* \\ & - \left(\frac{\sigma - 1}{\sigma} p_h - m\right)x_h n_h - \left(\frac{\sigma - 1}{\sigma} p_f^* - m\right)x_f n_f - f(n_h) - f(n_f) + 2L. \end{aligned}$$

The objective does not depend on offshore prices.

3.3. Nash Equilibrium and Unrestrained Entry Political Optimum

The efficiency of the unrestrained entry political optimum is interesting to evaluate because this is a point that symmetric countries can achieve through reciprocal trade negotiations, and its efficiency here would corroborate the theoretical case that imperfectly competitive externalities are irrelevant for the world trading system.

Before considering the efficiency of the unrestrained entry political optimum, it is worth considering what leads to inefficiency at the Nash equilibrium. If the only sources of inefficiency depend on the impact of offshore prices on welfare, then that suggests immediately that eliminating terms-of-trade manipulation will achieve global efficiency.

3.3.1. Sources of Inefficiency at Nash Equilibrium

With some manipulation, the Nash equilibrium conditions can be written as follows:⁷

⁷The Nash condition for the home marginal cost subsidy is $G_{p_h} \frac{dp_h}{d\psi} + G_{p_h^*} \frac{dp_h^*}{d\psi} + G_{p^{*w}} \frac{dp^{*w}}{d\psi} = 0$. Applying the export subsidy condition we have, $G_{p_h} \frac{dp_h}{d\psi} + G_{p^{*w}} \left(\frac{dp^{*w}}{d\psi} - \frac{dp_h^*}{d\psi} \right) = 0$. The simplified form for the home marginal cost subsidy Nash condition follows after noting that $\frac{dp^{*w}}{d\psi} = \frac{p^{*w}}{p_h} \frac{dp_h}{d\psi}$ and $\frac{dp_h^*}{d\psi} = \frac{p_h^*}{p_h} \frac{dp_h}{d\psi}$.

$$\begin{aligned}
G_{p_f} &= 0, & G_{p_f}^* &= -G_{p_f^w}, \\
G_{p_h^*} &= -G_{p_h^w}, & G_{p_h^*}^* &= 0, \\
G_{p_h} &= G_{p_h^w} \left(\frac{p_h^* - p_h^w}{p_h} \right), & G_{p_f^*}^* &= G_{p_f^w}^* \left(\frac{p_f - p_f^w}{p_f^*} \right), \\
G_{n_h} &= 0, & \text{and } G_{n_f}^* &= 0.
\end{aligned}$$

The conditions reflect convenient features of the model: only the export subsidy and marginal cost subsidy affect 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 features of the model are the domestic marginal cost subsidy and the entry subsidy. The marginal cost subsidy also affects the local price while the entry subsidy that determines the firm counts has no effect on any prices.

The global efficiency conditions for home's policy choices are

$$\begin{aligned}
(G_{p_f} + G_{p_f}^*) \frac{dp_f}{d\tau_h} &= 0, \\
(G_{p_h^*} + G_{p_h^*}^*) \frac{dp_h^*}{d\tau_h^*} &= 0, \\
(G_{p_h} + G_{p_h}^*) \frac{dp_h}{d\psi} + (G_{p_h^*} + G_{p_h^*}^*) \frac{dp_h^*}{d\psi} &= 0, \text{ and} \\
G_n + G_n^* &= 0.
\end{aligned}$$

These conditions can be simplified to

$$G_{p_f} + G_{p_f}^* = 0,$$

$$G_{p_h^*} + G_{p_h^*}^* = 0,$$

$$G_{p_h} + G_{p_h}^* = 0, \text{ and}$$

$$G_n + G_n^* = 0.$$

3.3.1.1. Trade Policy Inefficiency. At Nash 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.

$$G_{p_h^*} + G_{p_h^*}^* = -G_{p_h^w} = -n_h c_h^* \neq 0, \text{ and}$$

$$G_{p_f} + G_{p_f}^* = -G_{p_f^w} = -n_f c_f \neq 0.$$

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.

3.3.1.2. Domestic Marginal Cost Subsidy Inefficiency. To evaluate the Nash condition for the marginal cost subsidy, we need to decompose the home domestic price externality.

Foreign is influenced by the prices in home's market only through the volume of exports. We can then write the marginal effect of a change in export volume on foreign welfare as either

$G_{p_h^*}^* / \frac{dc_f}{dp_h}$ or $G_{p_f}^* / \frac{dc_f}{dp_f}$, so $G_{p_h}^* = G_{p_f}^* \left(\frac{dc_f}{dp_h} / \frac{dc_f}{dp_f} \right)$ must hold. We then have

$$\begin{aligned}
G_{p_h} + G_{p_h}^* &= G_{p_h^w} \left(\frac{p_h^* - p_h^w}{p_h} \right) - G_{p_f^w} \left(\frac{dc_f}{dp_h} / \frac{dc_f}{dp_f} \right) \\
&= n_h c_h^* \left(\frac{p_h^* - p_h^w}{p_h} \right) - n_f c_f \left(\frac{dc_f}{dp_h} / \frac{dc_f}{dp_f} \right) > 0.
\end{aligned}$$

We can sign the expression because $\frac{dc_f}{dp_h} / \frac{dc_f}{dp_f} < 0$ and $\frac{p_h^* - p_h^w}{p_h} = \tau + \phi > 0$.⁸

In conclusion, the Nash domestic subsidies are too low. Governments set the Nash domestic subsidies to be too low because there is terms-of-trade improvement from setting subsidies too low, and because foreign government policy choices are also distorted by terms-of-trade manipulation.

3.3.1.3. Entry Policy Inefficiency. For the Nash policies considered thus far, all distortions are due to terms-of-trade manipulation. For the entry policy determining firm counts, there is a free-rider effect that is not determined by terms of trade.

When foreign increases its number of firms, home benefits from an increase in variety without having to use scarce capital for entry. The increase in foreign variety has a similar effect on the price index as a reduction in foreign price due to a tariff decrease, but unlike the tariff decrease, home does not suffer from a loss in revenue from the foreign firm entry.

Since the entry efficiency condition is $G_{n_f} + G_{n_f}^* = 0$ and the Nash first order condition is $G_{n_f}^* = 0$, the entry choice is globally inefficient if $G_{n_f} \neq 0$. The sign of G_{n_f} depends on a balance of free-rider effects, and negative externalities due to profit-shifting. The profit-shifting externalities exist at the Nash equilibrium because terms-of-trade manipulation has led countries to set prices above marginal cost, so foreign firm entry decreases the rents home gets from home production.

This chapter does not attempt to sign G_{n_f} at the Nash equilibrium but the efficiency of firm policy choices at Nash is not what is important for our purposes. The important

⁸We established in the first chapter that the import tariff choices are always positive.

result here is that an externality exists whose existence does not depend on countries' desire to manipulate terms of trade. We will next verify that this externality persists at the unrestrained entry politically optimum.

3.3.2. Inefficiency of the Unrestrained Entry Political Optimum

The unrestrained entry political optimum consists of the policies countries would choose if they acted as if they did not value their ability to manipulate their terms of trade. The Nash conditions are the same as the politically optimal conditions for the import tariff and firm choices because these policies do not affect terms of trade, although these variables are still affected by distortions in other policy choices.

The conditions for the unrestrained entry political optimum imply that

$$\begin{aligned} G_{p_f} &= G_{p_h^*} = G_{p_h} = G_{p_h^*}^* = \\ G_{p_f}^* &= G_{p_f^*}^* = G_n = G_n^* = 0. \end{aligned}$$

In the case of the marginal cost subsidy, the subsidy affects both the local price and the terms of trade. Given that the politically optimal export subsidy is chosen, so that countries do not value changes in the local traded price, it then follows that there is no first-order effect of a change in the local domestic price.

3.3.2.1. Trade Policy Efficiency. As in Bagwell and Staiger (2009), the politically optimal trade policy choices immediately imply that the global efficiency conditions for trade policy are satisfied: $G_{p_f} + G_{p_f}^* = 0$ and $G_{p_h} + G_{p_h}^* = 0$.

3.3.2.2. Domestic Marginal Cost Efficiency. For the global efficiency condition for the domestic marginal cost subsidy to be satisfied, it must hold that there is no externality from home's local price on foreign's welfare. As mentioned in our discussion of the marginal cost

subsidy for Nash policies, because foreign prices influence home only through the export volume, then the marginal effect of a change in export volume on home can be written as $G_{p_h}^*/\frac{dc_f}{dp_h}$ or $G_{p_f}^*/\frac{dc_f}{dp_f}$. Since the effects of prices on the export volume are nonzero, and the politically optimal export subsidy condition $G_{p_f}^* = 0$ is satisfied, it then follows that foreign has no value for a marginal increase in its export volume to home, and $G_{p_h}^* = 0$, so a change in home's domestic price has no impact on foreign welfare. Consequently, the choice of domestic marginal cost subsidy is globally efficient: $G_{p_h} + G_{p_h}^* = 0$.

3.3.2.3. Entry Subsidy Inefficiency. Because efficiency conditions are satisfied at the unrestrained entry political optimum, there are no longer externalities from shifting the location of production, since there are no longer any rents to shift. But the positive externality from foreign product entry remains, and this leads to the entry subsidy being inefficient at the political optimum. $G_n = 0$ and $G_n^* > 0$ so the efficiency condition is not satisfied. The foreign entry subsidy gives home a benefit through the price index as if home were benefiting from a foreign price decrease from tariff reduction, but with only the tariff reduction, home also experiences a loss in revenue on the inframarginal trade volume. Consequently, home benefits from a foreign increase in variety even though home is indifferent regarding future reductions in its own import tariff.

To see the inefficiency of the entry subsidy, it is helpful to rewrite the government welfare function as follows:

$$G = \frac{1}{\varepsilon - 1}PD + n_h c_h (p_h - m) + n_f c_f (p_f - \phi p_f^* - p^w) + n_h c_h^* ((p_h - m)(1 + \phi) + (p^{*w} - p_h)).$$

At the politically optimal choices of trade policies and domestic marginal cost subsidy, we have

$$G = \frac{1}{\varepsilon - 1}PD + n_h c_h \left(\frac{1}{\sigma - 1}m - \frac{\sigma}{\sigma - 1}\psi \right) + \tau n_f c_f \\ + n_h c_h^* \left(\left(\frac{1}{\sigma - 1}m - \frac{\sigma}{\sigma - 1}\psi \right) (1 + \phi) - s \right).$$

It is then straightforward that policies at the unrestrained entry political optimum involve free trade and a domestic subsidy such that price equals marginal cost, e.g. $\tau = s = 0$ and $\psi = \frac{1}{\sigma}m$. At these policies, local products have price m and traded products have price $(1 + \phi)m$.

At the unrestrained entry political optimum, there is then no first-order effect of foreign firm entry on any component of welfare other than consumer welfare, because all other components are zero. The foreign firm entry has a positive impact on the price index:⁹

$$G_{n_f} = \frac{p_f c_f}{\sigma - 1} > 0.$$

Proposition 20. *The unrestrained entry political optimum is inefficient when countries negotiate over import policies, export policies, domestic marginal cost subsidies, and entry subsidies, due solely to the inefficiency in entry subsidy choices.*

3.4. 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 the unrestrained entry political optimum and the efficient entry political optimum.

⁹See Appendix A.1 for comparative statics.

3.4.1. 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 domestic subsidy at either the unrestrained entry political optimum or the efficient entry political optimum. The reduction in subsidy increases p_f^* and raises the foreign price index P^* and increases the export volume of home firms $n_h c_h^*$, so home market access is preserved. Within home's market, the increase in p_f^* , has no first-order on home's welfare because politically optimal policies have been chosen, but the subsidy decrease does impact the offshore price p_f^w , so home has suffered a terms-of-trade loss from foreign reducing its subsidy. Foreign benefits from such a subsidy decrease via an improvement in its terms-of-trade.

Consider the effects of a reduction in the foreign entry subsidy. The reduction in subsidy raises the foreign price index P^* and home's market access is preserved. Within home's market, the decrease in n_f has no effect on home through profits or government revenues because politically optimal policies have been chosen. But home's price index P rises due to the decrease in n_f , so home is worse off from the decrease in entry subsidy. At the efficient entry political optimum, foreign benefits from the reduction. At the unrestrained entry political optimum, where foreign has chosen its Nash entry subsidy, foreign is indifferent regarding the reduction.

Proposition 21. *A market access preservation rule that preserves the market access of exporters does not prevent countries from reducing a domestic policy to influence terms-of-trade, nor does it prevent countries from reducing entry subsidies to the detriment of trading partners.*

3.4.2. 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 either 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 $G_{p_f^w} dp_f^w = G_{p_f^w} dp_f = -n_f c_f dp_f$. 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.¹⁰ Thus, the rule that ensures the price index is constant also preserves home welfare.

Proposition 22. *When countries are at either the unrestrained entry or efficient entry political optimum, a market access preservation rule requiring that foreign preserves both*

¹⁰See Appendix A for comparative statics.

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 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.

3.5. Conclusion

This chapter has taken a model of trade with domestic policies and monopolistic competition and argued that the existence of subsidies to entry leads to inefficiency even if countries act as if they do not value their terms of trade. GATT market access rules are also problematic, though they are redeemable. A clear extension would be to consider a model where there is a single factor instead of two factors, and governments can choose to subsidize

the fixed cost of entry. This model would be more complicated because the number of firms would endogenously adjust to every policy choice.

The main message of this dissertation is that cross-border externalities that arise under imperfect competition do matter for the design of the world trading system. The claim does not imply that terms-of-trade externalities are unimportant or that GATT principles and rules cannot help countries achieve and maintain efficient policies, but it does argue that terms-of-trade externalities were not the only relevant externality for explaining and evaluating the world trading system over the past six decades. Along with the externalities that arise from the more recent rise in offshoring and bilateral bargaining (Antras and Staiger forthcoming), these externalities arising from imperfect competition should be considered in the future design of the world trading system.

References

- [1] Antras P., and R.W. Staiger (forthcoming), "Offshoring and the Role of Trade Agreements," *American Economic Review*.
- [2] Antras P. and R.W. Staiger (2012), "Trade Agreements and the Nature of Price Determination," *American Economic Review Papers and Proceedings*, May.
- [3] Bagwell, K. and P. C. Mavroidis (2010), "Too Much, Too Little... Too Late?" in K. Bagwell, G. A. Bermann, and P. C. Mavroidis (eds.), *Law and Economics of Contingent Protection in International Trade*, New York: Cambridge University Press.
- [4] Bagwell, K. and R. W. Staiger (1999), "An Economic Theory of GATT," *American Economic Review*, 89, 215-48.
- [5] Bagwell, K. and R. W. Staiger (2001a), "Domestic Policies, National Sovereignty, and International Economic Institutions," *Quarterly Journal of Economics*, May, 116, 519-62.
- [6] Bagwell, K. and R. W. Staiger (2001b), "Strategic Trade, Competitive Industries, and Agricultural Trade Disputes," *Economics and Politics*, 13, 113-128.
- [7] Bagwell, K. and R. W. Staiger (2002), *The Economics of the World Trading System*, Cambridge: MIT Press.
- [8] Bagwell, K. and R. W. Staiger (2006), "Will International Rules on Subsidies Disrupt the World Trading System," *American Economic Review*, 96, 877-895.
- [9] Bagwell, K., and R. W. Staiger (2009), "Delocation and Trade Agreements in Imperfectly Competitive Markets," NBER Working Paper No. 15444.
- [10] Bagwell, K. and R. W. Staiger (2010), "The WTO: Theory and Practice," *Annual Reviews of Economics*, 2.
- [11] Bagwell, K. and R. W. Staiger (forthcoming a), "The Economics of Trade Agreements in the Linear Cournot Delocation Model," *Journal of International Economics*.
- [12] Bagwell, K. and R. W. Staiger (forthcoming b), "Profit Shifting and Trade Agreements in Imperfectly Competitive Markets," *International Economic Review*.

- [13] Bagwell, K., P. C. Mavroidis and R. W. Staiger (2002), "It's A Question of Market Access," *American Journal of International Law*, 96, 56-76.
- [14] Baldwin, R. (1980), "The Economics of the GATT," in *Issues in International Economics*, Peter Oppenheimer ed., London: Oriel Press.
- [15] Baldwin, R. (1987), "Politically Realistic Objectives and Trade Policy," *Economic Letters* 24, 287-90.
- [16] Baylis, K. (2009), "Countervailing Duties," in J. D. Gaisford and W. A. Kerr (eds.), *Handbook of International Trade Policy*, Edward Elgar Publishing.
- [17] Bhagwati, J. and R. E. Hudec, eds. (1996), *Fair Trade and Harmonization: Prerequisites for Free Trade? Volume 1 (Economic Analysis)*, Cambridge: MIT Press.
- [18] Bhagwati, J. (1996), "The Demands to Reduce Domestic Diversity among Trading Nations," in J. Bhagwati, and R. E. Hudec, eds., *Fair Trade and Harmonization: Prerequisites for Free Trade? Volume 1 (Economic Analysis)* Cambridge: MIT Press.
- [19] Bhagwati, Jagdish and V.K. Ramaswami (1963), "Domestic Distortions, Tariffs and the Theory of Optimum Subsidy," *Journal of Political Economy* 71 (1), 44-50.
- [20] Brander, J. A. and B. J. Spencer (1985), "Export Subsidies and International Market Share Rivalry," *Journal of International Economics*, 18, 83-100.
- [21] Broda C. and D. Weinstein (2006), "Globalization and the Gains from Variety," *Quarterly Journal of Economics* 121, 541-85.
- [22] Brou, D., and M. Ruta (2009), "A Commitment Theory of Subsidy Agreements," retrieved from <http://www.etsg.org/ETSG2009/papers/ruta.pdf>, August
- [23] Chang, P.-L. (2005), "Protection for Sale Under Monopolistic Competition", *Journal of International Economics*, 66 (2), 509-526.
- [24] Diebold, W. (1993-1994), "Reflections on the International Trade Organization," 14 N. Ill. U. L. Rev. 335.
- [25] Dixit, A. (1984), "International Trade Policy for Oligopolistic Industries," *Economic Journal*, 94 supplement, 1-16.
- [26] Dixit, A. and J. Stiglitz (1977), "Monopolistic Competition and Optimal Product Diversity," *American Economic Review*, 67, 297-308.
- [27] Flam, H. and E. Helpman (1987), "Industrial Policy Under Monopolistic Competition," *Journal of International Economics*, 22(1-2): 79-102.
- [28] Francois J. and Hoekman B. (2010), "Services Trade and Policy," *Journal of Economic Literature*, 48, 642-692.

- [29] Goldberg P., and G. Maggi (1999), "Protection for Sale: An Empirical Investigation," *American Economic Review*, 89(5), 1135-1155.
- [30] Gawande K. and U. Bandyopadhyay (2000), "Is Protection for Sale? Evidence on the Grossman-Helpman Theory of Endogenous Protection," *Review of Economics and Statistics*, 82:1, 139-152.
- [31] Gros, D. (1987), "A Note on the Optimal Tariff, Retaliation, and the Welfare Loss from Tariff Wars in a Framework with Intraindustry Trade," *Journal of International Economics*, 23, 357-367.
- [32] Grossman, G. M. and E. Helpman (1994), "Protection for Sale," *American Economic Review*, 84, 833-50.
- [33] Grossman, G. M. and E. Helpman (1995), "Trade Wars and Trade Talks," *Journal of Political Economy*, 103(4), 675.
- [34] Grossman, G. M. and P. Mavroidis (2001), "US - Lead and Bismuth II United States - Imposition of Countervailing Duties on Certain Hot - Rolled Lead and Bismuth Carbon Steel Products Originating in the United Kingdom: Here Today, Gone Tomorrow? Privatization and the Injury Caused by Non - Recurring Subsidies', in H. Horn and P. Mavroidis (eds), *The American Law Institute Reporters' Studies on WTO Case Law - Legal and Economic Analysis*, Cambridge University Press, 183-213.
- [35] Grossman, G. M. and P. Mavroidis (2003), 'United States - Countervailing Measures Concerning Certain Products from the European Communities: Recurring Misunderstanding of Non-Recurring Subsidies', in Horn, H. and Mavroidis, P. (eds), *The American Law Institute Reporters' Studies on WTO Case Law - Legal and Economic Analysis*, Cambridge University Press: 381-390.
- [36] Helpman E., and P.R. Krugman (1989), *Trade Policy and Market Structure*, Cambridge, MIT Press.
- [37] Horn, H., G. Maggi, and R.W. Staiger (2010), "Trade Agreements as Endogenously Incomplete Contracts," *American Economic Review*, 100 (1), 394-419.
- [38] Horn. H, and J. Levinsohn (2001), "Merger Policies and Trade Liberalization," *The Economic Journal*, 111 (470), 244-276.
- [39] Horstmann I.J. and J.R. Markusen (1986), "Up the Average Cost Curve: Inefficient Entry and the New Protectionism," *Journal of International Economics*, 20 (3-4), 225-247.
- [40] Hufbauer G.C. and J. Shelton-Erb (1984), *Subsidies in International Trade*, IIE.
- [41] Irwin, D. A., P. C. Mavroidis, A.O. Sykes (2008), *The Genesis of the GATT*. New York: Cambridge University Press.

- [42] Janow, M.E., and R.W. Staiger (2003), "US-Export Restraints" in H. Horn and P.C. Mavroidis (eds.), *The WTO Case Law of 2001: The American Law Institute Reporters' Studies*, Cambridge University Press, Cambridge.
- [43] Krugman, P. R. (1980), "Scale Economies, Product Differentiation, and the Pattern of Trade," *American Economic Review*, 70 (5), 950-9.
- [44] Lee, G. M. (2011), "Optimal International Agreement and Treatment of Domestic Subsidy," *Research Collection School of Economics*. Paper 1254.
- [45] Maggi G., Rodriguez-Clare A. (2005), "Import Tariffs, Export Subsidies and the Theory of Trade Agreements," mimeo, July.
- [46] Maggi G., Rodriguez-Clare A. (2007) , "A Political Economy Theory of Trade Agreements," *American Economic Review*, 97, 1374-1406.
- [47] Marvel H., and E. Ray (1995), "Countervailing Duties," *Economic Journal*, 105, 1576-93.
- [48] Mavroidis P.C., P.A. Messerlin, and J.M. Wauters (2008), *The Law and Economics of Contingent Protection in the WTO*, Northampton: Edward Elgar Publishing.
- [49] Mitra D., D.D. Thomakos, and M. Ulubaşoğlu (2006), "Can We Obtain Realistic Parameter Estimates for the Protection for Sale' Model?" *Canadian Journal of Economics*, 39(1),187-210.
- [50] Mrazova, M. (2011), "Trade agreements when profits matter," mimeo, February.
- [51] Ossa, R. (2011), "A New Trade Theory of GATT/WTO Negotiations," *Journal of Political Economy*, 119(1): 122-152.
- [52] Rodrik, D. (2011), *The Globalization Paradox*, New York: Norton.
- [53] Roessler F. and P. Gappah, (2005) "A Re-appraisal of Non-violation Complaints Under the WTO Dispute Settlement Procedures," in Macrory, Appleton and Plummer (eds.) *The World Trade Organization, Legal, Economic and Political Analyses, Vol. I*, Springer.
- [54] Sauré P., (2010), "On Subsidies in Trade Agreements," mimeo., February.
- [55] Staiger R. W. and A. O. Sykes (2011), "International Trade, National Treatment and Domestic Regulation," *Journal of Legal Studies*, 40(1), 149-203.
- [56] Staiger R. W. (2011), "Non-tariff Measures and the WTO," mimeo.
- [57] Stiglitz, J.E. (2006), *Making Globalization Work*, W.W. Norton.
- [58] Sykes, A. O. (1989), "Countervailing Duty Law: An Economic Perspective," 89 *Columbia Law Review* 199-263.

- [59] Sykes, A. O. (2005), "The Economics of WTO Rules on Subsidies and Countervailing Measures," in P.F.J. McCrory, A.E. Appleton, and M.G. Plummer (eds.), *The World Trade Organization: Legal, Economic, and Political Analysis, Vol. 2*, Springer.
- [60] Sykes A. O. (2010), "The Questionable Case for Subsidies Regulation: A Comparative Perspective," *Journal of Legal Analysis*, 2 (2), 473-523.
- [61] Venables, A. J. (1985), "Trade and Trade Policy with Imperfect Competition: The Case of Identical Products and Free Entry," *Journal of International Economics*, 19, 1-20.
- [62] Venables, A. J. (1987), "Trade and Trade Policy with Differentiated Products: A Chamberlinian-Ricardian Model," *The Economic Journal*, 97(387), 700.
- [63] World Trade Organization (2006), "Subsidies, Trade and the WTO," *World Trade Report 2006*.
- [64] World Trade Organization (2009), "Trade Policy Commitments and Contingency Measures," *World Trade Report 2009*.
- [65] Wouters J. and D. Coppens (2010), "An Overview of the Agreement on Subsidies and Countervailing Measures—Including a Discussion on the Agreement on Agriculture," in K. Bagwell, G.A. Bermann, and P.C. Mavroidis (eds.), *Law and Economics of Contingent Protection in International Trade*, New York: Cambridge University Press.

APPENDIX A

Comparative Statics

This appendix chapter 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:

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

$$(A.2) \quad \begin{aligned} \hat{x}_h &= \frac{c_h}{x_h}\hat{c}_h + \left(1 - \frac{c_h}{x_h}\right)\hat{c}_h^*, \\ \hat{x}_f &= \left(1 - \frac{c_f}{x_f}\right)\hat{c}_f + \frac{c_f}{x_f}\hat{c}_f^*, \text{ and} \end{aligned}$$

$$(A.3) \quad \begin{bmatrix} \hat{x}_h \\ \hat{x}_f \end{bmatrix} = (\sigma - \varepsilon) \begin{bmatrix} \frac{c_h}{x_h} & 1 - \frac{c_h}{x_h} \\ \left(1 - \frac{c_f}{x_f}\right) & \frac{c_f}{x_f} \end{bmatrix} \begin{bmatrix} \hat{P} \\ \hat{P}^* \end{bmatrix} - \sigma \begin{bmatrix} \left(1 - \frac{c_h}{x_h}\right)\hat{p}_h^* \\ \left(1 - \frac{c_f}{x_f}\right)\hat{p}_f \end{bmatrix}.$$

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

$$(A.4) \quad \begin{aligned} dp_f &= p(d\tau_h + d\tau_f), \text{ and} \\ dp_h^* &= p(d\tau_h^* + d\tau_f^*). \end{aligned}$$

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: $(1 - \sigma)\frac{\widehat{P}}{\widehat{n}_f} = \frac{\widehat{P}}{\widehat{p}_f}$, $(1 - \sigma)\frac{\widehat{c}_h}{\widehat{n}_f} = \frac{\widehat{c}_h}{\widehat{p}_f}$, and $(1 - \sigma)\frac{\widehat{p}_f n_f c_f}{\widehat{n}_f} = \frac{\widehat{p}_f n_f c_f}{\widehat{p}_f}$.

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

$$(A.5) \quad \begin{aligned} \frac{\widehat{c}_h}{\widehat{p}_f} &= (\sigma - \varepsilon)(1 - S) > 0, \text{ and} \\ \frac{\widehat{c}_f}{\widehat{p}_f} &= \sigma - (\sigma - \varepsilon)(1 - S) > 1. \end{aligned}$$

A.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

$$(A.6) \quad \frac{dG}{d\tau^*} = \frac{(\frac{\alpha}{\sigma} - s)pn_h c_h^* \frac{\widehat{c}_h}{\widehat{p}_h^*}}{(1 + \phi + \tau^* - s)}.$$

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

$$(A.7) \quad \frac{dG}{ds} = \frac{(s - \frac{\alpha}{\sigma})pn_h c_h^* \frac{\widehat{c}_h}{\widehat{p}_h^*} - p_h^* n_h c_h^*}{(1 + \phi + \tau^* - s)}.$$

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

$$(A.8) \quad \frac{dG}{ds^*} = \frac{p_f n_f c_f - \alpha \left(\frac{p}{\sigma}\right) n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} - \tau p n_f c_f \frac{\widehat{c}_f}{\widehat{p}_f}}{(1 + \phi + \tau - s^*)}.$$

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

$$(A.9) \quad \frac{dG}{d\tau} = \frac{\alpha \left(\frac{p}{\sigma}\right) n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} + \tau p n_f c_f \frac{\widehat{c}_f}{\widehat{p}_f}}{(1 + \phi + \tau - s^*)}.$$

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

$$(A.10) \quad \frac{(1 + t + \phi)}{2} \frac{dW}{dt} = \alpha \frac{p}{\sigma} n \left[c_h \left(\frac{\widehat{c}_h}{\widehat{p}_f}\right) + (1 + \phi) c_h^* \left(\frac{\widehat{c}_h^*}{\widehat{p}_h^*}\right) \right] + t p \bar{M} \left(\frac{\widehat{c}_h^*}{\widehat{p}_h^*}\right).$$

A.2. Firm Entry Externalities Compared to Export Subsidy Externalities

Foreign firm entry has the following effect on home welfare, if foreign tariffs fall to preserve home exports to foreign. This expression could also be thought of as the trade-promoting effect of the foreign firm entry:

$$(A.11) \quad \frac{dG}{dn_f} \Big|_{dc_h^*=0} = \left(-PD \frac{\widehat{P}}{\widehat{n}_f} + \alpha \left(\frac{p}{\sigma}\right) n_h c_h \frac{\widehat{c}_h}{\widehat{n}_f} + \tau p n_f c_f \left(1 + \frac{\widehat{c}_f}{\widehat{n}_f}\right) \right) \frac{1}{n_f}.$$

The foreign firm entry effect can be rewritten in terms of price changes:

$$(A.12) \quad \frac{dG}{dn_f} \Big|_{dc_h^*=0} = \left(PD \frac{\widehat{P}}{\widehat{p}_f} - \alpha \left(\frac{p}{\sigma}\right) n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} - \tau p n_f c_f \left(1 + \frac{\widehat{c}_f}{\widehat{p}_f}\right) \right) \frac{1}{(\sigma - 1)n_f}.$$

The results imply a relationship between the trade-promoting effect of the foreign firm entry and the export subsidy externality:

$$(A.13) \quad \frac{dG}{dn_f} |_{dc_h^*=0} = \left((1 + \phi + \tau - s^*) \frac{dG}{ds^*} - \tau p n_f c_f \right) \frac{1}{(\sigma - 1)n_f}.$$

It immediately follows that if $\tau > 0$ and $\frac{dG}{ds^*} = 0$ (no export policy externalities), then $\frac{dG}{ds^*} < 0$. If $\tau > 0$ and $\frac{dG}{dn_f} |_{dc_h^*=0} = 0$, then $\frac{dG}{ds^*} > 0$ (if export policies are chosen unilaterally such that $\frac{dG}{ds^*} = 0$, then export subsidies are inefficiently low from the perspective of maximizing world objective W).

APPENDIX B

Existence of Efficient Policies

This section proves that the restriction $\alpha < \sigma$ ensures that trade policies which maximize W exist.

We derive the symmetric and efficient level of trade barriers that satisfy the trade policy efficiency conditions in the baseline model. In each country, profits are $\bar{\Pi}$ and import volume is \bar{M} . The trade elasticity with respect to prices is the same for both trade volumes $-\frac{\widehat{c_h^*}}{\widehat{p_h^*}} = -\frac{\widehat{c_f}}{\widehat{p_f}} \equiv \zeta = \sigma - (\sigma - \varepsilon)(1 - \bar{S}) > 1$. The import price elasticity of domestic demand is $\frac{\widehat{c_f^*}}{\widehat{p_h^*}} = \frac{\widehat{c_h}}{\widehat{p_f}} = (\sigma - \varepsilon)(1 - \bar{S}) = \sigma - \zeta > 0$. Define production share $\bar{X} = \frac{c_h}{x_h} = \frac{c_f}{x_f}$.

The net trade barrier first-order condition for maximizing world welfare is

$$\frac{\bar{t}}{2} \frac{dW}{dt} = \alpha \bar{\Pi} ([\bar{X}(\sigma - \zeta) + (1 - \bar{X})(-\zeta)] + t p \bar{M}(-\zeta)) = 0.$$

As in Bagwell and Staiger (2009), the world welfare condition is the sum of the unilateral import tax condition (A.9) and export tax condition (A.7), less the terms-of-trade effects of the export tariff ($p_f M$). The efficiency condition does not depend on the individual trade barriers chosen independent of the total trade barriers t .

The first-order condition implicitly defines the solution for t :

$$\alpha \bar{X} - \zeta \left(\frac{\alpha}{\sigma} + \frac{(1 - \bar{X})}{(1 + \phi)} t \right) = 0.$$

The number of firms and output divide out of the first-order condition—a consequence of the CES assumption and symmetry. Solving for the optimal firm count is not necessary to characterize the efficient policies.

The first order condition reflects the tradeoff between correcting the imperfectly competitive distortion in traded goods and distorting the balance of consumption between home and foreign goods. Recall that \bar{X} , the share of production spent at home, depends on t , as does ζ .

We show that the efficient level of trade subsidies falls between zero and the subsidy that fully corrects the foreign distortion. First, we can rule out positive net trade barriers ($t > 0$) as optima, as these further distort the marginal cost of consumption away from the marginal benefit abroad—there is no redistribution motive in the baseline model that would lead positive trade taxes to be efficient. We can establish existence by showing that $g(t) \equiv \alpha \bar{X}(t) - \frac{\zeta(t)}{\sigma} (\alpha + \frac{(1-\bar{X}(t))}{(1+\phi)} t)$ is negative at free trade and positive at the subsidy that yields first-best consumption in traded goods. There exist ϕ and α sufficiently high such that $g'(t)$ is increasing at free trade, so we cannot rely on global concavity to prove existence and uniqueness.

At free trade, $g(0) = -\frac{\alpha\varepsilon}{\sigma} \left(\frac{(1+\phi)^{2-\sigma}}{1+(1+\phi)^{1-\sigma}} \right) < 0$. The negative sign of this expression reflects that countries optimally make some attempt to correct the monopoly distortion in traded goods.

Consider the tariff t^* that establishes the first-best output for traded goods, such that $\frac{\alpha}{\sigma} + \frac{(1-\bar{X}(t^*))}{(1+\phi)} t^* = 0$. Such a $t^* < 0$ must exist because the continuous function $h(t) = \frac{\alpha}{\sigma} + \frac{(1-\bar{X}(t))}{(1+\phi)} t$ satisfies $h(0) > 0$, and as $t \rightarrow -1 - \phi$, $h(t) \rightarrow \frac{\alpha}{\sigma} - 1 < 0$. At t^* , $g(t^*) = \alpha \bar{X}(t^*) > 0$. The result reflects that countries would not subsidize to ensure first-best consumption in traded goods, since it would excessively distort consumption away from domestic goods.

Since $g(t)$ is continuous and differentiable, and we have shown that $g(0) < 0$ and $g(t^*) > 0$, then there must exist an optimum t^{eff} in $(t^*, 0)$ such that $g(t^{eff}) = 0$ and $g'(t^{eff}) < 0$.

To establish uniqueness, suppose the conditions $g(t^{eff}) = 0$, $g'(t^{eff}) < 0$, and $t^{eff} < 0$ are not uniquely satisfied. Let t^{eff} be the point closest to zero satisfying the conditions, so there

are no optima in the interval $(t^{eff}, 0]$. We can establish that for all $t < t^{eff}$, $g'(t) < 0$: expanding the derivative of $g'(t)$, all the positive terms receive weight S or X and become smaller as subsidies increase (domestic consumption becomes smaller), while all the negative terms receive weight $(1 - X)$ and become larger as subsidies increase (foreign consumption becomes larger). Consequently, $g(t) > 0$ for all $t < t^{eff}$. and since there were no equilibrium in $(t^{eff}, 0)$ by assumption, t^{eff} is the unique equilibrium.

APPENDIX C

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), which implies countries can benefit from cooperatively reducing trade barriers from Nash policies. \square

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 A.7 to 0) implies $\bar{s} = \frac{\alpha}{\sigma} + \frac{p_h^*}{p} / \frac{\widehat{c}_h^*}{\widehat{p}_h^*}$. Since $\frac{\widehat{c}_h^*}{\widehat{p}_h^*} < 0$, $\bar{s} < \frac{\alpha}{\sigma}$. \square

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 (A.6) 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 $\text{sign}(\frac{dG}{d\tau}) = \text{sign}(\alpha(\frac{p}{\sigma})c_h\frac{\hat{c}_h}{p_f} + \tau pc_f\frac{\hat{c}_f}{p_f})$. $\alpha(\frac{p}{\sigma})c_h\frac{\hat{c}_h}{p_f} > 0$ and $pc_f\frac{\hat{c}_f}{p_f} < 0$, so a lower tariff than the Nash tariff is necessary to induce a positive $\frac{dG}{d\tau}$. \square

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. \square

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 1.3.1, 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. \square

APPENDIX D

Proof of Proposition 17

The combined effects of foreign firm entry, derived in Section 1.3.4, are

$$n_f \frac{dG}{dn_f} \Big|_{c_h^*=0} = p_f n_f c_f \frac{1}{\sigma - 1} + \left[\alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\widehat{c}_h}{\widehat{n}_f} + \tau_h p n_f c_f \left(1 + \frac{\widehat{c}_f}{\widehat{n}_f} \right) \right] + \left[\left(\alpha \left(\frac{p}{\sigma} \right) n_h c_h^g + \tau_h^g p n_h c_h^g \right) \frac{\widehat{c}_h^g}{\widehat{n}_f} \right].$$

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:

$$n_f (\sigma - 1) \frac{dG}{dn_f} \Big|_{c_h^*=0} = p_f n_f c_f - \left[\alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} + \tau_h p n_f c_f \left(1 + \frac{\widehat{c}_f}{\widehat{p}_f} \right) \right] - \left[\left(\alpha \left(\frac{p}{\sigma} \right) n_h c_h^g + \tau_h^g p n_h c_h^g \right) \left(\frac{\widehat{c}_h^g}{\widehat{p}_f^g} \right) \right].$$

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_h and τ_h^g yields

$$(D.1) \quad \frac{dG}{dn_f} \Big|_{c_h^*=0} = \left(p_f n_f c_f + \left[\alpha \left(\frac{p}{\sigma} \right) n_h c_h \frac{\widehat{c}_h}{\widehat{p}_f} / \frac{\widehat{c}_f}{\widehat{p}_f} \right] + \left[p_h^* n_h c_h^g \frac{\widehat{c}_h^g}{\widehat{p}_f^g} / \frac{\widehat{c}_h^g}{\widehat{p}_h^g} \right] \right) \frac{1}{n_f (\sigma - 1)}.$$

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 ($\widehat{\frac{c_f}{p_f}}$ and $\widehat{\frac{c_h^g}{p_h^g}}$) 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, $-\widehat{\frac{c_h^g}{p_f^g}} / \widehat{\frac{c_h^g}{p_h^g}} < 1$, the consumer gain dominates. Further simplifying,¹

$$\frac{dG}{dn_f} \Big|_{c_h^*=0} = \left(p_f n_f c_f \varepsilon - \alpha \left(\frac{p}{\sigma} \right) n_h c_h \widehat{\frac{c_h}{p_f}} \right) \frac{1}{\left(-\widehat{\frac{c_f}{p_f}} \right) n_f (\sigma - 1)}.$$

By Lemma 8, there is no motive for subsidy rules when the following condition is satisfied:

$$(D.2) \quad \frac{dG}{dn_f} \Big|_{c_h^*=0} > 0 \iff \alpha < \frac{\varepsilon \sigma}{\sigma - \varepsilon} \frac{1}{\bar{S}^N}.$$

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

APPENDIX E

Income Effects, Imperfect Competition, and Trade Agreements

Most of this dissertation has considered the possibility that domestic policies create problem for trade agreements under monopolistic competition. Both Bagwell and Staiger (2009) and the third chapter of this dissertation found that imperfect competition did not lead to problems when countries have only import and export policies, but both papers relied on consumers with quasilinear preferences. Ossa (2011), who showed that negotiations over import tariffs alone creates a problem for trade agreements, used a framework with Cobb-Douglas preferences over the differentiated aggregate and the outside good, and therefore there were income effects. A natural question then is whether negotiations over both import and export policies continues to lead to no new problems for trade agreements under imperfect competition when countries have income effects.

This appendix section proposes a model with quite general government preferences over local prices and each country's income. Governments can choose to tax or subsidize either imports or exports, but no domestic policies. Following Bagwell and Staiger (1999), governments cannot lose from terms-of-trade appreciation or benefit from terms-of-trade deterioration. The model imposes a stronger restriction than Bagwell and Stagier (1999) in assuming that governments value trade policy only through its effects on trade tax revenue and the local prices faced by either nation.¹

Following Bagwell and Staiger, we consider the question of whether policies are efficiently chosen at the *political optimum*. The political optimum is one that countries can achieve by making reciprocal reductions in import taxes and export taxes—or increases in export

¹The Bagwell and Staiger (2002) appendix imposes a similar restriction in a multi-country, many good trade policy model while addressing a distinct research question from mine.

subsidies. Starting from these policies, governments do not achieve any first-order gains from changes in local prices. They do, however, gain from changes in their terms of trade. What then remains to be shown is that governments cannot mutually benefit from further cooperation in setting world prices, holding local prices fixed.

This section first shows that the political optimum is efficient when countries choose only import and export policies. A technical result makes it clear that in this general setting there is no further room for cooperation beyond the political optimum. The ratio of first-order changes in each country's trade tax revenue will be constant in response to any small change in any world prices from the political optimum. This result reduces the several channels by which trade policy can influence welfare down to one independent channel. Proving the efficiency of politically optimal policies then becomes as straightforward as in the Bagwell and Staiger (1999) framework, which allows for only one world price. In conclusion, the Bagwell and Staiger (2009) result does extend to a setting with income effects.

E.1. The Model

We use a static, two-country model with many goods and many prices. There is no specific structure on firms or consumers in the economy, other than assuming that agents' decisions are pinned down by all home and foreign prices, endowments, and net trade tax revenue in the economy. Prices here refers to both the prices consumers pay and the prices producers receive. Trade tax revenue is assumed to be collected by governments and then redistributed in whatever manner they consider to be optimal. Trade tax revenue is derived from government import or export policies, which can be distinct taxes or subsidies for each good.

E.1.1. Government Preferences

Governments choose their trade policies to maximize welfare. The strongest assumption I make on government preferences is that governments value trade policies only through their effects on trade tax revenues or any prices faced in either nation. Government indirect utility functions are assumed to exist with the form

$$W_h = W_h(P, T_h, T_f, \theta)$$

$$W_f = W_f(P, T_h, T_f, \theta)$$

where P is the vector of all home and foreign local prices, T_h and T_f are total home and foreign net trade tax revenue, respectively, and θ is a vector of endowments and all other parameters that are invariant to trade. These government utility functions are sufficiently general to allow for preferences over any distributional outcome in any economy, provided that the choices of firms and consumers are all also functions of prices, trade tax revenue, and endowments. By assumption there is a unique equilibrium in the world economy, taking government trade policies as given.

E.1.2. Local Prices and Trade Taxes

The vector P can be divided into subvectors:

$$P \equiv (p_h, p_h^*, r_h, r_h^*, p_f, p_f^*, r_f, r_f^*)$$

where p denotes consumer prices and r denotes prices producers receive. The h and f subscript denote nation of origin, home and foreign respectively, and the star indicates the destination is the foreign nation.

Governments can choose ad valorem trade taxes or subsidies for all goods. Trade policies and prices are linked by the equations

$$\begin{aligned} p_{hg}^* &= (1 + t_{hg}^* + t_{fg}^* + \phi_g^*)r_{hg}^* \\ p_{fg} &= (1 + t_{hg} + t_{fg} + \phi_g)r_{fg} \end{aligned}$$

Here g indexes goods. The consumer price p_{hg}^* is for a home export to foreign, t_{hg}^* is home's export policy (positive for a tax and negative for a subsidy), t_{fg}^* is foreign's import policy, ϕ_g^* is a transport cost for exports to foreign, and r_{hg}^* is the price domestic consumers receive for exports. The notation for foreign's exports follows a similar pattern.

Net trade tax revenue is implicitly defined as the sum of each nation's trade taxes and subsidies across all goods

$$\begin{aligned} T_h &\equiv \sum_g t_{hg}^* r_{hg}^* x_{hg}^* + \sum_g t_{hg} r_{fg} x_{fg} \\ T_f &\equiv \sum_g t_{fg}^* r_{hg}^* x_{hg}^* + \sum_g t_{fg} r_{fg} x_{fg} \end{aligned}$$

where x_h^* and x_f denote home and foreign export volume, respectively. The definition is implicit because the export volumes can depend on the net trade tax revenue.

E.1.3. Defining Terms-of-Trade

The terms-of-trade are defined to be the world prices in between nation's borders. Formally,

$$\begin{aligned} \text{(E.1)} \quad p_{hg}^w &\equiv (1 + t_{hg}^*)r_{hg}^* \\ p_{fg}^w &\equiv (1 + t_{fg})r_{fg} \end{aligned}$$

where p_{hg}^w and p_{fg}^w are the world prices of home and foreign exports, respectively, which are the producer prices augmented by the exporting nation's export policy.

Given this definition of world prices, government welfare and tariff revenue can be rewritten as a function of world prices and local prices as follows. Tariff revenue can be written as

$$(E.2) \quad \begin{aligned} T_h(P, p^w, \theta) &= \sum_g (p_{hg}^w - r_{hg}^*) x_{hg}^* + \sum_g (p_{fg} - p_{fg}^w - \phi_g r_{fg}) x_{fg} \\ T_f(P, p^w, \theta) &= \sum_g (p_{hg}^* - p_{hg}^w - \phi_g^* r_{hg}^*) x_{hg}^* + \sum_g (p_{fg}^w - r_{fg}) x_{fg} \end{aligned}$$

where p^w is the vector of home and foreign terms-of-trade. Writing the tariff revenue as a function of prices and endowments relies on the assumption that export policies are pinned down by local prices P , trade tax revenue, and endowments.

Government welfare can then be written as follows

$$\begin{aligned} W_h(P, p^w, \theta) &= W_h(P, T_h(P, p^w, \theta), T_f(P, p^w, \theta), \theta) \\ W_f(P, p^w, \theta) &= W_f(P, T_h(P, p^w, \theta), T_f(P, p^w, \theta), \theta) \end{aligned}$$

Having written welfare in this form, we introduce the assumption that governments weakly benefit from terms-of-trade improvement and weakly suffer from terms-of-trade deterioration, holding local prices fixed. More formally for home,

$$(E.3) \quad \begin{aligned} \frac{\partial \widetilde{W}_h}{\partial p_h^w} &\equiv \frac{\partial W_h}{\partial T_h} \frac{\partial T_h}{\partial p_h^w} + \frac{\partial W_f}{\partial T_f} \frac{\partial T_f}{\partial p_h^w} \geq 0 \\ \frac{\partial \widetilde{W}_h}{\partial p_f^w} &\equiv \frac{\partial W_h}{\partial T_h} \frac{\partial T_h}{\partial p_f^w} + \frac{\partial W_f}{\partial T_f} \frac{\partial T_f}{\partial p_f^w} \leq 0 \end{aligned}$$

Similar restrictions are assumed for the foreign nation. We assume strict inequality for at least one element of p_h^w and p_f^w . Terms-of-trade change, holding prices fixed, amounts to a direct income transfer between nations, so this assumption rules out the possibility that any nation would use trade policy as a means to make an income transfer. This assumption could be justified on the grounds that nations have other means to make such transfers. Similar restrictions on the effects of terms-of-trade changes on welfare were made in Bagwell and Staiger (1999).

E.2. Results

This section establishes that if a trade agreement forces governments to act as if they do not value the rents they gain from terms-of-trade changes, then the trade policies chosen are efficient. Following Bagwell and Staiger (1999, 2009), we define these policies to be *politically optimal*. The exposition and proof of this result proceed as follows (1) formally define noncooperative and politically optimal tariffs, (2) establish the condition that needs to be satisfied for politically optimal tariffs to be efficient, (3) show how this condition has been satisfied by previous papers in this literature, and (4) introduce a technical result that allows for the efficiency of political optimal tariffs to be satisfied more generally.

This section provides an overview of the main reasons, while proofs are provided in the following section.

E.2.1. Noncooperative and Politically Optimal Tariffs

Following Bagwell and Staiger (1999), noncooperative and political optimal tariffs are assumed to exist. Nations neither desire infinite subsidies nor infinite taxes, so noncooperative solutions are in the interior of the nation's policy space. For notational convenience, τ_h^i index home's trade policies and τ_f^j index foreign's trade policies, whether they be import or export policies. Nash policies then satisfy

$$\frac{dW_h}{d\tau_h^i} = 0 \quad \frac{dW_f}{d\tau_f^j} = 0 \quad \forall i, j$$

The derivatives of trade policies can be decomposed into their effects that operate through local prices P and the effects that operate through terms-of-trade. Define this latter residual as

$$\begin{aligned} \widetilde{\frac{dW_h}{d\tau_h^i}} &\equiv \frac{dW_h}{d\tau_h^i} - \frac{dW_h}{dP} \frac{dP}{d\tau_h^i} \quad \forall i \\ \widetilde{\frac{dW_f}{d\tau_f^j}} &\equiv \frac{dW_f}{d\tau_f^j} - \frac{dW_f}{dP} \frac{dP}{d\tau_f^j} \quad \forall j \end{aligned}$$

The Nash conditions can then be written as

$$(E.4) \quad \begin{aligned} \frac{dW_h}{dP} \frac{dP}{d\tau_h^i} + \frac{\widetilde{dW_h}}{d\tau_h^i} &= 0 \quad \forall i \\ \frac{dW_f}{dP} \frac{dP}{d\tau_f^j} + \frac{\widetilde{dW_f}}{d\tau_f^j} &= 0 \quad \forall j \end{aligned}$$

The politically optimal policies are those chosen when nation's act as if they do not value the rents they gain from terms-of-trade changes, as if $\widetilde{\frac{dW_h}{d\tau_h^i}} = \widetilde{\frac{dW_f}{d\tau_f^j}} = 0$. Thus, politically optimal policies satisfy

$$(E.5) \quad \begin{aligned} \frac{dW_h}{dP} \frac{dP}{d\tau_h^i} &= 0 \quad \forall i \\ \frac{dW_f}{dP} \frac{dP}{d\tau_f^j} &= 0 \quad \forall j \end{aligned}$$

E.2.2. Conditions for Efficiency

Having formally defined Nash and politically optimal trade policies, we can then answer the following questions: Is there any reason for a trade agreement? Are trade agreements that cause governments to choose politically optimal policies efficient?

The necessary condition for efficiency is a tangency condition between home and foreign welfare with respect to all pairings of trade policies. This condition results from the standard constrained optimization problem for one nation maximizing welfare, while preserving the other nation's level of welfare. Following Bagwell and Staiger (1999) we assume that the necessary conditions are also sufficient.

$$(E.6) \quad \frac{\frac{dW_h}{d\tau_h^i}}{\frac{dW_f}{d\tau_h^i}} = \frac{\frac{dW_h}{d\tau_f^j}}{\frac{dW_f}{d\tau_f^j}} \leq 0, \forall i, j$$

It is straightforward to show that the Nash policies are inefficient. Recall at Nash policies $\frac{\partial W_h}{\partial \tau_h^i} = \frac{dW_f}{d\tau_f^j} = 0$. It can be shown that $\frac{dW_h}{d\tau_f^j} \neq 0$, $\frac{\partial W_f}{\partial \tau_h^i} \neq 0$ for some i and j . In the next section we show the latter result follows from the distinct effects home and foreign trade policies have on world prices. Thus, a trade agreement is necessary because noncooperative policies are not Pareto efficient.

Substituting in the definition of political optimal tariffs (E.5) yields the following condition for the efficiency of political optimal tariffs.

$$(E.7) \quad \frac{\widetilde{\frac{dW_h}{d\tau_h^i}}}{\widetilde{\frac{dW_f}{d\tau_h^i}}} = \frac{\widetilde{\frac{dW_h}{d\tau_f^j}}}{\widetilde{\frac{dW_f}{d\tau_f^j}}} \leq 0, \forall i, j$$

This condition is equivalent to the statement that there is no combination of small trade policies that can alter world prices, holding local prices fixed, in a manner that makes both

nations better off. If this condition holds, nations have no reason to negotiate once they have reached the political optimum.

E.2.3. Special Cases From Prior Literature

For sake of comparison, we show how that condition (E.7) is satisfied in prior literature by stronger assumptions than we have imposed.

In Bagwell and Staiger (1999), international externalities influence welfare through one world relative price, whose movements shift each government's welfare in opposite directions. Thus, mutually beneficial gains through negotiations over this one world relative price are impossible. More formally, (E.7) can be rewritten as

$$(E.8) \quad \frac{\left(\frac{\partial W_h}{\partial p^w}\right) \left[\frac{dp^w}{d\tau_h^i}\right]}{\left(\left(\frac{\partial W_f}{\partial p^w}\right)\right) \left[\frac{dp^w}{d\tau_h^i}\right]} = \frac{\left(\frac{\partial W_h}{\partial p^w}\right) \left[\left[\frac{dp^w}{\partial \tau_f^j}\right]\right]}{\left(\left(\frac{\partial W_f}{\partial p^w}\right)\right) \left[\left[\frac{dp^w}{d\tau_f^j}\right]\right]} \leq 0, \forall i,$$

Terms with like brackets and parentheses cancel, so the equality condition above holds. The inequality condition follows from the assumption that shifts in terms of trade move each nation's welfare in opposite directions: $\left(\frac{\partial W_h}{\partial p^w}\right) \left(\frac{\partial W_f}{\partial p^w}\right) < 0$.

In Bagwell and Staiger (2009), income effects on demand are assumed away. Holding local prices fixed, net trade tax revenue and all other consumption choices are fixed, so negotiations over world-prices amount to zero-sum shifts in trade tax revenue between nations. This can be seen by summing the equations from (E.2) and observing that $\frac{\partial T_h}{\partial p^w} + \frac{\partial T_f}{\partial p^w} = 0$. The condition (E.7) then obviously holds because the ratios in (E.8) each reduce to -1 .

In our more general framework, the satisfaction of (E.7) is not obvious because trade policies on many goods offer many world price channels for influencing welfare. Prior literature does not rule out the possibility that there exists some shift in world prices that

could lead to mutually beneficial gains, thus leaving nations with room to negotiate from the politically optimal policies.

E.2.4. Proving Efficiency

To show the efficiency of politically optimal tariffs holds more generally, we establish a technical result that makes it obvious in my general setting that there is no further room for cooperation beyond the politically optimal policies. I show that the ratio of first-order changes in each country's trade tax revenue will be constant in response to any small change of any world prices. This result reduces the several channels by which trade policy can influence welfare down to one independent channel.

The result derives from the observation that the sum of tariff revenue has no dependence on world prices:

(E.9)

$$T_h + T_f = \sum_g (p_{hg}^* - r_{hg}^*(1 + \phi_g^*))x_{hg}^*(P, T_h, T_f, \theta) + \sum_g (p_{fg} - r_{fg}(1 + \phi_g))x_{fg}(P, T_h, T_f, \theta)$$

Consider any linear combination of world prices determined by a real constant vector c . Implicitly differentiating this expression with respect to any linear combination $c'p^w$, while holding local prices fixed, yields the same result for any choice of c .²

$$(E.10) \quad \frac{\widetilde{dT_f}}{dT_h} \equiv \frac{\frac{\partial T_f}{\partial c'p^w}}{\frac{\partial T_h}{\partial c'p^w}} \quad \forall c$$

This result implies that any trade policy, holding local prices fixed, must affect home and foreign tariff revenue by the same proportion. Formally,

²The appendix contains a more detailed version of all derivations in this subsection.

$$\frac{\widetilde{\partial T_f}}{\partial \tau} = \frac{d\widetilde{T_f}}{dT_h} \frac{\widetilde{\partial T_h}}{\partial \tau} \quad \forall \tau$$

Using this result, the effect of trade taxes on welfare through world prices can be decomposed as follows

$$\frac{\partial \widetilde{W}_h}{\partial \tau} \equiv \frac{\partial W_h}{\partial T_h} \frac{\widetilde{\partial T_h}}{\partial \tau} + \frac{\partial W_h}{\partial T_f} \frac{\widetilde{\partial T_f}}{\partial \tau} = \left(\frac{\partial W_h}{\partial T_h} + \frac{\partial W_h}{\partial T_f} \frac{d\widetilde{T_f}}{dT_h} \right) \frac{\widetilde{\partial T_h}}{\partial \tau}$$

This expression implies that at the political optimum, home and foreign tariff revenue are linearly dependent channels through which trade policy influences welfare. Thus, the many channels by which trade policy can influence welfare have been reduced to one. Rewriting (E.7) using the last expression yields

$$(E.11) \quad \frac{\left(\frac{\partial W_h}{\partial T_h} + \frac{\partial W_h}{\partial T_f} \frac{d\widetilde{T_f}}{dT_h} \right) \left[\frac{\widetilde{\partial T_h}}{\partial \tau^i} \right]}{\left(\left(\frac{\partial W_f}{\partial T_h} + \frac{\partial W_f}{\partial T_f} \frac{d\widetilde{T_f}}{dT_h} \right) \right) \left[\frac{\widetilde{\partial T_h}}{\partial \tau^i} \right]} = \frac{\left(\frac{\partial W_h}{\partial T_h} + \frac{\partial W_h}{\partial T_f} \frac{d\widetilde{T_f}}{dT_h} \right) \left[\left[\frac{\widetilde{\partial T_h}}{\partial \tau^j} \right] \right]}{\left(\left(\frac{\partial W_f}{\partial T_h} + \frac{\partial W_f}{\partial T_f} \frac{d\widetilde{T_f}}{dT_h} \right) \right) \left[\left[\frac{\widetilde{\partial T_h}}{\partial \tau^j} \right] \right]} \quad \forall i, j$$

Again, the terms in like brackets cancel, and the equality condition of (E.7) holds. I must still show that the inequality condition of (E.7) holds. We show in the following section that the inequality condition follows from the technical condition we derived (E.10) and the assumed effect of terms-of-trade on welfare (E.3).

Thus, we have shown that (E.7) holds generally in our model, and politically optimal tariffs are indeed always efficient. This completes the proof that an agreement is efficient if countries act as if they do not value the rent-shifting from terms of trade.

E.3. Proofs

Claim 23. *Nash policies are inefficient.*

Proof. Given efficiency condition (E.6), and Nash conditions $\frac{dW_h}{d\tau_h^i} = \frac{dW_f}{d\tau_f^j} = 0$, it remains to be shown that $\frac{dW_h}{d\tau_h^j} \neq 0$ or $\frac{\partial W_f}{\partial \tau_h^i} \neq 0$. I will focus on $\frac{dW_f}{d\tau_h^j} \neq 0$. Choose good index g such that $\widetilde{\frac{\partial W_f}{\partial p_{hg}^w}} < 0$, where g exists by assumption, τ_h^g is an export policy, and τ_f^g is an import policy imposed on the same good. Then $\frac{dW_f}{dP} \frac{dP}{d\tau_h^g} = \frac{dW_f}{dP} \frac{dP}{d\tau_f^g}$ because the derivatives on price only depend on the sum $\tau_h^g + \tau_f^g$. This result and the Nash condition $\frac{dW_f}{d\tau_h^g} = \frac{dW_f}{dP} \frac{dP}{d\tau_f^g} + \widetilde{\frac{dW_f}{d\tau_f^g}} = 0$ then imply that $\frac{dW_f}{dP} \frac{dP}{d\tau_h^g} = -\widetilde{\frac{dW_f}{d\tau_f^g}}$. Combing these equalities yields:

$$\frac{dW_f}{d\tau_h^g} = \frac{dW_f}{dP} \frac{dP}{d\tau_h^g} + \widetilde{\frac{dW_f}{d\tau_h^g}} = \widetilde{\frac{dW_f}{d\tau_h^g}} - \widetilde{\frac{dW_f}{d\tau_f^g}}$$

Now consider the world price p_i^w . The derivative $\frac{dp_{hg}^w}{d\tau_h^g} = (1 + \tau_h^g) \frac{dr_{hg}^*}{d\tau_h^g} + r_{hg}^*$, while $\frac{dp_{hg}^w}{d\tau_f^g} = (1 + \tau_h^g) \frac{dr_{hg}^*}{d\tau_f^g}$, and thus $\frac{dp_{hg}^w}{d\tau_h^g} - \frac{dp_{hg}^w}{d\tau_f^g} = r_{hg}^*$. Finally,

$$\frac{dW_f}{d\tau_f^g} = \widetilde{\frac{dW_f}{d\tau_h^g}} - \widetilde{\frac{dW_f}{d\tau_f^g}} = \frac{\partial \widetilde{W}_f}{\partial p_{hg}^w} r_{hg}^* < 0$$

where $\widetilde{\frac{\partial W_f}{\partial p_{hg}^w}} < 0$ by assumption. All other effects of welfare on $\widetilde{\frac{dW_f}{d\tau_h^g}}$ and $\widetilde{\frac{dW_f}{d\tau_f^g}}$ cancel because other trade policies affect world prices only through their sum. Thus, $\frac{dW_f}{d\tau_h^g} \neq 0$. \square

Claim 24. $\frac{\frac{\partial T_f}{\partial c' p^w}}{\frac{\partial T_h}{\partial c' p^w}}$ is constant $\left(\equiv \widetilde{\frac{dT_f}{dT_h}} \right)$ for all real vectors c .

Proof. Implicitly differentiating the expression for the sum of the trade tax revenue, holding prices fixed,

$$T_h + T_f = \sum_g (p_{hg}^* - r_{hg}^*(1 + \phi_g^*)) x_{hg}^*(P, T_h, T_f, \theta) + \sum_g (p_{fg} - (1 + \phi_g) r_{fg}) x_{fg}(P, T_h, T_f, \theta)$$

yields

$$\begin{aligned} \frac{\partial T_f}{\partial c' p^w} + \frac{\partial T_h}{\partial c' p^w} &= \sum_g (p_{hg}^* - r_{hg}^*(1 + \phi_g^*)) \left(\frac{\partial x_{hg}^*}{\partial T_h} \frac{\partial T_h}{\partial c' p^w} + \frac{\partial x_{fg}^*}{\partial T_f} \frac{\partial T_f}{\partial c' p^w} \right) + \\ &\quad \sum_g (p_{fg} - (1 + \phi_g) r_{fg}) \left(\frac{\partial x_{hg}}{\partial T_h} \frac{\partial T_h}{\partial c' p^w} + \frac{\partial x_{fg}}{\partial T_f} \frac{\partial T_f}{\partial c' p^w} \right) \end{aligned}$$

Thus,

$$\frac{\frac{\partial T_f}{\partial c' p^w}}{\frac{\partial T_h}{\partial c' p^w}} = - \frac{1 - \sum_g (p_{hg}^* - r_{hg}^* (1 + \phi_g^*)) \frac{\partial x_{hg}^*}{\partial T_h} - \sum_g (p_{fg} - (1 + \phi_g) r_{fg}) \frac{\partial x_{hg}}{\partial T_h}}{1 - \sum_g (p_{hg}^* - r_{hg}^* (1 + \phi_g^*)) \frac{\partial x_{fg}^*}{\partial T_f} - \sum_g (p_{fg} - (1 + \phi_g) r_{fg}) \frac{\partial x_{fg}}{\partial T_f}}$$

which does not depend on c . □

Claim 25. $\frac{\widetilde{\partial T_f}}{\partial \tau} = \frac{\widetilde{dT_f}}{dT_h} \frac{\widetilde{\partial T_h}}{\partial \tau} \quad \forall \tau$

Proof. By definition, $\frac{\widetilde{\partial T_h}}{\partial \tau_h^i} = \sum_g \frac{\partial T_h}{\partial p_g^w} \frac{dp_g^w}{d\tau_h^i}$ and $\frac{\widetilde{\partial T_f}}{\partial \tau_h^i} = \sum_g \frac{\partial T_f}{\partial p_g^w} \frac{dp_g^w}{d\tau_h^i}$. The previous proof implies $\frac{\partial T_h}{\partial p_g^w} = \frac{\widetilde{dT_f}}{dT_h} \frac{\partial T_f}{\partial p_g^w}$. Substitution and factoring then yields the desired result. □

Claim 26. $\frac{\frac{d\widetilde{W}_h}{d\tau_h^i}}{\frac{d\widetilde{W}_f}{d\tau_h^i}} \leq 0$ always, and the inequality condition for inefficiency always holds.

Proof. From (E.11), this proposition amounts to proving that

$$\left(\frac{\partial W_h}{\partial T_h} + \frac{\partial W_h}{\partial T_f} \frac{\widetilde{dT_f}}{dT_h} \right) / \left(\frac{\partial W_f}{\partial T_h} + \frac{\partial W_f}{\partial T_f} \frac{\widetilde{dT_f}}{dT_h} \right) \leq 0$$

Intuitively, there is no change in home tariffs through changes in world prices that would make both nations better off. Using (E.10), (E.3) can be rewritten as

$$\left(\frac{\partial W_h}{\partial T_h} + \frac{\partial W_h}{\partial T_f} \frac{\widetilde{dT_f}}{dT_h} \right) \frac{\partial T_h}{\partial p_h^w} \geq 0 \quad \text{and} \quad \left(\frac{\partial W_f}{\partial T_h} + \frac{\partial W_f}{\partial T_f} \frac{\widetilde{dT_f}}{dT_h} \right) \frac{\partial T_h}{\partial p_h^w} \leq 0$$

The desired result follows from combining these equations. □

APPENDIX F

Extensions

F.1. Model with No Domestic Consumers

A common simplification in the strategic trade literature is that countries have no domestic market for their products. The baseline model of Brander and Spencer (1985) and the three-country model of Bagwell and Staiger (forthcoming b) make such an assumption. The assumption eliminates the results of the first chapter. Observe the efficient trade policy condition without domestic consumers:

$$\alpha \left(\frac{p}{\sigma} \right) (\bar{M})(-\zeta) + \tau p \bar{M}(-\zeta) = 0.$$

Countries set export subsidies to $\tau = \frac{-\alpha}{\sigma}$ and eliminate the monopoly and political economy distortions. The foreign firm entry externality under such policies is

$$\left(\alpha \left(\frac{p}{\sigma} \right) + \tau p \right) \frac{\widehat{M}}{\widehat{n}_f} = 0.$$

The efficient trade policies eliminate any foreign firm externality and there is no role for trade agreements to coordinate entry-promoting policies.

F.2. Mirror Image Economy

The efficient policies in the baseline economy involve negative net trade barriers, regardless of the political economy weight. The result contrasts with Bagwell and Staiger (1999), where political economy motives can lead countries to agree on positive tariffs. The lack of distributive motives arises because the economy has a single factor. One way to address

this is to add a second factor to the economy. A simpler way to add a distributional motive is to have mirror image imperfectly competitive sectors in each country, much like the two-industry economy of Krugman (1980).

Total number of firms is the same in each country: $n_h = n_f = n$. A share $\chi > .5$ firms produce in industry a in home, and b abroad, so

$$n_{ha} = n_{fb} = \chi n, \text{ and}$$

$$n_{hb} = n_{fa} = (1 - \chi)n.$$

Preferences are such that the elasticity of substitution is σ between goods within an industry, but the elasticity of substitution is ω between the composite goods of each industry, where $\omega \in (\varepsilon, \sigma)$. The preferences yield the following demands:

$$x_{h\alpha} = p^{-\sigma} P_{\alpha}^{\sigma-\omega} P^{\omega-\varepsilon} + (1 + \phi) p_h^{*-\sigma} P_{\alpha}^{*\sigma-\omega} P^{*\omega-\varepsilon},$$

$$x_{hb} = p^{-\sigma} P_b^{\sigma-\omega} P^{\omega-\varepsilon} + (1 + \phi) p_h^{*-\sigma} P_b^{*\sigma-\omega} P^{*\omega-\varepsilon},$$

$$x_{f\alpha} = p^{-\sigma} P_{\alpha}^{*\sigma-\omega} P^{*\omega-\varepsilon} + (1 + \phi) p_f^{-\sigma} P_{\alpha}^{\sigma-\omega} P^{\omega-\varepsilon}, \text{ and}$$

$$x_{fb} = p^{-\sigma} P_b^{*\sigma-\omega} P^{*\omega-\varepsilon} + (1 + \phi) p_f^{-\sigma} P_b^{\sigma-\omega} P^{\omega-\varepsilon}.$$

The relevant price indices are

$$P = (P_a^{1-\omega} + P_b^{1-\omega})^{\frac{1}{1-\omega}}, \quad P^* = (P_{\sigma}^{*1-\omega} + P_{\beta}^{*1-\omega})^{\frac{1}{1-\omega}},$$

$$P_a = (n_{\alpha h} p^{1-\sigma} + n_{\alpha f} p_f^{1-\sigma})^{\frac{1}{1-\sigma}}, \quad P_{\alpha}^* = (n_{\alpha f} p^{1-\sigma} + n_{\alpha h} p_f^{1-\sigma})^{\frac{1}{1-\sigma}},$$

$$P_b = (n_{bh} p^{1-\sigma} + n_{bf} p_f^{1-\sigma})^{\frac{1}{1-\sigma}}, \text{ and } P_b^* = (n_{bf} p^{1-\sigma} + n_{bh} p_f^{1-\sigma})^{\frac{1}{1-\sigma}}.$$

Under symmetry we have $P = P^*$, $P_a = P_b^*$, and $P_b = P_a^*$.

The demand equations imply the home country's expenditure shares on goods a and b are

$$S_a = \frac{1}{1 + \left(\frac{P_b}{P_a}\right)^{1-\omega}}, \text{ and } S_b = \frac{1}{1 + \left(\frac{P_a}{P_b}\right)^{1-\omega}}.$$

Define S_a^* and S_b^* similarly for foreign consumers' expenditure share. Notice that $S_a > S_b$, $S_a = S_b^*$, $S_b = S_a^*$, and $S_a + S_b = 1$.

Define S_{ha} to be the share of a goods home purchases domestically:

$$S_{ha} = \frac{1}{1 + \frac{n_{af}}{n_{ah}} \iota^{1-\sigma}} = \frac{1}{1 + \frac{1-\chi}{\chi} \iota^{1-\sigma}}.$$

Define similar shares for foreign production and consumption. The subscript denotes location of production while the superscript denotes the location of consumption. Notice that $S_{ha} = S_{fb}^* > .5$, $S_{fa}^* = S_{hb}$, $S_{hb}^* = S_{fa} < .5$, and $S_{fb} = S_{ha}^*$.

A tariff increase by both countries has the following effects on the price indices:

$$\begin{aligned} \hat{P} &= S_a \hat{P}_\alpha + S_b \hat{P}_\beta = (S_a(1 - S_{ha}) + S_b(1 - S_{hb})) \hat{p}_f, \text{ and} \\ \hat{P}^* &= S_a^* \hat{P}_\alpha^* + S_b^* \hat{P}_\beta^* = (S_a^*(1 - S_{fa}^*) + S_b^*(1 - S_{fb}^*)) \hat{p}_h^*. \end{aligned}$$

Since $S_b(1 - S_{hb}) > S_a(1 - S_{ha})$, the tariff has a much larger benefit for the minority good in each country, which creates the motive for redistribution. The motive allows for the possibility of positive tariffs in a cooperative equilibrium, if the minority industry in each country receives a political economy weight sufficiently larger than the weight of the majority industry.

F.3. Single Factor Economy

This subsection considers how the first chapter's results hold up in a model like Ossa (2011) where there is a single labor factor for both the fixed cost and marginal cost of production. As in the first chapter's framework, the wage is constant for all factors in both countries.

Consider governments which choose a trade policy and a subsidy for the fixed cost of production. A consequence of such an environment is that there are no profits in equilibrium and firm production is $\frac{f_h}{m}(\sigma - 1)$, regardless of foreign policy changes.

The market clearing condition for home firms can be written as

$$n_h c_h + (1 + \phi)n_h c_h^* = n_h x_h.$$

Consider a change in foreign policy mix that lowers fixed costs and raises tariffs to preserve home's export volume to foreign. The policy change increases foreign firms, naturally, and home firms exit due to the tougher competition. Such a policy change has no effect on home prices or output or exports, so the log differential of the market clearing condition is

$$X_h(\hat{n}_h + \hat{c}_h) = \hat{n}_h.$$

And since $\hat{c}_h = (\sigma - 1)\hat{P}$:¹

$$\hat{P} = \frac{(1 - X_h)}{X_h(\sigma - 1)}\hat{n}_h < 0.$$

The fall in home firms implies a lower home price index which increases home welfare. Intuitively, if home firms exit when a zero-profit condition is in place, the home firms must be selling less to domestic consumers, which can only happen if consumers are better off

¹Ossa uses a Cobb-Douglas utility function for the outside sector and differentiated sector instead of a quasilinear function, so the elasticity of consumption with respect to the price index is $(\sigma - 1)$ instead of $(\sigma - \varepsilon)$.

from the change in foreign policy mix. Furthermore, if home is subsidizing entry, home's subsidy costs fall, providing an additional benefit.

The model can be augmented with mobility frictions that give home workers benefit to having production at home, but such an extension just moves the model closer to the first chapter's specific factor baseline model, which is a much simpler though more extreme approach. The result suggests that such frictions are central to the existence of the WTO subsidy rules.

F.4. Single Sector Economy

Consider a Krugman (1980) model without any outside sector (also studied by Gros 1987 and Ch. 7.1-7.2 of Helpman and Krugman 1989). Here there is no outside sector to pin down the wages, and a change in foreign policy mix has no effect on the number of firms or output at home.

The market clearing condition is $c_h + (1 + \phi)c_h^* = x_h$. A change in foreign policy mix which preserves foreign exports has no effect on the entry and production levels of home firms, so it must also preserve home consumption and the real wage of home consumers $\frac{w}{P}$. The result would hold true even if there were specific factors for the fixed requirement of production. The result suggests that having multiple sectors of the economy is crucial to the results, but the model is still reasonable because trade negotiations often take place over sectors that are small relative to the rest of the economy.