Strategic Trade Liberalization*

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Abstract

We analyze the selection of FTA partners as a way for countries to conduct strategic trade policy while complying with WTO rules. The domestic welfare implications of each agreement varies with the pass-through rate of tariff reductions and the substitution between imports and domestically produced goods. We first illustrate theoretically how primitives of the demand system, market penetration, and product specialization enter this comparison. To make the analysis concrete, we also conduct an empirical evaluation for Canada. We first construct a full counterfactual market equilibrium for the automobile market. Next, we apply a simplified framework to the major industries importing differentiated goods. Canada's choice to pursue an FTA with Korea ahead of one with the EU and Japan would be welfare maximizing if the consumer surplus of low-income households receives disproportionate weight in the social welfare objective.

JEL Codes: F1, F6, L1

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1 Introduction

In the 1980s, the international trade literature saw a flurry of studies on 'strategic trade policy' (Brander, 1995). In these oligopoly models, governments could boost national welfare by introducing tariffs or subsidies to shift profits from foreign to domestic firms. The policy relevance of this literature was limited for several reasons. Many findings turned out to be quite sensitive to the modeling assumptions, similarly to early applications of game theory in the field of industrial organization.[1] Two other drawbacks were more specific to the international trade setting. First, proposed policies had strong 'beggar-thy-neighbor' effects, raising domestic welfare at the expense of other countries. The possibility of retaliation leads to a prisoner's dilemma situation where everyone is worse off than in the cooperative outcome without interventions, which can be a Nash equilibrium under repeated interaction. Second, within the framework of the General Agreement on Tariffs and Trade (GATT) and its successor, the World Trade Organization (WTO), countries are not allowed to impose new import tariffs nor provide export subsidies.

Regional Trade Agreements are a WTO-sanctioned exception to the most-favoured nation principle which prohibits discrimination between WTO members. After broad-based tariff reductions had been achieved in the Uruguay round, which came into effect in 1995, the next (Doha) round of multilateral trade negotiations stagnated. Countries increasingly pursued bilateral trade deals, the vast majority of which are Free Trade Agreements (FTA).[2] Paraphrasing Article XXIV of the GATT, FTAs are allowed under two conditions: (i) trade restrictions imposed on other WTO members do not increase, and (ii) restrictions on 'substantially all trade' between FTA partners are eliminated. They are one policy tool that effectively allows discrimination between WTO members, while at the same time, their very nature minimizes the possibility of retaliation.

The policy decision boils down to a choice of FTA partner to eliminate all bilateral import tariffs with. We do not propose a general theory of FTA formation that maximizes domestic welfare, as a myriad of considerations would enter such a decision. Rather, we investigate when a government wants to liberalize trade, how the relative attractiveness of

[1]In particular, noncooperative trade policy equilibria would vary with the use of specific or ad valorem tariffs, Cournot or Bertrand style competitive behavior, homogeneous or differentiated products, and free or restricted entry, as investigated in Brander and Krugman (1983), Brander and Spencer (1984b), and in particular Eaton and Grossman (1986).

[2]As of January 17, 2020, the WTO reports that 303 RTAs were in force (`www.wto.org/english/tratop_e/region_e/region_e.htm`).

different FTA partners depends on primitives of the domestic economy. We study this in a setting of oligopolistic industries where all firms choose prices strategically. As it would be infeasible to perform counterfactual analyses for all markets in all countries, we focus on the domestic markets for differentiated products in a country that is considering to liberalize trade. According to models in the original strategic trade literature, e.g. Brander and Spencer (1984a), we expect domestic welfare to fall when tariffs are eliminated. The objective is to pick an FTA partner that minimizes this domestic loss. Naturally, a country also gains from improved market access abroad, but the domestic losses tend to play a disproportionate role in the political haggling surrounding FTA negotiations.

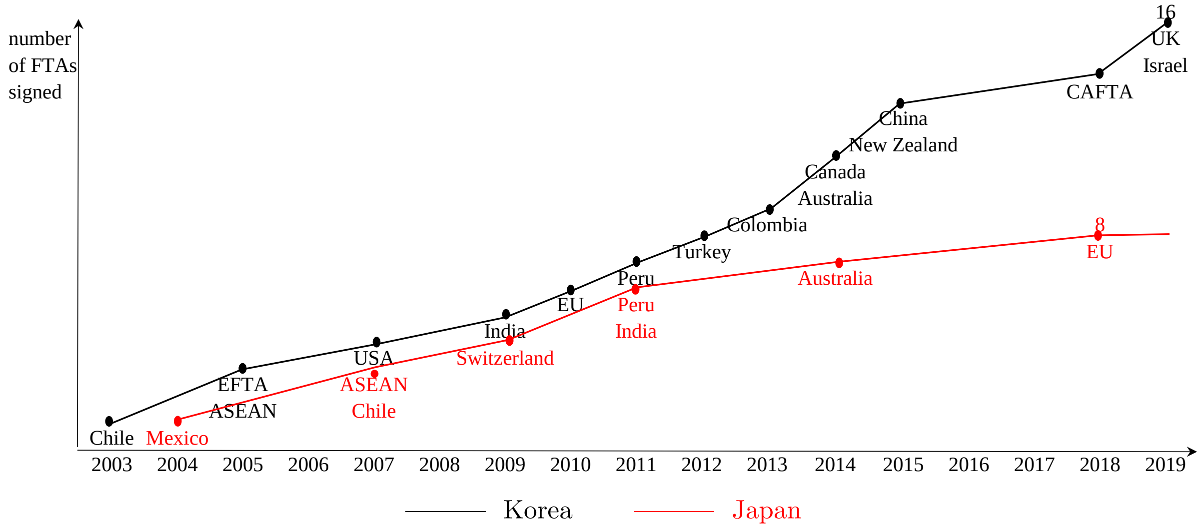
The objective of our analysis is to illustrate the features of domestic preferences (demand) and the existing product composition (supply) that lead to heterogeneous domestic effects for different FTAs. We first study theoretically how gains and losses vary due to the interaction of endogenous pricing and asymmetric product offerings. A first determinant is differential pass-through rates of tariff reductions, which determines the fraction of lost tariff revenue for the government that is re-captured by domestic consumers through lower prices. The second determinant is the extent increased competition falls on domestic producers. This depends on market segmentation and the composition of imports, as producers of close substitutes for the imports from FTA partners lose most market share and profits. Agreements with high pass-through rates and with profit losses falling mostly on third country importers are more likely to gather support.

To make the analysis concrete, we study the likely effects of several FTAs considered by the Canadian government around 2007, namely with Korea, Japan, and the EU. Joint Studies of the Benefits and Costs of Promotion of Bilateral Trade and Investment, usually conducted before the official start of FTA negotiations, were concluded in 2005 (with Korea), in 2007 (with Japan), and in 2008 (with the EU). Eventually, agreements were signed in 2014 with Korea and in 2016 with the EU, while negotiations with Japan are ongoing.[3]

Several factors make Canada a suitable study subject. As a small country its trade policy will not influence world prices. The government was actively searching for FTA partners to diversify its trade away from the United States. Its imports are highly concentrated: twenty products, at the 4-digit level in the Harmonized System, account

[3]The negotiations with Korea were delayed for several years as Korea prioritized an FTA with the United States, and delayed further as Canada tried to extract the same concessions as Korea agreed to in the USA-Korea FTA. The signing of the deal with the EU was delayed as some EU member states objected to elements in the initial agreement.

Figure 1: Number of FTAs signed by Korea and Japan



for almost half. Its exports outside of NAFTA are predominantly homogenous goods. The export benefits of joining an FTA are not to capture rents, but more likely general equilibrium considerations, e.g. supporting full employment, or political and diplomatic benefits.

Comparing Korea and Japan is instructive as both countries have similar import shares and are at a similar distance for many trading partners. While the larger Japanese domestic market makes it, *ceteris paribus*, a more attractive FTA partner, more countries have chosen to form an FTA with Korea. In the two list of signed FTAs, in Figure 1, many of the same partner countries show up, but the one with Korea often appears a few years before the one with Japan. Figure A.1 in the Appendix shows that both countries were initially equally eager to start FTA negotiations, by 2007 Korea had started nine and Japan eight. However, Korea concluded negotiations more quickly, signed more agreements, and started 13 new negotations (Japan only five).

Our analysis will show that a systematic difference in the type of manufactured products that the two countries export, plausibly a result of their different levels of development at the time, can help explain this discrepancy.[4] Similarly as in Asia, many countries have prioritized North American FTAs with Mexico over Canada, which could be rationalized on similar grounds.[5]

[4] At the eve of the Asian financial crisis in 1997, GDP per capita (in current USD) was almost three times higher in Japan than in Korea. When FTA explorations started in 2005, Canada and Japan had a similar GDP per capita, which was approximately twice that of Korea.

[5] For example, the EU signed an FTA with Mexico in 1997, but only in 2016 with Canada; Japan

To illustrate empirically the relevance of the two determinants of the theory, we conduct two counterfactual simulations. First, we calculate a new market equilibrium in the case of an FTA between Canada and either Korea, Japan, or the EU for the automobile market, the differentiated goods industry with the most imports. We can then calculate the change in domestic welfare associated with the tariff reduction, taking into account imported components in domestic production and consumer heterogeneity. Second, we apply a simplified methodology to all differentiated goods industries with large imports. This analysis only uses information on import flows and import penetration. It estimates comparable effects only from local variation in tariffs, without computing a new market equilibrium.

The results indicate that the domestic welfare loss is ... [complete later]

One important findings is that the various FTAs have notably different effects on consumer surplus across the income distribution. This is a third important determinant of domestic welfare. In particular, an FTA with the EU, and to a lesser extent with Japan, is a lot less attractive if the government uses a social welfare function where weights vary inversely proportional with income.

Relation with the literature ... [need some organization]

Computable general equilibrium models of trade, such as GTAP (Urata and Kiyota, 2003) and the new Michigan model (Brown et al., 2005) are the standard tools used to predict effects of a new FTA. After the Uruguay round, the remaining import tariffs in most countries are quite low, such that a single new FTA has only a negligible impact on income and factor prices. Rather than focusing on the general equilibrium, the more interesting effects of trade policy manifest themselves in a few industries.

Our analyses offers an alternative economic intuition for the fact that some countries have signed many more FTAs than others. For a more political view, see Ravenhill (2010) who contrasts Korea's narrow focus on the elimination of import tariffs with Japan's more comprehensive partnership agreements that include services, trade facilitation and investments. Our approach complements Rodrik (1995) who illustrated the importance of producer surplus relative to consumer surplus in the political debate.

Our methodology builds on previous studies that investigated welfare effects of trade policies, such as the Voluntary Export Restraints on Japanese automobile exports to the United States in the 1980s studied in Goldberg (1995) and Berry et al. (1999). In

signed with Mexico in 2004, but not yet with Canada; Korea signed with Canada in 2014, but not yet with Mexico, but it started formal negotiations about the same time with both countries.

that case, the domestic producer surplus increased significantly, mainly at the expense of domestic consumer welfare. Other studies have looked at the same industry in the context of the establishment of a Preferential Trade Area. Brambilla (2005) studies the Customs Union between Argentina and Brazil; Park and Rhee (2014) study the US and EU agreements from the Korean perspective. Tovar (2012) finds that increased variety is the largest benefit in Colombia.

Sheu (2014) calculates the benefit of India's WTO entry, and the gradual elimination of an import tariff of 20%, in the printer market. The relative importance of three possible factors that could boost welfare—lower price, higher quality, and greater variety—are assessed without a counterfactual analysis. She finds that higher quality of imports was the most important channel for welfare gains from trade. Irwin and Pavcnik (2004) assess the impact of the USA-EU agreement on limiting subsidiaries in civil aircraft and simulate market outcome of A-380 introduction.

[Needed?] We abstract from a number of possible effects shown in the literature. Pavcnik (2002) finds positive effects of tariff reductions on firm-level productivity, mostly through exit of low-productivity plants, while Amiti and Konings (2007) find even larger effects for reductions in import tariffs on inputs. Goldberg et al. (2010) find an increase in the number of varieties that are imported, which in turn leads to exports of new products. Lileeva and Trefler (2010) finds that lower tariffs in export markets also raise firm-level productivity.

The rest of this paper is organized as follows. In Section 2 we illustrate theoretically the different domestic welfare effects of an ad valorem tariff reduction in an oligopoly setting. In Section 3, we perform full counterfactual equilibrium simulations for various FTAs on the Canadian automotive market. In Section 4 we apply a simplified methodology to all major differentiated goods industries. We discuss some policy and methodological conclusions in Section 5.

2 Theoretical framework

2.1 Domestic welfare change in counterfactual equilibrium

We consider the simplest possible oligopoly model. There are three firms in the market, each selling a differentiated product. Firm 1 is the domestic producer, firm 2 is from the FTA partner country and its ad valorem import tariff τ_2 is to be abolished, and firm 3

Table 1: Comparison of prices on imports in two datasets (2009-2010)

	UN Comtrade data		Canadian auto market data		
	Quantity	Unit value $\times(1+\tau_i)$	Quantity	Market Price	MC (estimated)
NAFTA	501,122	18,665	819,411	25,504	17,502
Japan	198,102	16,921	177,368	23,376	16,572
EU	90,800	30,746	102,509	36,986	28,409
Korea	126,837	12,071	120,437	18,375	12,592

Note: The UN Comtrade data is the average for imports in calendar years 2009 and 2010. The unit value is the ratio of import value to quantity, aggregated over all 6-digit HS product categories within HS 8703, excluding 870310 which are golf carts, snowmobiles, etc. The data for the Canadian auto market refers to the model year and reflect sales from September 2009 to August 2010. All values are (sales-weighted) aggregates over all models, and the MC is estimated from the first-order condition of our demand model.

is from a third country with unchanged tariff τ_3. Firms choose prices $\mathbf{p} = \{p_1, p_2, p_3\}$ strategically and have constant marginal costs of production $\{c_1, c_2, c_3\}$. To evaluate the welfare effects of an FTA, we define a domestic welfare function that aggregates the domestic firm's profit π_1, consumer surplus CS, and tariff revenue T:

$$\begin{aligned} W &= \pi_1(\mathbf{p}) + CS(\mathbf{p}) + T(\mathbf{p}) \\ &= (p_1 - c_1)q_1(\mathbf{p}) + \frac{V(\mathbf{p})}{\alpha} + \tau_2 \frac{c_2}{1+\tau_2} q_2(\mathbf{p}) + \tau_3 \frac{c_3}{1+\tau_3} q_3(\mathbf{p}), \end{aligned} \tag{1}$$

with indirect utility $V(\mathbf{p})$ and marginal utility of income α.

Note that the import tariffs τ_i are applied to the landed marginal costs c_i and not to the market price. To reduce their tariff bill, multinationals have an incentive to trade at a transfer price that equals the factory gate price plus trade costs. The price-cost markup is only added in the destination country, after tariffs are applied at the border. In Table 1 we compare for the automotive industry $(1 + \tau_i)$ times the unit value observed in the trade data (the c.i.b. import value) with the market price and estimated MC on the product-level data for the Canadian automotive market.[6] As expected, the unit values at which import flows are recorded are much closer to the estimated MC than to the observed market prices.

Equation (1) places an equal weight on the producer and consumer surplus, but policymakers could attach disproportionate importance to domestic production (Rodrik, 1995). They could also place different weights on consumer surplus that accrues to

[6] Details on both datasets and the construction of the MC estimate are given below.

households with different income levels. In the empirical application, we will explicitly evaluate how the overall welfare effect changes if the consumer surplus term is replaced by $\sum_i w_i V(\mathbf{p}, y_i)/\alpha_i$, with y_i the deciles in the income distribution and $w_i = (y_i/\bar{y})^\gamma$ a welfare weight that varies with the relative income of group i to average income $\bar{y}$.

Producer surplus on export markets is not included mostly because the impact on domestic industries is generally the biggest source of opposition to trade liberalization in political debates (Rodrik, 1995). For the automotive sector in particular, which is analyzed first in Section 3, the negligible market share of Canadian exports to Korea, Japan, and the EU makes this a second order concern. More generally, gains on export markets will depend on many other factors, such as FTAs between trade partners and other countries. Export creation is also constrained by other policy instruments. For example, Kohpaiboon (2010) points to restrictive rules of origin that held back export growth and limited it to a small range of goods in the case of FTAs signed by Thailand.

Prices are a function of τ_2 as all market participants adjust them in response to an import tariff reduction enjoyed by firm 2. We use the first order condition for profit maximization of firm 1[7] and apply Roy's identity $q_i = -\partial CS/\partial p_i$ in consumer surplus. The effects of a FTA that eliminates import tariff τ_2 on the three components of domestic welfare equal

$$\begin{aligned}
\Delta W\Big|_{\tau_2\to 0} &= -\int_0^{\tau_2}\left(\frac{\partial \pi_1}{\partial \tau_2}+\frac{\partial CS}{\partial \tau_2}+\frac{\partial T}{\partial \tau_2}\right)d\tau_2 \\
&= \int_0^{\tau_2}\left(q_1p_1\frac{\eta_{12}}{\eta_{11}}\frac{\rho_2}{1+\tau_2}+q_1p_1\frac{\eta_{13}}{\eta_{11}}\frac{\rho_3}{1+\tau_2}\right)d\tau_2 && [PS]\\
&+ \int_0^{\tau_2}\left(q_1p_1\frac{\rho_1}{1+\tau_2}+q_2p_2\frac{\rho_2}{1+\tau_2}+q_3p_3\frac{\rho_3}{1+\tau_2}\right)d\tau_2 && [CS]\\
&- \tau_2\, q_2\frac{c_2}{1+\tau_2} - \tau_3\int_0^{\tau_2} q_3\frac{c_3}{1+\tau_3}\left(\eta_{31}\frac{\rho_1}{1+\tau_2}+\eta_{32}\frac{\rho_2}{1+\tau_2}+\eta_{33}\frac{\rho_3}{1+\tau_2}\right)d\tau_2 && [T]
\end{aligned}$$

where $\eta_{ij} = \frac{\partial q_i}{\partial p_j}\frac{p_j}{q_i}$ are the price elasticities for $i, j \in \{1,2,3\}$. The marginal cost pass-through elasticities of prices ρ_i are defined as

$$\rho_i = \frac{\partial p_i}{\partial \tau_2}\frac{1+\tau_2}{p_i}, \qquad \forall\, i \in \{1,2,3\}.$$

The direct pass-through ρ_2 indicates the fraction of tariff reduction reflected in the final

[7] There is no first order effect of the own-price reduction for product 1 in the PS. At the optimal price, the profit loss associated with a price reduction is exactly compensated by the profit gain from the quantity increases it entails. Only the profit loss associated with the rivals' price response remains.

price of product 2.[8]

The first component is negative as domestic profits go down. This term will be especially large if import penetration is low ($q_1 p_1$ is high), if direct pass-through ρ_2 is high, and if the domestic product is a close substitutes for product 2 (high cross-product elasticity η_{12}). The second term is positive as consumers benefit from the prices reductions. This effect is increasing in the direct (ρ_2) and indirect (ρ_1 and ρ_3) pass-through rates, which are weighted by the corresponding market share of each product. The third term represents the loss of tariff revenue for the government. Tariffs collected from product 2 are lost entirely. The revenue impact through reduced imports of product 3 will be relatively small as they are proportional to cross-product substitution rates (η_{31} and η_{32}) or to the indirect pass-through ρ_3. Moreover, no tariff revenue can be lost on imports that are already tariff-exempt (with $\tau_3 = 0$).

In Section 3, we simulate a counterfactual market equilibrium for a hypothetical FTA in the Canadian automotive market and calculate the effects on domestic welfare. The analysis proceeds in three steps. First, we estimate demand and infer the product-level marginal costs that are consistent with the observed prices being a Bertrand-Nash equilibrium on that demand system. Given that we allow policymakers to place different weights on consumer surplus gains of households in different income deciles, our demand model also accommodates heterogeneous price sensitivities. Second, we use the same set of first-order conditions to calculate new equilibrium prices if a particular FTA eliminates the ad valorem tariff τ for imports from one country, scaling the landed marginal cost by $1/(1+\tau)$. Marginal costs of domestic producers only fall proportionally with the fraction of intermediate inputs that are imported from the FTA partner country. Third, the difference between the simulated and actual welfare consists of the three components discussed above.

[8] Let the pass-through function be $p_2(\tau_2) \equiv \overline{p}_2(c_2^*)$ with $c_2^* = (1+\tau_2)c_2$, such that $\frac{\partial p_2}{\partial \tau_2} = \frac{\partial \overline{p}_2}{\partial c_2^*} c_2$. Starting from the usual definition of pass-through elasticity we then get

$$\rho_2 = \frac{\partial \overline{p}_2}{\partial c_2^*} \frac{c_2^*}{p_2} = \frac{\partial \overline{p}_2}{\partial c_2^*} \frac{(1+\tau_2)c_2}{p_2} = \frac{\partial p_2}{\partial \tau_2} \frac{1+\tau_2}{p_2}$$

and similarly for ρ_1 and ρ_3.

2.2 Approximation to the domestic welfare change

In Section 4, we consider the welfare effects of FTAs on a broader set of industries, as WTO rules dictate that tariffs are eliminated on 'substantially all trade.' To make such analysis feasible, we propose a simplified methodology both in terms of demand estimation and welfare calculations.

In particular, we calculate a first-order approximation to the change in domestic welfare. To illustrate the importance of different parameters, we first rewrite the change in welfare, grouping the effects by product rather than by welfare component (CS, PS, and/or T):

$$\begin{aligned}
\Delta W\Big|_{\tau_2\to 0} &= \int_0^{\tau_2}\left(q_1p_1\frac{\rho_1}{1+\tau_2} - q_1p_1\frac{\eta_{12}}{|\eta_{11}|}\frac{\rho_2}{1+\tau_2} + q_1p_1\frac{\eta_{13}}{|\eta_{11}|}\frac{\rho_3}{1+\tau_2}\right)d\tau_2 \\
&+ \int_0^{\tau_2}\left(q_2p_2\frac{\rho_2}{1+\tau_2}\right)d\tau_2 - \tau_2\, q_2\frac{c_2}{1+\tau_2} \\
&+ \int_0^{\tau_2}\left(q_3p_3\frac{\rho_3}{1+\tau_2} - \tau_3q_3\frac{c_3}{1+\tau_3}\left[\eta_{31}\frac{\rho_1}{1+\tau_2} + \eta_{32}\frac{\rho_2}{1+\tau_2} + \eta_{33}\frac{\rho_3}{1+\tau_2}\right]\right)d\tau_2
\end{aligned}$$

Because we only evaluate the entire abolition of the τ_2 tariff, we know exactly the tariff revenue lost on imports of product 2 (second term on second row). For all the other integrals, we need to integrate over the marginal changes associated with $d\tau_2$. As the initial tariff rates tend to be relative small already, we take a first order approximation for the full tariff abolition on product 2, $\Delta\tau_2 = \tau_2$, and assume the elasticity parameters are constant. We can then simplify the expression and regroup the terms by product to obtain:

$$\begin{aligned}
\Delta W\Big|_{\tau_2\to 0} &\approx \frac{\tau_2}{1+\tau_2}\, q_1p_1\left(\rho_1 - \frac{1}{|\eta_{11}|}\left[\eta_{12}\rho_2 + \eta_{13}\rho_3\right]\right) && \text{[Prod 1]} \\
&+ \frac{\tau_2}{1+\tau_2}\, q_2p_2\left(\rho_2 - \frac{c_2}{p_2}\right) && \text{[Prod 2]} \quad (2) \\
&+ \frac{\tau_2}{1+\tau_2}\, q_3p_3\left(\rho_3 - \frac{\tau_3}{1+\tau_3}\frac{c_3}{p_3}\left[\eta_{31}\rho_1 + \eta_{32}\rho_2 + \eta_{33}\rho_3\right]\right). && \text{[Prod 3]}
\end{aligned}$$

The first term in each of the three rows is the consumer surplus associated with the price decline of each product. The profit loss of domestic producers, in the first row, or the reduction in tariff revenue, in the next two rows, reduce the net effect for each product.

The net domestic welfare impact associated with product 1, in the first row, is positive if ρ_1, the price adjustment of product 1, exceeds the effects of ρ_2 and ρ_3 which are adjusted by the relative cross-price to own-price elasticity. This is possible, but not likely. It is more likely to hold if cross-price substitution is low and the own-price elasticity is high, as this lowers the weights $\eta_{12}/|\eta_{11}|$ and $\eta_{13}/|\eta_{11}|$. We expect a negative net effect because the price change for product 1 is likely to be much smaller than for product 2. This will be especially likely if the market is fragmented.[9] Therefore, the dominant term for product 1 is likely to be the domestic profit loss due to business stealing from product 2. It is decreasing in the own demand elasticity, but increasing in the value of domestic production ($q_1 p_1$), substitution between domestically produced goods and FTA-imports (η_{12}), and the direct pass-through (ρ_2).

The net effect for product 2 would be negative for most demand systems if the tariff rate were applied to the full price, including markup, as the term in brackets would become $(\rho_2 - 1)$. If the absolute value of the demand elasticity increases in price—as is the case for many realistic demand models—tariff reductions are passed-through only incompletely, i.e., $\rho_2 < 1$.[10] However, with tariffs applied to marginal costs, the consumer surplus gain is proportional to ρ_2, while the loss in tariff revenue is only proportional to c_2. Note that $(\rho_2 - c_2/p_2)$ can be rewritten as $(\rho_2 - 1) + (p_2 - c_2)/p_2$. The welfare change associated with product 2 can be positive if the initial markup is sufficiently high.

The net effect for product 3 is likely to be positive as the negative impact on tariff revenues is proportional to τ_3 and to the cross-price elasticities which tend to be low. The average MFN tariff rate in the main import sectors is quite low at approximately 5%. Moreover, for countries that already have an FTA with the domestic country τ_3 is already zero. The positive effect on consumer surplus remains, without the commensurate reduction in tariff revenue. In the case of Canada, imports from the United States and Mexico already enter duty free. In spite of the limited price response ρ_3, this component might still be large as the market share of third countries is quite large in many industries.

[**JVB: revisit after update of results**] In Section 4, we use equation (2) to

[9] As an example, for a simple logit demand in a duopoly model, we obtain $\frac{\partial p_2}{\partial \tau_2} = \frac{-(\eta_{22}+1)}{\alpha(1-s_1 s_2)(1+\tau_2)}$ and $\frac{\partial p_1}{\partial \tau_2} = \frac{-s_1(\eta_{22}+1)}{\alpha(1-s_1 s_2)(1+\tau_2)}$, where s_1 and s_2 are the two products' market shares. The price change for an individual firm producing a variety of product 1 approximates zero if its market share is very small. This is not the case for firms producing varieties of product 2. Their direct pass-through rate, even with a very small market share, simplifies to $\rho_2 = \frac{\eta_{22}+1}{\eta_{22}+1-\varepsilon_2}$, with ε_2 the price elasticity of the own-demand elasticity $\frac{\partial \eta_{22}}{\partial p_2} \frac{p_2}{\eta_{22}}$.

[10] Following Feenstra et al. (1996), we can differentiate the first-order condition for profit maximization by firm 2 and express direct pass-through as $\rho_2 = 1 + \frac{1+\tau_2}{\eta_{22}(\eta_{22}+1)} \frac{d\eta_{22}}{d\tau_2}$. The constant elasticity demand curve is a special case where $d\eta_{22}/d\tau_2 = 0$ and pass-through is complete. For demand models that are less convex, $d\eta_{22}/d\tau_2 < 0$ and $\rho_2 < 1$.

approximate the welfare effects of several hypothetical FTAs in the differentiated good industries with the largest imports. Due to data limitations, we work with a simplified demand system and need to shut down a few channels. The first-order approximation measures the effects at the existing consumption bundle, but does not compute a new market equilibrium. It ignores the welfare gains associated with the efficiency gain (reduction in deadweight loss) from households shifting their consumption bundle towards imports from the new FTA partner which experience the largest price declines. Moreover, due to the lack of price information for domestic products, we treat them as outside goods that do not change their price, i.e., we set $\rho_1 = 0$ in two terms. This ignores one source of consumer surplus gain, but also one source of tariff revenue loss.

3 Automobile industry

3.1 Data

We focus first on the automotive industry because it is often an important point of contention in trade negotiations, especially for Canada, Japan, Korea and the EU. Moreover, we observe detailed product information that allows us to estimate a reliable demand model for the domestic passenger vehicle market.

Our data set consists of annual sales volumes, prices, and other product characteristics for all car and light truck models for sale on the Canadian market between 1998 and 2010. After dropping models that sell fewer than 50 units per year and small-volume luxury brands such as Ferrari and Porsche, there are a total of 2,752 model-year observations. The number of models grows from 153 in 1998 to 244 in 2010. Over the same period, annual sales grow from 1.34 million to 1.56 million.

The following characteristics are included in the demand model: power per weight (maximum power in kw divided by weight in kg), size (length $\times$ width $\times$ height), fuel efficiency (liters of gasoline per 100 km), and the manufacturer's suggested retail price. All variables refer to the base model, the cheapest variety of each model in a given year. We also include a dummy variable whether the brand was originally owned by one of the three American firms. This is used to define a 'home origin' nest. It can influence demand directly, but also through the density of the network of dealerships due to these firms historic popularity. Table 2 shows summary statistics for the Canadian automobile market in 2010.

Table 2: Summary statistics on the Canadian car market in 2010

(a) Model sales and characteristics (244 models)

	Average	Standard deviation
Sales (units)	6,275	12,087
Price (1000 $)	37.54	19.76
Power/weight	9.67	2.70
Size	14.22	3.02
Liter/100 km	10.53	2.49
Domestic brand	0.34	0.47

(b) Sales and prices by production location

	Market share (%)	Average price ($)
Canada	20.0	25,003
USA & Mexico	53.9	25,523
EU	6.7	36,986
Japan	11.6	23,376
South Korea	7.9	18,375

(c) Sales and prices by market segment

	Market share (%)	Average price ($)
Regular cars (all sizes)	39.5	19,149
Luxury or sporty cars	5.8	38,866
SUVs	28.6	30,081
Pickups	19.7	25,474
Minivan	6.4	27,892

For our application to trade liberalization, it is important to know the assembly location, and hence the import status, for all models. In a few cases, models are reported as having multiple origins even in the same year, which happens when Korean or Japan firms switch production to North America. In such a case, we assign the assembly country where the majority of production took place. In 2010, the three American firms (GM, Ford and Chrysler) produced 97.8% of their sales within the NAFTA area. Only one third of the vehicles sold under a Japanese brand are imported from Japan, while two thirds are also produced locally in the NAFTA region. In 2010, Korean and European firms still imported approximately 70% of vehicles sold in Canada from their home countries (region).

Only one fifth of vehicles sold in Canada are assembled domestically. The majority of imports come from the other two NAFTA countries, the United States and Mexico, and those vehicles already enter the country duty-free. Market shares of the vehicles imported from Japan, Korea and the EU are 11.6%, 7.9%, and 6.7% respectively. The average prices (weighted by sales) indicate that while the vehicles made in Canada, USA/Mexico and Japan have fairly similar prices, that is not true for imports from Korea and the EU Korean vehicles tend to be cheaper than those of other countries in all segments. Moreover, about three-quarters of Korean imports are concentrated in the regular car segment. Almost half of European imports are luxury and sports cars, which on average have a price approximately double that of regular cars.

We take the total number of Canadian households, 12.9 million in 2010, as the potential market size. This implicitly defines an outside good, as the difference between the number of households and total sales. In an average year, 87% of households choose not to purchase a new vehicle.

3.2 Demand model and estimates

It is clear from the earlier derivations that the impact of any FTA depends on several features of demand: the own-elasticity and curvature of the elasticity, cross-product substitution, and the product composition in the market. We estimate a structural demand model in order to simulate a new market equilibrium in the case a FTA is implemented and some products enter duty-free. Based on the estimated parameters and the product composition in 2010, we can solve for the strategic price responses to any tariff reduction by totally differentiating the first order conditions of all the market participants.[11]

Discrete choice models have become the most popular approach to specify demand for differentiated products. They are able to generate flexible substitution patterns using a limited number of parameters and only aggregate (product-level) data. Policy questions in the automobile industry have received especially a lot of attention, see for example Goldberg (1995, 1998), Fershtman and Gandal (1998), Berry et al. (1999), Brambilla (2005), Brenkers and Verboven (2006), and Van Biesebroeck (2007). In our demand

[11] Here we allow for more than three products in the market. The price impacts $X_i = \partial p_i / \partial \tau$ for all n products are $X = (I_n - CJ_e)^{-1} B$, where X and B are $n * 1$ vector, and

$$B_i = \begin{cases} \frac{p_i}{1+\tau} & \text{if product } i \text{ benefits from a FTA} \\ 0 & \text{otherwise.} \end{cases}$$

I_n is the identity matrix of size n, C is a $n \times n$ diagonal matrix with $C_{ii} = p_i/(\eta_i(\eta_i + 1))$, and J_e is the Jacobian matrix of own-price elasticities. The C and J_e matrices can be obtained from the demand estimates.

model, we combine a random coefficient on price, as in Berry et al. (1995), with a two-level nested logit structure, as in Brenkers and Verboven (2006). It allows for heterogeneity in consumers' price elasticity and flexible substitution patterns that depend on the market segments products are placed in.[12]

In the automotive market, consumer i chooses to purchase one car or light truck model j among J available models. One of the options is the outside good, purchasing a used vehicle or postponing the purchase to a future year, which utility is normalized to zero. The indirect utility function of purchasing product j that belongs to subgroup h of nest g is given by:

$$u_{ij} \quad = \quad \sum_{i=1}^{K} x_{jk}\beta_k + \xi_j - \alpha_i p_j + \zeta_{iHg} + (1-\sigma_{Hg})(\zeta_{ig} + (1-\sigma_g)\varepsilon_{ij}). \tag{3}$$

The K dimensional vector of product characteristics x_j is valued the same by all consumers. $\delta_j = \sum_i x_{jk}\beta_k + \xi_j$ aggregates the terms identical to all individuals, where ξ_j is a vertical quality dimension unobservable to the econometrician. The remainder of the utility is individual specific.

The price variable is normalized by the average income level to be comparable over time. We model the price effect inversely proportional to income, $\alpha_i = \alpha/y_i$, to incorporate that high-income consumers tend to be less price sensitive.[13] The random coefficient on price makes it necessary to estimate by simulation, but the heterogeneous price elasticity will be important for policy.

The error specification allows for the possibility that models in the same marketing segments are closer substitutes. Products placed in the same segment share common features, for which consumers have correlated preferences. We aggregate the detailed classification into five market segments with different types of vehicles: regular cars (regardless of size), luxury and sports cars, SUVs, pickup trucks, and minivans.[14] Each segment has a subgroup (2nd-level nest) that distinguishes domestic and foreign mod-

[12]Rather than introducing consumer heterogeneity through random coefficients on all product characteristics, we use product nests as a transparent way to allow for asymmetric product substitution. Grigolon and Verboven (2014) show that both approaches yield similar price responses in merger simulations.

[13]If the price is low relative to income, this specification approximates the Cobb Douglas specification in Berry et al. (1995).

[14]The full classification of *JATO Dynamics* consists of 15 segments: Budget, Small, Low-mid, Mid, Upper mid, Sporty, Sports, Near luxury, Luxury, Small SUV, SUV, Full-size SUV, Compact pickup, Full-size pickup and Minivan.

els, based on the origin of the brand. ζ_{ig} measures the preference of individual i for vehicles from segment g; ζ_{iHg} captures their random taste for vehicles from origin H within that segment. The random term ε_{ij} is assumed to follow a Gumbel extreme value distribution.[15] The nesting parameters σ_g and σ_{Hg} capture the correlation of preferences and measure the degree of substitution within the nests: the higher a σ parameter, the stronger substitution between products in the same segments. We follow Brenkers and Verboven (2006) and allow varition in the nesting parameters, only imposing that $\sigma_{Hg} > \sigma_g$.

These distributional assumptions yields a demand system that can be written as follows:

$$s_j(p) = \frac{1}{N}\sum_{i=1}^{N} \frac{\exp((\delta_j - \alpha_i p_j)/(1-\sigma_{Hg}))}{\exp(I_{iHg}/(1-\sigma_{Hg}))} \frac{\exp(I_{iHg}/(1-\sigma_g))}{\exp(I_{ig}/(1-\sigma_g))} \frac{\exp(I_{ig})}{\exp(I_i)},$$

where N is the number of individuals drawn from the empirical income distribution. I_{iHg}, I_{ig} and I_i are the inclusive values for individual i, defined as

$$\begin{aligned} I_{iHg} &= (1-\sigma_{Hg}) \ln \sum_{j=1}^{J_{hg}} \exp((\delta_j - \alpha_i p_j)/(1-\sigma_{Hg})) \\ I_{ig} &= (1-\sigma_g) \ln \sum_{h=1}^{2} \exp(I_{iHg}/(1-\sigma_g)) \\ I_i &= \ln \sum_{g=1}^{5} \exp(I_{ig}) \end{aligned}$$

In the estimation we pool data for several years. Given that firms observe their models' quality ξ_{jt}, they incorporate it in their price setting decisions. This endogeneity problem carries over to the estimation of nesting parameters. We employ similar instruments as Berry et al. (1995): the numbers of competing products and the average rival characteristics within the same nests and sub-nests are used as instruments for the segment variables and price respectively. As the nesting parameters differ by segment, all instruments are interacted with segment dummies. In addition, we control for unobserved product features that do not change over time and the time-varying preference of a new car over outside goods using a model-fixed effects ξ_j and a year-fixed effect ξ_t.

[15] ζ_{ig} and ζ_{iHg} have the (unique) distributions such that $\zeta_{ig} + (1-\sigma_g)\varepsilon_{ij}$ and $\zeta_{iHg} + (1-\sigma_{Hg})(\zeta_{ig} + (1-\sigma_g)\varepsilon_{ij})$ are both extreme value distributed, see Cardell (1997).

Table 3: Demand estimates for the Canadian automobile market (1998-2010)

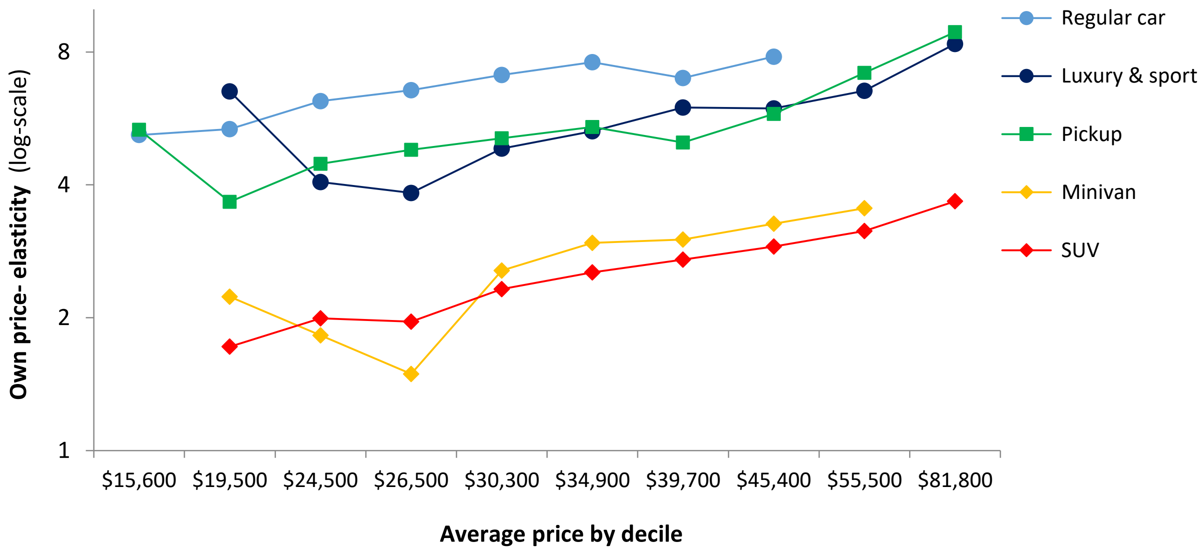
	Coefficient	Standard error
Price	-1.565	(.344)***
Power/weight	0.010	(.008)
Fuel efficiency	-0.010	(.008)
Size	0.081	(.014)***
σ_1 (regular cars)	0.836	(.031)***
σ_2 (luxury & sports cars)	0.727	(.064)***
σ_3 (SUVs)	0.189	(.224)
σ_4 (pickup trucks)	0.798	(.051)***
σ_5 (minivans)	0.068	(.117)
Sub-segment σ_{H1}	0.836	–
Sub-segment σ_{H2}	0.754	(.040)***
Sub-segment σ_{H3}	0.399	(.067)***
Sub-segment σ_{H4}	0.798	–
Sub-segment σ_{H5}	0.518	(.108)***
Observations	2,752	
Adjusted R^2	0.82	

Notes: Includes year and model-fixed effects as controls. Instruments are average rival characteristics for price and number of rival products for nest parameters. 2nd-level nest parameters σ_{Hi} are constrained not to be smaller than the corresponding 1st-level nest parameter σ_i. *** indicates significance at the 1% level.

The demand estimates are in Table 3. All coefficient estimates have the predicted signs. Consumers dislike high price and low fuel efficiency. They prefer vehicles with a higher power to weight ratio and a larger size. Important for our application are the estimates of the nesting parameters, which are all positive and between zero and one. Consumer preference over products in the same segment are more strongly correlated for higher nesting parameters, such that those products are more substitutable. The estimates suggest that product substitution among SUVs or minivans are barely higher within their segment than between segments.

Equilibrium pass-through of an ad valorem tariff in the price will be incomplete when the own elasticity is increasing in its price. This is a general feature of the (nested) logit model, but the random coefficient on price α_i might break or diminish this property. Figure 2 illustrates how the own-price elasticities evolve with price for models across different segments. Each value represent the average elasticity of all vehicles in a certain market segment and price decile. The price on the horizontal axis is the market average for each price decile, which closely approximates a log-scale. The absolute value of the

Figure 2: Evolution of own-price elasticity by segment



own-price elasticity on the vertical axis is explicitly shown on a log-scale. In the logit model, we would find a single upward-sloping line. Different aspects of our demand model introduce heterogeneity in this pattern.

All five segments have elasticities that increase with price, which will lead to incomplete pass-through. The lower price sensitivity of consumers with income has flattened the elasticity-price relationships, but all slopes remain positive. The large differences of the estimated 1st-level nest parameters lead to different vertical positions of the curves for different market segments. The much lower estimates for minivans and SUVs lower their overall own-price elasticities. We did not impose it, but all elasticities are estimated higher than one in absolute value, in line with profit-maximizing price setting behavior. The most conspicuous deviations from a linear pattern are driven by the presence of models with very high sales, which lowers the average elasticity. The large number of models in the SUV segment, which accounts for more than one third of all models, lowers the average price elasticity for the segment and leads to an especially linear pattern.

Heterogeneity of the price elasticities across countries and the strength of substitution with models produced in Canada are also important for studying alternative FTAs. In Table 4 we show average own-price elasticities by import destination and segment, as well as the cross-product elasticity with Canadian models. To interpret these statistics, it is useful to keep the different product composition of imports from different trading partners in mind. We omit the segments of luxury and sports cars and pickup trucks from

Table 4: Heterogeneity in substitution patterns

	Korea		Japan		EU	
(a) Own-price elasticity						
	weighted	median	weighted	median	weighted	median
Total	-4.27		-4.27		-5.00	
Regular cars	-4.90	-5.35	-5.12	-5.11	-5.89	-5.25
SUVs	-2.05	-2.00	-2.28	-2.10	-2.76	-2.18
Minivans	-2.33	-2.68	-2.23	–	-2.74	–
(b) Cross-price elasticity with Canadian models						
	overall	within	overall	within	overall	within
Total	.025	.069	.030	.084	.025	.130
Regular cars	.033	.083	.046	.118	.046	.121
SUVs	.006	.014	.005	.012	.005	.011
Minivans	.009	.074	.013	.105	.005	.041

Notes: Own-price elasticities: quantity-weighted and evaluated at the median price for the segment (if there are multiple models). Cross-price elasticities: averaged over all model-pairs and only over models within the same segment.

Table 4 because the domestic profits at stake in those two segments are negligible. We show the full breakdown over segments in Table 5 together with an indication in which segments Canadian producers earn most of their profits.

Korean and Japanese imports have the same average own-price elasticity of 4.27, which is lower than the 5.00 average for EU products, but higher than the overall market average of 4.16. This mostly reflect composition across segments. Passenger cars, both regular and luxury & sports, make up more than 70% of each country's imports and these segments had the highest price elasticities. EU imports tend to be priced much higher, which further raises the estimated own-price elasticity. Within each segment, Korean models have the lowest price elasticity, due to their low price, but evaluated at the median price, the Korean elasticities are the highest, due to lower market shares.

In terms of average cross-price elasticities, the three import countries do not differ much. The absolute values are much lower than the own-price elasticities, but they apply to all Canadian models and all imported varieties, of which there are 43 in the case of Japan. Cross-price elasticities for vehicles in different segments are not shown as they are one to two orders of magnitude lower, averaging 0.003 for Korea and Japan and even less for the EU. In the segment of regular cars, which has the largest Canadian sales, cross-product substitution is lowest for Korean imports. The high number of models and sales

Table 5: Composition of domestic production and imports by market segment

	Canada	Korea	Japan	EU
(a) Total turnover ($billion)	7.64	2.21	4.15	3.79
(b) Composition of sales by segment (%)				
Regular cars	46.1	75.2	59.7	28.8
Luxury & sports	2.4	3.3	7.3	45.7
SUVs	30.7	14.9	28.7	22.6
Pickup trucks	1.0			
Minivans	19.8	6.7	4.2	2.9
(c) Profit breakdown by segment (Canada) and number of imported models				
Regular cars	17%	9	14	9
Luxury & sports	2%	2	14	24
SUVs	43%	4	14	11
Pickup trucks	1%			
Minivans	38%	3	1	1

Notes:

volume of Japanese and EU SUVs are a threat to the profits of the Canadian industry. In particular, one third of Japanese imports are SUVs or minivans, two segments that account for more than 80% of domestic profits.

The optimal FTA partner from the Canadian perspective should have a high own-price elasticity to return most of the tariff reduction as lower prices to consumers. At the same time, the imported vehicles should predominantly be sold in segments with a small share of domestic products or with low cross-product substitution. While the EU is likely to be most attractive from the perspective of consumer surplus, an FTA with Korea is likely to face least objections by domestic producers. The low number of models and total turnover for Korea is also a positive factor as it raises pass-through because externalities on other models are not internalized.

Own- and cross-price elasticities provide the intuition for how the two dominant channels will work for different FTAs. However, the full effect on domestic welfare also depends on the absolute magnitude of current tariff revenue. Given that pass-through of tariff reductions will be incomplete, it will matter that the total value of Korean imports at $2.21 billion in 2010, is much lower than $3.79 billion for the EU and $4.15 billion for Japan. Moreover, large differences in price elasticities between segments translate in large differences in profit margins. Minivans and SUVs are by far the two most profitable segments, accounting for a much larger share of profits than of sales. The higher own-price elasticities and pass-through rates for EU imports and to a lesser extent Japanese imports, have an opposite effect here, raising the welfare cost. We now turn to the simulation of counterfactual price equilibria that allow to calculate the predicted welfare changes for various FTA options.

3.3 Counterfactual FTA equilibrium

Using the estimated demand model, we evaluate the likely impact of various FTAs for the Canadian automotive industry. We simulate a new industry equilibrium starting from the 2010 situation. At that time, one fifth of vehicles sold in Canada were assembled domestically and another 54% were imported duty-from NAFTA partners. Other imports, from Korea, Japan and the EU, incurred an import tariff of 6.1%. Some of these imports will become tariff-exempt under an FTA, which we model as a reduction in their landed marginal cost in Canada by 5.75% (0.061/1.061). The directly affected firms will adjust their optimal mark-ups to reflect their improved competitive position. Naturally, their competitors will also adjust pricing to defend their market shares.

We additionally include a reduction in marginal costs for some Canadian assembly plants. NAFTA has a 62.5% North America content requirement and we assume that imported parts of American-owned assembly plants are sourced mainly from the United States, Mexico, and low cost countries, such as China. Their part imports from potential FTA partners are low enough to ignore. However, the Canadian assembly plants of Honda and Toyota import a non-negligible fraction of parts from Japan. We assume that the non-NAFTA content requirement is binding and that one half of imports originates from their home country. Under an FTA with Japan, the marginal cost of these plants falls by 5.75% on this fraction.[16]

Our analysis reflects the short to medium run adjustment, which means that production locations of all models and the set of models offered for sale are unchanged. Canadian assembly plants on average export 85% of their output, mainly to other NAFTA countries. This is also assumed to be unaffected by an FTA between Canada and the three other trade partners. Moreover, the market share of Canada on the domestic market of its potential FTA partners is sufficiently small to also ignore in this analysis.

In the theoretical framework, we assumed that each firm produces a single product.

[16]In 2010, Chrysler produced a minivan for Volkswagen. Given its European design, we similarly assume that 18.8% of its marginal cost consists of parts sourced from the EU.

In reality, firms produce a range of products and will internalize cross-product effects to maximize profits at the firm level. Extending the oligopoly model to multiple products per firm is straightforward. Define θ^F as the firms' product ownership matrix such that $\theta^F(j,k)$ equals 1 if products j and k are produced by the same firm, and 0 otherwise. $q(p)$, p and c are $J \times 1$ quantity, price and marginal cost vectors, with J the total number of products in the market. Using $\odot$ for the Hadamard product, or element-by-element multiplication of two matrices of the same dimension, we recover the marginal cost vector as price minus markup:

$$c = p + (\theta^F \odot q'(p))^{-1} q(p). \tag{4}$$

In an FTA scenario, marginal costs of some firms are adjusted as described above. The same set of first-order conditions (4) is then used to calculate a new equilibrium price vector p^*.

Some features of the counterfactual market equilibria and a full decomposition of welfare effects are listed in Table 6. The import boost for the FTA partners are non-negligible: under their respective FTAs, Korean and EU imports increase by 21,800 units, which represents 1.4% of aggregate sales, while Japanese imports increase by 36,600 units (2.4%). It raises Korean imports by 18% and the corresponding increase is even more pronounced for Japanese (20.6%) or EU (20.7%) imports. This is as expected, because the relative pass-through of tariff reductions into prices reflects the average own-price elasticities, which are lowest for Korean models. Japanese firms have a similar pass-through rate as European firms even though their average own-price elasticity is lower, because their higher market share—consisting of imports and sales from their Canadian plants—makes them more reluctant to lower prices.

Canadian plants reduce output more than proportionately, compared to imported vehicles, but the overall change is small. The decline is largest in the case of an FTA with Korea, at 4,718 units, but this represents only 1.4% of their initial market share. The decrease is only one third as high in the case of an FTA with Japan, at 1,599 units, because Japanese-owned plants in Canada benefit from a tariff exemption on imported components from Japan.

Interestingly, the output reduction for the Canadian industry is also lower for an FTA with the EU than with Korea, at 3,390 units, in spite of similar average cross-price elasticities and larger price reductions for EU imports. The reason is that prices are not strategic substitutes in the case of an FTA with Korea. Firms not benefitting from a tariff reduction tend to increase their prices in response to lower prices for Korean vehicles. The average increase of 0.02% is quite small, but it applies to 226 of the 244 models. Moreover, it is in sharp contrast with the usual price declines in response to price reductions of Japanese or EU imports under their FTAs. The surprising price increase is due to Korean firms disproportionately selling to low-income consumers who are more price elastic. As a result, the average price elasticity for the remaining consumer base of other firms falls, and they respond by raising their markups. This limits the profit decline, but exacerbates the quantity decline.

Table 6: Counterfactual analysis of various FTAs

	FTA with		
	Korea	Japan	EU
Initial Situation of FTA partner:			
Total imports (units)	120,437	177,368	105,509
Market share (units)	7.9%	11.6%	6.7%
Market share (revenue)	5.7%	10.7%	9.8%
Change in sales (units):			
- Canada	−4,718	−1,599	−3,364
- FTA partner	+21,807	+36,624	+21,828
- Other imports	−12,764	−24,021	−10,924
Change in price:			
- Canada	+0.00%	−0.28%	−0.07%
- FTA partner	−4.51%	−4.91%	−5.04%
- Other imports	+0.02%	−0.01%	−0.03%
Change in (mio. of CAD):			
Total domestic welfare	−23.0	+45.7	+17.3
- Canada			
⋆ Consumer surplus	+2.1	+31.2	+7.7
⋆ Tariff revenue[1]	−0.7	−25.7	−0.6
⋆ Profits	−17.8	−8.3[2]	−22.8
- FTA partner			
⋆ Consumer surplus	+86.0	+195.4	+184.4
⋆ Tariff revenue	−87.2	−169.0	−167.4
- Other imports			
⋆ Consumer surplus	−0.3	+32.4	+23.3
⋆ Tariff revenue	−5.1	−10.3	−7.3

Notes: Changes in counterfactual equilibria for different FTAs relative to the observed 2010 situation.
[1] Tariff revenue on imports of parts from Japan by Japanese-owned plants in Canada.
[2] Includes a −3.1 mio. reduction in profits for Japanese-owned plants in Canada.

We next turn to the (domestic) welfare implications. Comparing the declines in government tariff revenue across the different FTAs is straightforward. It mostly reflects the initial differences in tariff revenue on the imports from each FTA partner. In the Japanese case, an additional effect is the much larger tariff loss from imported parts by Canadian assembly plants. It amounts to a revenue decline of 26 million CAD, compared to only 1 million CAD in the other two cases, which is due to lower sales of domestically produced vehicles.

Under the distributional assumption of nested logit model, consumer i's surplus is the expected value of the maximum indirect utility divided by her marginal utility of income α_i. The change in consumer surplus is then

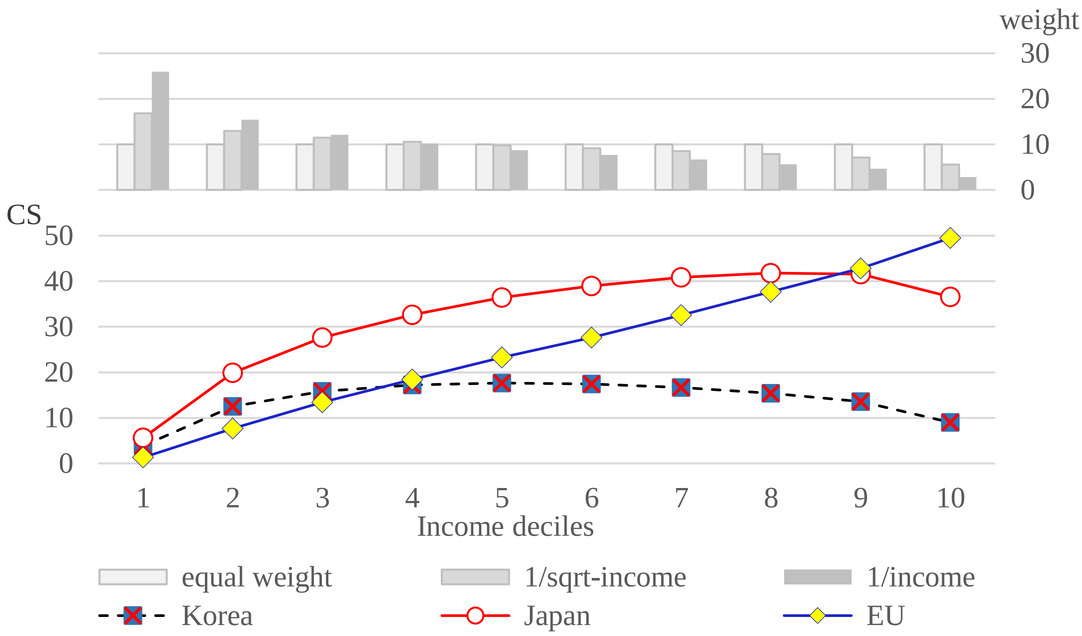
$$\Delta CS_i = \frac{I_i(p^*)}{\alpha_i} - \frac{I_i(p)}{\alpha_i},$$

where I_i is the inclusive value that is a function of the relevant price vectors before and after the implementation of each FTA. The changes in consumer surplus are calculated for a representative consumer in each income decile. The results in Table (6) are based on a cost-benefit criterion, summing up the unweighted changes over all consumers. It reflects the amount of money that could be removed from the economy, while keeping all consumers equally well off under the new price vector.

We expect the change in total consumer surplus to exceed the decline in tariff revenue, as the deadweight loss associated with the tariff distortion is removed. This is indeed the case for FTAs with Japan and the EU, but not with Korea. The lower pass-through rate for less price-elastic Korean imports is one factor limiting the gain in consumer surplus. However, it is adverse price evolution of competing models that is responsible for reducing the consumer surplus gain to a level below the loss of tariff revenue. Placing an import tariff on Korean vehicles has the perverse benefit of lowering the average price on all other vehicles which limits the harm from trade protectionism. As the tariff revenue can be distributed among consumers, it illustrates one potential benefit of strategic trade policy that a country forgoes under the trade liberalization that we consider.

Another peculiar feature of the consumer surplus gains associated with the Korea FTA is that benefits accrue rather evenly to consumers in all income deciles. Figure 3 plots the ΔCS_i by income decile for the three scenarios. Given that the probability of buying a new vehicle is increasing with income, it is natural for the gains to increase

Figure 3: Consumer surplus change and weights by income decile



with income as well. In the Korea case, benefits decline for consumers in the higher income deciles, because they are much less likely to buy relatively cheap Korean vehicles, while prices on other models increase ever so slightly under the Korean FTA. In contrast, consumer gains from an FTA with the EU rise throughout the income distribution with the probability of buying an inside good and buying an expensive European import.

Moreover, to translate utility gains into monetary values, we divide by the marginal utility of income α_i which in our model declines with income. This generated more realistic substitution patterns, but at the same time a given utility gain translates into a higher consumer surplus for richer, less price-elastic consumers.[17] As the aggregate consumer surplus under the cost-benefit criterion used in Table 6 is an unweighted sum of individual surpluses, it implicitly places a higher weight on utility gains of richer households, favoring trade liberalization of rich-country imports. A frequent justification for this practice is that with a positive total gain, a Pareto improvement is feasible if the gainers compensate the losers. However, Boadway (1974) has shown that a positive aggregate surplus is necessary but not sufficient for a potential Pareto improvement. Moreover, Blackorby and Donaldson (1990) argue that such an indifference towards the effects of a policy change on inequality is inconsistent with most social policy and with

[17] The reverse is true when a tariff is imposed. It is expensive to compensate the inelastic high-income consumers and their utility loss translates in a large drop in consumer surplus.

the overwhelming majority of individual preferences.

To mitigate these concerns, we follow Hau (1986) and specify a social welfare function that places a disproportionate weight on gains of poorer households:

$$SW = \frac{1}{1-\varepsilon} \sum_i w_i MCS_i^{1-\varepsilon}, \qquad \text{with } w_i = \left(\frac{y_i}{\bar{y}}\right)^{\gamma}.$$

MCS_i is Marshallian consumer surplus in money equivalent value, and w_i is the welfare weight for individual i with income y_i and average income in the population equal to $\bar{y}$. The degree of inequality aversion in society's objective function is determined by the parameters γ, which determines how quickly the weight declines with income, and ε, which determines the penalty for unequal outcomes.

We introduce a particular cardinality by normalizing y_i by $\bar{y}$ and setting $\varepsilon = 0$. The cost-benefit criterion then obtains when we also set $\gamma = 0$. Alternatively, for $\gamma = -1$, the social welfare function is $\sum_i I_i(p)/\bar{\alpha}$ with $I_i(p)$ the inclusive value (utility index) for individual i, normalized by the marginal utility of income at average income $\bar{\alpha} = \alpha/\bar{y}$ rather than by α_i. This amounts to Benthamite Utilitarianism where society maximizes an unweighted sum of individual utilities.[18] We also consider the intermediate case of a Generalized Utilitarian social welfare function where $\gamma = -0.5$ such that $w_i = \sqrt{\bar{y}/y_i}$. The bar-chart at the top of Figure 3 shows for each of the three cases the evolution of the corresponding weights over the income deciles.

The results in Table 7 show the sensitivity of the total consumer surplus gain to the social welfare function used in the aggregation. For an FTA with Korea, the total is almost constant, ranging from 85.9 to 88.9 million CAD, a 3% difference. This is a direct consequence of the relatively equal gains that accrue to each income decile. The inverted U-shaped pattern further reinforces the invariance; shifting weight from high to low income households will have only minor effects.

The pattern is markedly different for an FTA with the EU. Because gains for high income households are much larger, the aggregate gain is very sensitive to the social welfare function used. The cost-benefit criterion used in Table 6 is the most favorable to this trade liberalization, yielding an aggregate consumer surplus gain that is almost a third higher than the egalitarian Benthamite Utilitarianism. The latter criterion naturally disfavors the EU FTA greatly. Because the consumer surplus gains are highly skewed

[18] Weighting the consumer surplus changes by $1/y_i$ exactly compensates for the inverse relationship between income and the price sensitivity $\alpha_i = \alpha/y_i$ that we imposed in the demand model.

Table 7: Dependency of consumer surplus on the social welfare function

		FTA with	
	Korea	Japan	EU
Change in:			
- Government tariff revenue	−93.0	−205.0	−175.3
- Profit change (Canada)	−17.8	−8.3*	−22.8
- Consumer surplus			
* Cost-benefit criterion ($\gamma = 0$)	+87.8	+259.0	+215.4
* Generalized Utilitarianism ($\gamma = -0.5$)	+85.9	+237.3	+182.1
* Benthamite Utilitarianism ($\gamma = -1$)	+88.9	+230.8	+162.7
- Total domestic welfare			
* Cost-benefit criterion ($\gamma = 0$)	−23.0	+45.7	+17.3
* Generalized Utilitarianism ($\gamma = -0.5$)	−24.9	+24.0	−16.0
* Benthamite Utilitarianism ($\gamma = -1$)	−21.9	+17.5	−35.4

Notes: Change from the observed 2010 market situation for counterfactual market equilibria under three different FTAs. Values are in million CAD. The γ parameter refers to the weight on the consumer surpluses for different income deciles: $w_i = (y_i/\overline{y})^{\gamma}$.
* This includes the profit decline for Japanese-owned plants in Canada.

towards rich households, they are not sufficient to forego the tariff revenue that can be spent however the government sees fit.

The sensitivity of the aggregate consumer surplus on the choice of social welfare function is intermediate in the Japanese case. The net domestic gains become less positive for a more egalitarian criterion, but the difference is less pronounced than in the EU case. The net effect of a loss in tariff revenue and gain in consumer surplus is highest for Japan under the cost-benefit criterion, at 54.0 million CAD against 40.1 and -5.2 million CAD for the EU and Korea. It is the only scenario where the net gain remains positive even under the Benthamite criterion at 25.8 million CAD for Japan, against -12.6 and -4.1 million CAD for the EU and Korea.

The highly positive effects for Japan are puzzling given that Canada ended up signing FTAs with both Korea and the EU, but not with Japan.[19] Moreover, a government more averse to income inequality would be less inclined to sign a trade agreement with the EU and, ceteris paribus, view a Korean agreement more favorably. The Liberal government of Paul Martin did initiate FTA negotiations with Korea, but the negotiations did not move swiftly and were only concluded by the Conservative government of Stephen

[19]Negotiations were initiated in 2012, but are currently suspended.

Harper after nine years.[20] In contrast, the EU negotiations were started by the Harper government and were forcefully supported and finalized by Justin Trudeau's Liberal government. This apparent stronger support of the Liberal party for an agreement with the EU over Korea, is not in line with their overall more egalitarian stance.

We finally turn to the effects on the domestic industry's profits to investigate whether they help explain the outcomes of the FTA negotiations. Unfortunately, the differences again favor an FTA with Japan. As expected, domestic profits decline in each of the three cases, but the decline is less than half as large when Japanese imports are liberalized. Moreover, more than one third of the total profit decline is incurred by the Canadian plants of Honda and Toyota. Given that total profits of these two firms would increase greatly under this scenario, it is unclear whether the Canadian government will count it as a negative impact of the trade liberalization. Clearly, these firms will not lobby against an agreement, but to the extent that Canadian workers are able to appropriate some of the rents, the decline would be a net loss for the country.

One possibility is that the Canadian government does not consider profit gains or losses by all firms equally. The much longer production history of the three American carmakers could mean that they carry more political weight than their Japanese competitors. Moreover, the US firms are also likely to have some leverage with the US government that would be helpful for Canada when the NAFTA agreement is periodically re-negotiated.

Under an FTA with Korea, the bulk of the profit decline, 16.5 of the 17.8 million CAD, would be incurred by the Japanese-owned plants. This is driven by the weaker substitution between Korean and Canadian models, as discussed earlier. The profit decline for US-owned plants is exactly four times higher under an FTA with Japan than with Korea, a difference of -1.3 versus -5.2 million CAD. Governments may care more about profits and jobs moving aboard and get more tangible pressure from the opposition of domestic firms. Opposition by the domestic industry is often pitted against the potential benefits for consumers in political debate (Rodrik, 1995). However, in this case the government should place an implausibly large weight on this difference to sway the difference in consumer surplus gains.

[20] Part of this delay was due to Korea prioritizing their negotiations with the United States. However, with stronger political support from the Canadian side, the Canada-Korea agreement could have been concluded before the USA-Korea negotiations gathered steam.

4 Major importing industries of differentiated goods

4.1 Data

Of course, the Canadian government also considers other industries when evaluating potential FTA partners. We now put the trade-offs in a broader context, starting with an overview of the extent of tariff protection and the relative importance of different industries in total imports. At the end of 2011, before any of the negotiations we consider were concluded, Canada had eliminate bilateral trade barriers, through FTAs or similar RTAs, with eleven countries. Most are minor agreements, accounting for less than 1% of Canadian trade, with the NAFTA agreement between Canada, Mexico, and the United States—Canada's only neighboring country and by far its largest trading partner—the main exception.[21] Canada still protected its domestic producers in many industries against competitors from other major economies, such as the EU, China, Japan and Korea.

Table 8 shows the 20 product categories (industries) with the highest value of imports in 2010 from countries without an FTA with Canada. The data comes from the UN Comtrade database and is at the 4-digit level of aggregation of the Harmonized System (HS) classification. These 20 industries account for almost half (47.1%) of Canadian imports from non-FTA partners.

Rauch (1999) classified all commodities into three exhaustive categories: traded on an organized exchange, reference-priced, and differentiated products. We map our 4-digit HS categories into the Standard International Trade Classification (SITC) and take the conservative classification of Rauch to determine product differentiation. Most of the major import industries in Table 8 are differentiated goods where market power is more likely and trade barriers have the potential to shift rents. The four homogenous goods industries in the top-20 account for 20.5% of total non-FTA imports. Not coincidentally, they are all exempt from import tariffs.[22]

The situation is different for many of the differentiated products. In order to quantify and compare the degree of import protection, we calculate a weighted, ad valorem tariff per 4-digit industry. Only a few differentiated goods, for example wine, use specific

[21] Apart from NAFTA, Canada had agreements with EFTA (Iceland, Liechtenstein, Norway, Switzerland), Chile, Colombia, Costa Rica, Israel and Peru.

[22] Almost all refined oil products in the HS 2710 category consists of gasolines and diesel fuels that enter duty-free; the average tariff imposed on this product category is very close to zero.

Table 8: Top 20 industries importing from countries without an FTA with Canada

HS4	Industry	Differen-tiated?	Import share (%)	Import tariff (%)	Import penetration (%)
2709	Crude oil from petroleum & bituminous minerals		14.1	–	41
8703	Motor cars & vehicles for transporting persons	X	6.7	6.1	80
8471	Automatic data process machines	X	4.1	–	96
2710	Oil (not crude) from petrol & bitum. minerals		3.0	–*	17
7108	Gold (incl. plated), unwr, semi-mfr or powder		2.6	–	18
8708	Parts & accessories for motor vehicles	X	2.4	6.8	77
8517	Electric apparatus for telephony & parts	X	2.1	–	93
8443	Printing machinery, ancil. to printing & parts	X	1.3	5.4	77
8542	Electronic integrated circuits & microassemblies	X	1.3	6.5	82
9403	Furniture & parts	X	1.1	5.6	42
8528	Television receivers (incl. monitors, etc.)	X	1.0	4.3	70
2204	Wine of fresh grapes	X	.99	3.0	65
4011	New pneumatic tires of rubber	X	.89	6.8	93
9504	Articles for arcade, table, parlor games & parts	X	.86	–	97
2818	Aluminum oxide and hydroxide		.83	–	66
8525	Transistor apparatus for radiotelephony, etc.	X	.81	–	70
9503	Toys, scale models, puzzles & parts	X	.80	–	97
8803	Parts of balloons, aircraft, spacecraft, etc.	X	.78	–	68
6110	Sweaters, pullovers, vests; knitted or crocheted	X	.77	18.0	77
6403	Footwear, upper leather	X	.73	18.0	91

Notes: Synthetic oil and retail lubricating oils are subject to 8% and 5% tariffs respectively, but account for a minor share of imports in HS 2710.

tariffs which we convert into a percentage rate by taking the ratio of tariff revenue over import value. Like most countries, Canada imposes tariffs at the 8-digit HS level, while the 6-digit HS level is the most detailed breakdown in UN Comtrade. We choose the highest tariff rate among all 8-digit products within a 6-digit category and aggregate to the 4-digit level. Import shares from the United States are used as weights because their composition is only indirectly affected by tariffs and more likely to resemble the free trade situation.[23] The results indicate that for six differentiated goods industries tariffs are all but eliminated, averaging less than 0.1%. The ten remaining industries are still subject to significant import tariffs, averaging 6.9% (import-weighted).

The last column of Table 8 shows the import penetration based on information

[23]This may overestimate the average rate of protection for two reasons. First, extreme tariffs on some 8-digit products may raise the 6-digit average, even if only a small amount is imported from non-exempt countries. Second, imports from the United States may be shifted systematically towards goods with higher MFN tariffs.

from Industry Canada on trade and domestic production.[24] The results confirm the expectation that import barriers are only erected for industries with sizeable domestic production. Most of the industries with an import penetration above 90%, such as toys, telephones or computer hardware, have no import tariff. Footwear is an exception, it attracts a very high import tariff of 18%, even though less than one tenth of the market is supplied by domestic producers.

Automotive and related sectors, i.e. motor cars (HS 8703), parts and accessories for motor vehicles (HS 8708) and tires (HS 4011), are among the most important differentiated good sectors, accounting for one tenth of all non-FTA imports and more than one fifth of imports by the top-20 industries. They are subject to a relatively high rate of tariff protection, of 6.1% on cars and light trucks and 6.8% on parts and tires.[25] Among the top-20 industries, only textiles and footwear are protected more strongly.

We will apply the simplified methodology to calculate predicted welfare changes from various FTAs, focusing on the dominant effects for each of the three types of products (domestic, FTA, non-FTA) and ignoring second-order effects. For this analysis, we use Canadian import data between 1998 and 2010 that is taken from the UN Comtrade database. Observations are import flows into Canada for a 6-digit HS product, from each origin country, in a particular year. The only variables we observe are the quantity and value of the imports, from which we can calculate a unit value that we use a the average price.

4.2 Demand model and estimates

We follow the methodology of Khandelwal (2010) to estimate a demand system for the ten differentiated goods sectors in Table 8 that have positive import tariffs. In the absence of observable product characteristics, we employ a one-level nested logit model that only includes fixed effects, the price and unobservables. High-end and low-end segments are defined as in Van Biesebroeck (2011): product-country-year import flows at the HS 6-digit level that have a unit value above the median value for all product-country-year observations in the corresponding HS 4-digit industry are classified as high-end products.

[24] Source: http://strategis.ic.gc.ca/sc_mrkti/tdst/tdo/tdo.php?lang=30&productType=NAICS. We use the UN Comtrade concordance to map the HS categories into the North American Industrial Classification System (NAICS).

[25] The corresponding tariff rate on new vehicle imports is 10% by the EU, 8% by Korea, and 2.5% on cars, but 25% on light trucks by the United States. Japan is the only major car producing country that unilaterally eliminated its import tariff on all (non-military) transportation vehicles and parts.

The demand for each HS 4-digit industry is derived from the following indirect utility function for consumer i who purchases a product in HS 6-digit category p from country c that belongs to (high-end or low-end) segment g in year t:

$$u_{icpt} \;=\; \xi_c + \xi_p + \xi_t + \xi_{cpt} - \alpha_i\, p_{cpt} + \zeta_{ig} + (1-\sigma_g)\,\varepsilon_{icpt}. \tag{5}$$

The ξ_c and ξ_p fixed effects control for persistent differences by origin country and HS 6-digit product category, and ξ_t is a time-fixed effect. As before, we assume that the price sensitivity parameter α_i is inversely proportional to income and that the nesting parameters σ_g are segment specific. A domestically produced product variety is used as an outside good and its market share s_{0t} equals one minus the import penetration.

To estimate consistently the discrete choice demand system derived from indirect utility (5), we need instruments for price because firms are assumed to observe the quality index ξ_{cpt}. We follow Feenstra and Romalis (2014) and use the difference between the unit values reported by export and import countries as a proxy for transport and insurance costs. This exploits that the import values on the exporter's side are free-on-board (f.o.b.) prices, calculated prior to the inclusion of shipping cost, while the unit values on the importer's side reflect cost-insurance-freight (c.i.f.) prices. The so-called Washington-apples effect—that higher quality products tend to be shipped over longer distances—is already controlled for by the country effect ξ_c. This makes it more plausible that our proxy of transportation cost will be independent of the error term, while still be correlated with prices. We additionally use the two instruments for price that were suggested by Khandelwal (2010): the time-varying exchange rate and the interaction of distance with the oil price. The number of varieties by country, by segment, and by country-segment are the instruments to identify nesting parameters, similarly as in the automotive demand estimation.

Compared to the demand system used in the automotive case, data constraints require three simplifying assumptions that will influence the welfare calculations of an FTA. First, domestic production is modeled as the outside good and we do not observe its price, only total revenue. The own-price elasticity η_{11} for domestic firms cannot be estimated and is set equal to the average own-price elasticity over all imports in the sector. Second, following the Armington assumption, product varieties are identified by country of origin. If distinct, but unobservable varieties from the same country are substitutes, the own-price elasticity estimated at the country level will be lower than the firm-level elasticity that determines price setting. In particular, the country-level price elasticity might even be lower than one (in absolute value). In such a case, we assume firms from that country have enough market power to keep the whole tariff reduction as profits, i.e. that $\rho_2 = 0$. Third, we cannot identify imported intermediate inputs used in domestic production. We therefore cannot incorporate the benefits of tariff reduction working through the global supply chain of domestic producers.

4.3 Counterfactual FTA equilibrium

Despite its negligible share of motor vehicle imports, China is the second largest trade partner of Canada. It accounts for a large and growing share of imports in all major manufacturing industries that still benefit from tariff protection.

Table 9: Welfare effects of FTA in major importable sectors

		Domestic profit loss channel				Incomplete pass-through channel			
hs4	Sectors	KO	JP	EU	CN	KO	JP	EU	CN
8703**	Motor vehicles	-10.01	-27.43	-32.84		-1.83	13.12	24.60	
8703*	Motor vehicles	-10.50	-29.85	-41.89		-30.82	-70.98	-31.61	
8703	Motor vehicles	-9.81	-28.13	-39.94		-32.17	-74	-33.60	
8708	Motor vehicle parts	-3.97	-17.46	-6.62	-11.69	-0.55	-4.33	-0.54	-2.94
8443	Printing machinery	0.00	0.00	0.00	0.00	-0.27	-4.46	-1.06	-9.49
8542	Electronic circuits	0.00	0.00	0.00	0.00	-36.46	-2.75	-3.44	-3.17
9403	Furniture			-2.75	-6.47			-1.30	-5.45
8528	Television receivers	-0.05	-0.10	-0.07	-3.00	-0.07	-0.29	-0.11	-10.04
2204	Wine of fresh grapes			-4.26				-2.31	
4011	Rubber tires	-0.06	-0.08	-0.11	-0.33	-5.17	-18.22	-6.57	-17.78
6110	Sweaters, vests,...	-0.01		-0.15	-5.63	-0.18		-0.21	-27.84
6403	Footwear	0.00		-0.64	-1.76	0.00		-0.98	-36.67
	Total	**-13.9**	**-45.8**	**-54.5**	**-28.9**	**-74.9**	**-104.0**	**-50.1**	**-113.4**

		Rival import channel				Sum of three channels			
hs4	Sectors	KO	JP	EU	CN	KO	JP	EU	CN
8703*	Motor vehicles	-1.66	2.39	25.55		-42.98	-98.44	-47.98	
8703	Motor vehicles	-1.58	3.39	26.26		-43.56	-98.67	-47.27	
8708	Motor vehicle parts	0.42	2.25	1.77	0.11	-4.10	-19.53	-5.39	-14.52
8443	Printing machinery	0.00	0.00	0.00	0.00	-0.27	-4.46	-1.06	-9.49
8542	Electronic circuits	0.00	0.00	0.00	0.00	-36.46	-2.75	-3.44	-3.17
9403	Furniture			-0.20	-0.51			-4.2	-12.4
8528	Television receivers	0.20	0.33	0.26	10.24	0.08	-0.06	0.08	-2.80
2204	Wine of fresh grapes			0.06				-6.51	
4011	Rubber tires	1.45	2.09	1.16	8.69	-3.78	-16.21	-5.52	-9.42
6110	Sweaters, vests,...	0.00		0.10	-7.18	-0.19		-0.26	-40.64
6403	Footwear	0.00		0.36	-8.90	-0.01		-1.26	-47.34
	Total	**0.5**	**8.1**	**29.8**	**2.4**	**-88.3**	**-141.7**	**-74.9**	**-139.8**

Note: * Updated with last run of Matlab program

$$\begin{aligned} dW \approx\ & \frac{\tau_2}{1+\tau_2}\, q_1 p_1 \left(\rho_1 - \frac{1}{|\eta_{11}|}\left[\eta_{12}\rho_2 + \eta_{13}\rho_3\right]\right) && \text{[Prod 1]} \\ +\ & \frac{\tau_2}{1+\tau_2}\, q_2 p_2 \Big(\rho_2 - 1\Big) && \text{[Prod 2]} \\ +\ & \frac{\tau_2}{1+\tau_2}\, q_3 p_3 \left(\rho_3 - \frac{\tau_3}{1+\tau_3}\left[\eta_{31}\rho_1 + \eta_{32}\rho_2 + (1+\eta_{33})\rho_3\right]\right) && \text{[Prod 3]} \end{aligned}$$

Notes [JVB]:

1. In this local analysis, it seems we are not able to catch the change in DWL (we are calculating rectangles, ignoring triangles)
2. The theory for the incomplete pass-through channel applies tariffs to full price, not MC
3. Prod1 (dom. prod = outside good): The CS gains is not included in profit channel (nor in the rival prod. channel)

4. Prod3: again $\rho_1 = 0$, I believe both CS gains and tariff losses are included here

Table ?? presents the three product channels of FTA simulations for ten tariff-protecting differentiated good sectors that import most from the non-FTA trade partners. Since elasticity is increasing in price for logit models, imports from Europe is likely to pass most the tariff reduction on to consumers. We tackle this property with two settings in the model. First, we define the high-end and low-end segments. European products are found largely located in the high-end segment while China is more active in the low-end. Substitution in low-end segment is indeed higher than in high-end segment of most industries. The difference of nesting parameter estimates is not big enough (.1 on average) but will mitigate the elasticity gap between segments. Introducing price heterogeneity is another overture to adjust the elasticity within segment. It flattens the elasticity pattern by allowing different price effect across population. Those settings shorten the elasticity gaps between countries but do not reverse the pattern.

In contrast to Table 6, here we basically use different data set. Canada-EU FTA gives consistent market outcome for car industry in both analyses. The total turnover of European automobile imports are comparable in magnitude between two data sets, i.e. \$3.65 vs. \$3.79 billions. And the study of FTA with EU is less influenced by the elasticity underestimation in aggregate trade data as it has one observation for each country. This leads to similar direct price pass-throughs of EU regular car models, i.e. 85% vs. 88%. Consequently, net of tariff reduction and consumer surplus gains in Canadian automotive sector is \$-7.34 millions (26.26-33.6) in Table ?? vs. \$-9.5 millions (215.4-226.9) in Table 6 under Canada-EU FTA.

However, FTA with Korea has lower net welfare effect in Table ??. The total turnover of Korean automobile imports is just about two-thirds of the aggregate revenue in car data, i.e. \$1.48 vs. \$2.21 billions. The difference is likely to be the entrepot trade from the United States to Canada, given the lower tariff rates on passenger cars in the United States than in Canada. Unfortunately we are unable to identify the origin of re-export data. Moreover, this could also be linked somehow to the majority classification for multiple origins in Canadian car data.

The difference of Canada-Japan FTA impacts is much bigger in Table ??. Car data includes only normal cars, i.e. cylinder between 1500 and 4500cc (HS code 870323 and 870324) while trade flows include all transportation vehicles. Japanese cars dominate vehicles traveling on snow etc. (870310) and with cylinder below 1500cc (870321 and 870322), which account for \$11 million domestic welfare loss under a FTA with Japan.

Moreover, elasticity of Japanese cars might have been underestimated somehow because of the multiple models aggregating at country level. The pass-through of code 870323 sector is only 0.55 for Japan compared to average of 0.8 in Table 6. This results in a greater incomplete pass-through of tariff reduction for the FTA with Japan.

Not surprisingly, we obtain larger domestic profit losses in Table **??** as we could not separate domestic producers with significant political power using trade data. However the results are coherent. FTA with Korea has the least impact on total domestic production. Moreover, welfare in Table **??** equally aggregates individual consumer surplus. Korean cars are competing in the low end segment of market as they have the lowest unit value of imports. FTA with Korea would benefit the people in low income deciles more than those with high income. Therefore, the main implication still holds that Korea is preferred over Japan as FTA negotiation partner if policy makers put more weights on domestic profit loss or consumer surplus of low-income households.

Heterogeneity in sector composition is also important in choosing the strategic FTA partner. The ideally preferred country should specialize in sectors with large demand elasticities to maximize price reduction and in sectors with high import penetration to limit domestic profit loss.

Automobile and electronic integrated circuit are the main products imported from Korea. Car sector would allow Korea to pass through moderate part of its trade benefits to consumers while the tariff reduction in IC sector would fully go to the profit of Korean companies. Relatively small value of total import from Korea limits the tariff revenue loss and the effect of incomplete pass-through under FTA with Korea. In contrast, Japanese and Chinese firms would retain a large amount of tariff reduction from automobile sector and textile sectors respectively. This is attributed more to the big import turnover of Japan and China, since elasticities are relatively high for automobile and textile industries. FTA with EU has the largest impact on the other imports that are not directly affected. It arouses great consumer surplus gains by systematically reducing prices of car models assembled in the United States and Mexico.

In the aggregation of ten major importable sectors with significant tariff protection, Korea and China have small influence on the profits of Canadian producers on top of two aspects. First, different segmentation with Canadian competitors and low prices would lead to low cross-product price elasticities of Canadian products with respect to price change of Chinese and Korean imports within the same industry. Second, the overlap of Canadian domestic production and importation from Korea and China is low. Canadian import penetration is high in the electronic IC and textile industries.

In summary, FTA with Europe may raise most the consumer's surplus in a cost-benefit analysis while a FTA with Korea has the least impact on domestic profits. Korea slightly lags behind Europe but clearly stays on top of the other two Asian neighbors in sum of three product channels. Since the consumer's surplus gains associated with EU FTA mainly originate from the rich strata and policy makers might focus more on the impact of domestic production, Canadian government could be more likely to accept a FTA with Korea before the others.

We theoretically demonstrate that ideal FTA partners are supposed to specialize in sectors with high elasticity and high import penetration, and within each sector have higher elasticity and are less substitute to the domestic production. This suggests that North-South FTA should be more desirable than North-North or South-South FTAs because developed and developing countries are basically competing in different industries or market segments, and developing countries often concentrate on more competitive labour-intensive sector or low segment of industry.

Empirically, we look at the example of China, the largest developing country in the world. Despite the negligible car import from China to Canada, China is second largest trade partner of Canada. FTA with China would have important welfare effects in most of the importable sectors.

In our results, China has the least elasticity in most of the biggest importable sectors, mainly driven by the cheap price and large market share. However, Table 10 indicates that imports from China have the highest value weighted average own price elasticity. This is attributed to different import composition as China concentrates on the sectors with high elasticities, such as television, seat/furniture, and textiles. Tariff reduction will be largely passed on to consumers in those sectors. Import penetration in those sectors is usually high for Western countries. Protection against Chinese imports in the United States or Canada will benefit more the countries like Mexico rather than their domestic production. Cross-product elasticities of domestic products with respect to imports from China within the sectors could also be low because Chinese import is still located in the low-end segment of industry. Moreover, FTA with China is likely to benefit the poor population more than the rich one, which is preferable for the policy makers that are averse of income inequality. Relatively large domestic welfare loss in a FTA with China mainly stems from big trade volume between two countries.

Table 10: Value-weighted average elasticity for different imports

Import	Med. Elasticity	Mean Elasticity
Korea	-1.46	-1.76
Japan	-1.68	-2.93
EU	-2.27	-3.23
China	-2.98	-4.89
USA	-1.51	-2.94

5 Conclusions

This paper investigates the domestic welfare effect of alternative FTAs in a theoretical framework and empirically suggests that Korea is a more preferable FTA partner over Japan for Canada, if policy makers attach more importance to the concerns of domestic profit losses and income inequality. The loss of tariff revenue is minimized under a FTA with Korea as a result of relatively small import value from Korea. Since Korean products are less substitutable to Canadian-made goods, domestic producers would suffer the least from the reduction in market shares and profits under a FTA with Korea. In addition, the government that cares more about income inequality tends to choose the FTA with Korea as it benefits the low and middle strata more than the rich population in society.

The similar preference pattern is observed for Mexico being preferred over Canada by European countries. The economic intuition is also similar except that Mexico could specialize more in the sectors with high elasticities such as textile. Tariff cuts would be passed to a much greater extent on to domestic consumers.

However, some caveat of the methodology must be added in the end. First, different trading partners bring asymmetries not only on import but also on export. This paper focuses on the impact of FTAs on domestic markets rather than export benefits. Second, impact of global supply chain for domestic producers is ignored in the simplified methodology. This is likely to overestimate domestic profit loss and underestimate consumer surplus gains. Third, we examine only the counterfactual welfare effects from existing market equilibrium. Potential positive or negative impacts of FTA are not taken into account, such as improvement of variety and productivity, and influence on FDI decision.

In the future work, we could also estimate the counterfactual producer surplus in export markets although it requires much more data. If we assume countries export the same range of products to most of trade partners, exploiting their own comparative advantage, export benefits are approximately proportional to the market size and existing level of import protection in partner country.[26] It is relatively easy to qualitatively assess and compare the impact on exportation. For instance, China and EU have large market size while Korea and China have more protectionism on industries.

[26]Sector shares in Canadian export to Japan and to Korea are indeed very much correlated in our data.

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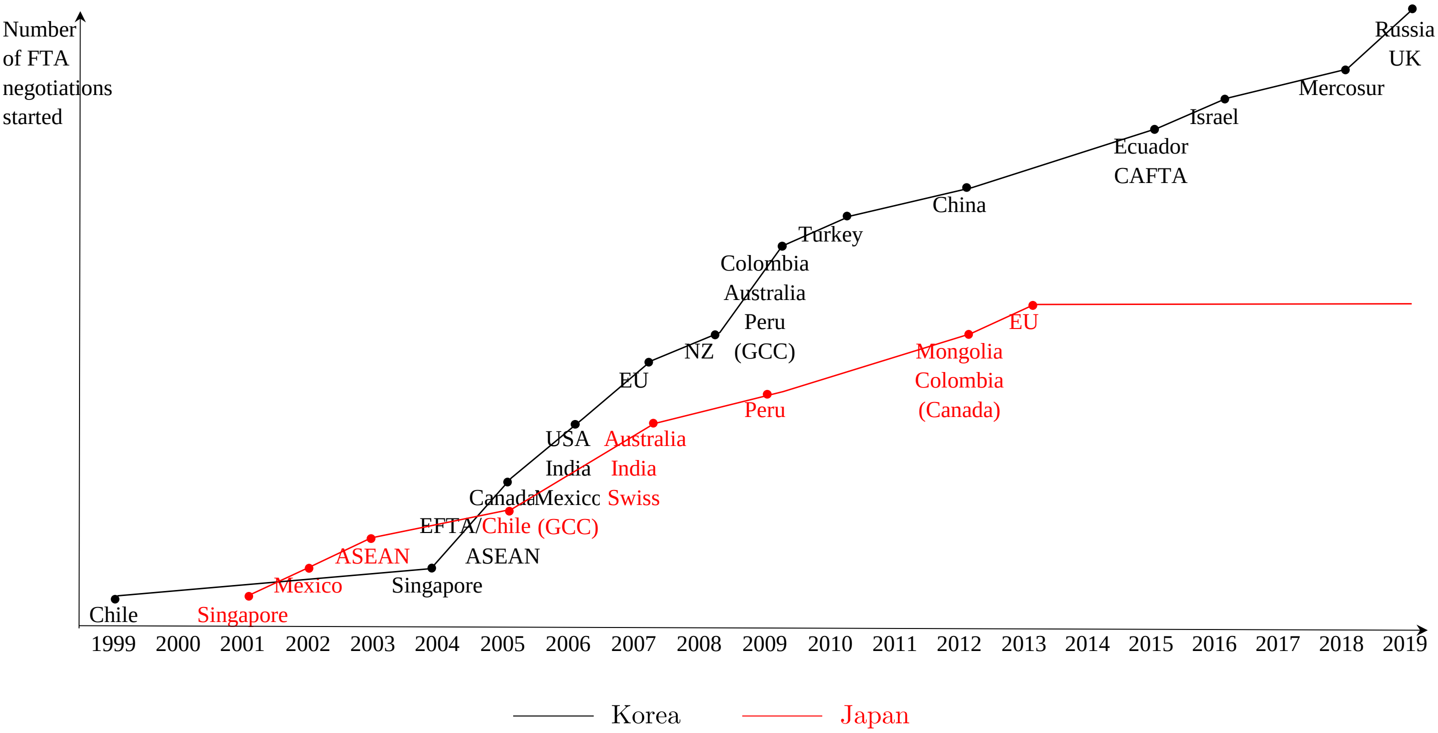
Appendix

A Additional results

Figure A.1: Number of FTA negotiations started by Korea and Japan



Note: Countries in brackets indicate negotiations that are formally suspended.