ESSAYS IN INTERNATIONAL ECONOMICS AND POLITICAL ECONOMY OF TRADE POLICY

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Abstract

My primary areas of research interest are international economics, political economy of trade policy, and protection of intellectual property rights (IPR). I focus the first chapter of my PhD dissertation on cross-border IPR protection. I use a mixture of theory and empirical analysis to study the economic incentive that drives dual standards in IPR protections in a country's legal system. The second and the third chapters of my dissertation focus on trade policies of regional trade agreements (RTA), and particularly on identifying political and economic incentives for tariff cooperation between governments in free trade areas and its implications for the world trade system.

In the first chapter, we address the following question - are judges concerned, in the same way as policy makers, with the effects of their decisions on national welfare? We analyze this question by examining the outcomes of intellectual property rights (IPR) litigations between domestic and foreign firms. We develop a simple model of oligopoly where foreign firms have access to more efficient production technology and show that discriminatory weak protection of foreign-owned IPR always increases national welfare. We also show that the positive welfare effect increases with the size of the foreign innovator, as well within the size of the domestic imitator. The predictions of the model are tested using the data on all Canadian IPR cases over a four-year period. We find that a domestic firm is substantially more likely, by 13 percentage points, to succeed in litigations with a foreign firm than with another Canadian firm. We also find evidence supporting the hypothesis of the home bias in the legal system. Specifically, we establish that courts' decisions are aligned with welfare maximization principles so that foreign firms are less likely to win in those cases when the implied welfare effects of not protecting foreign IPR are greater.

In the second chapter, we show that the Canada-US Free Trade Agreement (CUSFTA) tariff preferences have triggered a decline in Canadian external tariffs, explaining a two percentage point reduction in the average tariff between 1989 and 1998. Next, we found that industries which generate the least export rent to the US firms experienced deeper tariff cuts in Canada; this result provides evidence of cooperation in trade policies between the US and Canada. Finally, we estimate the effect of the CUSFTA on the intensity of industrial lobbying for trade policy in Canada and find no relationship between preferential trade liberalization and lobbying activity.

In the last chapter, we develop a model of endogenous trade policy formation to study the impact of preferential trade agreements (PTA) on members' external trade policies when members internalize the intra-bloc welfare effects. This model is empirically tested using global trade data covering 170 countries and 177 PTAs established between 1988 and 2011. This paper finds empirical evidence of tariff cooperation between members of FTAs. Using three different measures of political relations (the affinity scores from the UN General Assembly Voting Data, dyad alliances data, and bilateral events and interactions data), we show that members with good political relation cooperate more on external tariff policy after formation of FTAs. On average, an increase in market share of PTA partners' firms by one standard deviation is associated with about 3 percentage point increase in external tariff in industries that matter for intra-bloc members.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Home Country Bias in the Legal System: Empirical Evidence from the Intellectual Property Protection in Canada

1.1 Introduction

With the continuous rise in the number of intellectual property rights (IPR) suits and associated damages awards worldwide, there is a pronounced trend for firms involved in cross-border litigations to file complaints with, and often receive favor from, a home country jurisdiction. In the recent intellectual property battles between the U.S.-based Apple Inc. (Apple) and the South Korea-based Samsung Electronics Co. (Samsung), Apple sued Samsung for patent infringements over the design and technology of its mobile devices in several countries, and the outcomes vary substantially across different jurisdictions. The U.S. court ruled in favor of the U.S. firm and on August 24, 2012 awarded Apple over a billion dollars in damages.[1] However, when the same claim was filed with the Seoul Central District Court in South Korea, the decision was in largely favor of Samsung. Moreover, a counterclaim by the South Korean firm that Apple had violated some of its own patents resulted in several of Apple's devices being banned from sale in Korea. Yet the same claim was denied by the U.S. jury. Another patent infringement case between the Canadian Research in Motion (RIM) and the U.S. Visto share many similarities. Visto brought RIM to the U.S. court, and although Visto's patents were

[1] The damage amount was later revised to half a billion dollars.

broadly considered invalid, the lawsuit was settled with RIM paying 267.5 million dollars to Visto in 2009. In contrast, when RIM brought Visto to the Canadian Federal Court for patent violation, the decision was in favor of RIM.

The above prominent cases suggest that the legal system may become a form of protectionism, whereby firms involved in cross-country IPR litigations may have a significant advantage over foreign firms in their home country jurisdiction. In this study, we set out to investigate whether foreign firms are systematically disadvantaged in IPR litigations with domestic firms. We test this hypothesis using novel data on all IPR litigation cases in Canada that took place between 2007 and 2010. With 1079 litigation cases in our data, we identify the country of residence for 2502 firms involved in those cases, and relate it to the probability of winning the case in Canadian courts. We find that the nationality of a firm is a statistically and economically significant determinant of success rate in a courtroom. Foreign firms litigating in Canada have a much smaller likelihood of winning a case: while a Canadian firm has a 50% probability of winning in IPR litigation against another Canadian company, the probability of winning against a foreign firm is 60%. This result is very persistent and is remarkably robust to the definition of a foreign firm, to inclusion of a variety of case-related fixed effects, and to firm size controls.

We next attempt to identify whether foreign firms' disadvantage in IPR disputes can be driven by welfare-consideration concerns. A large body of literature analyzes welfare gains from the discrimination of foreign IPR owners. The success of a foreign firm in IPR litigation with a domestic firm implies a transfer of intellectual property along with its associated market value to a foreign jurisdiction, which may have a negative impact on both domestic profits and consumer surplus. Therefore, a welfare-maximizing policy maker may want to protect domestic innovators more rigorously than foreign ones. However, the room for discrimination of foreign IPR owners is substantially reduced by several international treaties on IPR protection. Most importantly, the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), to which all member countries of the World Trade Organization must adhere, determines the minimum standards for IPR protection and empowers legal authorities to grant relief by way of injunction or damages. Yet implementation of these agreements by the national legal system may not be completely unbiased towards foreign IPR owners. In particular, being concerned about the impact of their orders on national well-being, judges may factor welfare considerations

into their decisions. If domestic firms are more likely to win in those IPR cases which result in larger welfare gains, it would imply that, despite international treaties, countries can achieve better social outcomes by violating national treatment in patent protection. Whether the legal system fosters discrimination of foreign innovators or is independent of national welfare considerations is an empirical question, which we try to answer in this study.

To test whether home bias is present in the legal system, we develop a simple partial equilibrium model where domestic and foreign firms compete in an oligopolistic market with a homogeneous good. A foreign firm is assumed to have access to a more efficient production technology, associated with lower production costs, that domestic firms may try to imitate. Using this model, we identify several economic factors that increase welfare gains from weak protection of foreign IPR. First, the model predicts that a social planner would choose not to protect foreign IPR when the domestic imitator is larger, in which case imitation has a stronger negative effect on domestic prices and a positive effect on consumer surplus. Second, the welfare gains from not protecting foreign IPR are increasing with the size of the foreign firm due to a stronger profit reallocation effect from foreign to domestic firms. Therefore, the model predicts that if welfare considerations lead to home country bias in the legal system, we should expect the size of the firm to be positively (negatively) related to the likelihood of success in IPR litigation for domestic (foreign) firms.

Testing these two predictions of the model empirically, we find support for the home country bias hypothesis in the data. The analysis reveals that the size of a firm, measured either by revenue or employment, has a positive (negative) association with the probability of winning a case for domestic (foreign) firms. This relationship is statistically significant and economically sizable: a one standard deviation increase in log revenue is linked to a 13.3 percentage point increase in success probability for domestic firms and a 16.1 percentage point decrease for foreign firms. This result implies that courts' decisions are aligned with welfare maximization principles. Although this result admits alternative explanations, we believe that the provocative relationship between courts' decisions and the implied welfare effects will promote the research agenda and stimulate more research on identification of the factors behind foreign firms' disadvantage in IPR litigations.

Yet our empirical methodology does allow us to rule out some alternative interpretations of

the home bias hypothesis. First, this finding cannot be explained by different effort levels and resources that domestic and foreign firms put into litigation. For both types of firms, there is a positive relationship between the firm size and the private gains from IPR protection; hence, we would expect to see large foreign firms spending more resources on protecting their IPR. Therefore, the negative relationship between foreign firms' revenue and likelihood of success in a courtroom, observed in the data, cannot be rationalized by different efforts of domestic and foreign firms in IPR litigations. However, it is consistent with the home bias hypothesis because private gains of foreign firms are not part of national welfare, and the welfare gains from imitating the foreign firm's technology are increasing in the size of the foreign firm. Second, we find that our results are not driven by differences in familiarity with the Canadian legal system between domestic and foreign firms. In one of the robustness tests, we control for firms' prior litigation experience and find that our main results remain qualitatively unchanged. Third, we show that being registered in a country that has good political relations with Canada does not reduce the bias against foreign firms, suggesting that political factors are unlikely to explain our main finding. Finally, the results are robust to the inclusion of a wide range of fixed effects such as industry, location and type of jurisdiction, subject of litigation, and time period.

Our study provides several contributions to the literature on IPR protection. While the evidence of the presence of home bias in national policies abounds, whereby governments vary the intensity of IPR protection in order to increase national welfare at the expense of foreign agents, most of the previous literature assumes national treatment of foreign IPR owners. Our study is the first to show that discrimination against foreign firms can take place not only at the policy level but also at the implementation level as foreign innovators may not be able to protect their intellectual property as effectively as domestic ones. It implies that stringent IPR laws at the country level do not guarantee that the interests of foreign innovators is well protected.

This paper is also the first study that analyzes the role of the legal system in differential treatment of foreign and domestic IPR owners. We show that even if the policies conform to the national treatment principle and do not discriminate against firms based on their country of origin, the legal system can serve as a channel for violation of the national treatment if courts implement policies differently for domestic and foreign firms. Although courts are supposed to

prevent any discrimination against foreign IPR holders, this may not be the case if judges take into account the effect of their decisions on national well-being. Given the evidence we find in the Canadian data, home bias in the judicial system can be a more serious issue in developing countries where institutions are less efficient and legal systems are not completely independent from government influences.

The paper proceeds as follows. Section 1.2 surveys the literature on discrimination against foreign nationals in general and in IPR in particular. Section 1.3 presents the theoretical model on the effect of discrimination against foreign IPR owners on national welfare. Section 1.4 outlines the empirical strategy, which is followed by the data description in Section 1.5. The baseline results are reported in Section 1.6. Section 1.7 presents several extensions, and Section 1.8 concludes.

1.2 Literature Review

It is commonly agreed that government incentives to protect IPR vary across countries. In the theoretical literature, a number of studies show that countries actively involved in innovation activities are keener on protecting IPR than countries with low levels of innovation. Chin and Grossman (1991) and Grossman and Lai (2004) show that the interests of developed and developing countries conflict in the matter of IPR protection due to opposite impacts of stricter IPR enforcement on welfare in the two groups of countries. The innovative countries benefit from extension of stronger IPR rules to developing ones because stronger IPR protection increases the rent transferred from the latter to the former and the ability to recoup investments in R&D by innovating firms. In contrast, tightening of the IPR rules in the developing countries increases the monopolistic power of foreign firms and restricts the opportunity of domestic firms to produce inexpensive imitations using foreign technologies (also see Helpman, 1993; Diwan and Rodrik, 1991; Hunt, 2006).[2]

Since policy-makers tend to support domestic firms in competition with foreign ones, they

[2]Deardorff (1992) adds to the above literature that the global welfare as a whole decreases if stricter IRP rules extend globally because increased market power of firms in developed countries could eventually exhaust the market share of resource-constrained firms from developing countries. Due to the downside of extensive IPR protection, McCalman (2001) alert to the danger of the global spread of stronger IPR rules and advocate weaker IPR rules for developing countries.

are typically less interested in protecting IPR owned by foreign firms. It is thus not surprising that incentives for adoption and enforcement of IPR protection rules vary between countries depending on the relative innovation intensity of foreign and domestic firms.[3] Prior to the Uruguay Round of the WTO negotiations, the standards for IPR protection had varied a lot across the WTO members and this variation was closely related to their level of economic development. Developed countries were characterized by higher IPR standards designed to stimulate local innovation. A vast majority of developing countries, on the other hand, had weak IPR rules, with many of them lacking any adequate mechanisms for IPR protection. Rising welfare costs to the countries where innovative firms reside, implied by globalization and weak IPR rules in developing countries, led a group of developed countries to form a campaign for a global standardization of IPR protection, which resulted in Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement.

The TRIPS agreement, which came into force in 1996, is a system of rules that governs the practices of IPR protection among all WTO member countries. The TRIPS outlines the minimum protection standards for the length and the width of each type of intellectual property (e.g. trademarks, patent, industrial designs, and etc.) and details the enforcement procedures. Each WTO member country is required to meet the minimum standards of the TRIPS within a specified deadline, and most of the developing countries have undertaken substantial reforms to their legal systems in order to meet these standards. In contrast, the majority of the developed WTO member countries already had IPR protection laws that met or exceeded the TRIPS standards before the agreement became effective (Deere, 2008). Overall, the TRIPS has only mitigated the variation in international IPR protection but hardly eliminated the incentives of countries to deviate from the TRIPS standards. Large variation in TRIPS implementation persisted even ten years after the TRIPS had been in force. For example, developing countries often miss the deadline for domestic law reforms for TRIPS implementation or exploit the TRIPS flexibility which offers some degree of freedom in adjusting their policies to domestic needs (Maskus, 2000). Furthermore, developed and developing countries often interpret the

[3] Geng and Saggi (2013) point out that even countries at the same level of economic development may be better off from weaker global IRP protection in the presence of trade frictions. In this case domestic become more important than foreign markets and firms gain more from discreminatory treatment of foreign firms at home.

TRIPS provisions differently to their own advantage (Musungu and Oh, 2006).

The above studies highlight the incentives of policy-makers to adopt different levels of IPR protection depending on the relative stock of domestic and foreign-owned intellectual property. Developed countries stick to stricter IPR protection standards in order to prevent leakage of productive knowledge to other countries, while developing countries tend to encourage domestic firms to imitate foreign intellectual property by adopting weaker standards. Thus far, the majority of empirical studies on IPR in international context have focused on this relationship between the level of IPR protection standard and its associated impact on national welfare (e.g., Maskus, 1995; Yang & Kuo, 2008). However, as the TRIPS agreement has narrowed the room for differences in IPR protection standards across countries, policy-makers may have switched to alternative means of favoring domestic firms in order to either increase the transfer of foreign technologies or decrease the outflow of technologies to other countries. For example, there can be varying degrees of rigor with which policy-makers enforce IPR protection rules, depending on the nationality of the IPR owner.

Discrimination against foreign firms in various aspects of government policies is well documented in the literature. McAfee and McMillan (1989) discuss how the 1933 Buy American Act has impacted the international trade pattern in the US and increased national welfare by favoring local businesses with government procurement contracts. Branco (1994) shows that a government's home bias against foreign firms, whereby foreign firms are required to cut the prices of domestic firms by a certain margin, is necessary in order to induce lower market price and to boost consumer surplus.[4] A number of papers demonstrate that trade policies and regulations are used to discriminate against foreign firms in order to shift consumers' expenditure from foreign to domestic products (e.g., Maggi and Goldberg, 1999 ; Gawande and Bandyopadhyay, 2000). The above studies illustrate how the bias against foreign firms can arise in various policies set by welfare-maximizing policy-makers.

In the IPR context, a number of papers have demonstrated the presence of home bias. For example, several studies have shown that commercial and civil laws in some countries are

[4]Countries such as the US, Canada, Australia, and New Zealand have explicit laws that give domestic firms price advantages in auctions for government procurement contracts. European and Japanese governments have rather implicit rules and requirements that reduce the chance for foreign firms to win government procurement contracts (McAfee and McMillan, 1988).

designed to discriminate against foreign patentees in favor of domestic ones. Lerner (2002) shows that in a large number of countries discrimination against foreign patentees takes the form of higher registration costs, shorter duration periods, more limitations on extensions, and premature patent expirations. Liegsalz and Wagner (2013) argue that discrimination against foreign patentees can exist even after the implementation of the TRIPS by empirically showing that the Chinese State Intellectual Property Office favors domestic patentees by granting patents to foreign firms for a significantly shorter period of time. Webster et al (2014) investigate patent examination outcomes in European and Japanese patent offices and show that foreign inventors are less likely to obtain a patent grant than domestic inventors, and that the bias is stronger in areas of technological specialization of the domestic economy.

1.3 Theoretical analysis

In this section we develop a simple model to study the factors that determine the effect of foreign IPR protection on welfare. Predictions of this model will be used to test whether the bias that foreign firms may face in court can be explained by national welfare maximization concerns. Consider an oligopolistically competitive market with firms producing a homogeneous good traded at price p. On the demand side, preferences of a representative consumer are characterized by a quadratic utility function:

$$U = \alpha Q - \frac{\beta}{2} Q^2, \tag{1.1}$$

where $Q = \sum_i q_i$ is the total consumption of the homogeneous good and q_i is the quantity purchased from firm i. Maximizing utility function subject to the standard budget constraint, we obtain the inverse demand function

$$p = \alpha - \beta Q. \tag{1.2}$$

Suppose there are $N + 2$ firms in the market. Firm 1 (F1) is a home country firm which may attempt to imitate the production technology of a foreign firm. Firm 2 (F2) is the foreign firm exporting to the home country market and utilizing a potentially more advanced production

technology. The remaining N firms are symmetric in terms of costs and represent the rest of the industry. We assume they are all domestic firms. Denote a representative firm from the rest of the industry by F3. We further assume that each firm i has a constant marginal costs c_i. Profit function of firm i is then given by

$$\pi_i = (p - c_i)q_i. \tag{1.3}$$

Using first-order conditions for profit maximization and the market demand function, we obtain the industry total output, price, consumer surplus (CS), and welfare (W):

$$\begin{aligned} Q &= \frac{\alpha(N+2) - c_1 - c_2 - Nc_3}{\beta(N+3)} \qquad (1.4) \\ p &= \frac{\alpha + c_1 + c_2 + Nc_3}{(N+3)} \\ CS &= \frac{\beta}{2}Q^2 \\ W &= CS + \pi_1 + N\pi_3 \qquad (1.5) \end{aligned}$$

Suppose a foreign firm possesses a more advanced production technology, which lowers marginal costs by $\epsilon > 0$.[5] Let W_0 be the value of the welfare function when the domestic legal system protects IPR of the foreign firm and does not allow F1 to imitate its technology. In this case, the marginal costs of the three firms are $(c_1, c_2 - \epsilon, c_3)$. Also, let W_1 be the value of the welfare function when the legal system favors a domestic firm and allows it to imitate technology of F2, so that the marginal costs of the three firms become $(c_1 - \epsilon, c_2 - \epsilon, c_3)$. Then $\Delta W = (W_1 - W_0)$ reflects the welfare gain from not protecting the IPR of the foreign firm, and in our model ΔW is always positive. This result is very intuitive. Since π_1 enters the national welfare function and π_2 does not, an increase in relative productivity of F1 raises its market share at the expense of other firms, including F2, and decreases the market price, thus raising both consumer surplus and aggregate profit of domestic producers. Therefore, in the partial equilibrium framework, when the effect of IPR protection on incentives to innovate is not taken into account, allowing domestic firms to imitate advanced foreign technologies is always in a

[5] The case when a domestic firm possesses a superior technology and F2 tries to imitate it is symmetric and all predictions of the model continue to hold.

country's best interest.

In what follows we perform some comparative-static exercises to derive the implications of the relative size of domestic and foreign firms for the gain from not protecting foreign firm's IPR. Since a firm's relative size is determined by relative marginal costs, we first differentiate ΔW with respect to c_2:

$$\frac{\partial \Delta W}{\partial c_2} = -\frac{(2N+3)\,\epsilon}{\beta\,(N+3)^2} < 0. \tag{1.6}$$

Equation (1.6) implies that for small c_2 (when foreign firm is large and efficient) allowing F1 to imitate technology of F2 will have a stronger positive impact on home country welfare. This effect stems from reallocation of market shares from foreign to domestic firm, which is increasing in the size of the foreign firm. Similarly, the relationship between ΔW and the size of F1 is

$$\frac{\partial \Delta W}{\partial c_1} = -\frac{2\,(N+2)}{\beta\,(N+3)}\epsilon + \frac{3}{\beta\,(N+3)^2}\epsilon < 0. \tag{1.7}$$

Therefore, when a domestic firm is originally larger and more efficient (c_1 is small), the positive effect of allowing it to imitate foreign technology on welfare is stronger. This result is driven by reallocation of market shares from F2 to F1, which is increasing in relative productivity of F1, and by the effect on prices, which is stronger when the domestic imitator is larger.

The above results lead us to the following proposition:

Proposition 1 *If discrimination against foreign IPR owners by the judicial system is driven by national welfare considerations, then in IPR litigations between foreign and domestic firms, the following must hold:*

(a) Domestic firms have higher likelihood of success

(b) The probability of winning against a domestic firm must decrease in the size of a foreign firm

(c) The probability of winning against a foreign firm must increase in the size of a domestic firm

Proposition 1 allows as to test the hypothesis that welfare considerations are present in the legal system and can thus explain the bias against foreign IPR holders. Part (a) relates to the fact that ΔW is always positive; hence, a welfare-motivated judge would always tend to

protect domestic IPR more stringently than foreign. Parts (b) and (c) relate to equations (1.6) and (1.7), and state that the bias of a welfare-motivated court against foreign IPR owners is increasing in the size of both domestic and foreign firms.

1.4 Econometric Specifications

In this section we discuss the empirical strategy that we use to identify home bias in IPR enforcement in a legal system. The simplest structure to study the relationship between the country of origin of a firm and the likelihood of winning a court case is the following probit model:

$$\Pr(Y_{ij} = 1) = \Phi(\beta_1 Nat_{ij}) \tag{1.8}$$

where Y_{ij} is an indicator variable for success in court, which is equal to one if firm j succeeded in winning the case i, and Nat_{ij} is an indicator variable that takes the value of one when firm j involved in case i is foreign. The coefficient β_1 in equation (1.8) measures the relationship between nationality and the likelihood of winning the case. If foreign and domestic firms are treated on equal footing in Canadian courts, β_1 would be statistically indistinguishable from zero. Negative β_1 would support the hypothesis, formulated in Proposition 1(a) that foreign firms are in general more likely to lose in IPR litigations with domestic firms. Yet, $\beta_1 < 0$ could also signal the presence of some other factors, not necessarily related to bias, which could disadvantage foreign firms in litigation processes, such as information asymmetry.

In order to test parts (b) and (c) of Proposition 1, we include the size of domestic and foreign firms in equation (1.8):

$$Pr(Y_{ij} = 1) = \Phi(\beta_1 Nat_{ij} + \beta_2 Rs_{ij} + \beta_3 Nat_{ij} \times Rs_{ij}). \tag{1.9}$$

where Rs_{ij} is the log of revenue of firm j. If Canadian courts are more likely to favor domestic firms when the implied welfare gains are larger, as predicted by the model, we would expect the likelihood of winning the case to increase in the revenue for domestic firms ($\beta_2 > 0$) and to decrease in the revenue for foreign firms ($\beta_3 < 0$).

Previous literature has demonstrated that the outcome of the court's hearing can be affected by the relative size of litigating firms for reasons unrelated to national welfare. Lanjouw and Schankerman (2004) argue that legal costs imply a greater financial burden for smaller firms relative to larger ones, thus lowering the probability of a successful outcome. In addition, larger firms can afford lawyers with better legal expertise and experience, which may influence a court's decisions (Szmer et al., 2007; McGuire, 1995 and 1998; Haire et al., 1999). Therefore, positive β_2 estimate may reflect both the bias in the legal system and the negative impact on firms that lack financial resources. However, these channels have an opposite effect on β_3 and its estimate can thus be used to gauge the relative importance of these two factors.

To account for other factors that may affect a court's decisions, we add a number of fixed effects to equation (1.9). Specifically, we include fixed effects for the type of the jurisdiction interacted with location,[6] the subject of litigation,[7] and the 6-digit NAICS industry in which firm j operates. The 2012 Patent Litigation Study by PricewaterhouseCoopers[8] shows that the success rates and the median damage awards varies widely by industry, court's location, and the subject of litigation. For example, patent holders in medical devices and electronics have the highest success rate, while those in service business have the lowest success rate in litigation among industries. We also include year fixed effects to control for variation in IPR regulations and a court's willingness to enforce IPR over time (North, 1990). This rich array of fixed effects allows us to control for many unobservable and resolve omitted variable bias stemming from any possible variation in courts' decisions over jurisdictions, industries, and time.

Finally, we also include a plaintiff indicator variable ($Plaintiff_{ij}$) as a control which is equal to one if firm j involved in case i is a plaintiff and zero if it is a defendant

$$\begin{aligned} Pr(Y_{ij} &= 1) = \Phi(\beta_1 Nat_{ij} + \beta_2 Rs_{ij} + \beta_3 Nat_{ij} \times Rs_{ij} + \beta_4 Plaintiff_{ij} \\ &\quad + Jur + Subj + Indust + Year). \end{aligned} \tag{1.10}$$

[6] The types of the jurisdictions are municipal court, provincial court, federal court, court of appeal, supreme court, superior court, Canadian International Trade Tribunal, Trade-marks Opposition Board. Provincial courts and courts of appeal are interacted with provincial dummy variables. More than 80% of all cases come from federal court and Trade-marks Opposition Board.

[7] This includes copyright infringement, intellectual propterty violation, patent application opposition, patent infringement, trademark infringement, trademark opposition.

[8] This study is available on-line at http://www.pwc.com/en_US/us/forensic-services/publications/assets/2012-patent-litigation-study.pdf.

This control is important because of the selection effect in litigation, arising from asymmetric information between the parties. While a plaintiff has a choice of whether to initiate a litigation process or not, a defendant has no such choice. Since litigation is costly, plaintiffs will not file a claim unless the expected success rate is high enough for positive economic return. Therefore, plaintiffs may be better informed than defendants about the odds of winning the litigation process and this information asymmetry may be correlated with the nationality of a firm.

1.5 Data

Estimation of equation (1.10) requires information on the outcomes of a large number of IPR litigations and on the firms involved in those litigations. We construct a database of all IPR-related cases which took place in Canada in four consecutive years between 2007 and 2010. The data is retrieved from the Canadian Legal Information Institute (CanLII), which records all litigations across all Canadian jurisdictions.[9] For this study we select only those cases which relate to IPR and involve disputes over patents, copyrights, trade marks, and industrial designs.[10] The final data include $2,502$ firms involved in $1,079$ cases, where each case may comprise multiple claims. For every case and firm, we record information on the name of the firm, jurisdiction and location of the court, and the litigation subject. We also record information on the court's decision for every claim of a case and keep track of all cases in which the Canadian government is involved.

The data on IPR cases is complemented with firm-level information using three different sources: firms' annual reports, the Canadian Company Capabilities (CCC) database, and Manta. The data for publicly traded companies come from their annual reports, and include the firm's country of ownership, annual revenue, number of employees, and industrial affiliation, which we record using the 6-digit NAICS industry classification. For firms that are not publicly traded, our primary source of information is the CCC database maintained by the Industry Canada. It provides information on the same information as above, although the data on revenue is not as detailed.[11] Our secondary source of information for non-publicly traded firms is

[9] Appeals are recorded as different cases in the CanLII databases and we treated them accordingly.
[10] We exclude all cases which involve individuals.
[11] The CCC database records firms' revenues in ten size brackets. When CCC information on firm's revenue

Manta, an on-line business service directory which collects data directly from the companies. The objective of this on-line business listing service is to build a network of companies and connect possible partners, vendors, and suppliers. Manta provides the same information as the CCC database and covers a large number of smaller firms, which are often missing in the CCC database.[12] Using these three sources of information, we were able to obtain required data for 74% of firms in our sample.

To construct the nationality indicator variable, we employ two methods. Our first measure, Nat_{ij}, is based on the CCC's classification of firms into domestic and foreign, which defines nationality based on the location of a firm. Therefore, a subsidiary of a foreign firm located in Canada is recorded as a Canadian company according to CCC. As the second measure, Nat_HQ_{ij}, we define nationality of a firm based on the country of residence of its headquarters, which information we obtained either from the firm's annual report or from the company's website.[13] For example, AstraZeneca Canada Inc., a subsidiary entity of a multinational pharmaceutical company AstraZeneca plc., is classified as a Canadian firm in the CCC database because it has manufacturing facilities in Canada. However, it will be classified as a foreign firm in the second measure because its global headquarters is located in the United Kingdom. If the bias against foreign firms is present in the Canadian legal system, these two measures will allow us to say whether it is driven by the foreign ownership or by the geographical location of a firm. Figures 1.1 and 1.2 compare the kernel density for the log of employment and revenue between domestic and foreign firms respectively based on Nat_HQ definition. The figures show that foreign firms are considerably larger, employing four times more workers and earning seven times more revenue than an average domestic firm.

Construction of the dependent variable, which is an indicator variable for success in a case, is straightforward for cases which include a single claim. For multi-claim cases, which are

is used in our data, we take the average of the lower and upper value of the bracket. For example the revenue of the National Forming Systems Inc. is reported in CCC as "between $10 and $25 million", so we record 17.5 million for its annual revenue.

[12] The information provided by Manta is self-reported and is thus not as accurate as annual reports or Industry Canada's administrative records. However, for firms which are present in both Manta and CCC we did not find considerable discrepancies in reported revenue or employment.

[13] It should be noted that not in all cases it is possible to identify the presence of a headquarters abroad. Out of 1,458 firms in our sample which are registered in Canada, we managed to identified 117 with a headquarters in another country.

relatively scarce in our data,[14] the task is more challenging since only some of the claims may be granted to a plaintiff. Ideally, for such cases we would like to have information on the relative importance of different claims for the case, which would allow us to evaluate whether the main objective of the claim was achieved by the plaintiff. Unfortunately, this information is unavailable to us and we rely on several approaches to classify cases in order to make sure that our results are not driven by the way the dependent variable is constructed. First, we consider a plaintiff firm to win and the defendant to lose the case if at least one of the claims is successful. Second, a plaintiff firm is considered to win and the defendant to lose the case if at least half of the claims in a case are successful. The summary statistics for the two success indicators, Y_{ij}^1 and Y_{ij}^2, are presented in Table 1.1. The two definitions produce very similar measures of Y_{ij} with the means around 0.5 the correlation coefficient of 0.99. This similarity suggests that our results will not vary much with the definition of Y_{ij}. Yet we report estimation results from using several alternative ways of constructing the dependent variable in Section 1.7 and demonstrate that our main findings are not sensitive to the definition of success in a case.

1.6 Baseline results

Table 1.2 reports the probit regression of the baseline econometric specifications (1.8)-(1.10). Columns (1)-(4) show regression results when the case is assumed to be successful for the plaintiff if at least one claim is granted. The results for specification (1.8) show that β_1 is negative and statistically significant. This result implies that foreign firms have a lower probability of winning an IPR-related case in a Canadian court. Moreover, β_1 estimate has similar magnitude for both measures of nationality, Nat_{ij} (column 1) and Nat_HQ_{ij} (column 2), suggesting that having production facilities in Canada does not eliminate the bias. The average foreign firm in our sample is 12 percentage point less likely to succeed in IPR litigation in Canada relative to the average Canadian firm (column 2). In other words, while two local firms have equal chance of

[14] We have 165 firms involved in multiple claims, of which 124 involved in 2 cliams, 36 involves in 3 claims, only 5 involved more than 3 claims. Most of these multi-claim cases are multiple IPR violations, or one violation with improper use in multiple areas.

success in litigation with each other, in cases involving domestic and foreign firms, the odds are 0.56 and 0.44 in favor of the domestic firm.

The finding that foreign firms are less likely to successfully protect their IPR in Canada than local firms provides first support for the hypothesis of the legal system's bias against foreign firms. While this result may have other interpretations, columns (3) and (4) provide further evidence for the bias hypothesis. Regression results reveal a significant and positive link between revenue of domestic firms and their likelihood of winning against foreign IPR owners. This is consistent with the prediction of our theoretical model, summarized in Proposition 1(b), that welfare gains from imitating foreign IPR are greater when the domestic imitator is larger. Yet this result can also be explained by correlation between a firm's revenue and some unobserved firm-level characteristics. Most importantly, larger firms may have more to gain from a case and thus be more inclined to put more effort and resources into litigation.[15] However, the negative and significant coefficient on foreign firms' revenue is at odds with this explanation. Indeed, if the positive coefficient on domestic revenue were due to the stronger effort by larger firms, driven by positive correlation between size and private gains from IPR protection, then the coefficient on foreign firms' revenue would also be positive because larger foreign firms are losing more from imitation of their technologies. At the same time, $\beta_3 < 0$ is consistent with the bias hypothesis because private gains of foreign firms is not part of national welfare, while the negative effect of imitation of foreign IPS by domestic firms on prices is increasing with size of foreign firms.[16]

Turning to the quantitative assessment of the effect of revenue on courts' outcomes, evaluated at sample means, the coefficients $\beta_2 = 0.035$ and $\beta_3 = -0.025$ in column (4) suggest that a 10 percent increase in revenue is associated with a 0.14 percentage point increase in the probability of success in litigation for domestic firms but only with a 0.04 percentage point increase for foreign firms.[17] It is important to note that foreign firms' disadvantage in Cana-

[15] For example, Lanjouw and Schankerman (2004) and Szmer et al. (2007) show that larger firms have more advantages than smaller firms in litigation.

[16] By the same argument, we can rule out the possible correlation between revenue and the amount of available resources as the alternative interpretation for $\beta_2 > 0$ because the effect of resources on the likelihood of winning should be the same for domestic and foreign firms.

[17] One standard deviation increase in log revenue is linked to a 13.3 percentage point increase in success probability for domestic firms and a 16.1 percentage point decrease for foreign firms. Marginal effects of interaction terms are calculated by the procedures outlined in Ai, Chunrong, and Norton (2003).

dian courts operates entirely through the revenue term as the coefficient on the foreign status dummy variable becomes insignificant in column (4). Nevertheless, the estimates in column (4) imply that a foreign firm with average revenue is 9.18 percentage point less likely to win against a domestic firm, which is comparable to a 13.2 percentage point disadvantage identified in column (2).

In columns (5)-(8) of Table 1.2 we report estimates of specification with Y_{ij}^2 as the dependent variable. The results are very similar to those in columns (1)-(4), indicating that classification of multi-claim cases into successful or not does not play a major role in our analysis. Because of the high degree of similarity, in the analysis that follows we only report the results with Y_{ij}^2 as the dependent variable. Columns (9)-(11) present results for the benchmark specification with a full set of year, location of jurisdiction, industry, and subject of litigation fixed effects. The results do not suggest that industrial affiliation, jurisdiction and location of a court, or subject of litigation affect foreign firms' disadvantage in Canadian courts. That said, these additional fixed effects do help explain the variation in success rates among firms, since many of the binary variables are statistically significant and including them in the model increases pseudo R-sqared from 0.017 to 0.03. Adding a plaintiff indicator variable in column (11) reveals that plaintiffs are less likely to succeed, with the average success rate being 6.3 percentage points below of that for defendants. At the same time, the main coefficients of our interest are unaffected by inclusion of this variable in the regression.

1.7 Extensions

1.7.1 Prior litigation experience

Previous studies argue that process expertise, which is accumulated through past litigation experience, could play an important role in courts' outcomes because knowledge of institutional rules and practices may place a litigant in a better position (McGuire, 1995 and 1998; France, 1998; Szmer et al., 2007). If domestic firms, being more exposed to the local judicial system, have on average more experience with the Canadian courts than foreign firms, difference in experience levels could explain our previous results that foreign firms have a lower likelihood of success in litigations. Indeed, in our data, over 60% of the foreign firms have no prior litigation

experience in Canada compared to only 45% for the domestic firms. To control for firms' prior litigation experience, we expand equation (1.10):

$$\begin{aligned} Pr(Y_{ij} &= 1) = \Phi(\beta_1 Nat_{ij} + \beta_2 Rs_{ij} + \beta_3 Nat_{ij} \times Rs_{ij} + \beta_4 Plaintiff_{ij} \\ &\quad \beta_5 Exp_{ij} + Jur + Subj + Indust + Year). \end{aligned} \tag{1.11}$$

where Exp_{ij} is a legal experience indicator for firm j. To construct this indicator, we searched the CanLII database for the number of cases in which firm j had been involved in ten years prior to case i. Summary statistics for prior litigation experience are provided in Table 1.1. Figure 1.3 illustrates the difference in prior litigation experience between domestic and foreign firms. An average firm in our sample had been involved in 24 cases with the median being equal to one. We classify firms into experienced and not experienced using different thresholds on the number of prior cases in order to investigate the robustness of our results to the definition of Exp_{ij}. In columns (1)-(5) of Table 1.3 we use the thresholds of 1, 5, 10, and 30 on the number of previous cases, and for each definition we report the number of firms classified as experienced at the bottom of the table.

The results show that when firms' prior experience is controlled for, the coefficients on the key variables, such as domestic and foreign revenue, remain close to the benchmark values.[18] The coefficients on prior experience variables are statistically insignificant for all definitions of Exp_{ij}, although they are always positive. Contrary to previous studies, we failed to find a specification where the previous court experience would have a statistically significant effect on the dependent variable. In column (6) we differentiate firms in terms of the intensity of prior legal experience. In particular, we use four quartiles of the prior experience distribution to categorize all firms into four groups, using the firms without prior experience as a control group. More experienced firms are found to have a higher likelihood of success in a court but this pattern is also not statistically significant.

In columns (3)-(6) we use the log of a firm's age as a proxy for its outside-of-court experience.

[18] Note that after taking into account the size of both domestic and foreign firms in the estimation, the coefficient β_1 for Nat_{ij} becomes statistically insignificant, which means that there is no obvious evidence showing smaller size foreign firms are being disadvantaged against smaller size domestic firms.

The intuition for using this variable is that it captures the effect of a firm's relative experience in business operation and knowledge in the industry. Again, this measure of experience is positive but not statistically significant, and adding it to the benchmark specification does not affect our main results. Overall, we failed to find any evidence for the hypothesis that prior legal experience has a positive impact on success in a courtroom and that the difference in success rates between domestic and foreign firms is driven by difference in legal experience.

1.7.2 The role of political connections

In Section 1.3 we hypothesized that the legal system may factor in welfare considerations, as a government would do, in IPR disputes between domestic and foreign firms. The objective of this section is to test whether the government plays any role in the mechanism that leads to the disadvantage of foreign firms in Canadian courts. If both the courts and the government share welfare-maximization concerns, can firms rely on the latter to increase their chances in a courtroom? If they can, then we would expect politically connected firms to be more likely to succeed in litigations, and since domestic firms have stronger ties to the government, it could explain the findings of the previous section.[19]

To construct a measure of a firm's political influence, we use information on lobbying activity obtained from the Office of the Commissioner of Lobbying of Canada. Lobbying expenditure has long been used in the political economy literature to assess the degree of industrial political activity. However, since the data on lobbying expenditure by firms are unavailable in Canada, we approximate it by the number of officially registered lobbyists representing each firm. In Canada, every person seeking a conversation with a public office holder regarding any modifications to current legislation or policies is required to register with the Lobbyist Registrar and fill out a registration form. The form includes information on the beneficiaries of the lobbying activity (firms) and on the subjects of communication with the office holders, selected from a list of 46 descriptors. We use the subject of communication to categorize all lobbyists into three groups according to their relevance to IPR. We define a lobbyist as "highly relevant"

[19] While we do not expect politicians in Canada to be able to put direct pressure on the judiciary, indirect influence may be possible. For example, judges can be responsive to the media's reporting of legal proceedings, which may also represent the government's political agenda. Alternatively, if politically connected firms are also more likely to win in a court, it may simply reflect similarity in values of political and judicial powers rather than a formal relationship between the two.

for IPR when the subject of communication is related to "intellectual property", "law and justice enforcement", or "research and development"; lobbyists with subjects related to "industry", "international relations", and "science and technology", are classified as "relevant"; the remaining lobbyists are treated as "irrelevant". If political connections matter for IPR litigations, we would expect lobbyists proposing changes to the existing IPR regulations to have stronger impact on the outcomes of litigations.

We measure the degree of political connectivity with a binary variable which takes the value of one if a firm is connected and zero otherwise. Since firms differ in the number and the degree of relevance of lobbyists who represent them, we classify a firm as connected using different thresholds on the number of lobbyists. In column (1) of Table 1.4 a firm is considered to be politically connected if it is represented by at least one lobbyist of any relevance. With this definition, 15% of all firms are classified as connected; however, the coefficient on the indicator variable is negative and insignificant. This result is preserved for alternative definitions of political connectivity in columns (2)-(5). Only when firms with at least ten highly relevant lobbyists are classified as connected in column (6) does the coefficient on political connectivity variable become positive and significant. However, with this definition only 11 firms are defined as connected, and the coefficient of interest may not be well identified. In column (7), we include the interaction terms of foreign indicator with court experience and high relevant lobbying in the estimation, and find that the coefficients for these interaction terms are not statistically significant.

Results in Table 1.4 provide no evidence that the intensity of communications between litigating firms and policy-makers is associated with a higher likelihood of winning a case. Therefore, we find no support for the hypothesis that firms can use the legislative branch to influence a decision in a courtroom. To test whether the results are robust to different ways of constructing the success indicator, we provide the estimation results of the key independent variables in this study against the success indicator defined at different thresholds, and report in Table 1.5. We find that our main findings are consistent with various definitions of success in a case.

1.8 Conclusions

The objective of this study is to investigate whether or not foreign firms are disadvantaged by the Canadian legal system in IPR disputes with domestic firms, and whether economic incentives play any role in discrimination against foreign IPR owners. Using the Canadian litigation data on IPR disputes, we find several notable results. First, domestic firms are more likely to win in IPR litigations with foreign firms. The difference in litigation success rate between domestic and foreign firms is both economically and statistically significant: foreign firms have about a 15 percentage point lower probability of winning against domestic firms. Second, using a simple model, we show that discrimination against foreign IPR owners bring larger welfare gains when either the foreign innovator or domestic imitator is large. Our empirical results reveal that courts' decisions are aligned with welfare maximization principles: a 10 percent increase in the size of a domestic firm increases the litigation success rate by 2 percentage points, while a similar increase in size of a foreign firm decreases its success rate by 2.5 percentage points. In our empirical analysis we rule out some of the interpretations of the home bias result which are alternative to welfare-maximization behavior of Canadian judges. In particular, we show that discrimination against foreign firms cannot be explained by better familiarity of domestic firms with the local legal system, by stronger political connections of domestic firms, or by nationalism of Canadian judges.

The findings of this study are important because they open a new window to an alternative way to look for potential flaws in the IPR protection, which so far has been largely overlooked. The earlier theoretical and empirical literature on IPR protection under the North-South trade framework has mostly focused on IPR protection policy. It has been confirmed that developing countries tend to discriminate against foreign firms by adopting weaker IPR standards, because intellectual property is mostly generated overseas and protecting it would only increase the rent transferred to the North. With the proliferation of TRIPS, the scope for discrimination of foreign IPR owners has decreased substantially. Our study demonstrates that countries can violate national treatment in IPR protection since courts implement policies differently to domestic and foreign firms. As a result, even countries which adhere to TRIPS policies on IPR protection can still discriminate against foreign IPR owners by applying those rules discretionarily to domestic and foreign firms. Therefore, this study shows that raising international

standards of IPR protection does not guarantee complete elimination of the home bias, and the proper analysis of international IPR protection should look not only at the IPR protection policies but also at the implementation of those policies by the legal system.

1.9 Tables and figures

Table 1. Summary statistics

Variable	Mean	Standard deviation	Min	Max	Observations
Decision (Y)	0.508	0.5	0	1	2502
Decision (Y*)	0.524	0.5	0	1	2502
Foreign indicator	0.361	0.48	0	1	2340
Foreign indicator (HQ)	0.411	0.492	0	1	2335
Log employees	5.053	3.1	0	13.21	1985
Log revenues	17.881	4.016	9.99	26.637	1856
Plaintiff indicator	0.482	0.5	0	1	2502
Gov. with domestic Firms	0.031	0.173	0	1	2335
Gov. with foreign Firms	0.039	0.194	0	1	2335
Experience	24.19	87.906	0	705	2337
Lobbying	0.452	1.882	0	40	2502

Source: CanLII, Industry Canada, Office of the Commissioner of Lobbying of Canada, Manta, and firms' annual reports. Decision(Y) is the court decision which equals 1 if any of claim succeed. Decision(Y*) equals 1 if at least half of the claims succeed. Nat is a foreign indicator if no research or manufacturing facilities, and subsidiary entities present in Canada. Nat_HQ is a foreign indicator if headquarter is outside of Canada. Plaintif equals 1 indicating for firms being as plaintif in litigation. Dom_gov indicates for cases that government is on the side of domestic firms while foreign_gov indicates for government on the side of foreign firms in the litigation. High_lobb, Low_lobb, and Irre_lobb indicate the number of lobbyists hired for high relevent, low relevent, and irrelevent lobbying activities respectively. Lob_H equals 1 if at least 1 high relevent lobbyists hired.

Table 1.2 Probit regression estimation of court outcomes on firms' country of origin

	Y				Y*						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Foreign indicator	-0.304***				-0.285***						
	(0.05)				(0.05)						
	[-0.121]				[-0.114]						
Foreign indicator (HQ)		-0.335***	-0.480***	-0.030		-0.321***	-0.476***	0.004	-0.505***	0.105	0.107
		(0.05)	(0.07)	(0.30)		(0.05)	(0.07)	(0.30)	(0.07)	(0.32)	(0.32)
		[-0.132]	[-0.191]	[-0.012]		[-0.128]	[-0.190]	[0.002]	[-0.201]	[0.042]	[0.043]
Log revenue			0.022***	0.035***			0.023***	0.037***	0.029***	0.047***	0.049***
			(0.01)	(0.01)			(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
			[0.009]	[0.014]			[0.009]	[0.015]	[0.012]	[0.019]	[0 .020]
Foreign (HQ) x log revenue				-0.025				-0.026		-0.033**	-0.033*
				(0.02)				(0.02)		(0.02)	(0.02)
				[-0.010]				[-0.010]		[-0.012]	[-0.012]
Plaintiff indicator											-0.158**
											(0.06)
											[-0.063]
Jurisdiction FE	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Subject FE	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Industry FE	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Year FE	No	No	No	No	No	No	No	No	Yes	Yes	Yes
Wald chi2	30.233	35.540	43.092	46.645	25.462	31.366	40.563	44.281	73.128	78.735	85.250
Log likelihood	-1607	-1600	-1264	-1262	-1609	-1602	-1265	-1263	-1229	-1227	-1224
No. of observation	2340	2335	1855	1855	2340	2335	1855	1855	1829	1829	1829

Notes: Marginal effects are calculated at the sample means of the variables. The marginal effect of the interaction terms are calculated by following the procedures in Ai, Chunrong, and Edward C. Norton (2003). Partial effect of the dummy variables is calculated as the increase in the probability of litigation success rate with a change in the dummy variable from zero to one. Standard errors and marginal effects are reported in round brackets and square brackets respectively. Y is the court decision which equals 1 if any of the claims succeeds. Y* equals 1 if at least half of the claims succeed. Foreign indicator=1 if no research or manufacturing facilities, and subsidiary entities present in Canada. Foreign indicator (HQ)=1 if headquarter is outside of Canada. Plaintif idicator=1 for firms being as plaintiff in litigation. ***, **, and * indicate p<0.01, p<0.05, and p<0.1 respectively.

Table 1.3 Probit regression estimation of court outcome on firms' nationalities takeninto account effects from prior experience.

	(1) 1X	(2) 5X	(3) 5X	(4) 10x	(5) 30x	(6)
Foreign indicator (HQ)	0.106	0.096	0.322	0.305	0.339	0.313
	(0.32)	(0.32)	(0.34)	(0.34)	(0.35)	(0.35)
	[0.042]	[0.038]	[0.081]	[0.075]	[0.089]	[0.080]
Log revenue	0.049***	0.044***	0.044***	0.044***	0.050***	0.045***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
	[0.020]	[0.017]	[0.019]	[0.019]	[0.021]	[0.019]
Foreign (HQ) x log revenue	-0.033*	-0.031*	-0.039**	-0.038**	-0.041**	-0.039**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
	[-0.012]	[-0.012]	[-0.013]	[-0.013]	[-0.014]	[-0.013]
Plaintiff indicator	-0.159**	-0.164***	-0.161**	-0.160**	-0.155**	-0.160**
	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)
	[-0.063]	[-0.065]	[-0.062]	[-0.062]	[-0.060]	[-0.061]
Log firm age			0.011	0.011	0.014	0.011
			(0.04)	(0.04)	(0.04)	(0.04)
			[0.003]	[0.003]	[0.004]	[0.003]
Court experience	0.007	0.079	0.086	0.099	0.001	
	(0.07)	(0.08)	(0.08)	(0.09)	(0.12)	
	[0.003]	[0.031]	[0.029]	[0.035]	[0.006]	
Exper.(1st - 25th per)						-0.025
						(0.10)
						[-0.010]
Exper. (26th - 50th per)						0.027
						(0.11)
						[0.005]
Exper. (51th - 75th per)						0.054
						(0.11)
						[0.017]
Exper. (76th - up)						0.074
						(0.12)
						[0.021]
Number of firms [(a)]	1354	828	828	646	410	[373,241,282,458]
Wald chi2	94.675	94.927	85.196	85.440	85.163	85.071
Log likelihood	-1219	-1219	-1101	-1101	-1101	-1101
No. of observation	1830	1830	1655	1655	1655	1655

Notes: Marginal effects are calculated at the sample means of the variables. The marginal effect of the interaction terms are calculated by following the procedures in Ai, Chunrong, and Edward C. Norton (2003). Partial effect of the dummy variables is calculated as the increase in the probability of litigation success rate with a change in the dummy variable from zero to one. Standard errors and marginal effects are reported in round brackets and square brackets respectively. Court experience indicates for firms that have at least the number of litigation involvements specified by each column head in the last 10 year prior to litigation. The number of firms satisfying the specification is summarized in "Number of fims". All regressions are controlled for subject, jurisdiction location, industry, and time trend fixed effects. ***, **, and * indicate p<0.01, p<0.05, and p<0.1 respectively. (a) This value indicates the number of firms in the sample that satisfy the criteria to be experienced firms in litigation in Canada. In column (6), 373, 241, 282, 458 indicate the number of firms in the first, second, third and fourth litigation experience quartile respectively.

Table 1.4 Robustness checks for probit regression estimation of court outcome on firms' nationalities taken into account effects from prior experience and lobbying.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Any	High_Low	High	High X 2	High X 5	High X 10	High
Foreign indicator (HQ)	0.103	0.098	0.100	0.095	0.146	0.136	0.178
	(0.32)	(0.32)	(0.32)	(0.32)	(0.32)	(0.32)	(0.35)
	[0.041]	[0.039]	[0.040]	[0.038]	[0.058]	[0.054]	[0.071]
Log revenue	0.046***	0.045***	0.045***	0.044***	0.045***	0.045***	0.047***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
	[0.018]	[0.018]	[0.018]	[0.018]	[0.018]	[0.018]	[0.019]
Foreign (HQ) x log revenue	-0.032*	-0.031*	-0.032*	-0.031*	-0.035**	-0.034**	-0.037*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
	[-0.012]	[-0.012]	[-0.012]	[-0.012]	[-0.013]	[-0.013]	[-0.014]
Plaintiff indicator	-0.164***	-0.164***	-0.164***	-0.163***	-0.166***	-0.169***	-0.167***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
	[-0.065]	[-0.065]	[-0.065]	[0.065]	[-0.066]	[-0.068]	[-0.067]
Court experience (5x)	0.101	0.096	0.091	0.090	0.065	0.067	0.074
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.080)	(0.10)
	[0.040]	[0.038]	[0.036]	[0.036]	[0.026]	[0.027]	[0.030]
Lobbying	-0.094	-0.081	-0.071	-0.067	0.210	0.805*	-0.115
	(0.11)	(0.11)	(0.11)	(0.12)	(0.18)	(0.44)	(0.16)
	[-0.038]	[-0.032]	[-0.028]	[-0.027]	[0.084]	[0.321]	[-0.046]
Foreign (HQ) x Court experience (5x)							0.045
							(0.17)
							[0.018]
Foreign (HQ) x Lobbying							0.087
							(0.22)
							[0.035]
Number of firms [(a)]	278	261	217	188	60	11	217
Wald chi2	95.535	95.221	95.032	94.970	96.541	97.989	95.294
Log likelihood	-1218	-1218	-1219	-1219	-1218	-1217	-1218
No. of observation	1830	1830	1830	1830	1830	1830	1830

Notes: Marginal effects are calculated at the sample means of the variables. The marginal effect of the interaction terms are calculated by following the procedures in Ai, Chunrong, and Edward C. Norton (2003). Partial effect of the dummy variables is calculated as the increase in the probability of litigation success rate with a change in the dummy variable from zero to one. Standard errors and marginal effects are reported in round brackets and square brackets respectively. Court experience (5x) indicates at least 5 times litigation involvements for the firm in the past prior to litigation. Lobbing=1 if the firm hires the type and the number of the regarding lobbyist specified by each column head. For example, in column (1) `Any' indicates the firm has hired any lobbyist; in column (4) `High X 2' indicates the firm has hired at least 2 lobbyists communiting high relevant subjects on behalf of the firm. All regressions are controlled for subject, jurisdiction location, industry, and time trend fixed effects. The specification of the lobbyist indicator is defined by each column and the number of firms satisfying the specification is summarized in "Number of fims". ***, **, and * indicate p<0.01, p<0.05, and p<0.1 respectively. (a) This value indicates the number of firms in the sample that satisfy the criteria to be political connected firms.

Table 1.5 Robustness checks for different thresholds of win-ratio for probit estimation of court outcome on nationality.

	Y_01	Y_25	Y_50	Y_75	Y_90
	(1)	(2)	(3)	(4)	(5)
Foreign indicator (HQ)	-0.004	0.002	0.100	0.414	0.350
	(0.32)	(0.32)	(0.32)	(0.32)	(0.32)
Log revenue	0.038***	0.040***	0.045***	0.049***	0.049***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Foreign (HQ) x log revenue	-0.026	-0.026	-0.032*	-0.047***	-0.045***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Plaintiff indicator	-0.162***	-0.172***	-0.164***	-0.162***	-0.175***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Court experience (5x)	0.099	0.094	0.091	0.126	0.123
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Lobbying (high relevent)	-0.097	-0.095	-0.071	-0.005	-0.004
	(0.11)	(0.11)	(0.11)	(0.12)	(0.12)
No. of observation	1835	1835	1830	1830	1830
Log likelihood	-1219	-1221	-1219	-1211	-1209
Wald chi2	97.906	96.035	95.032	103.221	107.012

Notes: Standard errors are reported in round brackets. Y_01, Y_25, Y_50, Y_75 and Y_90 are success indicators which equal 1 if win ratios are at least 0.01, 0.25, 0.50, 0.75 and 0.90 respectively. All regressions are controlled for subject, jurisdiction location, industry, and time trend fixed effects. ***, **, and * indicate $p<0.01$, $p<0.05$, and $p<0.1$ respectively.

Figure 1.1
Comparison of log employment between domestic and foreign firms

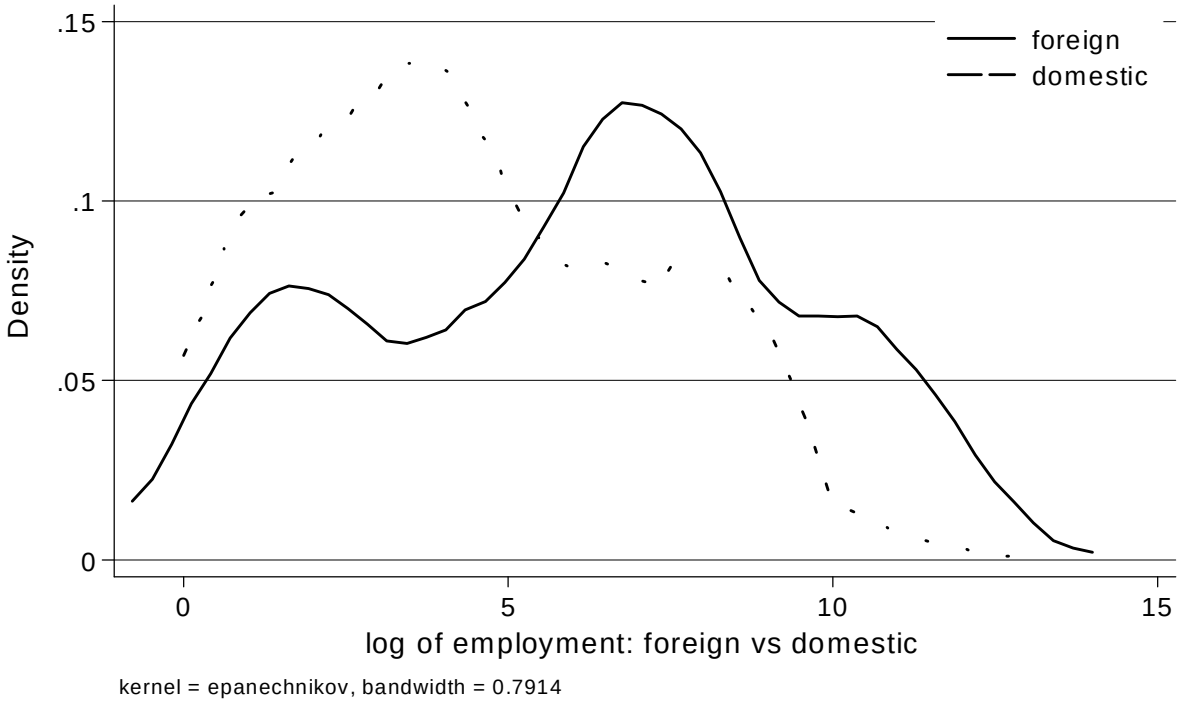


Figure 1.2
Comparison of log revenue between domestic and foreign firms.

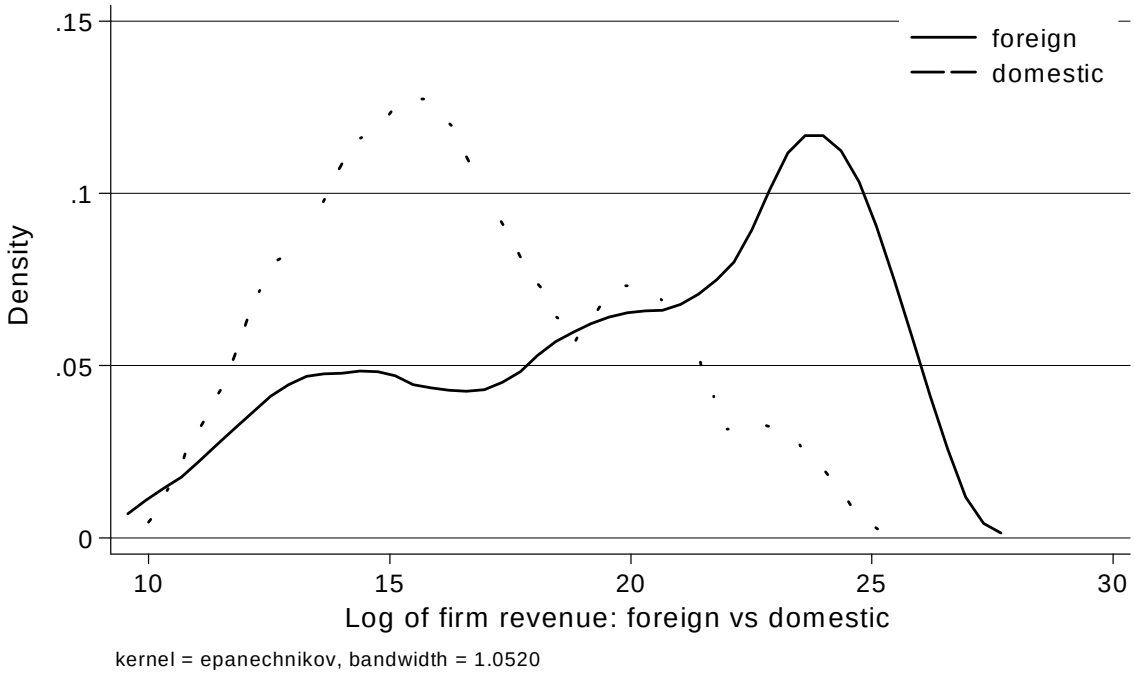
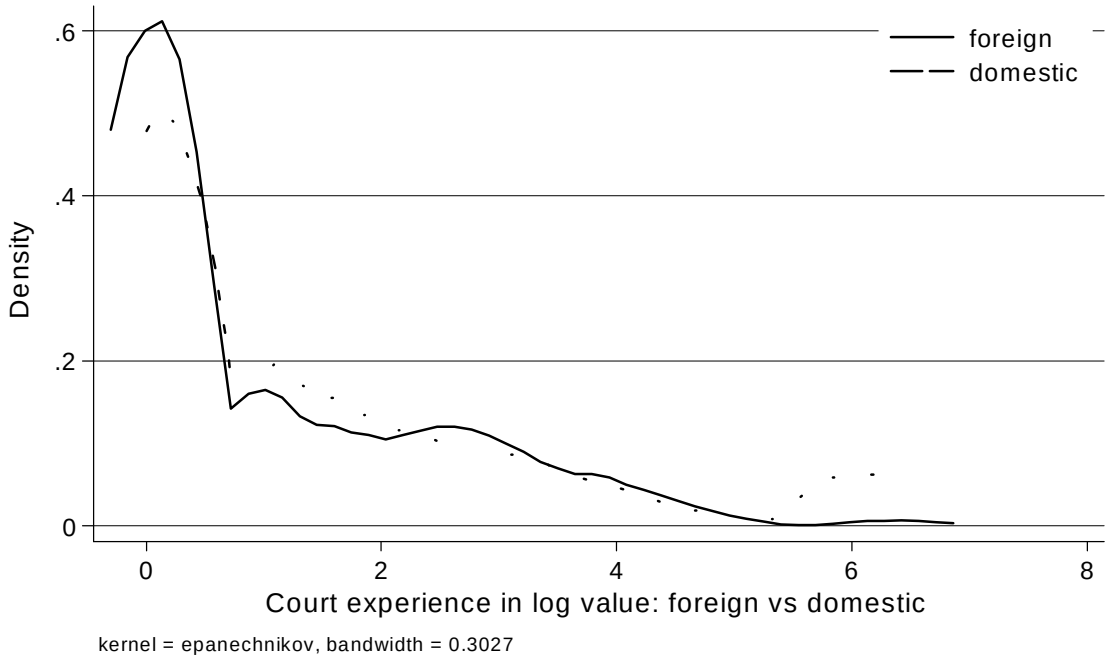


Figure 1.3
Comparison of prior litigation court experience between domestic and foreign firms.



Chapter 2

The Effect of the Canada-US Free Trade Agreement on Canadian Multilateral Trade Liberalization

2.1 Introduction

Do members in Free Trade Area (FTA) cooperate on their external tariff policy? This is an important question to policy makers because it carries the centric information on the welfare consequencies of FTA. Preferential trade agreements (PTA) have flourished around the world ever since the first one was established in 1958. Extensive research has been done concerning the implications of PTAs on multilateral trade liberalization and the welfare of member countries. However, neither theoretical nor empirical analysis has reached a consensus on whether or not joining a PTA would make a country more or less open to trade with non-members. The theoretical literature proposed several channels for the effect of a PTA on external tariffs, and while some of them lead to acceleration in trade liberalization towards non-member countries (Bagwell and Staiger, 1997b; Freund, 2000; Bond, Riezman, and Syropoulos, 2004; Ornelas, 2005a), others have the opposite effect (Panagariya and Findlay, 1994; Grossman and Helpman, 1995; Krishna, 1998; Limao, 2007). As the impact of a PTA on trade policy may vary across agreements, it has become necessary to provide more country-specific analysis in order to understand the welfare implication of a PTA for specific nations.

In this paper, we study the effect of the Canada-US Free Trade Agreement (CUSFTA) on Canada's multilateral trade liberalization (MTL). We develop a simple theoretical model with endogenous trade policy formation. This model incorporates the main channels, identified in

previous literature, through which a Free Trade Agreement (FTA) can affect the MTL of its member countries. Using Canadian trade data to test predictions of this model, we demonstrate that the CUSFTA tariff preferences have resulted in considerable reduction in Canadian tariffs, explaining a 2.21 out of 4.02 percentage point decline in the average most favoured nation (MFN) tariff rate between 1989 and 1998. We also show that the MFN tariff reductions were deeper in industries that generated the least export revenue for US exporters. This finding suggests that the Canadian government may be more inclined to reduce preference margins for products which have smaller potential to generate rent to the partner country.

To outline our theoretical model, we consider the economy of three large countries and monopolistically competitive markets. We start by deriving the effect of an FTA on external tariffs if they were set non-cooperatively by welfare-maximizing governments. In this framework there are two sources of complementarity between external and preferential tariffs. First, there are the terms-of-trade and tariff revenue effects, similar to the ones obtained by Richardson (1993) and Bagwell and Staiger (1997b), which lead to a decline in MFN tariffs. A reduction in the MFN tariffs following the CUSFTA can moderate some efficiency loss caused by the distortionary effect of preferential market access on the relative price of imports (Bagwell and Staiger, 1997b; Freund, 2000; Ornelas, 2005b) and restore part of tariff revenue loss caused by the shift in import demand towards the US-produced goods (Richardson, 1993). Second, there is a market structure effect which stimulates policy-makers to raise protection in industries with a large domestic presence and a low degree of product differentiation in order to redistribute consumer expenditure from foreign to domestic varieties. Since in the presence of an FTA the MFN tariff targets only the rest of the world (ROW) firms and part of the protection benefits flow to the partner country firms, the FTA will thus reduce the redistributive power of the MFN tariff and contribute to deeper MTL.

Next, we extend the model by introducing cooperative motives in trade policy formation by assuming that when the government of one country sets trade policy, it takes into account the effect on welfare of the partner country. When FTA member countries mutually internalize the effect of their policies, they keep external tariffs high in order to generate more export rent to their FTA partners. In a similar vein, Lim (2006) demonstrated that trade agreements with cooperative trade policies tend to become more protectionist in the context of multilateral trade

negotiations. This "stumbling block" effect of an FTA enters the expression for the equilibrium tariff rate in additively separable way, which allows us to empirically identify its effect on the external tariffs independently from other influences.

As a last extension of our model, we incorporate political economy factors in policy-makers' preferences using the protection-for-sale framework of Grossman and Helpman (1994). The theory predicts that the strength of domestic lobbying for protection is inversely related to the measure of import penetration. Hence, increased imports from a partner country following formation of an FTA would weaken the lobbying power of domestic special interest groups and reduce the level of protectionism. This effect is identified by Ornelas (2005b) as "rent destruction" since in the presence of an FTA a part of the rent from protection will flow to the partner country firms, making lobbying less attractive and weakening political economy distortions.

Our model identifies and generates testable predictions for three factors that lead to complementarity between multilateral and preferential tariffs, and one factor contributing to substitutability. Estimating the model with Canadian tariff data during the time period of the CUSFTA implementation, the main findings of this study are as follows. First, the study reveals a strong tariff complementarity between Canadian preferential and MFN tariffs which propagates through terms-of-trade and tariff revenue effects. This positive relationship between external and internal tariffs is robust across all of our specifications. Our results indicate that a one percentage point reduction in preferential tariffs was accompanied by 0.05 percentage points reduction in MFN tariffs in the short run and $0.3 - 0.35$ percentage points reduction in the long run. These estimates imply that the CUSFTA tariff preferences generated a decrease in the MFN tariff rate of 2.1% for the average Canadian industry between 1989 and 1998, accounting for 55% of observed external tariff cuts during that period. This result suggests that the size of the partner country may play an important role for the effect of an FTA on MTL because an FTA will have small effect on the terms-of-trade and tariff revenue when the partner country is small.

The results on the effect of the CUSFTA on lobbying activity, however, is inconclusive. Using various measures of industrial lobbying activity we failed to find any relationship between preferential tariff liberalization and MFN tariff changes in politically organized industries. These

results echo Ketterer, Bernhofen, and Milner (2014) who found no effect of political economy factors on the Canadian MFN tariff reductions in 1990s.[1] Unlike most of the previous studies that estimate the effect of FTAs on the political economy of trade policy, we move away from the assumption that all industries are equally involved in lobbying. We differentiate industries by lobbying intensity using the data from the Canadian Lobbyists Registry in order to identify the number of lobbyists representing each industry. Through the use of these data, we construct several alternative measures of industrial lobbying activity and use the modified protection for sale model to structurally estimate the effect of the CUSFTA on lobbying for MFN tariffs. In most specifications we unable to find any evidence of deeper tariff reductions in politically active industries. While this result may imply that the "rent destruction" effect was not among the main factors of the Canadian trade policy, it may as well be driven by lack of reliable measures of sectorial lobbying intensity.

The evidence on the presence of trade policy cooperation in the CUSFTA is mixed. On one hand, we show that the Canadian MFN tariffs declined deeper in 20% of the industries comprising the smallest US exports to Canada. The result that the Canadian government is more open to trade liberalization in industries where it does not erode exports rent of the US exporters is consistent with the hypothesis of trade policy cooperation. On the other hand, we do not find any effect of the US exports rent on the Canadian MFN tariffs in the remaining 80% of the industries. This partial evidence of trade cooperation is consistent with the findings by Lim (2006) and Karacaovali and Limão (2008) for the US and the EU, however contrast with Ketterer, Bernhofen, and Milner (2014), who document deeper Canadian tariff reductions in industries with the US presence. In these studies the identification of the "stumbling block" effect relies on whether products are imported from the partner country or not. For FTAs with small partners there is likely to be enough cross-industry variation in export status to identify the effect of interest. For the CUSFTA, however, more than 99% of all 6-digit HS products are exported by the US to Canada, which makes the identification of the stumbling block effect difficult as it relies on a very small number of industries. Our identification strategy, derived from the model of cooperative trade policy formation, relies on a richer cross-industry variation

[1] On the other hand, Karacaovali and Limão (2008) confirmed the presence of "rent destruction effect" in the EU trade policy during the Uruguay round of the WTO tariff reductions.

in the preference rent collected by the partner country. This allows us to run a more general test of the trade policy cooperation hypothesis.

The rest of the paper is organized as follows. Section 2.2 introduces a theoretical model of endogenous trade policy in the presence of an FTA, presenting the results on the effect of trade agreements on non-cooperative (Section 2.2.1), cooperative (Section 2.2.2), and political (Section 2.2.3) trade policies. Sections 2.3.1 and 2.3.2 develop the analytical framework for estimating the effect of FTAs on external import tariffs, and Sections 2.3.4 and 2.3.5 present regression results and extensions. Finally, section 2.4 concludes with a summary of our findings.

2.2 The Theory of FTA Trade Policy

In this section we review the main channels identified in the previous literature through which an FTA may affect external tariffs of its member countries. We present a simple model of monopolistic competition with differentiated products and restricted market entry[2] to illustrate those channels and to derive the equilibrium trade policy of an FTA under different theoretical assumptions. Predictions of this model will lay foundations for our empirical specifications which we use to estimate the effect of the CUSFTA on the Canadian trade policy.

Consider an economy with three countries indexed by H, P, and F, denoting home, FTA partner, and the rest of the world, respectively. All countries produce and trade $N+1$ goods, with the first good being a numeraire, traded at no costs and produced by perfectly competitive firms. This assumption fixes wages at the price of the numeraire good, normalized to 1. For all other industries i the number of firms in each country j is fixed and equals to n_{ij}, and each firm produces a distinct variety of the good. The representative consumer at Home is characterized by the following quasi-linear utility function:

$$U(X_0, X_i) = X_0 + \sum_{i=1}^{N} a_i \ln X_i, \quad \sum_{i=1}^{N} a_i = 1 \tag{2.1}$$

where X_0 is consumption of the numeraire good. X_i is the constant elasticity of substitution

[2] All key predictions of this model hold under alternative market structures as long as the terms-of-trade motive for trade policy is present.

sub-utility derived from consumption of good X_i:

$$X_i = \left(\sum_{j=H,P,F} \sum_{f=1}^{n_{ij}} d_{ijf}^{\frac{1}{\sigma_i}} c_{ijf}^{\frac{\sigma_i - 1}{\sigma_i}} \right)^{\frac{\sigma_i}{\sigma_i - 1}} \tag{2.2}$$

where σ_i is the elasticity of substitution between varieties of product i and d_{ijf} denotes the preference or quality parameter for good i produced by firm f in country j. Suppose that production costs in country j and industry i are constant and equal to w_{ij} and $d_{ijf} = d_{ij}$ for all i and j.[3] Then the profit-maximizing pricing strategy that firm f in industry i sets in the Home country market is

$$p_{ijf} = \left(\frac{\sigma_i}{\sigma_i - 1} \right) (w_{ij} + \tau_{ij}) \tag{2.3}$$

where τ_{ij} is the specific tariff imposed by the home country government on imports of good i from country j with $\tau_{iH} = 0$. National welfare W, defined as the indirect utility of the representative consumer, is the sum of consumer surplus from consumption of differentiated goods (CS), tariff revenue (TR), and profits of domestic firms (π_H):[4]

$$W_0(\tau) = CS(\tau) + TR(\tau) + \pi_H(\tau) \tag{2.4}$$

$$CS(\tau) = U(X_0, X_i, \tau) - \textstyle\sum_{j,i,f} p_{ijf} c_{ijf}$$
$$TR(\tau) = \textstyle\sum_{j=P,F} \sum_{i,f} \tau_{ijf} c_{ijf}$$
$$\pi_H(\tau) = \textstyle\sum_{i,f} \pi_{i,H,f}(\tau_i) = \sum_{i,f} \frac{p_{i,H,f} x_{i,H,f}(\tau_i)}{\sigma_i}$$

where τ is $2N \times 1$ vector of endogenously determined import tariffs set by the home country government according to some objective function. A common problem in the theoretical literature is that this objective function is unknown and what one assumes about the government's preferences may have important implications for the equilibrium trade policy. In what follows, we consider several specifications of the government's objective function most commonly used in the literature and then rely on empirical analysis to differentiate amongst the alternative specifications.

[3] This assumption implies that all firms within each country and industry are symmetric in terms of the costs structure and consumer's demand.

[4] Labor income is normalized to one and is omitted from the expression for welfare for simplicity.

2.2.1 Non-cooperative trade policy of an FTA

A large body of literature on FTAs with endogenous trade policy assumes that governments of FTA member countries have no political economy motivations and set import tariffs non-cooperatively. With the government's objective function being equal to national welfare, $G_0(\tau) = W_0(\tau)$, the resulting equilibrium ad-valorem import tariff t_{it}^F for imports of product i in year t from country F will maximize national welfare (2.4) and will take the form[5]

$$\varepsilon_i t_{it}^F = (\sigma_i - 1) s_{it}^P t_{it}^P + \frac{\sigma_i - 1}{\sigma_i} s_{it}^H \tag{2.5}$$

where ε_i is the price elasticity of import demand at Home, t_{it}^P is the preferential ad-valorem tariff rate on imports from the partner country, and s_{it}^j is the share of the Home country's market supplied by firms from country $j = H, P$. The first term on the right-hand side shows that the FTA's external and internal tariffs are positively related. This result was first obtained by Richardson (1993) and later termed as the "tariff complementarity" effect due to Bagwell and Staiger (1997b). Intuitively, a decline in the tariff rate towards the FTA partner country reduces imports from the ROW, thus reducing tariff revenue proportional to the partner country's market share s_i^P. Furthermore, the tariff revenue effect is stronger if varieties imported from the partner country and from the ROW exports are close substitutes. The second term on the right-hand side reflects the government's incentives to protect imperfectly competitive industries. This term stems from government's incentives to use trade policy in order to shift consumer expenditure from foreign to domestic producers because only profits of the latter enters the expression for national welfare and the government's objective function. Since the size of the market share of domestic firms affects the share of consumers' expenditure redirected to domestic producers, the strength of the reallocating effect of an import tariff is proportional to s_{it}^H. Moreover, the ability of trade policy to redistribute expenditure from foreign to domestic varieties is stronger when these varieties are close substitutes.

[5] See Technical Appendix (B) for complete derivation.

2.2.2 Cooperative trade policy of an FTA

The literature based on cooperative tariff formation has different predictions about the effect of an RTA on external tariffs. Using different theoretical frameworks, Kennan and Riezman (1990), Bagwell and Staiger (1997a), Bagwell and Staiger (1997b), and Ornelas (2007a) show that members of customs unions (CU), which set the common external tariff (CET) cooperatively in order to maximize the joint welfare of the union, tend to increase the MFN tariff relative to pre-CU level. There are two main contributing factors to the protectionist trade policies of a CU. Firstly, there is the terms of trade argument that arises from an increase in the economic size of the trading block, which in turn increases its market power and thereby allows member countries to redistribute surplus from their non-member trading partners. Secondly, CUs tend to have higher tariffs because their members take into account the effect of a CET on each others welfare. The cooperative trade policy of a CU internalizes the positive effect of a CET on export rents within the block, thus making CUs more protective than FTAs.

While the first factor simply reflects the increasing market power of the trading bloc, the second factor illustrates the role of cooperation on trade policy issues. When members of the trading block coordinate their trade policies, as they do in CUs, then the resulting trade policy becomes more protectionist as the member countries internalize the externalities created by their trade policies. Of course, one can argue that members of an FTA may not have enough incentive to cooperate on their trade policies, whereas countries in a CU are forced to cooperatively choose their CET. However, several recent studies have suggest that this may be the case. The theoretical model of an RTA, constructed by Limao (2007), features a public good supplied by individual countries which generates positive regional spillover. In his model, preferential tariffs can be used indirectly to forge cooperation on non-trade issues between RTA partners and to address the problem of underprovision of the public good with cross-border spillover effects. Accordingly, RTA members want to maintain their preference margins by keeping the MFN tariff high in order to stimulate economic and political involvement of their partners in non-trade issues, thus internalizing the decision on the provision of the regional public good.

We model trade policy cooperation by assuming that FTA member countries take into account the effect of their trade policies on each other and set import tariffs in order to maximize

the sum of their welfare. With segmented markets, the objective function of the home country government becomes the sum of national welfare and profits earned by the partner country's firms:

$$G_1(\tau) = W_0(\tau) + b\pi_P(\tau) = CS + TR + \sum_i (n_{iH}\pi_{iH} + bn_{iP}\pi_{iP}) \tag{2.6}$$

Parameter $b \in [0;1]$ measures the degree of trade policy cooperation between the two countries. When $b = 0$, $G_1(\tau) = G_0(\tau)$ and there is no trade policy cooperation. When $b = 1$, home country policymakers internalize the effect of τ on partner country's welfare completely. Differentiating the wights on foreign and domestic welfare in the objective function allows us to empirically test the trade cooperation hypothesis against the alternative of no cooperation.

In the presence of trade policy cooperation, the equilibrium import tariff with and without the agreement becomes:[6]

$$\begin{aligned}
\varepsilon_i t_i^F &= (\sigma_i - 1)\, t_i^P s_{iP} + \frac{\sigma_i - 1}{\sigma_i} s_{iH} + b\frac{\sigma_i - 1}{\sigma_i} s_{iP} && \text{with FTA} \\
\varepsilon_i t_i^F &= (\sigma_i - 1)\, t_i^P s_{iP} + \frac{\sigma_i - 1}{\sigma_i} s_{iH} - b\frac{\sigma_i - 1}{\sigma_i}\left(\frac{s_{iP}}{s_{iP} + s_{iF}}\right) && \text{without FTA}
\end{aligned}$$

and the effect of the agreement on the MFN tariff is

$$\frac{\sigma_i}{\sigma_i - 1}\varepsilon_i \Delta t_{it}^F = \sigma_i \Delta\left(s_{it}^P t_{it}^P\right) + \Delta s_{it}^H + b\left(s_{iP}^1 + \frac{s_{iP}^0}{s_{iP}^0 + s_{iF}^0}\right) \tag{2.7}$$

As long as FTA member countries cooperate their policies, there is an additional stumbling block effect of an FTA (the last term on the right-hand side of equation 2.7). This effect originates from the incentive of the home country's government to maintain a large enough preference margin for the partner by increasing the MFN tariff subsequent to FTA formation (or by decreasing it insubstantially).

2.2.3 Trade policy of an FTA under political economy

Our third empirical specification follows from a political economy model of trade policy proposed by Grossman and Helpman (1994). This model departs from welfare maximizing trade policy

[6] See Technical Appendix (B) for complete derivation.

and assumes instead that governments choose the level of tariffs in order to maximize the weighted sum of national welfare W and political contributions C provided by domestic special interest groups:

$$G_2(\tau) = aW_1(\tau) + C \tag{2.8}$$

where $W_1(\tau)$ is national welfare as defined in the previous section and $a > 0$ is the weight that government attaches to one dollar of welfare relative to one dollar of contributions. As in Grossman and Helpman (1994), we assume that some domestic industries are politically organized and provide the government with contribution schedules, which are contingent on its choice of trade policy, while others are not and do not participate in the tariff-setting process. Let I_i be an indicator variable which takes the value of one if industry i is organized or zero otherwise. Then the objective of the home country government is to choose τ which maximizes

$$G_2(\tau) = aW_1(\tau) + \sum_i I_i C_i(\tau) \tag{2.9}$$

Grossman and Helpman (1994) show that with truthful contribution schedules, the optimum trade policy choice maximizes the preference-weighted sum of national welfare and welfare of organized interest groups, which includes profits, consumer surplus and their share in redistributed tariff revenue. In the presence of a preferential trade regime between countries H and P, the equilibrium tariff imposed on imports from country F takes the following form:

$$\frac{\sigma_i}{\sigma_i - 1}\varepsilon_i t_{it}^F = \sigma_i s_{it}^P t_{it}^P + \frac{a}{a+\alpha} s_{it}^H + \frac{1}{a+\alpha} I_i s_{it}^H + \frac{b}{a+\alpha} s_{iP} \tag{2.10}$$

where α is the share of population represented by one of the lobbying groups. The third term on the right-hand side measures the effect of domestic lobbying on the MFN tariff. The positive coefficient implies that MFN tariffs are higher in industries with the presence of domestic lobbying.[7] As with the second term, the redistributive power of import tariffs depends on the

[7] It is important to note that under the assumption that all industries are politically organized ($I_i = 1$ for all i), used in most of the political economy of trade literature, equation (2.10) becomes

$$\frac{\sigma_i}{\sigma_i - 1}\epsilon_i t_{it}^F = \sigma_i s_{it}^P t_{it}^P + \frac{a+1}{a+\alpha} s_{it}^H + \frac{b}{a+\alpha} s_{iP}$$

and the effect of lobbying cannot be identified separately from the market structure effect in the regression

share of domestic firms in the market and on the degree of product differentiation. Equation (2.10) states that there is an additional channel for the effect of an FTA on the MFN tariff. Since the strength of domestic lobbying is proportional to s_{it}^H, an FTA and the following reduction in the market share of domestic firms will weaken lobbying power of the industry and reduce its lobbying intensity for protection. This additional pro-liberalization effect of trade agreements was first identified by Ornelas (2005b) who demonstrated that FTAs erode protection rent enjoyed by home country firms.

2.3 Empirical implementation

2.3.1 Econometric specifications

Equations (2.5), (2.7), and (2.10) summarize three main channels for the effect of an FTA on trade policies of member countries and motivate our main empirical specifications. After the introduction of an error term to the most parsimonious model, which excludes cross-border externalities and political economy factors, the empirical specification based on model (2.5) becomes:[8]

$$\begin{aligned} Y_{it} &= \alpha + \phi_1 X_{it}^1 + \phi_2 X_{it}^2 + \gamma_i + \gamma_t + u_{it} \\ Y_{it} &= \frac{\sigma_i - 1}{\sigma_i} \varepsilon_i t_{it}^F, \; X_{it}^1 = s_{it}^P t_{it}^P, \; X_{it}^2 = s_{it}^H \end{aligned} \tag{2.11}$$

where γ_i and γ_t are industry and year fixed effects which capture the influences of time- and industry-invariant factors that are not present in the theoretical model but may affect trade policy formation. Given that the model is static and does not inform us about the dynamic response of MFN tariffs to changes in the right-hand side variables, we apply two alternative time-difference operators in order to identify coefficients ϕ_1 and ϕ_2:

$$\Delta Y_{it} = \alpha + \phi_1 \Delta X_{it-1}^1 + \phi_2 \Delta X_{it-1}^2 + \gamma_t + u_{it} \tag{2.12}$$

$$\Delta_9 Y_{i,98} = \alpha + \phi_1 \Delta_9 X_{i,1998}^1 + \phi_2 \Delta_9 X_{i,1998}^2 + u_i \tag{2.13}$$

analysis.

[8] We exclude σ_i from X_{1t} in the estimation equation to reduce the chance of having a measurement error.

Equation (2.12) is in first differences and measures short-term relationship between MFN and preferential tariffs (all explanatory variables are lagged by one year to allow for a small delay in response in the dependant variable). Although CUSFTA tariff cuts took place between 1989 and 1998 whilst most of the MFN tariff reductions, negotiated at the Uruguay Round of the WTO, occurs after 1995, there is still enough variation in both variables prior to 1995 to identify the presence of short-term response in MFN tariffs to CUSFTA trade liberalization.[9] Yet, Canada does not change its import tariffs frequently and it may take more than one year for the MFN tariff to react to changes in the market environment. Therefore, our second empirical specification is equation (2.11) differenced over the entire time period of the CUSFTA trade liberalization in order to estimate the long-term response of the MFN tariffs to variation in the right-hand side variables.[10] While model (2.12) can provide important information on short-term adjustments in trade policy to preferential liberalization, the more general long-run model (2.13) will be used to gauge the overall effect of the CUSFTA on Canadian multilateral tariff changes during the Uruguay Round of the WTO tariff reductions.[11]

Estevadeordal, Freund, and Ornelas (2008), henceforth EFO, use the intuition behind equilibrium import tariff (2.5) in order to test the reduced form relationship between external and internal tariffs for a group of Latin American countries. Their findings confirm that tariff preferences within RTAs are inversely related to changes in MFN tariff rates. Before presenting results for the structural estimation, we will start with the empirical specification similar to the one suggested by EFO and examine the response of Canadian MFN tariffs to preferential tariff cuts on US imports:

$$\Delta t_{it}^{F} = \alpha + \phi_0 \Delta t_{i,t-1}^{P} + \gamma_t + u_{it} \tag{2.14}$$

[9] More than half of the variation in MFN tariffs during 1990-1994 time period occurs within industry, comparing to three quarters for the time period 1995-1998. These fractions are very similar when calculated using 10-digit HS industry classification at which commodity tariffs are defined. Although the overall variation in MFN tariffs after 1995 is four times greater than before, we believe it is enough to identify ϕ_1 and ϕ_2 on both subsamples. In the Section 2.3.5 we report results estimated from the two subsamples separately.

[10] There can be a concern about endogeneity that arises from elasticity in the dependent variable because elasticity may determine market shares. We address this concern by using a number of different instrument variables for market shares. For example, factor endowments, used as instruments for Canadian market shares, should be independent of elasticity and external policy, and at the same time provide exogenous variation in the Canadian market shares. Details about other instrument variables are provided in section 2.3.2.

[11] The negotiation of CUSFTA began in the mid-80s before it became effective on Jan 2^{nd} 1988, so the reduction of preferential tariff is predetermined before the Uruguay Round in 1995. Therefore the reduction of preferential tariff should be exogenous to the Uruguay Round.

$$\Delta_9 t^F_{i,1998} = \alpha + \phi_0 \Delta_9 t^P_{i,1998} + u_i \tag{2.15}$$

Since tariff preferences to a partner country reduce socially optimal external tariffs both through the tariff revenue effect (X^1_{it}) and through the market structure effect (X^2_{it}), we expect $\phi_0 > 0$. Positive ϕ_0 would imply that reductions in preferential tariff are followed by MFN tariff cuts and support the tariff complementarity hypothesis.

The intuition for the test of the trade policy cooperation hypothesis comes from equation (2.7). When countries set their trade policies cooperatively, an FTA will have an additional positive effect on the MFN tariff which operates through two channels. First, cooperation implies lower tariffs in industries with large US market shares prior to the establishment of an FTA, and this effect vanishes once US firms receive preferential market access in Canada. Second, MFN tariffs generate rent to the partner country firms under the FTA so that the home country government will tend to provide more protection to industries which yield more rent to the partner country's firms. Together, these two effects induce an increase in the external tariffs amongst industries that have a large US presence in the Canadian market.

However, with trade policy restrictions imposed by the WTO, identification of cooperation in trade policy from equation (2.7) becomes problematic. First, the WTO tariff ceiling binding will either prevent tariffs from raising entirely or narrow the scope for increase to the gap between the binding and the applied tariff rates. Second, at the Uruguay Round (UR) of the WTO negotiations, the Canadian government committed to a 33% reduction in the average MFN tariff between 1995 and 1999, and by 1999 the applied MFN tariff rate had increased in only 3% of all industries relative to pre-CUSFTA levels. These two exogenous constraints on tariff adjustments imply that the effect of trade policy cooperation on changes in the MFN rates may not propagate through the US market share in the way predicted by equation (2.7).[12]

To identify the trade policy cooperation effect, we rely on the variation in MFN tariffs generated by the UR of tariff reductions. By varying the depth of tariff cuts across industries, countries had a considerable degree of flexibility in achieving the UR target of the reduction in the average MFN tariff by one-third. Although a common presumption is that the GATT trade liberalization is based on reciprocity, Finger, Reincke, and Castro (2002) point out that there

[12] It is important to note that the two other three effects of FTA on external tariffs studies in this paper are negative and can thus be identified in the presence of ceiling tariff bindings.

was no specific formula applied to achieve the average tariff reduction target, giving negotiators some freedom in applying discretionary tariff cuts in different industries. Since tariff concessions are the outcome of a bargaining process in which every country protects its national interests, negotiators would trade-off interests of different industries and could extend protection to some industries at expense of deeper concessions in others. Therefore, the observed tariff concessions must reflect those national interests, and in particular the trade cooperation motive, if it is present in the objective function of a policymaker.

To understand how tariff concessions will differ across industries in the presence of trade policy cooperation, we differentiate the rent earned by the partner country exports to the home country with respect to the MFN tariff:

$$b\frac{\partial \Sigma_i \left(n_{iP}\pi_{iP}\right)}{\partial \tau_{iF}} = bn_{iP}\frac{\partial \pi_{iP}}{\partial \tau_{iF}} = b\xi_i \frac{\sigma_i - 1}{\sigma_i}\left(n_{iP}p_{iP}q_{iP}\right)$$

where $\xi_i = \frac{\partial P_i}{\partial \tau_{iF}}\frac{\tau_{iF}}{P_i}$ is the elasticity of the price index with respect to the MFN tariff. The MFN tariff affects a partner country's export rent through ξ_i (when ξ_i is large, tariffs have stronger effect on foreign firms' prices), elasticity of substitution (large σ_i implies stronger redistributive effect of price changes on consumer expenditure), and the value of imports from the partner country ($n_{iP}p_{iP}q_{iP}$). Therefore, when $b > 0$ and the partner country's rents enter the objective function of the home country's policymaker, a commitment to reduce the average MFN tariff by a certain amount will stimulate the home country to cut tariffs deeper in industries with smaller imports from the partner country, all else being equal. This is because in those industries a given preference margin applies to a smaller volume of exports and as such generates less rent to the partner country. In the absence of reliable data on the elasticity of substitution and price elasticity with respect to tariff, we rely on the variation in the value of US exports to identify the effect of trade policy cooperation.

The above result implies that if cooperation motives are present in the objective function of a policymaker, they should only play a role in industries where the partner country earns non-zero rent. We therefore introduce an indicator variable D_{it} which takes the value of one for goods imported from the US in specifications (2.12) and (2.13):

$$\Delta Y_{it} = \alpha + \beta_0 D_{it} + \phi_1 \Delta X^1_{it-1} + \phi_2 \Delta X^2_{it-1} + \gamma_t + u_{it} \tag{2.16}$$

As with equations (2.12) and (2.13), the model (2.16) is estimated using short and long time differencing. If $b > 0$, we would expect to find $\beta_0 < 0$. It should be emphasized that this test is identical to Lim (2006) and Karacaovali and Limão (2008) who derive the relationship between tariff reduction and preferential import indicator variables from the model where countries choose cooperative tariff rates in order to generate more rent to their FTA partner and to stimulate provision of the regional public good.

However, our preferred method for estimating the stumbling block effect is different from model (2.16) for two reasons. First, Canadian imports from the US are positive for nearly 99% of all 6-digit HS industries and identification of coefficient β_0 relies on too few observations. Second, in the presence of trade policy cooperation we would expect sectors with greater US involvement to observe less trade liberalization since the tariff concessions in those industries have stronger negative impact on the partner's export rent. Therefore, we differentiate industries according to their importance for US exports to Canada, and estimate the relationship between the volume of exports and trade liberalization along the distribution of the share of each industry in total US exports to Canada. In particular, we use quintiles of the distribution of the US export share to Canada to categorize industries into five groups. Denoting by D_{it}^k a dummy variable which takes the value of one if industry i falls into k-th quintile, the empirical specification becomes as follows:[13,14]

$$\Delta Y_{it} = \alpha + \sum_{k=1}^{4} \beta_k D_{it}^k + \phi_1(\sigma_i - 1)\Delta\left(s_{it}^P t_{it}^P\right) + \phi_2 \frac{\sigma_i - 1}{\sigma_i} \Delta s_{it}^H + \gamma_t + u_{it} \tag{2.17}$$

If tariff cooperation exists in the CUSFTA, industries that have higher US representation should receive more protection against foreign competition in the Canadian market. Thus, we expect

[13] We also experimented with the interactions of D_{it}^k and preferential tariff changes to check if the effect of the terms-of-trade channel varies across industries with different US exports. Since these interactions are insignificant in all of our specifications, we do not report the results in the paper but they are available upon request.

[14] It is important to note that while the empirical specification (2.17) is different from Lim (2006) and Karacaovali and Limão (2008), introduction of the regional public good in our theoretical model will lead to the same prediction that industries with more imports from the US should experience smaller MFN tariff reductions. In Venables and Limao (2002) model Home country and the rest of the world negotiate multilateral tariff cooperatively in order to maximize joint welfare. Under this assumption, the effect of tariff preferences on public good provision is positive only for the corner case when the preferential tariff rate is zero and can thus be empirically estimated only for a subset of industries with free trade between FTA partners. In the absence of multilateral tariff negotiations, as in the case of our model, the effect of tariff preferences on the public good provision by the partner will be increasing in the US revenue from exporting to Canada. Derivations are available upon request.

all β_i to be negative which would imply that industries that contribute the most to the US exports to Canada are the least liberalized ones (the omitted category is industries with the largest US exports to Canada). Moreover, if industries with larger export shares tend to be more protected, we would expect to find the following ranking of β_k coefficients:

$$\beta_{k-1} < \beta_k < 0, \forall k = 2, 3, 4 \tag{2.18}$$

Therefore, since the US exports to Canada are positive for nearly all 6-digit HS product categories, we use equation (2.17) to identify the cross-industry variation in the strength of the trade policy cooperation effect which varies with the partner country's gain from tariff preferences.

Finally, to arrive at our most complete empirical specification with political economy factors, we rearrange equation (2.10) by adding fixed effects and time differencing it:

$$\Delta Y_{it} = \alpha + \beta_0 D_{it} + \phi_1 \Delta X^1_{it-1} + \phi_2 \Delta X^2_{it-1} + \phi_3 \Delta X^3_{it-1} + \gamma_t + u_{it} \tag{2.19}$$

$$\Delta_9 Y_{i,98} = \alpha + \beta_0 D_i + \phi_1 \Delta_9 X^1_{i,1998} + \phi_2 \Delta_9 X^2_{i,1998} + \phi_3 \Delta_9 X^3_{i,1998} + u_i \tag{2.20}$$

where $X^3_{it} = I_i s^H_{it}$. Positive coefficient ϕ_3 would imply that while politically organized industries tend to receive more protection from policymakers in general, a reduction in the domestic market share, triggered by the partner country's preferential market access, would cause deeper tariff cuts in those industries.[15] The reason for deeper tariff cuts is that FTAs lead to a reduction in protectionist rent retained by domestic firms since a part of this rent will be netted by the partner country's firms. This "rent destruction" effect, originally identified by Ornelas (2005b), weakens the incentives of domestic firms to lobby for protection and results in lower levels of external tariffs by moderating political economy distortions.

2.3.2 Estimation issues

Since we are interested in establishing a causal effect of the CUSFTA on Canadian multilateral trade liberalization, it is important to discuss endogeneity concerns with preferential trade

[15] Most of the previous empirical literature, e.g. Karacaovali and Limão (2008) and Ketterer, Bernhofen, and Milner (2014), assumed that all industries are equally active in lobbying. Under this assumption, $X^1_{it} = X^3_{it}$, making it impossible to identify separately the market structure and political economy effects.

liberalization measures and the ways of dealing with them. Preferential tariff cuts is the primary concern for potential endogeneity. The CUSFTA came into force on January 1, 1989, and resulted in the elimination of nearly all tariffs by 1998. Trade liberalization between the two countries followed tariff reduction schedules, which were adopted in 1986-1987 when the CUSFTA was negotiated. Given that most MFN tariff cuts took place after 1995, preferential tariff reductions can be viewed as predetermined relative to subsequent MFN tariffs and the reverse causation from multilateral to preferential trade policy is unlikely. While there can be other factors affecting both preferential and MFN tariffs, such as industry-specific variation in economic and political conditions, to the extent that the Canadian government committed itself to removing tariffs on US imports entirely, preferential tariff cuts seem to be *a priori* exogenous to variation in MFN tariffs.

However, there is one caveat that should be kept in mind when preferential tariff cuts are viewed as exogenous. The fact that tariffs were completely eliminated by 1998 implies that in specifications with changes over the entire CUSFTA phase-out period, Δt^P will be highly collinear with the initial MFN tariff rate and may thus capture the ease of tariff cut implementation. This should be less of a problem in structural specifications where the interaction of Δt^P with the US market share captures the economic value of tariff complementarity effect for tariff revenue. Yet, as a robustness test, we also run specifications where Δt^P and ΔX^1 enter separately to isolate the effect of the FTA on the government's economic incentives to change external tariffs from the effect of initial tariff rate on flexibility of trade policy adjustment. In general, however, the causal interpretation of our results should be treated with caution in the absence of good instruments for preferential tariff changes.

The indicator variables for the US presence in the Canadian market can also be endogenous due to the reverse causation since the decision to export to Canada and the share of industry in total US exports may depend on the preference margin. To deal with the endogeneity of the FTA's partner export dummy variable, we follow Limao (2006) and use the instrumental variable approach. The first instrument for D_{it} is the dummy variable which takes the value of one for products exported by the US to Canada in 1988, the last year before the first round of the CUSFTA tariff cuts, which makes this instrument independent of tariff preferences. Our second instrument is the dummy variable which takes the value of one for products exported by the US

to the ROW in 1988. This is a valid instrument because, on one hand, the US export structure to other countries prior to the CUSFTA formation is independent of Canadian trade policy during the years 1989-1998, and, on the other hand, positively correlated with the structure of the US exports to Canada. The third instrument is the change in the world price for product i, which is measured as the absolute change in price in the previous year for the short-run specifications and as a change between 1989 and 1994 for the long-run specifications. While correlated with incentives to export, world price changes occurring prior to the decision to adjust MFN tariffs are likely to be exogenous. Using the same logic, we use quintile dummies for product i in year 1988 and their interactions with price changes as defined above to instrument D_{it}^k variables. Quintile dummies constructed for 1988 represent valid instruments for D_{it}^k because ranking of industries' in US exports to Canada prior to CUSFTA formation is independent of subsequent MFN tariff changes but is highly correlated over time. When interacted with price changes, these variables capture transitions across quintiles of the US export share distribution over time due to exogenous changes in the world prices.

Another challenge with the estimation of equations (2.19) and (2.20) is the endogeneity problem arising from the simultaneity of market shares and the MFN tariff rate. We address this problem by using a number of different instrumental variables for s_{it}^H and s_{it}^P suggested by previous literature. For the Canadian market share, the list of instruments includes factor shares of physical capital, non-production labour, intermediate inputs, and fuel and electricity in industry's output using 6-digit NAICS industry classification. Trefler (1993) suggests that industry's factor endowments are independent of the level of protection and thus provide exogenous variation in the Canadian market share. As an additional instrument, we use the revealed comparative advantage index proposed by Balassa (1965).[16] An increase in the revealed comparative advantage index would imply an increase in the competitiveness of Canadian firms, and one would expect to see an increase in the share of domestic firms and a decrease in the share of foreign firms in the Canadian market. At the same time, we found no evidence that

[16] The revealed comparative advantage index is constructed at the product level as $RCA_{it} = \frac{X_{it}/\Sigma_j X_{jt}}{Z_{it}/\Sigma_j X_{jt}}$, where X_{it} is Canadian exports of good i in year t to all countries other than US, and Z_{it} is the corresponding level of exports by all other countries to all destinations excluding the US. The US market is excluded from the calculation since US tariff preferences for Canada, determined simultaneously with Canadian preferences for the US, could have changed the structure of the Canadian exports. In the empirical analysis we use a symmetric index of revealed comparative advantage: $RSCA_{it} = \frac{RCA_{it}-1}{RCA_{it}+1} \in [-1; 1]$.

Canadian tariff preferences for the US products are related in any systematic way to the growth rate of Canadian exports to other countries, thus there are no reasons to believe that the revealed comparative advantage index is affected by the Canadian MFN tariff.[17] Similarly, the index of the US revealed comparative advantage in the world market, excluding Canada, is used to instrument the share of US firms in the Canadian market.

To address the issue of measurement error in the political organization dummy variables, constructed from an indirect measure of lobbying activity and discussed in details in the next section, we follow the general approach in the political economy literature by instrumenting them with the market concentration ratio and with the log of average scale. Equation (2.19) and (2.20) are estimated by 2-step GMM and all instruments which do not pass the orthogonality to the structural error test at a 95% confidence level are excluded from the first stage regression. Since both equations are non-linear in endogenous variables, we also include the cross product of instruments for market shares and political organization dummy variables in the list of instruments.[18] Similarly, to instrument X_{it}^1 we use the cross-products of instruments for s_{it}^P and the preferential tariff changes, treating the latter as exogenous. All empirical specifications include Canadian tariff rate in 1988 as an additional regressor to control for the cross-industry variation in the scope of the MFN tariff reductions.

2.3.3 Data

The data used for this paper come from several different sources and cover the time period from 1989 to 1998, which is the entire phase-out period of import tariffs under the CUSFTA. While trade data is available at 6-digit HS product classification, all industry-level data is only available at 6-digit NAICS. We keep the data at the 6-digit HS classification, and whenever data are available only at a higher level of aggregation, it is replicated for all 6-digit HS codes within the corresponding aggregate industry.[19] Canadian import and tariff data are obtained

[17] Bown and Crowley (2007 JIE), however, document positive effect of US antidumping duties against China on Chinese exports to other countries. Therefore, in our empirical analysis we pay close attention to the validity of the exclusion restriction tests.

[18] Wooldridge (2010) shows that cross-products of two sets of exogenous variables are the most relevant instruments when dealing with the product of two endogenous variables.

[19] For this reason, in all regressions where industry-level data is used the standard errors are clustered at the 6-digit NAICS level.

from Statistics Canada at HS-6 level. Import tariffs are constructed as a ratio of import duties over the value of imports.[20] The data on output, capital, employment, intermediate inputs, and fuel and electricity consumption is also provided by Statistics Canada. It is recorded at 6-digit NAICS, and we use concordance provided by Industry Canada to make it compatible with the 6-digit HS classification. The home country's market shares were constructed at 6-digit NAICS level as the value of industry shipments (net of exports) relative to total consumption (total shipments minus net exports). The US market share is constructed similarly as the ratio of Canadian imports from the US relative to domestic consumption. The data on Canadian, US, and the ROW's exports, used in the construction of revealed comparative advantage indices, come from the World Bank's World Integrated Trade Solution (WITS) database, and is recorded at a 6-digit HS classification. Elasticities of substitution for Canada, σ_i, were obtained from Broda, Greenfield, and Weinstein (2006b) at 3-digit HS industry classification. Import demand elasticities were obtained from LooiKee, Nicita, and Olarreaga (2009) at 6-digit HS level.

Table 2.1 provides the summary statistics for the key variables in this study. The average MFN tariff is 5.7% and the average preferential tariff is 2.5% during the phase out period, suggesting that the average preferential margin is equal to 3.2%. The average annual reduction in the MFN tariff is 0.4%, which is 0.3 percentage points less than the average reduction in the preferential tariff. The mean value for the Canadian home market share decreased by approximately 1% annually, from 63% in 1990 to 53% in 1998. During the same period, the US market share in Canada increased by 1% annually, from 21% in 1990 to 29% in 1998.

To construct political organization dummy variables we use data from Stoyanov (2009) and then apply different approaches to categorize industries into politically organized and unorganized ones. The data include information on lobbyists officially registered with the Canadian Registrar of Lobbyists, the subject-matter for communicating with government officials, and the firms which recruited them. Working with only those lobbyists who contact policymakers regarding international trade policy issues allows us to construct political economy variables with a more pronounced relationship to trade policy formation. Each firm is assigned to one 6-digit NAICS industry based on its primary manufacturing activity. We then calculate the

[20] Since this is not a perfect measure of import tariffs, we exclude 1% of observations with the highest MFN and preferential tariffs from the data to minimize the risk of measurement error.

total number of lobbyists representing interests of each 6-digit NAICS industry. Since the theory is not very informative about how to classify industries into politically active or non-active, we, thus, construct four different measures of industrial political organization to analyze the sensitivity of estimation results to the formulation of this generated variable. In our first two measures, we classify an industry as politically active ($I_i = 1$) if it is represented by at least one and at last three lobbyists, respectively. The summary statistics for these two dummy variables, I_1 and I_2, is presented in Table 2.1.

To build our third measure of political activity, we follow Gawande and Bandyopadhyay (2000b) and regress the number of lobbyists in an industry on the import penetration ratio interacted with a 3-digit NAICS dummy variables and a constant term.[21] All industries with positive coefficients on these interactions are defined as politically active. The intuition behind this definition of political organization is that industries threatened more by import competition will seek greater protection from the government. We label this variable as I_3.

In construction of the fourth measure of political organization dummy, we follow Matschke (2008) in which the number of lobbyists is regressed on the deadweight loss of protection (normalized by the value added) interacted with 3-digit NAICS dummies. As with the previous measure, all industries with positive coefficients are assumed to be politically organized ($I_4 = 1$), while others are not. This specification is motivated by the theoretical prediction that in industries with larger welfare losses from protection domestic interest groups should spend more resources on lobbying and recruit more lobbyists.

The last mechanism for constructing political organization relies on the rates of Canadian preferential liberalization. Tariff reduction schedules between Canada and the US classified all products into three categories. Tariffs on products in the first category were eliminated entirely in the first year of the agreement, and tariffs for the other two groups were eliminated in equal annual stages over five and ten years, respectively. Assuming that the most politically active industries would be sheltered by more protectionist tariff reduction schedules, we classify all industries in the third category as politically organized. In other words, we use information on

[21] Since we do not model endogenous lobby formation, we do not allow industrial political activity to vary over time. Hence, in construction of the third and fourth measures of political organization we use the data for 1988 and then extrapolate the results for the rest of the sample. Focusing on the lobbying stucture in the year leading up the the CUSFTA formation has the advantage that these measures of lobbying activity are unlikely to be driven by factors related to the agreement.

the observed changes in trade policy to reveal "sensitive" industries, which makes this measure better connected to lobbying for trade policy than the ones based on lobbyist headcount. At the same time, we should keep in mind that industries may be sensitive for a variety of factors unrelated to lobbying.

2.3.4 Estimation Results

In this section, we present the estimation results for the empirical models described in Section 2.3.1 and discuss the implications of each of them.

Table 2.2 presents short-run estimation results for reduced form specification (2.14). The positive and statistically significant estimate of ϕ_1 coefficient in column (1) supports the tariff complementarity hypothesis and indicates that tariff preferences granted to the US are associated with reductions in the MFN tariff rate in the following year. The estimate of 0.1053 implies that every one percentage point reduction in preferential tariffs is associated with 0.1053 percentage points reduction in the MFN tariffs, which is nearly identical to the estimates of $0.1-0.12$ obtained by EFO for Latin American countries in comparable empirical specifications. If one believes that the tariff preference schedules, negotiated in 1987-88, are pre-determined, then this relationship can be considered casual unless there are some dynamic factors which had affected the CUSFTA negotiations in 1980s and the propensity to liberalize MFN tariffs in 1990s. Applying our results for an average industry, the reduction in preferential tariff rates caused an additional annual reduction in the MFN rate by 0.08 percentage points and can explain almost 20% of the overall MFN tariff cuts between 1989 and 1998.

To test the hypothesis that Canadian MFN tariff reductions in 1990s were set cooperatively with the US, we regress annual changes in the MFN tariff on the indicator variable D_{it} in column (2). Canadian preferential tariffs provide US firms with a competitive advantage against firms from outside of the CUSFTA. Therefore, if the CUSFTA trade policy is set cooperatively, the Canadian government would rely upon trade policy to protect the interests of US firms in Canada and we would expect to observe slower MFN tariff reductions in industries with larger share of imports from the US. The OLS estimate of the coefficient on D_{it} in column (2) is insignificant, both statistically and economically, which does not support the hypothesis of cooperative trade policy. However, as it was discussed previously, the construction of this

variable may result in a specification problem since for more than 99% of all industry-year observations there is a positive value of Canadian imports from the US. Hence, there may not be enough variation in D_{it} to identify the presence of cooperative motives in trade policy formation.

Column (3) presents results with D_{it} disaggregated into quintiles of industry i's share in total US exports to Canada. With the fifth quintile being the omitted category, we would expect tariffs to decrease faster in industries in the first four quintiles if tariffs were set cooperatively. Indeed, all coefficients are negative but only one of them is statistically significant at 85% confidence level, providing little evidence of a smaller reduction in Canadian MFN tariffs in industries which are more important for the US exports. Finally, results of a complete specification in column (4) suggest that the size of the US industry is not related to the change in Canadian MFN tariffs, while tariff complementarity effect is still present and statistically significant.

The results with IV estimates in columns (5)-(8), which address simultaneity of MFN tariffs and import indicator variables D_{it} and D_{it}^{k}, also point to the dominance of the "building block" effect of the CUSFTA. The coefficient on preferential tariff change is nearly the same as in the OLS specifications and is statistically significant, indicating that every percentage point increase in tariff preferences is associated with around 0.1 percentage points reduction in the MFN tariff in the following year and by 0.179 percentage points over three years (column 8).[22] At the same time, the evidence on slower MFN tariff reduction in industries which have more economic significance for the US is weak as only one of the dummy variables has expected sign and is statistically significant.

The results presented so far focus on the reduced-form short-run relationship between MFN and preferential tariffs. In Table 2.3 we report the regression results for short-run specifications derived from the theoretical model of an FTA with endogenous trade policy. Column (1) illustrates the estimation results for equation (2.12) derived from the model with non-cooperative trade policy formation (2.5). The positive and statistically significant estimate of ϕ_1 indicates that a drop in the preferential tariff is associated with a reduction in the MFN tariff. Com-

[22] The Angrist-Pischke first stage F-test always rejects the null of weak instruments for all endogenous variables in all specifications at 99% confidence level. We also cannot reject the hypothesis of exogeneity of instruments, suggesting that our instruments are overall of a good quality.

paring the magnitude of this effect with the one in the reduced-form specification, the two are qualitatively similar. The coefficient of 1.6817 in column (1) indicates that an average industry experiences a 0.07 percentage points reduction in the MFN tariff per year due to CUSFTA tariff preferences, which accounts for nearly 17% of observed average MFN tariff reduction over the analyzed period. The coefficient on the Canadian market share, which captures the role of industry structure in imperfectly competitive markets for trade policy, is not statistically significant in all specifications.

Estimates of the model (2.17) in columns (3) and (4) produce more clear evidence on the presence of trade policy cooperation between the CUSFTA member countries. Analyzing the OLS results in column (3), we find that industries with less exports from the US observe deeper MFN tariff reductions, as predicted by the model with cooperative trade policy. For instance, the coefficient $\beta_1 = -0.0139$ implies that industries in the first quintile of the US import share distribution experience additional 0.4 percentage points decrease in MFN tariff per year relative to industries in the fifth quintile.[23] Furthermore, the ranking of β_k coefficients confirms that industries contributing relatively more to the US exports to Canada receive smaller reduction in multilateral tariffs. In results from IV regressions in column (4) this ranking is not preserved, however the hypothesis that the industries with less imports from the US are liberalized at a faster rate still cannot be rejected.[24]

The results discussed so far suggest that there is a strong contemporaneous relationship between reductions in MFN and preferential tariffs. We now turn to estimating the long-term effect of the CUSFTA on Canadian multilateral tariffs. In Table 2.4 we report the estimates for equation (2.15) to see how total changes in MFN tariffs between 1989 and 1998 were associated with the overall reduction in preferential tariffs and the accompanying changes in market shares over the entire CUSFTA trade liberalization time period. The comparison of the long-run and short-run elasticities of the MFN tariff change with respect to the preferential tariff change reveals considerable differences between them. The coefficient of 0.1996 in the first column of Table 2.4 indicates that each percentage point reduction in the preferential tariff that took place

[23] With the mean value for the elasticity-adjustment term $\frac{\sigma_i - 1}{\sigma_i}\epsilon_i$ being equal to 3.5, an additional reduction in the MFN tariff for the average industry in the first quintile is $\frac{0.0139}{3.5} \simeq 0.004$.

[24] Moreover, the Hausman endogeneity test fails to reject the null hypothesis of endogeneity of D_{it}^k variables and thus we cannot reject the consistency of the OLS estimates in column (3).

between 1989 and 1998 is associated with 0.2 percentage points reduction in the multilateral tariff, which is nearly twice as large as the short-run elasticity. Results from the structural estimation, presented in Table 2.5, point to similar conclusion: MFN tariff changes are two to four times more responsive to preferential tariff cuts in the long run than in the short run.

Another noticeable difference between the short-run and long-run results are the coefficients on the US import dummy variables which all turn positive in the OLS regressions. This result seems to suggest deeper tariff cuts in industries with a larger US presence. However, these aforementioned results should be treated with caution. When the relationship between the MFN and preferential tariffs is estimated using the structural model (2.13), the coefficients on D_{it}^k become negative (Table 2.5, column 3). The likely reason for this is that larger tariff preference may lead to a larger increase in the US presence in Canadian markets, making the MFN import tariff less efficient in protecting domestic producers and, thus, weakening protectionist forces. Once the effect of the US market share in Canada is controlled for through the X_i^1 variable in the structural model, the results of the short-run and long-run models become very similar. In the most complete specification (column (4) of Table 2.5), industries in the first quintile of the US export share to Canada experience additional 4.57 percentage point reduction in the MFN tariff relative to industries in the fifth quintile over the period 1989-1998. In fact, it is only 20% of industries with the smallest US exports to Canada which observe larger reductions in the MFN tariff. The effect of the size of the US exports does not vary across the remaining industries.

In sum, there is strong evidence that Canadian MFN tariff rates feature complementarity with CUSFTA tariff preferences. Reductions in the preferential tariff rates are always found to induce a reduction in the multilateral tariffs. The evidence on the presence of cooperative motives in trade policy is less clear though. The OLS results provide strong support for the hypothesis that Canadian multilateral tariffs decreased slower in industries which generate more revenue for US exporters. This suggests that Canadian policymakers at least partially internalize the effect of MFN tariff choice on US producers. The IV results are less conclusive, but we can never reject the hypothesis that industries in the fifth quintile of the US export share distribution experience greater reductions in the MFN tariffs than industries in the first three quintiles.

We now turn to empirically testing the final prediction of the theoretical model concerning the effect of an FTA on MFN tariffs in the presence of political economy factors. According to the model (equation 2.10), an FTA reduces the share of domestic firms in the market due to an increase in the partner country firms' presence, weakening the redistributive power of the import tariff and reducing the incentive for domestic special interest groups to lobby for protection. The estimation results of the full model using IV-GMM are presented in Table 2.6. The first five columns report results for the short-run model (2.19) using five different measures of I_i, and the last five columns report results for the long-run model (2.20).

The estimation results provide no evidence for the effect of the CUSFTA on lobbying for protection: the estimates of ϕ_3 are statistically insignificant and are not robust to the definition of the political organization. Contrary to the model's prediction, a shrinking domestic market share is not found to be associated with a decline in lobbying power of special interest groups and a deeper reduction in the level of protection granted to politically organized industries. The study by Ketterer, Bernhofen, and Milner (2014) also find no effect of the CUSFTA on lobbying for protection against outsiders, although they do not attempt to classify industries by the degree of political organization and simply assume that all industries are equally active in lobbying.[25] It is important to note that although we do not find support for the hypothesis of the negative effect of the CUSFTA on lobbying for protection, the power of our test can be low due to poor measurement of industrial lobbying activity. This problem, which is common to the political economy of trade literature, can make it difficult to pick up the effect of our interest in noisy data.[26]

Turning to other estimates of equations (2.19) and (2.20), they are very similar to our

[25] If we also assume that all industries are politically oranized, as in Ketterer, Bernhofen, and Milner (2014) and Karacaovali and Limão (2008), specification (2.20) becomes

$$\Delta_9 Y_{i,98} = \alpha + \beta_0 D_i + \phi_1 \Delta_9 X^1_{i,1998} + (\phi_2 + \phi_3)\, \Delta_9 X^2_{i,1998} + u_i$$

and the effects of lobbying and market structure become separately unidentifiable. Under this assumption IV results in Table 2.5 demonstrate that $(\phi_2+\phi_3)$ is not statistically different from zero and do not support the hypothesis of the effect of the CUSFTA on lobbying for protection.

[26] Another source of inconsistency with the theory can be the static nature of the PFS model and the long-run equilibrium analysis and may not be well suited to describe the short-run changes in trade policy. Furthermore, FTAs may affect lobbying activity through channels other than "rent destruction" effect. For example, the estimates may also reflect the "surge protection" forces as in the model by Imai, Katayama, and Krishna (2009) where government provides additional protection to politically organized industries when imports surges and the share of domestic firms in the market decline.

previously reported findings. The estimates for ϕ_1 are positive and statistically significant for all measures of lobbying intensity, pointing to a strong tariff complementarity effect: each percentage point reduction in preferential tariff is associated with approximately 0.06 percentage points reduction in the MFN tariff in the short run and 0.31 in the long run.[27] This difference in the elasticities of the MFN tariff with respect to preferential tariff suggests that a large fraction of the cumulative effect of a one-off preferential tariff cut on the MFN tariff rate is spread across several subsequent years. Taking the sample average of the preferential tariff change and elasticities, the results from column (5) imply a total of 2.21 percentage point reduction in the MFN tariff, which accounts for 55% of MFN tariff cuts between 1989 and 1998. The coefficient on the domestic market share, ϕ_2, is negative but statistically insignificant in the long-run specification, indicating that the MFN tariffs were not adjusted for domestic industries facing shrinking market shares and that the market structure is not among the main determinants of the Canadian trade policy.

Consistent with our previous findings, the coefficient estimates on the US import share dummy variables D_{it}^k remain negative but only β_1 is statistically significant. This result provides some support for the cooperative trade policy hypothesis, indicating that Canadian policymakers were more willing to liberalize industries which play the least important role in the US exports. To gauge the importance of this factor for the MFN tariff changes, we calculate its implied effect for an average industry in each quintile of the US export share distribution in our sample. The estimates in column (6) imply that industries in the first three quintile of the US export share distribution experienced a respective 4.53, 0.92, and 0.31 percentage point reduction in MFN tariffs in addition to the average 2.21 percentage reduction in industries in the fifth quintile. Since we do not find statistically significant variation in the rate of tariff reduction across industries in the last fourth quintiles of the US export share distribution, deeper tariff cuts in the first quintile provide only partial support to the Limao's hypothesis of cooperation in trade policy in the Canadian context.

Overall, our results reveal that the CUSFTA formation induced more open trade policy in Canada. The finding of tariff complementarity between preferential and MFN tariff rates

[27] With the sample mean value for the elasticity-adjustment term $\frac{\sigma_i - 1}{\sigma_i}\epsilon_i$ being equal to 3.5, and the US market share of 15%, the elasticity of the MFN tariff with respect to preferential tariff can be calculated as $0.04 \cdot \phi_1$.

is very strong and persistent. The implied reduction in the MFN tariff in response to a one percentage point decrease in preferential tariff is in the range of $0.3 - 0.35$ percentage points for an average industry. At the same time, we found only limited support for the trade policies of CUSFTA member countries to be formed cooperatively. While Canada provides less protection to industries with the least imports from the US, changes in the MFN tariff rates are not systematically related to export rents generated by those industries to US exporters. Finally, we do not find any effect of the CUSFTA on the intensity of industrial lobbying for trade protectionism.

2.3.5 Robustness tests and extensions

In this section we perform several robustness exercises. The first two columns of Table 2.7 report estimation results for the short-run and long-run models with 2-digit HS industry fixed effects to control for unobserved industry-specific trends which may be related to the pace of trade liberalization. We still obtain positive and highly significant ϕ_1 and β_1 coefficients, confirming all of our previous findings.

As another robustness test, we focus on industries with positive pre-CUSFTA MFN tariffs rates. Given that industries with zero initial tariffs cannot respond to changes in preferential trade, they do not contribute to the identification of the coefficients of our interest. In columns (3) and (4) we drop industries with the MFN tariff rate in 1988 lower than 1% and it again does not affect the results. In columns (5) and (6) we estimate the two models on the subsample of industries for which the CUSFTA tariff reductions were scheduled over the entire ten-year phase-out period. Being the most sensitive product categories, they are also more likely to have higher initial tariffs and thus have more room for MFN tariff cuts. The results show that the elasticity of the MFN tariff with respect to preferential tariff is the same as in the benchmark specification.[28]. For this subsample, industries with the least imports from the US experienced additional $5.1 - 5.3$ percentage points decline in the MFN tariff relative to industries in the top three quintiles of the US import share distribution.

In columns (7) and (8) of Table 2.7 we depart from the strict structure of the theoretical model and remove elasticity terms from the construction of the right-hand side variable. Al-

[28] An increase in the ϕ_1 coefficient is largely offset by a reduction in Δs_{it}^P in the estimation sample.

though there are strong reasons to believe that import demand and substitution elasticities may play an important role in trade policy by making it more or less distortive, the elasticities are also likely to be measured with error. Moreover, Gawande and Bandyopadhyay (2000b) found that the elasticity terms bear little explanatory power for import tariffs in the protection for sale model. To make sure that our results are not driven by imprecisely measured elasticities, we use the MFN tariff rate as the dependent variable in these two specifications. With this modification, the estimates are qualitatively similar to those obtained previously, pointing to the importance of the tariff complementarity effect and market shares of US exporters.

As a final robustness test, we exclude the pre-CUSFTA import tariff from the long-run model. Since CUSFTA member countries had committed to a complete elimination of import tariffs by the year 1998, the change in preferential tariff between 1989 and 1998 is highly correlated with the starting value of import tariff, which may cause a high degree of multicollinearity between the 1988 tariff rate and the X_{it}^1 variable. The results in column (9) reveal a marginal increase in ϕ_1 coefficient, indicating that multicollinearity is unlikely to be a serious problem.

2.4 Conclusions

Whether FTAs induce or deter the incentive of member countries for multilateral trade liberalization has been a central question in the regionalism literature for the last few decades. So far, no consensus has been reached on the effect of an FTA membership on external tariffs. The theoretical literature on regionalism proposed several channels for the effect of an FTA on multilateral tariffs which can rationalize both rises and falls in the level of protectionism following the formation of an agreement. Furthermore, the empirical evidence on the relationship between FTA membership and an MTL is inconclusive: while some agreements were found to slow down MTL, others resulted in deeper trade liberalization. Identifying the factors associated with one outcome or another is thus an important empirical question. In this paper, we provide further evidence on the relationship between preferential trade liberalization and MFN tariffs by analyzing the effect of the CUSFTA on Canadian external tariffs. To test this relationship, we developed a model of endogenous trade policy formation that combines several forces leading to complementarity and substitutability between FTA internal and external tar-

iffs, which allows us to analyze the relative importance of those forces for Canadian MTL in a unified empirical framework.

The main finding of this paper is that the CUSFTA did in fact facilitate a greater liberalization of Canadian multilateral tariffs. The main factor contributing to complementarity between preferential and MFN tariffs operates through the terms-of-trade and tariff revenue effects. We find that a one percentage point reduction in the Canadian preferential tariff rate leads to a $0.3 - 0.35$ percentage points reduction in the MFN tariff, which accounts for around 55% of tariff decline observed during the Uruguay round of the WTO negotiations. This result implies that the size of a partner country may play an important role for the effect of an FTA on incentives to liberalize trade multilaterally, since the effect of an FTA on the terms-of-trade and tariff revenue is small when the partner country is small.

In this study we failed to find any consistent evidence on the negative impact of the CUSFTA on the lobbying power of domestic special interest groups. Despite the theoretical prediction that intensified competition with US firms and declining domestic market share should have had a negative impact on the return to lobbying activity and reduce incentives for lobbying, we do not observe deeper tariff reductions in industries with strong political connections. Yet, it is hard to obtain reliable measures of lobbying intensity, and this finding can be derived by the poor quality of our political economy variables.

Our study also provides weak evidence on the presence of trade policy cooperation between Canada and the US. We show that industries that generate less export revenue for the US had experienced deeper tariff cuts during the Uruguay round. This result is consistent with the hypothesis that the Canadian government is reluctant to erode the rents of US exporters generated by their preferential treatment. However, contrary to the tariff cooperation hypothesis, we failed to find any relationship between changes in MFN tariffs and US export rents among industries with large exports to Canada. Overall, the dominance of a tariff complementarity effect of the CUSFTA suggests that the main purpose of the agreement was to exchange market access between the two countries.

2.5 Tables and figures

Table 2.1
Summary statistics for key variables

	Mean	Standard deviation	Minimum	Maximun	Number of observations
MFN Tariff	0.057	0.064	0	0.249	38,445
Δ(MFN Tariff)	-0.004	0.013	-0.068	0.052	38,445
Preferential Tariff	0.025	0.04	0	0.222	38,445
Δ(Preferential Tariff)	-0.007	0.011	-0.054	0.031	38,445
Canadian market share	0.578	0.196	0.066	0.999	41,204
Δ(Canadian market share)	-0.011	0.032	-0.445	0.445	40,779
US market share	0.253	0.144	0.001	0.797	41,190
Δ(US market share)	0.009	0.026	-0.392	0.376	40,758
I1	0.506	0.501	0	1	243
I2	0.239	0.427	0	1	243
I3	0.235	0.425	0	1	243
I4	0.453	0.499	0	1	243
I5	0.520	0.500	0	1	5020
Import demand elasticity	-2.958	4.906	-37.979	-0.213	4,018
Log of firm scale	16.143	1.286	13.593	21.805	243
Material share	0.511	0.118	0.164	0.898	243
Labor share	0.191	0.073	0.015	0.37	243
Non-prod. Labor share	0.202	0.089	0.057	0.594	243
Fuel and electricity share	0.027	0.039	0.001	0.314	243

Notes: Summary statistics is calculated for 6-digit HS industries for the time period 1989-1998. Political activity indicators I1 and I2 take the value of one if an industry has at least one and three lobbyists, respectively. Political indicator I3 is constructed as in Gawande and Bandyopadhyay (2000), and I4 is constructed as in Matschke (2008). I5 is equal to one for industries which received the most protection during the CUSFTA grace period. Import demand elasticities are obtained from Kee, Nicita, and Olarreage (2009).

Table 2.2
The determinants of annual change in the MFN tariff

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) IV-GMM	(6) IV-GMM	(7) IV-GMM	(8) IV-GMM
$\Delta tariff\_us_{it-1}$	0.1053***			0.1054***			0.0996***	0.1067***
	(6.69)			(6.97)			(6.92)	(6.01)
$\Delta tariff\_us_{it-2}$								0.0540***
								(4.87)
$\Delta tariff\_us_{it-3}$								0.0316***
								(4.59)
US imports indicator (D)†		0.0009		0.0019	-0.0067		0.0358	0.1816**
		(0.73)		(1.29)	(-1.30)		(0.90)	(2.22)
Exp. Shr, quintile 1 (D^1)†			-0.0000	0.0003		-0.0001	0.0008	0.0010
			(-0.04)	(0.83)		(-0.29)	(1.45)	(1.42)
Exp. Shr, quintile 2 (D^2)†			-0.0006	-0.0002		-0.0014***	-0.0010**	-0.0012**
			(-1.43)	(-0.62)		(-2.65)	(-2.01)	(-2.17)
Exp. Shr, quintile 3 (D^3)†			-0.0002	-0.0000		-0.0003	-0.0002	-0.0000
			(-0.71)	(-0.12)		(-0.79)	(-0.57)	(-0.01)
Exp. Shr, quintile 4 (D^4)†			-0.0001	0.0001		-0.0005	-0.0004	-0.0003
			(-0.23)	(0.38)		(-1.14)	(-0.99)	(-0.74)
R-squared	0.050	0.041	0.041	0.050				
Hansen J-statistics, p-val. [(a)]					0.38	0.68	0.50	0.69
Endogeneity test, p-val. [(b)]					0.256	0.000	0.006	0.036
N	37,508	38,854	38,854	37,508	37,170	37,170	36,190	28,390

Notes: The dependent variable is the annual change in the MFN tariff. * Significant at 10%, **significant at 5%, *** significant at 1% confidence level. (a) Test for overidentifying restrictions. The null hypothesis is that instruments are exogenous. (b) Housman specification test for endogeneity of variables marked with"†". Under the null hypothesis the variables are exogenous and the OLS is consistent. Standard errors are clustered at 6-digit NAICS industry level. All specifications include 1988 MFN tariff rate as an additional control.

Table 2.3
Estimation results for the short-run structural model.

	(1) OLS	(2) IV-GMM	(3) OLS	(4) IV-GMM
L.Δ(US market share×Pref. tariff),$(\Delta X^{1}_{it-1})^{\dagger}$	1.682***	1.684**	1.780***	1.231*
	(3.72)	(2.28)	(3.92)	(1.79)
L.ΔCanadian market share,$(\Delta X^{2}_{it-1})^{\dagger}$	0.036	-0.208	0.037	-0.154
	(1.09)	(-0.91)	(1.09)	(-1.29)
US imports indicator $(D)^{\dagger}$			0.028	-1.874
			(1.06)	(-1.38)
Exp. Shr, quintile 1 $(D^{1})^{\dagger}$			-0.014***	-0.023**
			(-3.12)	(-2.08)
Exp. Shr, quintile 2 $(D^{2})^{\dagger}$			-0.005**	0.006
			(-2.11)	(0.64)
Exp. Shr, quintile 3 $(D^{3})^{\dagger}$			-0.003	-0.010*
			(-1.47)	(-1.71)
Exp. Shr, quintile 4 $(D^{4})^{\dagger}$			-0.003*	0.006
			(-1.72)	(1.51)
R-squared	0.018		0.019	
Hansen J-statistics, p-val. [(a)]		0.45		0.69
Endogeneity test, p-val. [(b)]		0.194		0.237
N	25,193	14,035	25,193	14,035

Notes: The dependent variable is the elasticity-adjusted annual change in the MFN tariff. * Significant at 10%, ** significant at 5%, *** significant at 1% confident level. (a) Test for overidentifying restrictions. The null hypothesis is that instruments are exogenous. (b) Housman specification test for endogeneity of variables marked with "†". Under the null hypothesis the variables are exogenous and the OLS is consistent. Standard errors are clustered at 6-digit NAICS industry level. All specifications include 1988 MFN tariff rate as an additional control.

Table 2.4
Estimation results for the reduced-form long-run model

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) IV-GMM	(6) IV-GMM	(7) IV-GMM
$\Delta tariff\_us_{it}$	0.120***			0.201***			0.205***
	(6.34)			(5.94)			(6.14)
US imports indicator (D)†		-0.008	-0.002		-13.119	0.076	
		(-0.72)	(-0.15)		(-1.01)	(0.32)	
Exp. Shr, quintile 1 (D^1)†			0.010***	0.010***		0.020***	0.019***
			(4.03)	(4.20)		(5.56)	(6.53)
Exp. Shr, quintile 2 (D^2)†			0.005***	0.005***		0.002	0.005
			(2.66)	(2.88)		(0.41)	(1.01)
Exp. Shr, quintile 3 (D^3)†			0.005***	0.005***		0.003	0.001
			(3.07)	(3.29)		(0.56)	(0.34)
Exp. Shr, quintile 4 (D^4)†			0.003*	0.003**		0.002	0.002
			(1.75)	(2.01)		(0.54)	(0.57)
R-squared	0.231	0.216	0.225	0.24			
Hansen J-statistics, p-val. [(a)]					0.00	0.22	0.24
Endogeneity test, p-val. [(b)]					0.365	0.016	0.020
N	3,864	3,887	3,887	3,864	3,785	3,785	3,764

Note: The dependent variable is the change in the MFN tariff between the years 1998 and 1989. * Significant at 10%, ** significant at 5%, *** significant at 1% confidence level. (a) Test for overidentifying restrictions. The null hypothesis is that instruments are exogenous. (b) Housman specification test for endogeneity of variables marked with "†". Under the null hypothesis the variables are exogenous and the OLS is consistent. Standard errors are clustered at 6-digit NAICS industry level. All specifications include 1988 MFN tariff rate as an additional control.

Table 2.5
Estimation results for the long-run structural model

	(1) OLS	(2) IV-GMM	(3) OLS	(4) IV-GMM
Δ(US market share×Pref. tariff),$(\Delta X^1_{it})^{\dagger}$	3.947***	7.577***	4.011***	7.821***
	(3.63)	(3.68)	(3.89)	(3.61)
ΔCanadian market share,$(\Delta X^2_{it})^{\dagger}$	0.078***	0.003	0.125***	0.008
	(2.68)	(0.01)	(3.25)	(0.06)
Exp. Shr, quintile 1 $(D^1)^{\dagger}$			-0.152***	-0.160**
			(-3.38)	(-2.02)
Exp. Shr, quintile 2 $(D^2)^{\dagger}$			-0.076***	-0.028
			(-3.25)	(-0.29)
Exp. Shr, quintile 3 $(D^3)^{\dagger}$			-0.035*	-0.009
			(-1.77)	(-0.18)
Exp. Shr, quintile 4 $(D^4)^{\dagger}$			-0.021*	0.038
			(-1.93)	(0.96)
R-squared	0.076		0.093	
Hansen J-statistics, p-val. [(a)]		0.73		0.54
Endogeneity test, p-val. [(b)]				0.003
N	3,178	2,315	3,178	2,315

Note: The dependent variable is the change in the MFN tariff between the years 1998 and 1989. * Significant at 10%, ** significant at 5%, *** significant at 1% confidence level. (a) Test for overidentifying restrictions. The null hypothesis is that instruments are exogenous. (b) Housman specification test for endogeneity of variables marked with "†". Under the null hypothesis the variables are exogenous and the OLS is consistent. Standard errors are clustered at 6-digit NAICS industry level. All specifications include 1988 MFN tariff rate as an additional control.

Table 2.6
Estimation results for the political economy model (11)

Model:	(1)	(2)	(3) Short run	(4)	(5)	(6)	(7)	(8) Long run	(9)	(10)
Δ(US market share×Pref. tariff),$(\Delta X^1_{it})^{\dagger}$	1.57**	1.65**	1.52**	1.73***	1.49**	7.80***	7.79***	7.71***	7.86***	7.36***
	(2.40)	(2.55)	(2.30)	(2.62)	(2.25)	(3.57)	(3.61)	(3.58)	(3.66)	(2.82)
ΔCanadian market share,$(\Delta X^2_{it})^{\dagger}$	-0.079	-0.084	-0.163	0.214	-0.227*	0.036	-0.022	-0.028	0.020	-0.099
	(-0.52)	(-0.85)	(-0.96)	(0.67)	(-1.67)	(0.17)	(-0.14)	(-0.17)	(0.13)	(-0.34)
Δ(Canadian market share)×I,$(\Delta X^3_{it})^{\dagger}$	-0.074	-0.382	-0.095	-0.412	0.328	-0.043	0.101	0.065	-0.029	0.185
	(-0.36)	(-1.40)	(-0.46)	(-1.42)	(0.92)	(-0.21)	(0.50)	(0.40)	(-0.17)	(0.49)
Exp. Shr, quintile 1 $(D^1)^{\dagger}$	-0.008	-0.009	-0.009	-0.010	-0.008	-0.159**	-0.166**	-0.154**	-0.157*	-0.151*
	(-1.09)	(-1.28)	(-1.10)	(-1.46)	(-1.10)	(-2.02)	(-2.11)	(-1.97)	(-1.93)	(-1.75)
Exp. Shr, quintile 2 $(D^2)^{\dagger}$	-0.004	-0.001	-0.004	-0.002	-0.003	-0.032	-0.024	-0.016	-0.029	-0.033
	(-0.37)	(-0.06)	(-0.37)	(-0.21)	(-0.31)	(-0.33)	(-0.25)	(-0.17)	(-0.31)	(-0.35)
Exp. Shr, quintile 3 $(D^3)^{\dagger}$	-0.005	-0.006	-0.005	-0.005	-0.004	-0.011	-0.007	-0.005	-0.009	0.008
	(-0.89)	(-0.97)	(-0.98)	(-0.84)	(-0.79)	(-0.21)	(-0.13)	(-0.10)	(-0.17)	(0.12)
Exp. Shr, quintile 4 $(D^4)^{\dagger}$	0.004	0.005	0.004	0.004	0.004	0.036	0.037	0.041	0.038	0.043
	(0.99)	(1.20)	(0.93)	(0.97)	(0.92)	(0.85)	(0.95)	(1.03)	(0.98)	(1.00)
Hansen J-statistics, p-val. [(a)]	0.45	0.51	0.53	0.61	0.59	0.56	0.64	0.58	0.51	0.73
Endogeneity test, p-val. [(b)]	0.367	0.341	0.248	0.374	0.200	0.005	0.003	0.003	0.005	0.002
N	14,035	14,035	14,035	14,035	14,035	2,315	2,315	2,315	2,315	2,315

Notes: The dependent variable is the elasticity-adjusted annual change in the MFN tariff. * Significant at 10%, ** significant at 5%, *** significant at 1% confident level. (a) Test for overidentifying restrictions. The null hypothesis is that instruments are exogenous. (b) Housman specification test for endogeneity of variables marked with "†". Under the null hypothesis the variables are exogenous and the OLS is consistent. Standard errors are clustered at 6-digit NAICS industry level. All specifications include 1988 MFN tariff rate as an additional control.

Table 2.7
Robustness tests and extension

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Model:	Short run	Long run	Short run	Long run	Short run	Long run	Short run	Long run	Long run
Δ(US market share×Pref. tariff),(ΔX^1_{it})†	3.031**	4.828**	1.724***	7.769***	2.495***	11.188**	1.565**	7.796***	9.341***
	(2.32)	(2.07)	(2.65)	(3.03)	(3.04)	(2.38)	(2.40)	(3.57)	(4.80)
ΔCanadian market share,(ΔX^2_{it})†	-0.949	-0.213	0.019	0.050	0.076	0.164	-0.079	0.036	0.017
	(-0.44)	(-1.08)	(0.07)	(0.20)	(0.16)	(0.49)	(-0.52)	(0.17)	(0.08)
Δ(Canadian market share)×I,(ΔX^3_{it})†	-0.246	0.282	-0.309	-0.095	-1.106*	-0.372	-0.074	-0.043	-0.055
	(-0.21)	(1.24)	(-1.23)	(-0.36)	(-1.67)	(-0.75)	(-0.36)	(-0.21)	(-0.26)
Exp. Shr, quintile 1 (D^1)†	-0.150*	-0.110	-0.009	-0.174**	-0.017	-0.186*	-0.008	-0.159**	-0.162**
	(-1.68)	(-1.35)	(-1.05)	(-2.29)	(-1.58)	(-1.82)	(-1.09)	(-2.02)	(-1.99)
Exp. Shr, quintile 2 (D^2)†	0.016	-0.103	-0.007	-0.073	0.006	-0.097	-0.004	-0.032	-0.040
	(0.26)	(-1.03)	(-0.65)	(-0.68)	(0.62)	(-0.77)	(-0.37)	(-0.33)	(-0.41)
Exp. Shr, quintile 3 (D^3)†	0.111**	0.016	-0.004	-0.008	-0.012	0.004	-0.005	-0.011	-0.001
	(2.00)	(0.29)	(-0.65)	(-0.13)	(-1.13)	(0.04)	(-0.89)	(-0.21)	(-0.03)
Exp. Shr, quintile 4 (D^4)†	-0.055	0.009	0.005	0.032	0.001	0.006	0.004	0.036	0.038
	(-0.93)	(0.21)	(1.25)	(0.64)	(0.10)	(0.09)	(0.99)	(0.85)	(0.93)
Condition	2-digit HS fixed effects		No industries with zero tariffs in 1988		Only industries with gradual preferential tariff reductions		No elasticities in the dependent variable		No initial tariff
Hansen J-statistics, p-val. [(a)]			0.72	0.49	0.83	0.40	0.45	0.56	0.58
Endogeneity test, p-val. [(b)]			0.466	0.024	0.302	0.216	0.331	0.025	0.002
N	14,035	2,315	11,378	1,895	6,671	1,104	14,035	2,315	2,317

Notes: The dependent variable is the elasticity?adjusted change in the MFN tariff. * Significant at 10%, ** significant at 5%, *** significant at 1% confidence level. (a) Test for overidentifying restrictions. The null hypothesis is that instruments are exogenous. (b) Housman specification test for endogeneity of variables marked with "†". Under the null hypothesis the variables are exogenous and the OLS is consistent. Standard errors are clustered at 6?digit NAICS industry level. Columns (1)?(8) include 1988 MFN tariff rate as an additional control. Columns (1) and (2) include 2?sigit HS industry fixed effects. Column (3) and (4) exclude industries with zero MFN tariff in 1988. Column (5) and (6) are estimated on industries with 10?year phase?out periods for the CUSFTA preferential tariff reductions. In columns (7) and (8) the dependent variable is the change in the MFN import tariff.

Chapter 3

Tariff Cooperation in Free Trade Area

3.1 Introduction

Does members in Free Trade Area (FTA) cooperate on their external tariff policy? This question is centric to policy makers who want to understand the welfare implications of FTA for its members. If FTA members cooperate on the level of their external tariffs, they would behave similarly to those in Customs Union (CU), and become more protectionist against outsiders after the formation of the trade agreement.[1] As a result, trade creation within the trade bloc can be plausibly generated at the cost of trade loss from the outsiders of the bloc. Theoretical literature have shown that FTA leads to further reduction in trade protection among its members but this result is mainly built on the assumption of non-cooperative policy of FTA members. However, empirically there has been very little known on this matter.

In this paper, we attempt the empirical study on this matter. To do so, first we construct a model of endogenous trade policy formation that incorporates some of the channels, identified in previous literature, through which FTA can affect the external tariffs of a FTA member. This base model provides a testable prediction on how tariff complementarity and tariff revenue affact the choice of external tariff policy for FTA members through terms-of-trade effects.

[1] See Syropoulos (2002), Facchini et al. (2013), Kennan and Riezman (1990), Bagwell and Staiger (1997b), Ornelas (2005) and Freund and Ornelas (2010).

Similar results are found in Bond, Riezman, and Syropoulos (2004b), Ornelas (2005c), and Estevadeordal, Freund, and Ornelas (2008). These results show that FTA induces acceleration on external tariff liberalization among its members, and this result is consistent to the findings in previous literature about the 'building block' effect of FTA.

Next, we extend this model by introducing a political factor that allows us to capture and differentiate the motive for tariff cooperation between FTA members. FTA members will internalize the effect of their external tariff policy on their partner's welfare if they are concerned about each others. The internalization takes the form of jointly optimization of external tariff by incorporating the partner's welfare function into each other's objective functions. We allow heterogeneity in the degree of internalization which is weighted by this political factor. We use political relation between FTA partners as the measure for this political factor. This political feature of the model shows that FTA members coordinate more on external tariff setting when their political relations are closer. It also implies that when a FTA is formed by close political partners, their external trade policy tends to be more protectionist as what we would expect to find among CU members.

To test for tariff cooperation among FTA members, we formulate our empirical specification based on the predictions of the equilibrium external tariff policy from the structural model. From the theoretical model, we derive two equilibrium policies: (i) equilibrium external tariff policy under *non-cooperative* setup; (ii) equilibrium external tariff policy under *cooperative* setup. We derive the difference in external tariff policy from the equilibrium under these two setups and specify our empirical strategy to test the difference as the effect of tariff cooperation on external tariff.

The data we use for this project come from several sources. Data on tariff cover 170 different countries for the period from 1988 to 2011 at HS 6-digit level. During this time period, a total of 177 free trade agreements have been established. Industrial data in manufacturing sector covering these countries during the periods are at ISIC 3-digit level. To approximate political relations between countries we employ three measures: (i) the affinity scores from the UN General Assembly Voting Data; (ii) the formal alliance status from the Correlates of War Formal Alliance data; and (iii) bilateral political events and interactions from the Conflict and

Peace Data Bank.[2]

We then estimate our empirical specification using the data. Our results provide strong evidence for tariff cooperation among the FTA formed during the period from 1988 to 2011. On average, the external tariffs on the rent-generating industries for FTA partners liberalize 20% slower compared to other industries. The results also show that political relation plays an important role in determining FTA partners' external tariff policy. Comparing to the results *without* the political factor as the benchmark, we find an addition of 8% slower liberalization in external tariffs on the rent-generating industries among the FTA partners who share similar economic and political interests, and an addition of 20% slower liberalization among those who have formal alliance with military defense treaty.

Our work is related to the strand of literature on the impact of regionalism on multilateralism. As in Grossman and Helpman (1994) and Stoyanov (2009), RTA weakens the motivation for tariff protection by creating leakage in this protectionist trade policy so that reduces the incentive for special politically active group lobbying for protection. Levy (1997) shows that bilateral trade agreement may disproportionally benefits the countries' median voters, thus increasing the support against protection liberalization. Krishna (1998) suggests that if RTA creates large gains to some powerful economic groups, reduction is external protection becomes politically infeasible.

Our work is also related to the studies on incentives to alter external tariffs in RTAs. Kennan and Riezman (1990) show that in a three-country general equilibrium endowment economy, equilibrium external tariffs are higher when countries moving from FTA to CU. Richardson (1993) finds that FTA members tend to lower external tariffs to mitigate the negative impact from trade diversion generated by RTA. Bagwell and Staiger (1997b), Freund (2000), Bond, Riezman, and Syropoulos (2004b), Ornelas (2005a, 2005b), and Saggi and Yildiz (2010) illustrate how FTA induces incentive for multilateral trade through terms-of-trade effect.

Our paper is also related to Limao (2007)'s study. He looks at tariff cooperation of FTA partners in "non-trade" issues. Preferential treatment is offered to RTA partners in exchange for cooperation on, for example, drug trade issues. A reduction on external tariff protection would diminish the benefit the RTA partners from this preferential treatment, so that it could erode

[2]Detail descriptions of the data can be found in Section 3.4.

the incentive for the partners to maintain their cooperation on non-trade issues. This paper is closely related to Mai and Stoyanov (2013)'s study, which analyse the effect of CUSFTA on Canadian external trade policy. In this study, they categorize Canadian industries in quartiles ranked by the rent generated to US, and they find that the industries which create the least rent to US have exhibited fastest liberalization in external tariffs.

The paper is organized as the follows. In the next section, we present the model of endogenous trade policy formation and derive the equilibrium external tariff policy under tariff cooperation. In Section 3.3, we present the empirical specification and the interpretations of the key variables. In Section 3.4, we discuss the data used for this project. In Section 3.5, we present the empirical results and the discussion of the results. Section 3.6 concludes.

3.2 The Theory

In this section, we study the channels through which different degrees of political relation can affect a country's choice on its external tariffs. We present a monopolistic competition model with differentiated products and free market entry, and derive the equilibrium trade policy for a country which faces heterogeneous political affinity to her partners with preferential trade agreements (PTA). The theoretical model will lay foundations for our empirical specifications.

To identify tariff cooperation within a FTA, our strategy is to incorporate a measurement for political relations among FTA partners as the weights for the importance of the partners' national welfare that are taken into consideration into government's decision of the formation of its external trade policy. Then derive and compare the equilibrium trade policy *with* and *without* tariff cooperation.

Consider a model with a Home country, H, trading with R partner countries with PTA and F countries *without* PTA, hereafter indexed by H, f and r respectively. Note that $f = 1, ..., F$ and $r = 1, ..., R$, and country $j \in \{H, f, r\}$. All countries produce and trade $N + 1$ goods, with the first good being a numeraire, traded at no costs and produced by perfectly competitive firms. For all other industry i the number of firms in each country j is fixed and equal to n_{ij}, and each firm produces a distinct variety of a good. All firms in industry i are assumed to be symmetric within country j, therefore they share the same demand function, production

technology and charge the same price. There are $(n_{iH} + \sum_{f=1}^{F} n_{if} + \sum_{r=1}^{R} n_{ir})$ varieties in industry i available to consumers in country H for $H \neq f$ and $H \neq r$.

Suppose that the preferences of a representative agent in country j can be denoted by a quasilinear utility function with a constant elasticity of substitution for varieties in industry i

$$U = X_0 + \sum_{i=1}^{n} \alpha_i \ln X_i, \;\; \sum_{i=1}^{n} a_i = 1 \tag{3.1}$$

where α_i is the fraction of total expenditure the agent spends on industry i goods. X_0 is consumption of the numeraire good. X_i is the sub-utility derived from the consumption of differentiated product i produced at home and abroad, and assumed to take the non-symmetric CES form, which can be represented by

$$X_i = \left(n_{iH} d_{iH}^{\frac{1}{\sigma_i}} x_{iH}^{\frac{\sigma_i - 1}{\sigma_i}} + \sum_{r=1}^{R} n_{ir} d_{ir}^{\frac{1}{\sigma_i}} x_{ir}^{\frac{\sigma_i - 1}{\sigma_i}} + \sum_{f=1}^{F} n_{if_j} d_{if}^{\frac{1}{\sigma_i}} x_{if}^{\frac{\sigma_i - 1}{\sigma_i}} \right)^{\frac{\sigma_i}{\sigma_i - 1}} \tag{3.2}$$

where $\sigma_i > 1$ is the elasticity of substitution among varieties of good i, d_{ij} denotes the taste parameter for i from country j, and x_{ij} is the demand for i produced in country j. Maximizing equation (3.1) subject to standard budget constraint, we obtain the demand function and aggregate price index for the differentiated product i:

$$x_{ij} = a_i d_{ij} p_{ij}^{-\sigma_i} P_i^{\sigma_i - 1} \;\forall\; j \in \{H, f, r\} \tag{3.3}$$

$$P_i = \left(n_{iH} d_{iH} p_{iH}^{1-\sigma_i} + \sum_{r=1}^{R} n_{ir} d_{ir} p_{ir}^{1-\sigma_i} + \sum_{f=1}^{F} n_{if} d_{if} p_{if}^{1-\sigma_i} \right)^{\frac{1}{1-\sigma_i}}. \tag{3.4}$$

Home country government sets two types of ad valorem tariffs - preferential tariff, τ_{ir}, on imports from country r and MFN tariff, τ_{if}, on imports from country f. The profit function facing different firms in Home country can be written as:

$$\begin{aligned} \pi_{iH} &= (p_{iH} - c_{iH})\, q_{iH} \\ \pi_{ij} &= ((1 - \tau_{ij}) p_{ij} - c_{ij})\, q_{ij} \;\; \forall \;\; j \in \{f, r\} \end{aligned} \tag{3.5}$$

where q_{ij} is the quantity supplied and c_{ij} is the marginal costs of production. Assuming the

number of firms is large enough that an individual firm's decision on pricing has no impact on the aggregate price index P_i, each firm takes the price index as given. Knowing the demand function, each firm maximizes profit by setting its price:

$$p_{iH} = \left(\frac{\sigma_i}{\sigma_i - 1}\right) c_{iH},\ p_{ij} = \frac{\sigma_i}{(\sigma_i - 1)} \frac{1}{(1 - \tau_{ij})} c_{ij} \ \forall \ \ j \in \{f, r\} \tag{3.6}$$

where τ_{ij} is the ad valorem tariff collected by the Home country government. Each firm sets its price by a mark-up over its marginal cost. Substituting equation (3.6) into (3.5), the profit functions can be written in a convenient form:

$$\begin{aligned} \pi_{iH} &= \sigma_i^{-1} p_{iH} x_{iH} \\ \pi_{ij} &= (1 - \tau_{ij}) \sigma_i^{-1} p_{ij} q_{ij} \ \forall \ \ j \in \{f, r\}. \end{aligned} \tag{3.7}$$

The next step towards deriving the optimal trade policy on external tariff is to set up government's objective function. One issue is that we do not know the form of the objective function. Participation in any trade agreement is afterall a political decision therefore this function can take various forms depending on the objectives of governments.[3] For now, we assume that governments' objectives are socially desirable for their domestic welfare. Let the objective function, G, consist of the sum of consumer surplus from consumption of differentiated goods (CS), tariff revenue (TR), and profits of domestic firms (π_{iH}):

$$G = CS(\tau_{ij}) + TR(\tau_{ij}) + \sum_{i=1}^{n} n_{iH} \pi_{iH}(\tau_{ij}) \tag{3.8}$$

where

$$CS(\tau_{ij}) = U(X_0, X_i, \tau_{ij}) - \sum_{i=1}^{n} \sum_{j=1}^{H,F,R} p_{ij} n_{ij} x_{ij}, \tag{3.9}$$

and

$$TR(\tau) = \sum_{i=1}^{n} \sum_{j=1}^{F,R} \tau_{ij} n_{ij} x_{ij}. \tag{3.10}$$

[3] Grossman and Helpman (1994), (1995), Krishna (1998), and Stoyanov (2009) show that special interest groups influence governments' objectives. Limao (2007) shows that RTAs can be used by governments as motives to induce partner country to cooperate in non-trade areas.

3.2.1 Tariff cooperation in FTA

One distinction between members of FTA and CU is that FTA members maintain autonomous external tariff policies while CU members jointly set and share common external tariffs. This subtle difference creates the tendency for members of CUs to coordinate and adopt higher external tariffs than those of FTAs.[4] Tariff coordinations among CUs have been criticized because they could hinder the viability of multilateral free trade. However, it is not yet clear whether tariff coordination exists among FTAs because government can adjust external tariff rates to accommodate the impact from the changes in preferential policy and reassure its objectives.[5]

Next, we look at the case when a government of FTA members is concerned about the welfare of other members of the FTA, it incorporates the welfare of other members into its objective function (3.8), it becomes:

$$G = CS(\tau_{if}) + TR(\tau_{if}) + \sum_{i=1}^{n} n_{iH}\pi_{iH}(\tau_{if}) + \sum_{r_j=1}^{R} \phi_r W_r, \tag{3.11}$$

where W_r is the welfare of partner country r and $\phi_r \in [0,1]$ measures the degree of concern country H to W_r.[6] Since the external policy of H will affect the profits of exporting firms of r in H and not affect the consumer surplus and tariff revenue of partner r, we can simplify expression (3.11) as the following:

$$G = CS(\tau_{if}) + TR(\tau_{if}) + \sum_{i=1}^{n} n_{iH}\pi_{iH}(\tau_{if}) + \sum_{i=1}^{n}\sum_{r=1}^{R} \phi_r n_{ir}\pi_{ir}(\tau_{if}), \tag{3.12}$$

where $n_{ir}\pi_{ir}$ is the total profits of firms from partner r in industry i in H. Government of H internalizes the profits of firms from partner r (essentially partner's welfare) into consideration when optimizing its objective function, and the larger is ϕ_r the higher degree of internalization takes place for its partner r's welfare in H's objective function. By choosing the level of

[4] See Kennan and Riezman (1990) and Facchini et al. (2013) among others for rationales for higher external tariffs under CUs. Estevadeordal et al. (2008) find tariff complementarity only in FTAs.

[5] See for example of optimal external tariffs settings Kennan and Riezman (1990), Richardson (1993), Yi (1996), Bagwell and Staiger (1999), Cadot et al. (1999), Freund (2000) and more recently Ornelas (2005a, 2005b), (2007), Facchini et al. (2009).

[6] A common method used in literature to model tariff cooperation among CU members which choose a common tariff to maximize joint welfare. See Bagwell and Staiger (1997a) and Ornelas (2007b) for example.

external tariff rate τ_{if}, H maximizes its object in (3.12), and after collecting terms, we obtain the following equilibrium external tariff policy:

$$\epsilon_i^f \tau_{if} = \frac{\sigma_i - 1}{\sigma_i} s_{iH} + (\sigma_i - 1) \sum_{r=1}^{R} \tau_{ir} s_{ir} + \frac{\sigma_i - 1}{\sigma_i} \sum_{r=1}^{R} \phi_r (1 - \tau_{ir}) s_{ir} \tag{3.13}$$

where $s_{iH} = \frac{n_{ir} p_{ir} x_{ir}}{a_i}$ is the market share of domestic firms in industry i and $s_{ir} = \frac{n_{ir} p_{ir} x_{ir}}{a_i}$ is market share of firms in industry i from partner country r in H. On the left hand side of equation (3.13) is external tariff rate τ_{if} multiplied by ϵ_i^f, which is the import demand elasticity for goods i imported from outsiders. In (3.13), s_{iH} and s_{ir} are positively related to external tariff τ_{if}. The positive relation between s_{iH} and τ_{if} suggests that if the market share of domestic firms in industry i is low after the formation of FTA, it is optimal to have a low external tariff rate for i. One explanation for this positive relation is the protection leakage effect. If s_{iH} is small in H, protection from high τ_{if} will be an inefficient rent-generator for domestic firms, instead, part of the rents would go to the partners' firms. Because protection for rents to domestic firms becomes less effective when s_{iH} is small, H would be better off to shift some of the rents from FTA partners back to CS by lowering τ_{if}.

The second term in (3.13) reflects the effect of tariff complementarity such as in Richardson (1993). If preferential tariffs are low - large preferential margins, it is optimal for government to lower the corresponding external tariffs. The complementary effect is stronger with larger market share of partner firms and closer substitute of product i. Intuitively, a drop in intra-bloc tariff induces a shift of imports from outsiders, who have comparative advantage in production of i, to less efficient partner r thanks to preferential tariff treatment. Thus, the trade diversion reduces overall welfare. To mitigate the welfare lost from the distortion of trade pattern, governments can lower external tariffs to redirect some of the imports back to their original sources.[7]

The last term in (3.13) indicates the effect from tariff cooperation. The positive relation between τ_{if} and s_{ir} suggests that, if H is concerned about partner r's welfare, it is optimal to coordinate with high external tariff for industry i if the market shares of firms from partner r

[7] Other researchers also provide different explanations for tariff complementarity, for example Bagwell and Staiger (1999) in terms of trade motivations; Grossman and Helpman (1994) and Ornelas (2005a) in political economy factors; Saggi and Yildiz (2010) in endowment models with endogenous trade agreements.

in industry i is large after the formation of FTA. The intensity for tariff cooperation is strong if ϕ_r is high. Reducing the external tariff in i would induce competition coming from external firms and thus reduce the rents of the partner's firms.

For the case when $\phi_r = 0$, it implies no tariff cooperation between FTA members. The welfare function of FTA partner W_r in (3.11) does not enter the objective function of H government. In such case, the external tariff policy in equilibrium becomes

$$\epsilon_{iROW}\tau_{iROW} = \frac{\sigma_i - 1}{\sigma_i} s_{iH} + (\sigma_i - 1) \sum_{r=1}^{R} \tau_{ir} s_{ir}. \tag{3.14}$$

3.3 Empirical specification

Policy response often may not be instantaneous. To allow for policy response delays, we introduce time dimension to both (3.13) and (3.14). Next, we move to estimate tariff cooperation among FTA partners. First, suppose H and r form a trade agreement at time t. If H coordinates its external tariff for r into period $t+1$, from (3.13), we have

$$\epsilon_i^f \tau_{if,t+1} = \frac{\sigma_i - 1}{\sigma_i} s_{iH,t+1} + (\sigma_i - 1) \sum_{r=1}^{R} \tau_{ir,t+1} s_{ir,t+1} + \frac{\sigma_i - 1}{\sigma_i} \sum_{r=1}^{R} \phi_r \left(1 - \tau_{ir,t+1}\right) s_{ir,t+1}. \tag{3.15}$$

Comparing (3.15) to the equilibrium external tariff policy represent by (3.14) in period t, and time differencing gives us the following:

$$\epsilon_i^f \Delta_1 \tau_{i,t}^f = \frac{\sigma_i - 1}{\sigma_i} \Delta_1 s_{iH,t} + (\sigma_i - 1) \sum_{r=1}^{R} \Delta_1 \tau_{ir,t} s_{ir,t} + \frac{\sigma_i - 1}{\sigma_i} \sum_{r=1}^{R} \phi_r \left(1 - \tau_{ir,t}\right) s_{ir,t} \tag{3.16}$$

where Δ_1 represent time difference by 1 period. Note that the last term on the right hand side of (3.16) is the market share from r in level, for which, one interpretation can be that it captures the importance of industry i to partner r.

Equation (3.16) outlines the two forces driving external tariffs in opposite directions - tariff complementarity and tariff coordination. With our main goal focused on testing tariff coordi-

nation among FTAs, and motivated by (3.16), our empirical framework is the following:

$$\frac{\sigma_i}{\sigma_i - 1}\epsilon_i^f \Delta_1 \tau_{i,t}^f = \beta_0 + \beta_1 \Delta_1 s_{iH,t} + \beta_2 \sum_{r=1}^{R} \Delta_1 \tau_{ir,t} s_{ir,t} + \beta_3 \sum_{r=1}^{R} \phi_{r,t} \left(1 - \tau_{ir,t}\right) s_{ir,t} + \epsilon_{i,t} \quad (3.17)$$

where $s_{ir,t}$ is measured by the value of imports of good i from partner r over the total domestic spending on i at time t and $s_{iH,t}$ is the domestic output over the total domestic spending on i at t. Equation (3.17) assembles the relationship between external tariff and the key explanatory variables from the model into an econometric form. Note that for the FTAs where $\tau_{ir,t}$ immediately reduce to zero, for following years $\Delta\tau_{ir,t}$ become zero. In such case, the term $\sum_{r_j=1}^{R} \Delta\tau_{ir_j,t} s_{ir_j,t}$ disappears and $\sum_{r_j=1}^{R} \phi_{r_{j,t}} \left(1 - \tau_{ir_j,t}\right) s_{ir_j,t}$ becomes $\sum_{r_j=1}^{R} \phi_{r_{j,t}} s_{ir_j,t}$. In previous literature, the role of political affinity is often overlooked when investigating the relationships between preferential tariff and MFN tariff for industries traded with FTA partners and outsiders.[8] The effects of preferential tariff from different FTA partners on MFN tariff are treated homogeneously. However, relations of countries are heterogeneous and thus there is a strong reason to believe the effect of tariff cooperation on external tariff must be different by country if political relationship between partner countries matters when a country sets up its external policies. One novelty of this study is that we estimate the effect of preferential tariff on external tariffs under a political economic perspective by differentiating the importance of FTA partners' welfare to government H so that the impact on its external policy is weighted differently by how close the political relations are its partners. In equation (3.17), ϕ_r is a partner country specific political parameter that weights the importance of the market shares from r in H. The idea is that, if partner country r is politically close to H, ϕ_r is high and share of partner firms $s_{ir,t}$ matters more in the relation to $\Delta\tau_{i,t}^f$ ceteris paribus, we would expect a more significant of β_3 in the estimation of (3.17).

To test whether or not political relation ϕ_r matters for tariff cooperation, we estimate two sets of results on (3.17) - one treating all r homogeneously (e.g. $\phi_r = 1$ for all r), and another allowing ϕ_r to vary. Consider four scenarios - a pair FTA partners can have high or low ϕ_r pre- or post- FTA formation. Figure 3.1 illustrates the level of MFN tariff of H for non-members

[8] For example, Limao's (2006) approach is to assign a dummy variable that equals one for industries US imports from its PTA partner and compare the change in MFN tariffs in these industries to those that do not import from PTA partners post- and pre- Uruguay Round.

before and after the formation of FTA. External tariff, $\tau^f_{i,t}$, on country f is at $\tau^f_{i,t_0}(\phi^L_{r_{j,t_0}}, \phi^H_{r_{j,t_0}})$ from time t_0. Suppose H and r forms a FTA at time t_1, the external tariff on f can either go up or down or remain unchanged.[9] The average MFN tariff rate is 9.6% for the period from 1988 to 2011, and have decreased by 0.35% per year. Figure 3.1 shows this general downward trend of global MFN tariffs. The idea is that if Home and country r_j are close political partners, Home is concerned about r_j's welfare and adopts a more protective external policy after the formation of FTA. In such case, τ_f is higher than it would otherwise be in post PTA period t_1. For the country pair, political affinity set $(\phi^H_{r_{j,t_0}}, \phi^H_{r_{j,t_1}})$ and $(\phi^L_{r_{j,t_0}}, \phi^H_{r_{j,t1}})$, $\tau^f_{i,t+1}$ will be at $\tau^{f_{High}}_{i,t_1}$. External tariff is lower at $\tau^{f_{Low}}_{i,t_1}$ for $(\phi^H_{r_{j,t_0}}, \phi^L_{rj,t_1})$ and $(\phi^L_{r_{j,t_0}}, \phi^L_{rj,t_1})$. The difference between $\tau^{f_{High}}_{i,t_1}$ and $\tau^{f_{Low}}_{i,t_1}$ is the stumbling effect on external liberalization coming from tariff cooperation based on their level of political affinity $\phi_{r_{j,t}}$. More importantly, a statistically significant $\phi_{r_{j,t}}$ would provide a possible answer to the puzzle why some find stumbling block effect in FTAs while others find building block effect.

If tariff cooperation exists, we would be more likely to find it in industries that import under PTA. We expect there is no tariff cooperation for industries that have no imports from PTA partners because the higher external tariff rate does not increase the profits of partner countries' firms, and it is not in the interest of the Home government too. We expect the effect of cooperation will be stronger if the size of market share of partners' firms in i is large.[10] The the effect of PTA on external tariff would probably be undermined because the dummy variable forgoes the size effect.

The key variable of interest is $\sum_{r=1}^{R} \phi_{r,t} (1 - \tau_{ir,t}) s_{ir,t}$ because we are interested to know how $\tau^f_{i,t}$ responds in industries that are beneficial to r. For capturing the potential further delays in policy responds, we include 6 more lag periods of $\sum_{r=1}^{R} \phi_{r,t} (1 - \tau_{ir,t}) s_{ir,t}$ in (3.17). Changes in preferential policy will force partners' firms to adjust their production and management, and the process likely take time. Any changes in Home's market conditions coming from the impact of partners' firms' adjustments are more likely to emerge in later periods. We expect

[9] WTO member conutries have legally bound commitments on tariff rates, which act as the ceilings on tariffs. Governments can adjust tariff rates upward only if the applied rates are lower than the bound rates.

[10] Using import share of PTA partner firms in Home may not be the best way to measure the importance of industry i to partner country as some suggest the importance of industry i in Home for PTA partner country should be measured by the export share of i in partner country to Home. However, we argue this is a reasonable measure for capturing tariff cooperation because if Home is concerned about welfare of partner country, it cares the most for large industries in the Home market.

government's response through external policy to any market condition changes will not happen simultaneously so we lag all explanatory variables to one period time. After implementing the lag periods, the estimation equation becomes

$$Y_{i,t} = \beta_0 + \beta_1 X^1_{i,t-1} + \beta_2 X^2_{i,t-1} + \beta_3 X^3_{i,t-1} + \beta_4 X^3_{i,t-2} + ... + \beta_8 X^3_{i,t-6} + \epsilon_{i,t} \tag{3.18}$$

where $Y_{i,t} = \frac{\sigma_i}{\sigma_i - 1}\epsilon^f_i \Delta_1 \tau^f_{i,t}$, $X^1_{i,t-1} = \Delta_1 s_{iH,t} = s_{iH,t} - s_{iH,t-1}$, $X^2_{i,t-1} = \sum_{r=1}^{R} \tau_{ir,t} s_{ir,t} - \sum_{r=1}^{R} \tau_{ir,t-1} s_{ir,t-1}$, $X^3_{i,t-1} = \sum_{r=1}^{R} \phi_{r,t-1} (1 - \tau_{ir,t-1}) s_{ir,t-1}$ and $X^3_{i,t-2} = \sum_{r=1}^{R} \phi_{r,t-2} (1 - \tau_{ir,t-2}) s_{ir,t-2}$. Also note that time difference in equation (3.18) can also help remove any country-industry fixed effects.

3.3.1 Estimation issues

Endogeneity is a serious concern when estimating the effect of market share on external tariff policy because the level of external tariff can reversely affect the market shares of both domestic and foreign firms. Since we are interested in establishing the causal relationship, a good instrument for the market shares of PTA partners in Home becomes very important. To do this we construct an instrument variable for traded goods from PTA partners following the methodology detailed in Frankel and Romer (1999). We predict trade flows between countries using geographic characteristics from gravity equation. This is a valid approach because trade flows between countries are highly correlated to their geographical characteristics, which are unlikely correlated to any trade policies. We regress the values of imports in log for every industry i on dyadic gravity variables. We perform the following:

$$\begin{aligned} \ln(M_{ij}) \quad = \quad & a_0 + a_1 \ln D_{ij} + a_2 \ln N_i + a_3 \ln N_j + a_4 \ln A_i + a_5 \ln A_j \\ & + a_6 (L_i + L_j) + a_7 B + a_8 B \ln D_{ij} + a_9 B \ln A_i + a_{10} B \ln A_j \\ & + a_{11} B \ln N_i + a_{12} B \ln N_j + a_{14} B (L_i + L_j) . \end{aligned} \tag{3.19}$$

In equation (3.19), D_{ij} is the distance between country i and j, N_i and A_i are the population and area in country i respectively, and L_i indicates whether country i is landlocked. The fitted values of equation (3.19) are used as our instrument variable (IV) for imports of Home

i from partner r_j, denoted by $import\_iv1$ in Table 3.1 We construct three additional IV to ensure results will be not sensitive to the way we construct the IV. For the second IV, we extend equation (3.19) to include controlling for high dimensional country-year fixed effects for country i and j following the estimation procedure in Martyn et al. (2006). The fitted values are denoted by $import\_iv2$ in Table 3.1 The third IV and the fourth IV, include controls for industry-year fixed effects and country-industry-year fixed effects respectively and are denoted by $import\_iv3$ and $import\_iv4$.

3.4 Data

This paper uses data from several different sources. Tariff data comes from UN Comtrade Database, covering 183 free trade agreements involved 170 different countries for the time period from 1988 to 2011, available at the 6-digit HS classification level. Tariff rates are aggregated to ISIC 3-digit level based on Product Concordance from World Integrated Trade Solution (WITS). The data on output, imports, exports and import demand elasticities ϵ_i^f are obtained from Nicita, and Olarreaga (2006). Domestic share, $s_{iH,t}$, is constructed by the value of domestic output in industry i over the total domestic spending on i. Similarly, the share of PTA partner, $s_{ir_j,t}$, is the ratio of the value of imports from partner r_j to domestic spending in i. The missing values in output data is imputed with the fitted value from regressing output data to industry index. The data on elasticity of substitution, σ_i, is obtained from Broda and Weinstein (2006) at ISIC 3-digit level. The data on geographical characteristics is from Mayer and Zignago (2011). Gravity equation variables come from Head and Mayer (2013).

We employ several approaches to measure bilateral political relation $\phi_{r_{j,t}}$. For our first measure, we use the affinity score index constructed by Voeten (2013) based on the United Nations General Assembly Voting Data (UNGAVD). The data records voting information on General Assembly resolutions for each UN member country. UN members can approve, abstain, or disapprove of each resolution. Based on the voting data, the dyadic affinity scores is constructed as the share of similar votes between country i and country j over the total of country i's votes. The affinity score index is often used to measure the degree of similarity in the economic and geopolitical interests of a pair of countries (Alesina and Dollar, 2000). For

example, the average magnitude of the affinity score index for US and its major political allies (Canada, France, Israel, UK, and Australia) ranges from 0.58 to 0.86 for the period between 2000 and 2012, and the score ranges from 0.17 to 0.21 for countries such as Iraq, Afghanistan, Cuba, Indonesia, and China during these periods.

Common political interests between countries is an important indicator of good international relations, yet not a perfect one. As Voeten (2013) points out, some countries may have share similar voting patterns in the UN on global matters but have poor political relations (e.g. India and Pakistan). Therefore, it is necessary to have additional political relation proxies to complement UN affinity scores.

Our second measure of political relations is the formal alliance status between two countries. We retrieve alliances data from the Correlates of War Formal Alliance (COWFA) v4.1 data set first constructed by Small and Singer (1969) and maintained by Gibler and Press (2009). This data set covers the periods from 1835 to 2012. The COWFA divides country i's alliances into 3 categories - defense pact, neutrality (non-aggression) treaty, and entente agreement. We use an indicator variable to classify countries are in good political relation if there is defense pact, which is the highest level of military commitment among these three classes and it requires intense political cooperation.

For the third measure of political relations, we use the frequencies of bilateral events and interactions from the Conflict and Peace Data Bank (COPDAB), which records actions of approximately 135 countries toward one another on a daily basis. The majority of the international events that involve countries are related to political relations (37.6%), economic relations (27.5%), military and strategic relations (14.9%), and cultural and scientific relations (10%). The bilateral interactions are categorized as cooperative, neutral or uncooperative. The events are recorded for the period from 1948 to 1978, a bit over 20 years prior to the first year of our data set, and the relevance of these events for the current political relations is certainly a concern. However, we argue that the international relations between countries have remained relatively stable since the end of the Second World War and the frequency of diplomatic interactions from 1950s to 1970s can still be informative of the current international relations.[11]

[11] This may not be the case for relationship with countries from the former Soviet Block, so we excluded them from this analysis.

In order to isolate the role of political relations from other influences to the frequency of bilateral events, such as the relative size of two countries, we first regress the number of diplomatic cooperative interactions on the log of population, GDP, geographic area, and the log of distance from one another using the full sample of country-pairs.[12] Because the dependent variable is a count variable with a large dispersion, the model is estimated by negative binomial regression with country-year fixed effects. We use the residuals from the regression as our measure of political relations, which is essentially the frequency of bilateral events purged from the scale effect. Figure 3.2 plots political interactions index against the affinity scores for US and other countries in our sample. It reveals that the frequency of diplomatic interactions is positively correlated with affinity scores, suggesting that the two measures capture similar aspects of political relations.

Table 3.1 summarizes the variables of interests in this study. The average MFN tariff in our sample is 7.3% during the period from 1988 to 2011. The average reduction of MFN tariff is about 0.4% each year during this period. The shares of domestic output over domestic consumptions are just over 60% and shrinks at about 1% per year on average for countries in our sample. The political relation proxies from UN affinity scores, defense pack, political interactions are summarized in ϕ_{UN}, $\phi_{Defense}$, and $\phi_{Interaction}$ respectively.

3.5 Results

In this section, we will provide results from estimating specification (3.18) and discuss their economic implications.

First, we want to learn whether in general countries are concerned with the welfare of their PTA partners. One way is to test if countries offer protectionist trade policy to umbrella the industries that are important to their PTA partners. We begin with estimating specification (3.18) without including any political relation proxy. This estimation shows how external tariff of each country H responds in the industries which have presence from their PTA partners' firms. If there is tariff coordination between PTA members, we would expect external tariffs to be relatively higher in these industries or they are liberalized slower than they would otherwise

[12] These variables are retrieved from Research and Expertise on the World Economy (CEPII).

be. Linear regression results are provided in Table 3.2. Column (1) reports the result on how changes in external tariff respond in industries with market presence of partners' firms for lagged 6 periods. Results in column (2) and column (3) are adjusted by elasticity of substitution and import demand elasticity respectively. Results in column (4) are adjusted by both types of elasticity. All these results are controlled for country-industry fixed effects. Results in Table 2 show that there are positive associations between changes in external tariffs and market presence of PTA partner countries' firms. The effects are stronger in the 2^{nd} and the 3^{rd} lagged periods with coefficients statistically significant at 0.01. The results suggest that an increase in market share of PTA partners' firms by one standard deviation is associated with about 3 percentage points increase in external tariff in industry i for the 3^{rd} period after formation of PTA.

We report the panel structure regression results from estimating specification (3.18) with different political relation proxies in Table 3.3. Column (1) provides the results unweighted by any political relation measures as the benchmark. For estimation results in Column (2) to (4), the market share from PTA partners' firms are weighted by political relation proxies. For example, when $s_{ir_j,t}$ is weighted by defense treaty $\phi_{Defense,r}$ (in Column 3), it estimates the effect of those industries imports from country H's political alliances. The estimation results relaxing the elasticity are reported in column (5) - (8). If close political relation between countries induces higher cooperation on external trade policy, we would expect the effect of weighted $s_{ir_j,t}$ on changes in external tariff to be stronger. Comparing to the benchmark results in Column (1), we find results weighted by political relation proxies are stronger especially for the 2^{nd} and 3^{rd} periods into PTA. For example, results in Column (2) suggests that those industries with firms from PTA partner countries which share similar geopolitical and economic interests enjoy about 50% more tariff protection at 3^{rd} year into PTA. We find similar effects when $s_{ir_j,t}$ is weighted by $\phi_{Defense,r}$ and $\phi_{Interaction,r}$.

Next, we report the IV estimation results for Imports from PTA partners. First, we estimate the benchmark model using unweighted $s_{ir_j,t}$ and which is instrumented by four different IVs which discussed in the previous section. Results are reported in Table 3.4 Column (1) - (4). Column (5) - (8) report the estimation results excluding the elasticity. In Table 3.5, we show the IV estimation results for specification (3.18) using three political relation proxies. The results from IV estimators are robust and consistent to the previous findings.

3.6 Conclusion

In this paper, we develop an endogenous trade policy formation model in a monopolistic competition framework with differentiated products and free market entry. We derive the equilibrium trade policy that incorporates a political factor to captures tariff cooperation between FTA member countries. Using this model, we show that multilateral liberalization is slower if FTA partners are concerned about the welfare of other members when setting their external trade policy.

We test this the prediction of the model using comprehensive trade and industry data, and find evidence that supports the tariff cooperative hypothesis. In addition, we find that the closer are the two FTA partners in political relations the more likely these two members coordinate their external trade policy to benefit the national welfare of the other.

3.7 Tables and figures

Table 3.1
Summary statistics of variables of interest.

	Mean	Standard deviation	Min	Max	N
MFN tariff	.073	.161	0	25.662	84429
Δ_{t-1} *MFN tariff*	-.004	.183	-2.586	13.834	77430
Preferential tariff	.001	.011	0	1.958	84429
Δ_{t-1} *Preferential tariff*	0	.015	-1.958	1.901	77430
Import demand elasticity	7.2	40.471	1.042	2944.918	63015
Elasticity of substitution	-1.093	1.066	-38.681	-.003	50835
$Share_{iH,t}$	.633	.297	0	1	12068
$\Delta_{t-1} Share_{iH}$	-.007	.093	-.971	.895	10469
$Share_{ir,t}$	.002	.028	0	.973	15458
$\Delta_{t-1} Share_{ir,t}$	0	.039	-.954	.973	13043
ln(import)	5.651	3.187	0	18.956	2374356
$ln(import\_IV_1)$	5.172	1.748	.002	16.705	1525623
$ln(import\_IV_2)$	5.403	2.715	0	22.337	2173609
$ln(import\_IV_3)$	5.405	2.714	0	22.345	2173609
$ln(import\_IV_4)$	5.43	2.675	0	20.023	1525623
ϕ_{UN}	.834	.151	0	1	387840
$\phi_{Defense}$	.793	.405	0	1	60349
$\phi_{Interaction}$	-.2	.533	-1	6.06	11151

Note: *MFN tariff* and *Preferential tariff* are aggregated from 6-digit HS classification to 3-digit ISIC classification. $Share_{iH,t}$ is the ratio of domestic output to domestic consumption of i at time t. $Share_{ir,t}$ is the ratio of import from partner r to domestic consumption of i at time t. Imports are recorded at 6-digit HS classification. The correlations between imports and its instrument variables $import\_IV_1$ - $import\_IV_4$ are 0.505, 0.829, 0.83, and 0.832 respectively. ϕ_{UN} is UN affinity score. $\phi_{Defense}=1$ when two countries is with defense treaty. $\phi_{Interaction}$ is the measure of political interactions between countries purged from scale effects.

Table 3.2
Linear regression results of the effects of political relation on external tariffs.

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Share_{iH,t}$	0	0	0	0	0	0
	(0.250)	(0.212)	(0.328)	(0.335)	(0.416)	(0.567)
$\Sigma_r (1-\tau_{ir,t-1}) Share_{ir,t-1}$	0.096*	0.049*	0.273	0.138	0.048	0.070
	(0.097)	(0.091)	(0.143)	(0.142)	(0.185)	(0.164)
$\Sigma_r (1-\tau_{ir,t-2}) Share_{ir,t-2}$	0.385***	0.201***	0.527**	0.263**	0.198***	0.338***
	(0.000)	(0.000)	(0.026)	(0.021)	(0.003)	(0.000)
$\Sigma_r (1-\tau_{ir,t-3}) Share_{ir,t-3}$	0.298***	0.154***	0.631***	0.322***	0.104***	0.230***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Sigma_r (1-\tau_{ir,t-4}) Share_{ir,t-4}$	0.042**	0.021**	0.114*	0.056*	0.004	0.020*
	(0.036)	(0.035)	(0.055)	(0.053)	(0.296)	(0.095)
$\Sigma_r (1-\tau_{ir,t-5}) Share_{ir,t-5}$	0.067**	0.034**	0.187**	0.093**	0.003	0.028*
	(0.030)	(0.029)	(0.049)	(0.048)	(0.122)	(0.088)
$\Sigma_r (1-\tau_{ir,t-6}) Share_{ir,t-6}$	0.063*	0.032*	0.179*	0.089*	0.010*	0.021
	(0.066)	(0.065)	(0.085)	(0.083)	(0.067)	(0.198)
Country-industry fixed effects	Yes	Yes	Yes	Yes		Yes
Industry-year fixed effects					Yes	
Year fixed effects		Yes	Yes			Yes
R^2	0.054	0.031	0.116	0.234	0.063	0.095
No. of Obs.	13031	12465	10626	10085	13031	13031
F statistics	17.13	16.75	6.91	8.36	3.31	3.31

The dependent variable is $\Delta\tau_{ij,t}$ in column (1), (5), (6,), and $[\sigma_{ij}/(\sigma_{ij}-1)]\Delta\tau_{ij,t}$ in column (2), and $\varepsilon_{ij}\Delta\tau_{ij,t}$ in column (3), and $\varepsilon_{ij}[\sigma_{ij}/(\sigma 1)]\Delta\tau_{ij,t}$ in column (4). $\Delta Share_{iH,t}$ is 1-period time difference in the ratio of domestic output to domestic consumption of i. $Share_{ir,t}$ is the ratio of import from partner r to domestic consumption of i at time t. Column (1) - (4) include country-industry fixed effect. Column (5) includes industry-year fixed effects. Columne (6) includes country-industry and year fixed effects. p-values, based on standard errors clustered at country-industry level, are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table 3.3
Estimation results for the effects of political relation on external tariffs in panel structure.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$\phi_r=1$	$\phi_{UN,r}$	$\phi_{Defense,r}$	$\phi_{Interaction,r}$	$\phi_r=1$	$\phi_{UN,r}$	$\phi_{Defense,r}$	$\phi_{Interaction,r}$
$\Delta Share_{iH,t}$	0	0	0	0	-0.000	-0.000	-0.000	-0.000
	(0.300)	(0.303)	(0.317)	(0.302)	(0.537)	(0.541)	(0.549)	(0.538)
$\Sigma_r \phi_r (1-\tau_{ir,t-1}) Share_{ir,t-1}$	0.137	0.520	0.093***	0.122	0.070	0.297	0.025	0.060
	(0.112)	(0.140)	(0.000)	(0.114)	(0.134)	(0.114)	(0.100)	(0.139)
$\Sigma_r \phi_r (1-\tau_{ir,t-2}) Share_{ir,t-2}$	0.289**	0.274**	0.736***	0.436**	0.338***	0.478***	0.890***	0.427***
	(0.011)	(0.028)	(0.000)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)
$\Sigma_r \phi_r (1-\tau_{ir,t-3}) Share_{ir,t-3}$	0.331***	0.487***	0.441***	0.420***	0.230***	0.345***	0.221***	0.268***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Sigma_r \phi_r (1-\tau_{ir,t-4}) Share_{ir,t-4}$	0.056**	0.076**	0.095***	0.051*	0.020*	0.058	0.007	0.016
	(0.037)	(0.046)	(0.000)	(0.067)	(0.072)	(0.102)	(0.464)	(0.110)
$\Sigma_r \phi_r (1-\tau_{ir,t-5}) Share_{ir,t-5}$	0.093**	0.138**	0.157***	0.084*	0.028*	0.068*	0.009	0.022
	(0.033)	(0.043)	(0.000)	(0.061)	(0.066)	(0.060)	(0.528)	(0.117)
$\Sigma_r \phi_r (1-\tau_{ir,t-6}) Share_{ir,t-6}$	0.088*	0.083	0.172***	0.080	0.021	0.023	0.007	0.016
	(0.062)	(0.134)	(0.000)	(0.107)	(0.166)	(0.250)	(0.676)	(0.259)
Country-industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects					Yes	Yes	Yes	Yes
F-statistics	9.73	6.25	17.73	11.42	30.26	26.53	33.61	29.53
Rho	.49	.49	.49	.49	.14	.14	.13	.14
R^2	0.000	0.000	0.000	0.000	0.050	0.051	0.047	0.049
No. of Obs.	10085	10085	10085	10085	13031	13031	13031	13031

The dependent is $\varepsilon_{ij}[\sigma_{ij}/(\sigma_{ij}-1)]\Delta\tau_{ij,t}$ in column (1) - (4) and $\Delta\tau_{ij,t}$ in column (5) - (8). Column (1) and (5) report estimates not weighted by proxy of political relation. $Share_{iH,t}$ is 1-period time difference in the ratio of domestic output to domestic consumption of *i*. $Share_{ir,t-1}$ is the ratio of import from partner *r* to domestic consumption of *i* at time *t-1*. ϕ_r is the political relation proxy. Estimates in column (2) and (6) are weighted by political affinity scores from UN Assembly Votings. Estimates in column (3) and (7) are weighted by defense treaty dummy. Estimates in column (4) and (8) are weighted by dyad political interactions. p-values, based on standard errors clustered at country-industry level, are reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table 3.4

Estimation results for the effects of on external tariffs using instrument variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Iv_1	Iv_2	Iv_3	Iv_4	Iv_1	Iv_2	Iv_3	Iv_4
$\Sigma_r (1-\tau_{ir,t-1}) Share_{ir,t-1}$	1.583***	0.769**	0.645**	0.602**	1.034***	0.465***	0.410**	0.397**
	(0.000)	(0.020)	(0.026)	(0.025)	(0.000)	(0.007)	(0.011)	(0.013)
$\Sigma_r (1-\tau_{ir,t-2}) Share_{ir,t-2}$	0.534***	0.288***	0.258***	0.237***	0.479***	0.474***	0.462***	0.457***
	(0.004)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
$\Sigma_r (1-\tau_{ir,t-3}) Share_{ir,t-3}$	0.520***	0.429***	0.382***	0.372***	0.413***	0.359***	0.331***	0.326***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Sigma_r (1-\tau_{ir,t-4}) Share_{ir,t-4}$	0.975***	0.381***	0.302***	0.281***	0.669***	0.271***	0.224***	0.213***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Sigma_r (1-\tau_{ir,t-5}) Share_{ir,t-5}$	1.218***	0.485***	0.396***	0.393***	0.162**	0.287***	0.236***	0.231***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.022)	(0.000)	(0.000)	(0.000)
$\Sigma_r (1-\tau_{ir,t-6}) Share_{ir,t-6}$	0.981***	0.311***	0.248***	0.252***	0.865***	0.202***	0.168***	0.168***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Delta Share_{iH,t}$	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.333)	(0.286)	(0.289)	(0.289)	(0.276)	(0.218)	(0.217)	(0.217)
Country-industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LM statistic	7.50	9.94	4.33	8.12	15.50	8.07	4.46	6.54
Cragg-donald wald	0.62	64.96	111.49	132.47	9.36	87.59	153.67	194.22
Hansen J. statistics	0	0	0	0	0	0	0	0
F-statistics	8.70	9.83	10.2	10.55	16.66	21.67	22.17	20.55
No. of Obs.	9882	9875	9920	9936	12779	12775	12824	12844

The dependent is $\varepsilon_{ij}[\sigma_{ij}/(\sigma_{ij}-1)]\Delta\tau_{ij,t}$ in column (1) - (4) and $\Delta\tau_{ij,t}$ in column (5) - (8). $\Delta Share_{iH,t}$ is 1-period time difference in the ratio of domestic output to domestic consumption of i. $Share_{ir,t-1}$ is the ratio of import from partner r to domestic consumption of i at time $t-1$. Column (1) and (4) are instrumented with Iv_1. Column (2) and (6) are instrumented with Iv_2. Column (3) and (7) are instrumented with Iv_3. Column (4) and (8) are instrumented with Iv_4. p-values, based on standard errors clustered at country-industry level, are reported in parentheses. LM statistic reports for underidentification test. Wald F. statistic reports for weak identification test. Hansen J statistic is zero for the case of exact identification. * p<0.10, ** p<0.05, *** p<0.01

Table 3.5

Estimation results for the effects of political relation on external tariffs using instrument variables.

	$\phi_{UN,r}$				$\phi_{Defense,r}$				$\phi_{interaction,r}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	IV1	*IV2*	*IV3*	*IV4*	*IV1*	*IV2*	*IV3*	*IV4*	*IV1*	*IV2*	*IV3*	*IV4*
$\Sigma_r \phi_r (1-\tau_{ir,t-1}) Share_{ir,t-1}$	2.719***	2.140***	1.868***	1.599***	0.963***	0.293***	0.203***	0.191***	2.319***	0.779**	0.631**	0.579**
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.003)	(0.009)	(0.005)	(0.000)	(0.033)	(0.046)	(0.045)
$\Sigma_r \phi_r (1-\tau_{ir,t-2}) Share_{ir,t-2}$	0.486***	0.348***	0.320***	0.308***	1.100***	1.104***	1.092***	1.121***	1.105***	0.438***	0.401***	0.357***
	(0.006)	(0.000)	(0.000)	(0.001)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Sigma_r \phi_r (1-\tau_{ir,t-3}) Share_{ir,t-3}$	0.752***	0.531***	0.485***	0.483***	2.797**	0.587***	0.497***	0.505***	0.936***	0.524***	0.465***	0.468***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.043)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Sigma_r \phi_r (1-\tau_{ir,t-4}) Share_{ir,t-4}$	1.039***	0.723***	0.618***	0.531***	0.990***	0.362***	0.237***	0.222***	1.134***	0.398***	0.308***	0.287***
	(0.005)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Sigma_r \phi_r (1-\tau_{ir,t-5}) Share_{ir,t-5}$	1.391***	0.868***	0.751***	0.726***	1.292***	0.443***	0.291***	0.292***	1.477***	0.500***	0.399***	0.392***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Sigma_r \phi_r (1-\tau_{ir,t-6}) Share_{ir,t-6}$	1.014***	0.283***	0.247***	0.246***	0.624***	0.385***	0.237***	0.259***	1.241***	0.343***	0.263***	0.269***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\Delta Share_{iH,t}$	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.337)	(0.291)	(0.293)	(0.293)	(0.298)	(0.318)	(0.317)	(0.318)	(0.346)	(0.285)	(0.288)	(0.288)
Country-industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LM statistic	20.65	13.28	2.46	12.9	3.81	2.63	2.63	2.68	6.58	7.52	3.25	5.91
Cragg-Donald Wald	1.86	19.51	2.36	29.84	0.56	54.3	1.72	31.9	0.91	25.03	1.81	26.44
No. of Obs.	9882	9875	9920	9936	9882	9875	9920	9936	9882	9875	9920	9936

The dependent variable is $\varepsilon_{ij}[\sigma_{ij}/(\sigma_{ij}-1)]\Delta\tau_{ij,t}$. $\Delta Share_{iH,t}$ is 1-period time difference in the ratio of domestic output to domestic consumption of i. $Share_{ir,t-1}$ is the ratio of import from partner r to domestic consumption of i at time $t-1$. Estimates in column (1) - (4) are weighted by political affinity scores from UN Assembly Votings. Estimates in column (5) - (8) are weighted by defense treaty dummy. Estimates in column (9) - (12) are weighted by dyad political interactions. p-values, based on standard errors clustered at country-industry level, are reported in parentheses. LM statistic reports for underidentification test. Wald F. statistic reports for weak identification test. Hansen J statistic is zero for the case of exact identification. * p<0.10, ** p<0.05, *** p<0.01

Figure 3.1
Change in MFN tariff after formation of PTA for high and low political relation.

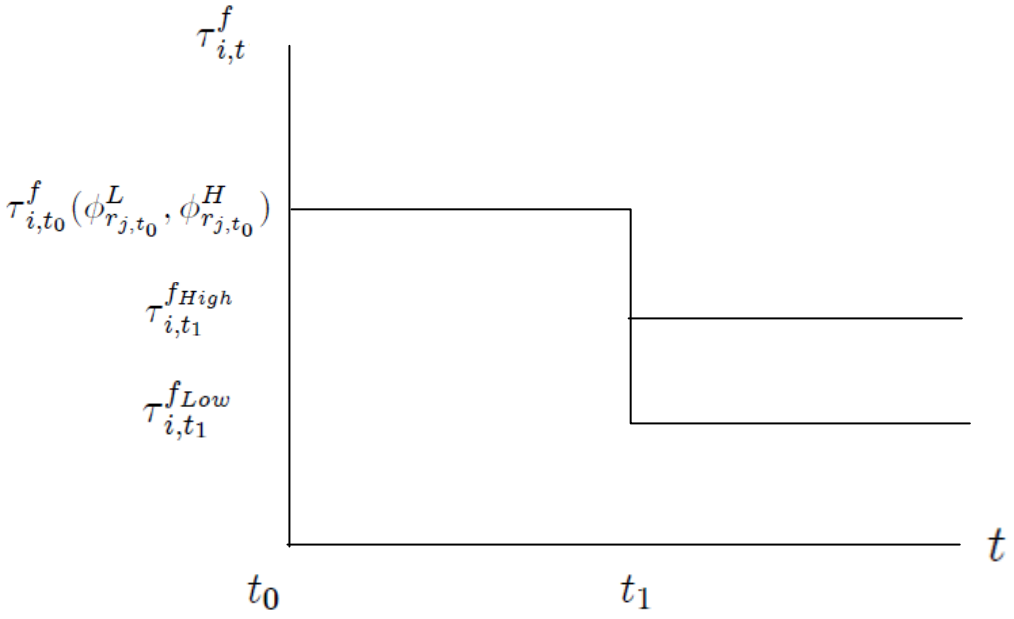
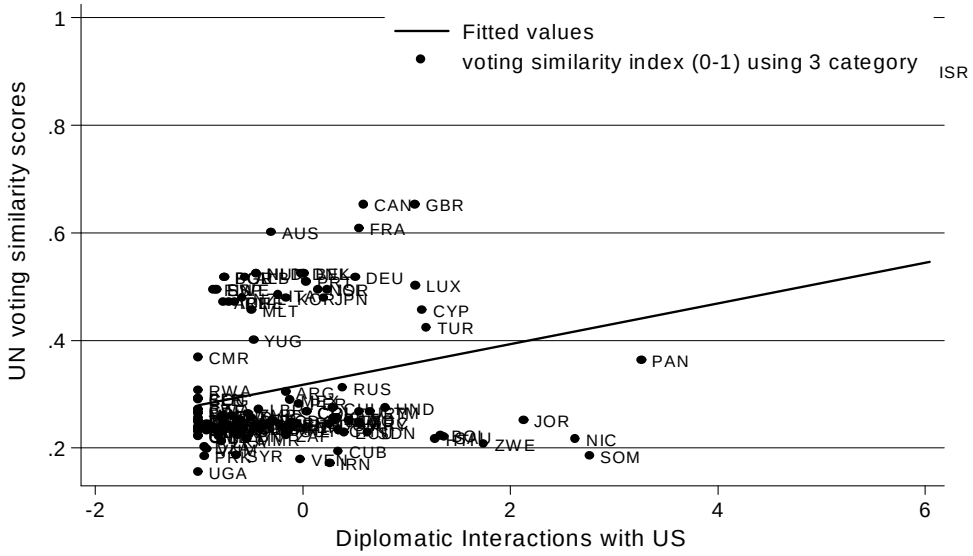


Figure 3.2
UN voting similarity scores against frequency of diplomatic interactions



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Appendix A

Chapter 1 Appendix

Partial equilibrium model with one industry producing homogeneous product traded at price p.

Assume that preferences of a representative consumer are characterized by a quadratic utility function:

$$U = \alpha Q - \frac{\beta}{2} Q^2$$

where $Q = \sum_i q_i$ is the total consumption of the homogeneous good and q_i is quantity purchased from firm i. Maximizing utility function subject to the standard budget constraint we obtain inverse demand function

$$p = \alpha - \beta Q$$

Suppose there are $(N + 2)$ firms in the market. Firm 1 (F1) is a home country firm which will attempt to imitate production technology of a foreign firm, firm 2 (F2) is the foreign firm exporting to the home country market utilizing a potentially more advanced production technology, and the remaining N firms are symmetric in terms of costs and represent the rest of the industry. We assume they are all domestic firms although this assumption is not critical. A representative firm from the rest of the industry we call firm 3 (F3). We further assume that each firm i has a constant marginal costs c_i. Profit function of firm i is then given by

$$\pi_i = (p - c_i)\, q_i$$

If all equilibrium quantities are positive, then the first-order conditions for profit maximization give the following best response functions

$$q_1 = \frac{\alpha - c_1}{2\beta} - \frac{q_2 + Nq_3}{2}$$
$$q_2 = \frac{\alpha - c_2}{2\beta} - \frac{q_1 + Nq_3}{2}$$
$$q_3 = \frac{\alpha - c_3}{(N+1)\beta} - \frac{q_1 + q_2}{(N+1)\beta}$$

Solving this system of equations we obtain equilibrium output of each firm:

$$q_1 = \frac{\alpha - (N+2)c_1 + c_2 + Nc_3}{\beta(N+3)}$$
$$q_2 = \frac{\alpha + c_1 - (N+2)c_2 + Nc_3}{\beta(N+3)}$$
$$q_3 = \frac{\alpha + c_1 + c_2 - 3c_3}{\beta(N+3)}$$

Total output, price and consumer surplus:

$$Q = \frac{\alpha(N+2) - c_1 - c_2 - Nc_3}{\beta(N+3)}$$
$$p = \frac{\alpha + c_1 + c_2 + Nc_3}{\beta(N+3)}$$
$$CS = \frac{\beta}{2}Q^2$$

Suppose foreign firm possesses a more advanced production technology characterized by lower marginal costs. We want to compare two cases: when domestic legal system protects IPR of the foreign firm and does not allow F1 to imitate its technology; when the legal system favors domestic firm and allows it to imitate technology of F2. We want to analyze the relationship between size of F1 and F2 and the change in welfare from technology transfer. Since in our model a firm's relative size depends on relative marginal costs, we want to know how welfare change varies with c_1 and c_2.

Some partial derivatives:

$$\begin{aligned}
\frac{\partial Q}{\partial c_1} &= \frac{\partial Q}{\partial c_2} = -\frac{1}{\beta\left(N+3\right)} \\
\frac{\partial p}{\partial c_1} &= \frac{\partial p}{\partial c_2} = \frac{1}{\left(N+3\right)} \\
\frac{\partial CS}{\partial c_1} &= \frac{\partial CS}{\partial c_2} = -\frac{Q}{\left(N+3\right)} \\
\frac{\partial q_1}{\partial c_1} &= \frac{\partial q_2}{\partial c_2} = -\frac{N+2}{\beta\left(N+3\right)} \\
\frac{\partial q_1}{\partial c_2} &= \frac{\partial q_2}{\partial c_1} = \frac{\partial q_3}{\partial c_2} = \frac{\partial q_3}{\partial c_1} = \frac{1}{\beta\left(N+3\right)} \\
\frac{\partial \pi_1}{\partial c_1} &= \frac{q_1}{\left(N+3\right)} - q_1 - \left(p-c_1\right)\frac{\left(N+2\right)}{\beta\left(N+3\right)} \\
\frac{\partial \pi_1}{\partial c_2} &= \frac{q_1}{\left(N+3\right)} + \left(p-c_1\right)\frac{1}{\beta\left(N+3\right)} \\
\frac{\partial \pi_3}{\partial c_1} &= \frac{\partial \pi_3}{\partial c_2} = \frac{q_3}{\left(N+3\right)} - \left(p-c_3\right)\frac{1}{\beta\left(N+3\right)}
\end{aligned}$$

Welfare:

$$W = CS + \pi_1 + N\pi_3$$

$$\begin{aligned}
\frac{\partial W}{\partial c_2} &= -\frac{Q}{\left(N+3\right)} + \frac{q_1}{\left(N+3\right)} + \left(p-c_1\right)\frac{1}{\beta\left(N+3\right)} + \frac{q_3}{\left(N+3\right)} - \left(p-c_3\right)\frac{1}{\beta\left(N+3\right)} \\
&= -\frac{q_2}{\left(N+3\right)} + \frac{N+1}{\beta\left(N+3\right)}p - \frac{1}{\beta\left(N+3\right)}c_1 - \frac{1}{\beta\left(N+3\right)}c_3
\end{aligned}$$

Consider the case when F2 has access to production technology which reduces marginal costs by $\varepsilon > 0$. Denote by Δx the change in variable x when we move from the equilibrium in which F1 is not allowed to imitate this technology to the one where it is allowed. Then

$$\frac{\partial \Delta W}{\partial c_2} = -\frac{\Delta q_2}{\left(N+3\right)} + \frac{N+1}{\beta\left(N+3\right)}\Delta p - \frac{1}{\beta\left(N+3\right)}\Delta c_1$$

shows the extent to which the size of the foreign firm affects the benefit of not protecting its

IPR. Using the following conditions:

$$\begin{aligned}
\Delta q_2 &= -\frac{\varepsilon}{\beta\left(N+3\right)} \\
\Delta q_1 &= \frac{\left(N+2\right)\varepsilon}{\beta\left(N+3\right)} \\
\Delta p &= -\frac{\varepsilon}{\left(N+3\right)} \\
\Delta c_1 &= -\varepsilon
\end{aligned}$$

we obtain the result:

$$\frac{\partial \Delta W}{\partial c_2} = -\frac{\left(2N+3\right)\varepsilon}{\beta\left(N+3\right)^2} < 0$$

This result implies that for small c_2 (when foreign firm is large and efficient) allowing F1 to imitate IPR of F2 will have a stronger positive impact on home country welfare.

Similarly,

$$\begin{aligned}
\frac{\partial \Delta W}{\partial c_1} &= -\Delta q_1 - \frac{\Delta q_2}{\left(N+3\right)} - \frac{2}{\beta\left(N+3\right)}\Delta p + \frac{\left(N+2\right)}{\beta\left(N+3\right)}\Delta c_1 \\
&= -\frac{2\left(N+2\right)}{\beta\left(N+3\right)}\varepsilon + \frac{3}{\beta\left(N+3\right)^2}\varepsilon < 0
\end{aligned}$$

Therefore, when domestic firm is originally larger and more efficient (c_1 is small), the positive effect of allowing it to imitate foreign IPR is stronger.

As a result, if a court has welfare-maximizing objectives, it would tend to favor domestic firms in their litigations against foreign when both domestic and foreign firm tend to be larger.

Appendix B

Chapter 2 Appendix

B.1 Derivation of equilibrium trade policies

Consumers' preferences are given by

$$U\left(X_0, X_i\right) = X_0 + \sum_{i=1}^{N} a_i \ln X_i, \quad \sum_{i=1}^{N} a_i = 1$$

$$X_i = \left(\sum_{j=H,P,F} \sum_{f=1}^{k_{ij}} d_{ijf}^{\frac{1}{\sigma_i}} c_{ijf}^{\frac{\sigma_i - 1}{\sigma_i}} \right)^{\frac{\sigma_i}{\sigma_i - 1}}$$

Utility-maximizing consumption of variety (i, j, f) is

$$c_{ij} = \frac{a_i d_{ijf}}{p_{ijf}} \left(\frac{p_{ijf}}{P_i} \right)^{1-\sigma_i}$$

where p_{ijf} is the price for variety (i, j, f) and P_i is the ideal price index for product i:

$$P_i = \left(\sum_{j=H,P,F} \sum_{f=1}^{k_{ij}} d_{ijf} c_{ijf}^{1-\sigma_i} \right)^{\frac{1}{1-\sigma_i}}$$

We assume that firms from the same country and industry are symmetric and share the same constant marginal costs c_{ij} so that the firm subscript can be skipped for brevity. With the specific tariff on imports of good i from country j given by τ_{ij} ($\tau_{iH} = 0$), profit function of a

firm from country j operating in industry i is

$$\pi_{ij} = (p_{ij} - c_{ij} - \tau_{ij})\, q_{ij}$$

and the profit-maximizing price is

$$p_{ij} = \frac{\sigma_i}{\sigma_i - 1}\,(c_{ij} + \tau_{ij})$$

Before deriving equilibrium trade policies, it is useful to calculate the responsiveness of equilibrium prices and quantities to change in the tariff rate.

$$\frac{\partial q_{ij}}{\partial \tau_{iF}} = (\sigma_i - 1)\,\frac{q_{ij}}{P_i}\frac{\partial P_i}{\partial \tau_{iF}}, \quad j = H, P$$

$$\frac{\partial q_{iF}}{\partial \tau_{iF}} = (\sigma_i - 1)\,\frac{q_{iF}}{P_i}\frac{\partial P_i}{\partial \tau_{iF}} - \frac{\sigma_i^2}{\sigma_i - 1}\frac{q_{iF}}{p_{iF}}$$

$$\frac{\partial P_i}{\partial \tau_{iF}} = \frac{\sigma_i}{\sigma_i - 1} s_{iF}\frac{P_i}{p_{iF}}$$

where $s_i^j = \frac{n_{ij}p_{ij}q_{ij}}{X_i P_i} = n_{ij}d_{ij}\left(\frac{p_{ij}}{P_i}\right)^{1-\sigma_i}$ is the share of firms from country j in the home country's market for good i.

The effect of a change in tariff τ_{iF} in tariff revenue (TR), consumer surplus (CS), and profits are

$$\begin{aligned}
\frac{\partial TR}{\partial \tau_{iF}} &= \frac{\partial\left(\tau_{iP}n_{iP}p_{iP}q_{iP} + \tau_{iF}n_{iF}p_{iF}q_{iF}\right)}{\partial \tau_{iF}} \\
&= X_i\frac{\partial P_i}{\partial \tau_{iF}}\left\{(\sigma_i - 1)\,\frac{\tau_{iP}}{p_{iP}}s_i^P + \frac{\sigma_i - 1}{\sigma_i} + \frac{\tau_{iF}}{p_{iF}}\left[(\sigma_i - 1)\,s_i^F - \sigma_i\right]\right\}
\end{aligned}$$

$$\frac{\partial CS}{\partial \tau_{iF}} = -X_i\frac{\partial P_i}{\partial \tau_{iF}}$$

$$\frac{\partial\left(n_{ij}\pi_{ij}\right)}{\partial \tau_{iF}} = \frac{\sigma_i - 1}{\sigma_i}s_i^j X_i\frac{\partial P_i}{\partial \tau_{iF}}, \quad \text{for } j = H, P$$

$$\frac{\partial\left(n_{iF}\pi_{iF}\right)}{\partial \tau_{iF}} = -\frac{\sigma_i - 1}{\sigma_i}\left[1 - s_i^F\right]X_i\frac{\partial P_i}{\partial \tau_{iF}}$$

B.2 Non-cooperative trade policy

Without political economy factors and cooperating in trade policies between FTA member countries, home country government chooses import tariffs in order to maximize the following objective function:

$$G_0(\tau) = W_0(\tau) = CS + TR + \sum_i n_{iH}\pi_{iH}$$

The first-order condition is

$$\frac{\partial G_0}{\partial \tau_{iF}} = X_i \frac{\partial P_i}{\partial \tau_{iF}} \left\{ (\sigma_i - 1) \frac{\tau_{iP}}{p_{iP}} s_i^P - \frac{1}{\sigma_i} + \frac{\tau_{iF}}{p_{iF}} \left[(\sigma_i - 1) s_i^F - \sigma_i \right] + \frac{\sigma_i - 1}{\sigma_i} s_i^H \right\} = 0$$

Solving it for $\frac{\tau_{iF}}{p_{iF}}$, we obtain the equilibrium non-cooperative ad-valorem tariff rate for imports from country F, t_i:

$$\varepsilon_i t_i^F = (\sigma_i - 1) t_i^P s_i^P - \frac{1}{\sigma_i} + \frac{\sigma_i - 1}{\sigma_i} s_i^H \tag{B.1}$$

where $\varepsilon_i = \frac{\partial q_{iF}}{\partial p_{iF}} \frac{p_{iF}}{q_{iF}}$ is the price elasticity of demand for imports from country F. Allowing import tariffs and market shares to vary over time, the change in the MFN tariff is then equal to

$$\varepsilon_i \Delta t_{it}^F = (\sigma_i - 1) \Delta \left(t_{it}^P s_{it}^P \right) + \frac{\sigma_i - 1}{\sigma_i} \Delta s_{it}^H$$

B.3 Cooperative trade policy

When home and partner countries set trade policies cooperatively, the objective function of the home country government is

$$G_1(\tau) = W_0(\tau) + b \sum_i n_{iP}\pi_{iP} = CS + TR + \sum_i \left(n_{iH}\pi_{iH} + b n_{iP}\pi_{iP} \right)$$

where $b \in [0, 1]$ is the parameter that reflects relative importance of domestic and partner's welfare for home country's government and measures the degree of political cooperation. The first order condition for import tariff in the presence of an FTA is

$$\frac{\partial G_1}{\partial \tau_{iF}} = \frac{\partial G_0}{\partial \tau_{iF}} + b \frac{\sigma_i - 1}{\sigma_i} s_i^P X_i \frac{\partial P_i}{\partial \tau_{iF}} = 0$$

and the resulting equilibrium cooperative tariff for imports from outsider of the agreement is

$$\varepsilon_i t_i^F = (\sigma_i - 1)\left(t_i^P s_i^P\right) - \frac{1}{\sigma_i} + \frac{\sigma_i - 1}{\sigma_i} s_i^H + b\frac{\sigma_i - 1}{\sigma_i} s_i^P \tag{B.2}$$

The short-run year-to-year changes in the MFN tariff following FTA formation are then equal to

$$\varepsilon_i \Delta t_{it}^F = (\sigma_i - 1)\,\Delta\left(t_{it}^P s_{it}^P\right) + \frac{\sigma_i - 1}{\sigma_i}\Delta s_{it}^H + b\frac{\sigma_i - 1}{\sigma_i}\Delta s_{it}^P$$

In order to identify long-run change in the MFN tariff resulting from FTA formation, we need to compare the MFN rates at the end of the ten-year CUSFTA grace period to the pre-FTA rates. Assuming that FTA has no impact on the degree of cooperation between member countries (i.e. parameter b does not change over time), the equilibrium pre-FTA tariff rate is

$$\varepsilon_i t_i^F = (\sigma_i - 1)\left(t_i^P s_i^P\right) - \frac{1}{\sigma_i} + \frac{\sigma_i - 1}{\sigma_i} s_i^H + b\frac{\sigma_i - 1}{\sigma_i}\left(\frac{s_i^P}{s_i^P + s_i^F}\right) \tag{B.3}$$

Without an FTA, cooperation between H and P will have an additional negative impact on the MFN tariff captured by the last term on the right-hand side which is proportional to the share of imports from partner country in total imports of country H. Subtracting (B.3) from (B.2) we obtain the change in the MFN tariff

$$\varepsilon_i \Delta_9 t_{it}^F = (\sigma_i - 1)\,\Delta_9\left(t_{it}^P s_{it}^P\right) + \frac{\sigma_i - 1}{\sigma_i}\Delta_9 s_{it}^H + b\frac{\sigma_i - 1}{\sigma_i}\left(s_i^{1P} + \frac{s_i^{0P}}{s_i^{0P} + s_i^{0F}}\right) \tag{B.4}$$

where $\Delta_9 x_{it} = x_i^1 - x_i^0$ and x_i^1 stands for the value of variable x in the final year of the CUSFTA and x_i^0 for the pre-CUSFTA value.

It is also possible that negotiations and implementation of the agreement can boost cooperation between member countries on various issues, including trade policy. In the extreme case when there is no cooperation between home and partner country before the agreement, pre-FTA tariff rate would be given by (B.1) and the change in the MFN tariff is thus

$$\varepsilon_i \Delta_9 t_{it}^F = (\sigma_i - 1)\,\Delta_9\left(t_{it}^P s_{it}^P\right) + \frac{\sigma_i - 1}{\sigma_i}\Delta_9 s_{it}^H + b\frac{\sigma_i - 1}{\sigma_i} s_i^P \tag{B.5}$$

In the absence of any restrictions on t_{it}^F adjustments the effect of tariff cooperation could be

estimated directly from (B.4) or (B.5).

B.4 Cooperative trade policy under political economy

In the presence of political economy factors, the home country government set import tariff to maximize the weighted sum of national welfare, partner country's rent, and political contributions from domestic industries C:

$$G_2(\tau) = aW_0(\tau) + b\sum_i n_{iP}\pi_{iP} + C(\tau)$$

where a represents government's preference for welfare relative to contributions. We follow Maggi and Rodriguez-Clare (1998) and model this lobbying process as a simple bargaining process between government and industries so that the equilibrium political tariff maximizes the sum of payoffs:

$$\tau_F = \arg\max\left\{aW_0 + \alpha(CS + TR) + \sum_i \left[bn_{iP}\pi_{iP} + I_i\pi_{iH}\right]\right\}$$

where I_i is a binary variable which takes the value of one for politically organized industries and α is the share of population represented by lobbying groups. Solving for the equilibrium tariff we obtain (see Stoyanov, 2014, for complete derivation):

$$\begin{aligned}\varepsilon_i t_i^F &= (\sigma_i - 1)\, t_i^P s_i^P - \frac{1}{\sigma_i} + \frac{\sigma_i - 1}{\sigma_i}\left[\frac{a}{a+\alpha}s_i^H + \frac{1}{a+\alpha}I_i s_i^H\right] \\ &\quad + \frac{ab}{a+\alpha}\frac{\sigma_i - 1}{\sigma_i}\left(\frac{s_i^P}{s_i^P + s_i^F}\right)\end{aligned}$$

Appendix C

Chapter 3 Appendix

The response of price and quantity to change in the tariff rate:

$$\frac{\partial x_{iH}}{\partial \tau_{if}} = (\sigma_i - 1)\frac{x_{iH}}{P_i}\frac{\partial P_i}{\partial \tau_{if}}$$

$$\frac{\partial x_{ir_j}}{\partial \tau_{if}} = (\sigma_i - 1)\frac{x_{ir_j}}{P_i}\frac{\partial P_i}{\partial \tau_{if}}$$

$$\frac{\partial x_{if_j}}{\partial \tau_{if}} = -\sigma_i \frac{x_{if_j}}{1-\tau_{if}} + (\sigma_i - 1)\frac{x_{if_j}}{P_i}\frac{\partial P_i}{\partial \tau_{if}}$$

$$\frac{\partial P_i}{\partial \tau_{if}} = \frac{P_i}{1-\tau_{if}}\sum_{f_j=1}^{F} n_{if_j} d_{if_j}\left(\frac{p_{if_j}}{P_i}\right)^{1-\sigma_i} = \frac{P_i}{1-\tau_{if}}\sum_{f_j=1}^{F} s_{if_j}$$

Response of consumer surplus to changes in external tariff:

Consumer surplus is

$$CS(\tau) = V(Y, P_i) - Y = -\sum_{i=1}^{n} a_i + \sum_{i=1}^{n} a_i \ln\left(\frac{a_i}{P_i}\right) = \sum_{i=1}^{n} a_i \left(\ln a_i - 1 - \ln P_i\right)$$

$$\frac{\partial CS(\tau)}{\partial \tau_{if}} = -\frac{a_i}{P_i}\frac{\partial P_i}{\partial \tau_{if}} = -X_i \frac{\partial P_i}{\partial \tau_{if}} = -X_i \frac{P_i}{1-\tau_{if}}\sum_{f_j=1}^{F} s_{if_j}$$

Response of tariff revenue to change in external tariff:

$$\frac{\partial TR(\tau)}{\partial \tau_{if}} = \frac{\partial \sum_{i=1}^{n}\sum_{j=1}^{F,R} \tau_{ij} p_{ij} n_{ij} x_{ij}}{\partial \tau_{if}}$$

$$= \sum_{f_j=1}^{F} \left[a_i s_{if_j} + \frac{a_i(1-\sigma_i)}{1-\tau_{if}} \tau_{if} s_{if_j} + (\sigma_i - 1) X_i \frac{\partial P_i}{\partial \tau_{if}} \tau_{if} s_{if_j} \right] + \sum_{r_j=1}^{R} (\sigma_i - 1) \frac{\partial P_i}{\partial \tau_{if}} X_i \tau_{ir_j} s_{ir_j}$$

$$= \sum_{f_j=1}^{F} a_i s_{if_j} - \sum_{f_j=1}^{F} \frac{a_i(\sigma_i - 1)}{1-\tau_{if}} \tau_{if} s_{if_j} + \sum_{f_j=1}^{F} (\sigma_i - 1) X_i \frac{\partial P_i}{\partial \tau_{if}} \tau_{if} s_{if_j} + \sum_{r_j=1}^{R} (\sigma_i - 1) \frac{\partial P_i}{\partial \tau_{if}} X_i \tau_{ir_j} s_{ir_j}$$

$$= a_i \sum_{f_j=1}^{F} s_{if_j} - \frac{a_i(\sigma_i - 1)}{1-\tau_{if}} \tau_{if} \sum_{f_j=1}^{F} s_{if_j} + (\sigma_i - 1) X_i \frac{\partial P_i}{\partial \tau_{if}} \tau_{if} \sum_{f_j=1}^{F} s_{if_j} + (\sigma_i - 1) \frac{\partial P_i}{\partial \tau_{if}} X_i \sum_{r_j=1}^{R} \tau_{ir_j} s_{ir_j}$$

$$= \frac{a_i(1-\tau_{if})}{P_i} \frac{\partial P_i}{\partial \tau_{if}} - \frac{a_i(\sigma_i - 1)}{1-\tau_{if}} \tau_{if} \frac{(1-\tau_{if})}{P_i} \frac{\partial P_i}{\partial \tau_{if}} + (\sigma_i - 1) X_i \frac{\partial P_i}{\partial \tau_{if}} \tau_{if} \sum_{f_j=1}^{F} s_{if_j} + (\sigma_i - 1) \frac{\partial P_i}{\partial \tau_{if}} X_i \sum_{r_j=1}^{R} \tau_{ir_j} s_{ir_j}$$

$$= X_i \frac{\partial P_i}{\partial \tau_{if}} \left[1 - \tau_{if} - (\sigma_i - 1)\tau_{if} + (\sigma_i - 1)\tau_{if} \sum_{f_j=1}^{F} s_{if_j} + (\sigma_i - 1) \sum_{r_j=1}^{R} \tau_{ir_j} s_{ir_j} \right]$$

Response of firms' profits to change in external tariff:

$$\frac{\partial \sum_{i=1}^{n} \sum_{r_j=1}^{R} n_{ir_j} \pi_{ir_j}}{\partial \tau_{if}} = \frac{\sigma_i - 1}{\sigma_i} X_i \frac{\partial P_i}{\partial \tau_{if}} \sum_{r_j=1}^{R} (1 - \tau_{ir_j}) s_{ir_j}$$

$$\begin{aligned} \frac{\partial \sum_{i=1}^{n} \sum_{f_i=1}^{F} n_{if_i} \pi_{if_i}}{\partial \tau_{if}} &= X_i \frac{\partial P_i}{\partial \tau_{if}} \left[-\frac{1-\tau_{if}}{\sigma_i} + \frac{\sigma_i - 1}{\sigma_i}(1-\tau_{if}) \sum_{f_j=1}^{F} s_{if_j} - \frac{\sigma_i - 1}{\sigma_i}(1-\tau_{if}) \right] \\ &= X_i \frac{\partial P_i}{\partial \tau_{if}} \left[-\frac{1-\tau_{if}}{\sigma_i} - \frac{\sigma_i - 1}{\sigma_i}(1-\tau_{if}) \left(1 - \sum_{f_j=1}^{F} s_{if_j} \right) \right] \end{aligned} \tag{C.1}$$

Import demand elasticity:

$$\frac{\partial x_{if_j}}{\partial \tau_{if}} \frac{\tau_{if}}{x_{if_j}} = \frac{\tau_{if}}{1-\tau_{if}} \left[-\sigma_i + (\sigma_i - 1) \sum_{f_j=1}^{F} s_{if_j} \right]$$

$$|\epsilon_{i\tau_F}| = \frac{1-\tau_{if}}{\tau_{if}} \frac{\partial x_{if_j}}{\partial \tau_{if}} \frac{\tau_{if}}{x_{if_j}} = \sigma_i - (\sigma_i - 1) \sum_{f_j=1}^{F} s_{if_j}$$

$$
\begin{aligned}
\frac{\partial x_{if_j}}{\partial p_{if_j}} \frac{p_{if_j}}{x_{if_j}} &= \frac{\partial x_{if_j}}{\partial \tau_{if}} \frac{\partial \tau_{if}}{\partial p_{if_j}} \frac{p_{if_j}}{x_{if_j}} \\
&= \left[\frac{-\sigma_i x_{if_j}}{1-\tau_{if}} + (\sigma_i - 1) \frac{x_{if_j}}{P_i} \frac{P_i}{1-\tau_{if}} \sum_{f_j=1}^{F} s_{if_j} \right] \frac{(\sigma_i - 1)(1-\tau_{if})}{\sigma_i c_{if_j}} \frac{p_{if_j}}{x_{if_j}} \\
&= -\sigma_i + (\sigma_i - 1) \sum_{f_j=1}^{F} s_{if_j}
\end{aligned}
$$

$$
|\epsilon_{i\tau_F}| = \left| \frac{\partial x_{if_j}}{\partial p_{if_j}} \frac{p_{if_j}}{x_{if_j}} \right| = \sigma_i - (\sigma_i - 1) \sum_{f_j=1}^{F} s_{if_j}
$$