FTAs, Auto Tariffs & Trade Policy

A Counterfactual Impact Analysis on the Canadian Auto Industry

by

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Foreword

With Canada in the midst of negotiating free trade agreements with South Korea and the European Union, Japanese automakers in Canada are concerned about the impact of bilateral FTAs with competing auto producing and exporting jurisdictions. In the event that both of these bilateral agreements are ratified, Korean and European automakers (none of which have manufacturing facilities in Canada) would be handed a significant duty-free market advantage, and only Japanese automakers (with heavy investments in Canadian production facilities) would be paying the 6.1% MFN tariff on vehicle imports from Japan.

This unbalanced treatment will disrupt the domestic market in Canada, particularly in the intensely competitive and price-sensitive small vehicle segment that dominates the Canadian market. Currently all automakers are treated the same with respect to Most Favoured Nation (MFN) tariff treatment for imported vehicles that don't qualify for NAFTA.

In the absence of a similar bilateral negotiation between Canada and Japan, Japanese automakers in Canada would be impacted in two fundamental ways: first, imports from Japan would be competitively disadvantaged in Canada; and secondly, this could undermine current and/or future investments due to market inequities stemming from unbalanced preferential auto trade policies.

Since the Canada-US Auto Pact in 1965, Canada has maintained a unique position in the North American auto industry. Canada accounts for about 16% of total NA production, but only about 8% of total NA vehicle consumption. Auto manufacturers in Canada are currently either US or Japanese, and are deeply integrated into the North American industry as a result of NAFTA. Currently over 90% of US automakers' production and about 75% of Japanese automakers' production in Canada is exported to the US. Production for export to non-NAFTA countries continues at the margins, but only in relatively small quantities. Clearly, for Japanese automakers in Canada, the focus is on meeting the local transportation needs of Canada and US consumers.

In 2006, Foreign Affairs & International Trade (DFAIT) commissioned Professor Johannes Van Biesebroeck to undertake an impact analysis of various FTA configurations on the Canadian auto market at the launch of bilateral negotiations with South Korea. Rather than forecasting the impact on vehicle sales in future years, the report utilized 'counterfactual analysis' to calculate what might have happened in 2006, assuming these different tariff and trade policy scenarios were already in effect. The 2006 report considered four scenarios: an FTA with South

Korea, an FTA with the European Union, an FTA with Japan and unilateral tariff elimination (equivalent to a multilateral implementation of bilateral FTA provisions for preferential tariff treatment).

Last year, JAMA Canada commissioned Professor Van Biesebroeck to update his analysis using 10 years of available data to look at the impacts on the Canadian vehicle market in 2008, assuming Canada had concluded Free Trade Agreements with both South Korea and the European Union, as well as the impact of a multilateral elimination of import tariffs on finished light duty motor vehicles. Using the same econometric modelling, this paper examines various tariff reduction scenarios: an FTA with Korea, an FTA with the EU, combined FTAs and multilateral tariff elimination.

Apart from the specific impact on the auto market in Canada, JAMA Canada is also concerned about the longer term effect on the structure of the auto industry in Canada, particularly as the industry remains highly dependent upon open trade, as well as fair, transparent and balanced policies which offer equal treatment for all automakers in Canada.

We hope this report will contribute to the ongoing discussion about automotive trade policy as well as strategic initiatives to ensure the long term vitality and global competitiveness of the Canadian auto industry.

Japan Automobile Manufacturers Association of Canada

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Executive Summary:

The Canadian auto industry is heavily dependent on and derives significant benefits from international trade. The vast majority of light duty vehicle production in Canada is exported, while the majority of sales in Canada are imported vehicles. Producers in Canada—U.S. and Japanese firms alike—take advantage of NAFTA by producing for the larger North American market.

In this report, we evaluate the likely impact of alternative trade policy scenarios on the Canadian automotive market. Tariffs add non-manufacturing cost to vehicles, which have a direct impact on consumer prices and an indirect effect on the relative competitiveness of different firms. In the analysis, we construct counterfactual market equilibria under various possible trade policies, starting from the observed situation in 2008. We calculate new equilibrium values for prices, sales, local production, and variable profits and report effects broken down by country of ownership. Two possible Canadian trade policies receive most attention: (i) bilateral free trade agreements (FTAs) with both Korea and the EU; and (ii) full multilateral elimination of MFN tariffs.

Under the first scenario, by and large the only vehicles that would still attract the current 6.1% import tariff are those imported from Japan. Other vehicles would be tariff-exempt under NAFTA or either of the FTAs. Compared to the status quo, this would adversely affect especially the Japanese firms and to a lesser extent the American firms. Under the benchmark assumptions, total sales of Japanese vehicles (those sold by Japanese firms, irrespective of assembly location) are predicted to have declined by about 1,900 units, while sales of European firms would have increased by 9,200 units and Korean sales by almost 3,000 units in 2008.

Additional results suggest that the sales decline for Japanese firms would be substantially higher in the segment of entry-level vehicles. If the total size of this segment would remain constant under alternative trade policies, the decline in Japanese sales would increase three fold. Considering a more aggressive pricing strategy for the firms, in particular maximizing sales subject to a break-even constraint rather than maximizing profits, would increase the effect further. In the worst case scenario, we calculate a 2.04% sales decline for Japanese firms compared with sales expansions of 10.49% and 12.18% respectively for European and Korean firms.

To limit the market share effect, Japanese firms are predicted to lower their prices slightly, resulting in a profit decline of similar magnitude of the sales decline. In contrast, variable profits of the firms benefiting from the FTAs (Europeans and Koreans) would increase dramatically, both because of an imperfect pass-through of the tariff elimination to consumer prices and because of higher sales. In quantitative terms, these effects are very large, with increases in variable profits of $101 million for European firms and $38

million for Hyundai, versus a profit decline of $23 million for Japanese firms even under the conservative benchmark scenario. If those profits are invested in strengthening market positions, e.g. expanding the dealership network or increasing advertising expenditures, the long term competitive harm to Japanese firms could be a lot larger.

Instead of comparing the predicted effects of joint FTAs with Korea and the EU with the status quo, it is illustrative to also compare them with the alternative trade policy of full tariff elimination for all WTO members. For both European and Korean firms, the two scenarios result in very similar outcomes. The average price reductions, as well as sales and variable profit increases, are of equal magnitudes. For Japanese firms, on the other hand, the outcomes would be very different. Under full tariff elimination, their average prices would decline by -0.89% (compared to -0.01% under joint FTAs), but these would be compensated by savings in tariffs. Sales are predicted to increase by 1.80% (compared to a decline by 0.32% under the FTAs). The difference is even more pronounced in the entry-level segment and assuming sales maximizing behavior: Japanese sales would now increase by decline by 3.95% under multilateral tariff elimination, versus a 2.04% decline under the bilateral FTAs.

It is striking that full tariff elimination would be most beneficial to the group of firms that is satisfying most of its local Canadian vehicle demand from domestic production. In 2008, 30.6% of Japanese vehicle sales in Canada were produced locally (versus 25.1% for American firms, 0.3% for European firms, and nothing for the Korean firms). Over the crisis, this advantage has even grown further. It is especially remarkable that the difference between the joint FTAs scenario and full tariff elimination for Japanese firms is largest in the segment of entry-level vehicles, where 38.4% of Japanese firm sales are produced in Canada. The discriminatory nature of various FTAs leads to the counterintuitive situation that multilateral tariff elimination is less beneficial for the firms that import most.

Conclusions:

As FTAs are inherently discriminatory, it is not surprising that different firms are affected differently. A number of patterns are worth highlighting:

- The combined effect of Canadian FTAs with both South Korea and the EU would be more harmful to Japanese firms than both of these FTAs in isolation
- The sensitivity of the benchmark effects to a few important modeling assumptions is non-negligible:
    - Effects are more pronounced if consumers are estimated to be more price sensitive. If “luxury and sporty cars” (representing 8.9% of sales)

are eliminated, the estimated effects of the trade policy simulations are more damaging for Japanese firms.

  - If the total Canadian market would not expand in response to the price declines, i.e. no new customers would flock to the market, the effects of the trade policy simulations are again found to be a lot more damaging for Japanese firms.
  - The effects on prices and sales are a lot more pronounced if firms are assumed to set prices in a sales maximizing fashion rather than to maximize profits. The effects on profits are less pronounced.

- Effects are larger on the segment of entry-level vehicles. Korean firms gain a lot more there and Japanese firms, which are sales leaders in this segment, incur more damage than American firms.
- While Japanese firms are harmed most by joint FTAs with Korea and the EU, they would benefit most from full tariff elimination as well. The discriminatory nature of the various FTAs lead to the counterintuitive situation that full tariff elimination is less beneficial for the firms that import most.
- Effects on sales for firms benefitting directly from an FTA will be muted because firms will likely only pass a portion of the tariff decline on to consumers.
- Effects on sales will be further muted as other firms, which are only indirectly affected by the FTAs due to changes in the competitive environment, will defend market share by lowering their own prices.
- Profit margins of directly benefiting firms will increase, as only a fraction of the cost reduction is passed on, and those of other firms will decrease, as prices are reduced without any cost savings.
- As a result, the effect on total profits for the firms benefiting from the FTAs can be quite substantial and they could use these profits in a variety of ways to improve their competitive position for the longer run.

1 Introduction

Canada has been conducting negotiations with South Korea for several years to form a Free Trade Agreement (FTA) that would abolish most of the import tariffs between the two countries. Recently, it also started FTA negotiations with the E.U.[1] The most important aspect of these FTAs for the Canadian automotive market is that it would abolish the current 6.1% import tariff on new passenger vehicles – perhaps subject to some domestic content requirements as was the case under NAFTA.

From Canada's perspective, the expected effect of eliminating the 6.1% tariff can be broken down into the following components:

Effect	=	Benefit – Cost	
	=	Lower price for consumers	(1)
		+ higher sales of vehicles	(2)
		+ tariff concessions by trade partners	(3)
		– lost tariff revenue	(4)
		– lost FDI	(5)
		– lower domestic production	(6)

Of greatest importance to Japanese automakers and the subject of this report are the product substitution effects that are buried in item (2). Firms from countries that benefit from an FTA—or more accurately for models that are assembled in those countries—will be able to lower their prices as they do not face import tariffs anymore, and as a result they will increase their sales. To some extent this will draw new consumers in the market, but most of the increase is expected to come from reduced sales of firms that do not benefit from the new FTA.

In addition, as firms benefiting from an FTA lower their prices, all competitors in the Canadian market are likely to adjust their pricing to some extent. If they lower prices in response, which is what profit maximizing behavior predicts, this will reduce the profit margin for firms not benefiting from an FTA. Together with the sales reduction an FTA is thus expected to have a clear negative effect on total profits of firms not benefiting from the tariff elimination.

We will quantify the effect on sales and profits for all firms. Estimates of items (1) and (6) above—prices and Canadian production—are not the focus of the analysis, but

[1] The E.U. already has a FTA with Mexico. The U.S. and South Korea signed the KORUS FTA on June 30, 2007, but it has still not been approved as "outstanding issues remain", in particular related to automobiles. No law has yet been submitted to the U.S. Congress for consideration. Negotiations for the FTA between South Korea and the EU were completed and an agreement signed on October 15, 2009. It is not clear what the timeline is for this agreement to take effect.

summary statistics will also be reported. The likely effect of an FTA on FDI, item (5) above, will also be discussed briefly towards the end.

The way we will obtain estimates for the predicted changes in prices, quantities, and profits is in three steps.

First, we estimate a discrete choice model of consumers' vehicle purchase decisions in the Canadian automobile market. This follows in the economics tradition of using oligopolistic models of competition in differentiated products to characterize a number of primitives from the observed market equilibrium outcomes. In particular, the objective of the preliminary econometrics work is to obtain estimates on the parameters that determine consumer preferences.

Secondly, we then estimated the demand parameters and the assumption of how utility maximizing consumers make their purchase decisions with an assumption of how profit maximizing firms determine prices or quantities. This allows us to infer what the (unobservable) marginal cost for each model has to be in order for the observed prices to be optimal from the firms' perspective. In particular, we will assume that firms set prices in a profit maximizing fashion, taking into account the strategic responses of competitors and the fact that each firm sells multiple different models.

Third and finally, with demand and marginal cost estimates in hand, and assumptions on consumer choice decisions and firms' price setting policies, it is possible to conduct a counterfactual simulation. A new market equilibrium can be calculated if one of the primitives of the model is changed. In particular, an FTA that abolishes the import tariff for some country will lower the marginal landed cost for models imported from that country. In this calculation, each participant is allowed to adjust their behavior—firms can change their prices and consumers can change their purchase decisions—and new prices, quantities, and profits will be realized.

The main benefit of such an analysis is that we even allow firms that are only indirectly affected by the policy change, e.g. most Japanese firms, to update their strategies. We obtain an estimate of the likely effect of the trade policy change only keeping the primitives of the firms' environment constant, not their observed strategies.

The rest of this report is organized as follows. In Section 2, we give a brief overview of the Canadian automotive market. This is followed, in Section 3, by a more detailed description of the empirical strategy to estimate the counterfactual outcomes under alternative trade policies. In Section 4, we briefly describe the data used to perform the analysis. In Section 5, the discrete choice model of vehicle demand and the econometric estimates of the parameters in the model are described. To provide some intuition, some summary statistics on the implied own-price elasticities are reported and it is explained how marginal costs can be calculated from these results.

Section 6 is the core of the report, containing the results from the benchmark counterfactual trade policy simulation. This will take the form of a reduction in the marginal costs 5.75% for the models imported from a country that forms an FTA with Canada.[2] We update the analysis on the expected effect of the FTA with South Korea that was performed 3 years ago for the Department of Foreign Affairs and International Trade. The results differ because (1) the comparison year is different, 2008 instead of 2005, and Hyundai is now producing two models in North America; (2) the fraction of sales produced within NAFTA for foreign-owned firms has increased; and (3) the demand model has been improved. In addition, we analyze a possible FTA with the E.U., simultaneous FTAs with South Korea and the E.U., leaving only the Japanese firms to face import tariffs, and multilateral vehicle tariff cuts where Canada abolishes its import tariffs on finished vehicles entirely.

The next two sections of the paper explore the sensitivity of the results. In Section 7, some sensitivity checks are reported to illustrate the robustness of the analysis. In Section 8, a couple of crucial assumptions are changed to illustrate that the benchmark results are conservative estimates. The effects would be larger (1) if we do not allow the market to expand, (2) if we focus just on the entry-level segment, and (3) if we assume firms are maximizing sales rather than profits.

Finally, in Section 9 a couple of other trade issues are discussed—FDI and exchange rates—and in Section 10 are the conclusions.

2 Automotive industry in Canada

The firms active on the Canadian light vehicles market can be categorized into four ownership groups. The American firms are comprised of GM, Ford, and Chrysler. Each of these firms sell vehicles under a number of brands. European-branded models produced by these firms, e.g. Volvos for Ford or Saabs for GM, are included in the American category as we follow ownership of the parent firm.

The Japanese group is comprised of all models owned by Honda, Mitsubishi, Mazda, Nissan, Subaru, Suzuki, and Toyota[3]. The Korean group consists only of Hyundai, which sells vehicles in North America under its own name and under the Kia brand. Finally, the European group is made up of BMW, Daimler, and Volkswagen. Tata Motors is lumped with the Europeans as the only vehicles they sell in North America are Jaguars and Land Rovers which are assembled in Europe.

Total sales for 2008, in units and market share, as well as the growth in sales over the last five years are depicted in the first three columns of Table 1. The American group is

[2] As the calculated marginal cost include the current tariff rate, the cost reduction is estimated at 5.75% or 0.061/(1+0.061).

[3] Mazda is treated as an independent firm, i.e. independent of Ford when it comes to pricing decisions, consistent with the Canadian situation throughout and the current situation everywhere.

responsible for 48.1% of total sales or 776,001 vehicles in 2008, but their share is shrinking. The Japanese group had a combined market share of 38.1% and saw its sales increase by 24.3% since 2003, in spite of the onset of the crisis. Sales growth by Koreans was similar over the last five years, but accelerating. Sales growth by European producers was even higher, although starting from a much lower level.

Table 1: Total sales and country of origin for light vehicle sales in Canada in 2008

	Total Sales in 2008			Production site				
	units	share	growth since 2003	Canada	U.S. & Mexico	Japan	Europe	Korea
American	776,001	(48.1%)	-13.9%	25.1%	70.4%		2.0%	2.5%
Japanese	615,602	(38.1%)	24.3%	30.6%	26.1%	43.1%		0.3%
European	104,449	(6.5%)	61.9%	0.3%	38.9%		60.8%	
Korean	118,152	(7.3%)	23.2%		8.7%			91.3%
Total	1,614,204		3.7%	23.8%	46.9%	16.4%	4.9%	8.0%

Notes: Based on 2008 sales statistics. Tata is counted as a European manufacturer (Land Rover)

Japanese firms produced 30.6% of their sales locally in Canada in 2008, more than any other group—see statistics in the fourth column of Table 1 --- 23.8% of all Canadian sales were produced locally. 16.4% of all vehicles sold in Canada in 2008 originated from Japan, 4.9% from Europe, and 8.0% from Korea. The final two columns break down which group of firms will benefit and to what extent from FTA's with South Korea or the E.U.

Canada is running a trade surplus in finished vehicles and the fraction of Canadian production sold locally is even lower, at approximately 15%.[4] We can thus characterize the Canadian automotive industry as highly integrated with the rest of the world. More than three quarters of sales are vehicles assembled abroad; almost 30% even originates from another continent. Approximately 85% of production is exported—almost all to other NAFTA countries—and this share is lower for Japanese plants.

An important distinction, especially for the Canadian market, is between "entry-level" vehicles and all others. In making this distinction, we follow the classification in the publications of the Canadian consulting firm DesRosiers (www.desrosiers.ca). The only difference is that we exclude small pickup trucks from the entry-level category, as no such vehicles are imported into North America. For the Canadian market, these small pickups only account for 3.2% of sales, much less than in the U.S.

[4] At the same time, Canada has been running a large trade deficit in automotive parts and trucks for an overall trade deficit in total automotive trade since 2006.

A number of crucial statistics are reported separately for the entry-level segment and all other vehicles in Table 2. A few distinctions are worth pointing out:

- In 2008, the two segments were of equal importance, splitting total Canadian sales almost evenly
- Over the last 5 years, entry-level vehicles sales increased by 37%, while other vehicle sales slumped by 16%
- Japanese firms are the market leader with 51% of sales in the entry-level segment
- Korean firms sell two and a half as many entry-level as other vehicles in Canada
- The entry-level versus other vehicle composition of sales is exactly opposite for Japanese and American firms: two-thirds entry-level for Japanese, versus two-thirds other vehicles for American firms
- Korean and European producers also have different specializations: 72% of Korean sales are in the entry-level segment, versus only 40% of European sales
- Japanese firms are assembling almost 40% of entry level vehicles domestically in Canada[5], while for American firms the local production is more important for other vehicles

Table 2: Sales and domestic production separately for entry-level and other vehicles

	unit sales	market shares	growth since 2003	share of total	made in Canada
(a) entry-level segment in 2008					
American	264,940	(33.2%)	29.4%	34.1%	8.5%
Japanese	407,693	(51.0%)	47.7%	66.2%	38.4%
European	41,618	(5.2%)	28.1%	39.8%	
Korean	84,958	(10.6%)	20.5%	71.9%	
Total	799,209		36.9%	49.5%	22.4%
(b) all other segments in 2008					
American	511,061	(62.7%)	-26.6%	65.9%	33.8%
Japanese	207,909	(25.5%)	-5.1%	33.8%	15.1%
European	62,831	(7.7%)	96.0%	60.2%	0.6%
Korean	33,194	(4.1%)	30.7%	28.1%	
Total	814,995		-16.2%	50.5%	25.1%

Note: entry level segment defined as in DesRosiers publications, excluding small pickup trucks, i.e. subcompact and compact cars and compact SUVs.

[5] This share (1) has gone up in the crisis; (2) has been hurt by the enormous popularity of the Mazda3 in Canada, and (3) would be marginally higher if small pickup trucks are included, courtesy of the Honda Ridgeline.

The importance of the entry-level segment marks an important difference between the Canadian and the U.S. market. In market commentary, which tends to be dominated by U.S. sources, evolutions in the entry-level segment tend not to receive the same attention they would deserve from a Canadian perspective.

Furthermore, the increasing prominence of (CO2) emissions in the public debate surrounding climate change and government policy are certain to increase the importance of the entry-level segment in the near future. In 2009, for example, entry level sales exceeded other sales for the first time (even if small pickup trucks are counted with other vehicles).[6]

3 The nature of a counterfactual analysis of trade policy

The logic underlying our estimate of the likely effect of a trade policy change has the following three steps.

First, starting from the observed market outcomes for a number of years, 1998 to 2008 in our case, we can estimate the price responsiveness of Canadian consumers. We do this by estimating a standard demand model that has been used regularly to study various features of automotive markets worldwide. The outcome of this part of the analysis is an estimate of to what extent the sales of each model respond to given percentage change in its own price and to changes in prices of competing vehicles.

Second, using the estimated demand model and the observed prices for each model in the market place, we calculate what the underlying variable costs per vehicle have to be if the observed prices are rational for profit maximizing firms. We use models of competitive price setting from economic theory to find out which unobserved costs are consistent with the observed prices.

Third, starting from the observed market equilibrium in 2008, i.e. using the observed information on market share, price, ownership, and production location for each model sold in the Canadian market, we calculate *how the prices would have been different in 2008 if a different trade policy had been in place.*

Example: In particular, if an FTA with South Korea had been in effect in 2008, the variable cost of all the models imported from Korea would have been only 1/(1+0.061) of the cost we calculated for 2008 as no tariffs would have been due. Our estimate of the consumers' price sensitivity will tell us how much of the tariff reduction a profit maximizing Korean firm will want to pass on to consumers (to grab market share). In addition, as Korean prices fall, our pricing model together with the cross-effects in the demand model will tell us to what extent other firms will want to respond to these price

[6] In 2009 the entry-level segment accounted for more than half of all sales, even without counting small pickups. As the recession took a smaller bite out of small vehicle sales, it is not certain this will persist over the recovery.

cuts. In the new price equilibrium all models will be cheaper, but vehicles imported from Korea will see the largest price decline, models that are close substitutes will also see a noticeable price decline (firms will sacrifice some profits to limit the impact on their sales), and models that are poor substitutes will hardly see any change. The demand model will further tell us the market shares for all models implied by these new prices.

For each of the above three steps, we do some robustness analysis (change the assumptions):

- **First**, an important input in the analysis is the price sensitivity of consumers (step 1). To assess the robustness of our findings, we have re-estimated the effects excluding pickup trucks (in Section 7.2) and excluding the most price-insensitive market segments (in Section 7.3).
- **Second,** we will use different approaches to recover costs (in the second step). In the benchmark case firms are assumed to maximize profits over their entire product portfolio. In a sensitivity check (in Section 7.4), firms are assumed to maximize profits model by model. In a second sensitivity check (in Section 8.3), firms are assumed to maximize sales, i.e. the markup will be fixed.
- **Third**, we have also estimated the effects holding total sales constant (in Section 0), i.e. not assuming that the lower prices would draw new consumers into the market, and focusing on the important segment of entry-level vehicles (in Section 8.2). Both of these two changes increased the estimated effects on Japanese firms considerably.

Finally, in terms of interpretation, a few important issues should be pointed out:

- One should not interpret the results as a prediction of the likely future effects of trade policy changes. Rather, we calculate what the market equilibrium *would have* looked like in 2008 if an alternative trade regime *would have* been in effect.
- The calculated effects should be interpreted as medium-term. The results take responses of directly and indirectly affected firms into account. All market participants have adjusted their price setting to the new situation in terms of tariffs and marginal costs. However, we consider the location of production of each model and the firms' product portfolio as unchanged.
- Because transaction prices are not observed, we have to work with MSRPs. If either the gap between the listed and actual price is similar for different firms or if the gap (in percentage terms) remains the same before and after the trade policy change, the results would be the same using MSRPs or transaction prices.
- The difference between the list prices and calculated costs should not be interpreted as (accounting) profits, but rather as the contribution of each sale to the firms' fixed costs. It is a markup that firms need to apply to cover costs that are shared over their

entire operations, e.g. advertising, tooling and equipment, design of vehicles, R&D, etc. These are still costs, but they cannot be attributed to individual vehicles.

4 Data set

We assembled annual information on each passenger vehicle model for sale in the Canadian market between 1998 and 2008. Models that sell less than 50 units per year are dropped, as well as pure luxury brands (including Porsche). We further dropped commercial vehicles and full size vans, which gives us a sample of 2,262 observations, growing from 153 in 2004 to 239 in 2008. Average annual sales stands at 1.54 million units, growing from 1.34 million in 1998 to 1.61 million in 2008.

We observe the specifications and prices for several varieties of each model, but only the sales information at the model level. Therefore the entire analysis has to be conducted at the model level, and we have chosen to use the specifications (including the price) of the cheapest variety of each model available for sale in a given year.

The one characteristic that is important later on is the assembly location and we also use that of the cheapest version. In most cases where different varieties of a model are assembled in different countries, this is immaterial for the trade analysis as they come from different NAFTA countries (e.g. Nissan Sentra). In a few cases, the multiple origins are a temporary situation as production switches, e.g. from Japan or South Korea to North America, and there were still imports in the start-up year. In just five cases are there varieties of the same model produced in different countries.[7]

We have to rely on the assembly location of the models the way it was reported to us at the start of 2008 for our analysis. This means, for example, that the Sonata is the only model of Hyundai or Kia produced in the U.S. and that Suzuki was still assembling vehicles in Canada—which has ceased by now.

In order to incorporate consumers that did not purchase a vehicle at prevailing prices in 2008, but which might be enticed to do so at lower prices, it is customary to include an "outside good". This requires an estimate for the potential market size, which we take to be the total number of households—12.58 million in 2008. As such, in an average year we find that 87% of households choose not to buy a new vehicle.

The dependent variable in the demand estimation is the market share of each model. As explanatory variables, we follow most closely the papers by Berry *et al.* (1995) and Petrin (2002). The following variables are included: price (in thousands of dollars), power per weight (maximum power in kw divided by weight), size (length x width x height), and

[7] In 2008, only 4 models are really affected by this problem, i.e. they are assembled in two countries, at least one is not a NAFTA country: VW Golf/Rabbit (EU & Brazil), Mercedes-Benz G-class (USA & EU), Toyota RX (Canada & Japan), Hyundai Santa Fe (USA & Korea). For each of these, we picked the first country listed.

fuel efficiency (liters of gasoline per 100 km). In addition, we include a dummy variable whether the brand has traditionally been owned by an American firm to capture the historical reach of the dealership system.

Summary statistics for 2008—the year for which we do the trade policy simulations—are in Table 3. Vehicles are assigned into one of 5 segments, listed at the bottom, which will play an important role in the demand estimation.

Table 3: Summary statistics for 2008 (239 models)

	Average	Standard Deviation
Sales (units)	6,754	11,302
Model characteristics:		
Price (‘000 $)	35.905	20.403
Power/weight	9.582	2.400
Size	14.348	3.116
Liter/100 km	10.659	2.465
Domestic brand	0.377	0.486
Production location	Fraction of models	Fraction of sales
Canada	11.3%	23.8%
U.S. & Mexico	42.7%	45.8%
E.U.	18.4%	4.9%
Japan	17.2%	16.4%
South Korea	9.6%	7.9%
Segments	Fraction of models	Fraction of sales
Regular cars (all sizes)	29.3%	45.7%
Luxury or sporty cars	23.8%	8.9%
SUVs	32.6%	21.9%
pickups	7.9%	15.9%
minivan	6.2%	7.7%

5 Demand estimation

5.1 Specifying the model of demand

The automobile industry has proved to be a popular proving ground for discrete choice models that estimate demand for differentiated products. The state-of-the-art in estimating aggregate demand is the random coefficient model discussed in Berry (1994) and first taken to the data (U.S. automobile purchases) in Berry, Levinsohn, and Pakes

(1995). Micro-level data, as in Goldberg (1995) or Berry, Levinsohn, and Pakes (2004), can be used to obtain more precise parameters. An intermediate solution, in Petrin (2002), adds micro-moments to the aggregate estimation. Several studies have used these models to evaluate trade policies. Important recent studies that use aggregate data include Irwin and Pavcnik (2004) for airlines and for automobiles we should mention Fehrstman and Gandal (1998), Berry, Levinsohn, and Pakes (1999), Brambilla (2005), Brenkers and Verboven (2006). The only estimates for the Canadian automotive market are in Van Biesebroeck (2007).

In this study, we use a nested logit model, see Anderson and De Palma (1992) and Verboven (1996a) for details and Berry (1994) for a comparison with the general framework. This model can be interpreted as a restricted random coefficients model, see Cardell (1998), where consumers share the valuation on all the observable characteristics, except on a set of nesting dummies that segment the market.

Consider the Canadian automobile market where *I* consumers are considering to purchase a car or light truck. They can choose between *J* available models, one of which is the outside good, i.e. purchasing a second hand vehicle or postponing the purchase to a future year. The utility of the outside good purchase will be normalized to zero. A consumer *i*'s conditional indirect utility function from purchasing product $j = 1 \ldots J$ that belongs to nest/segment *g* is given by:

$$u_{ij} = \underbrace{\sum_{k=1}^{K} x_{jk}\beta_k + \xi_j - \alpha p_j}_{\delta_j} + \xi_{ig} + (1-\sigma)\varepsilon_{ij}$$
$$= \delta_j + \sum_g d_{jg}\xi_{ig} + (1-\sigma)\varepsilon_{ij}$$

Utility thus consists of a component that is common to all consumers (δ_j) which groups together the first three terms, a random taste of consumer *i* for vehicles in segment *g* (ζ_{ig}, which can be positive or negative), and an individual-model specific random utility draw (ε_{ij}). The common part depends on K observable characteristics that each consumer values identically (fuel-efficiency, horsepower, size, etc.), a model-specific unobservable characteristic (combining the effect of style, advertising, etc.), and price—the only characteristic that we assume the firms can adjust easily. The benefit of such a modeling strategy versus specifying a traditional demand system at the product level is that with only a few parameters we are able to generate very general cross-price substitution patterns between all models. An important feature, given that in 2005 a total of 239 different models are sold in the Canadian market. Specifying the demand directly would require an extraordinary amount of parameters to allow for flexible substitution patterns.

We assume that the distribution of the random utility term (ε_{ij}) follows the extreme value distribution, such that we can derive market shares in analytical form, for more details on

the nested logit model see Anderson and De Palma (1992) and Verboven (1996a). We further assume the market can be partitioned into G exclusive and exhaustive segments. Each segment contains J_g models and $\sum_g J_g = J$. Each consumer will choose one model to maximize her utility.

The nested logit distributional assumptions on the random utility term yield the following choice probability for individual i for product j that belongs to segment h as a function of the entire $Jx1$ price vector:

$$s_{ij}(p) = \frac{\exp((\delta_j - \alpha p_j)/(1-\sigma))}{\sum_{l=1}^{J_h} \exp((\delta_l - \alpha p_l)/(1-\sigma))} \cdot \frac{\exp(I_h/(1-\sigma))}{\sum_{g=1}^{G} \exp(I_g/(1-\sigma))}$$

where

$$I_g = (1-\sigma) \ln \sum_{l=1}^{J_g} \exp((\delta_l - \alpha p_l)/(1-\sigma))$$

is called the 'inclusive value' for segment $g = 1 \ldots G$. The predicted aggregate market share for model j is obtained by averaging the choice probabilities over all individuals which in our (simple) case is simply $N.s_{ij}$ because our choice probabilities are not individual specific.

The nested logit model will result in higher elasticities of substitution between models in the same segment than across segments if the σ coefficients are estimated positively. This is a major improvement over the simple logit model. An unattractive feature of the logit model that partially remains is that the own-price elasticity of substitution for each model will be increasing in price within each segment.

The model is generalized further by letting let the parameter that governs the degree of substitution within nests (σ) vary by segment. If demand elasticity is higher for cheap small cars than for expensive luxury cars, it would show up as a higher σ parameter in the small car segment, see Brenkers and Verboven (2006) for an illustration on the European car market. A high level for a nest-specific σ parameters would indicate that the likelihood that substitution in response to price changes remains within the segment is high. As a result, competition within the segment will be fiercer and price-cost markups lower.

5.2 Estimating the model of demand

We estimate the nested logit model, introduced in the previous section, first with a common substitution parameter and also with nest-specific substitution parameters using five nests: regular cars, luxury and sporty cars, SUVs, pickup trucks, and minivans. The standard transformation of the model yields the following market share equation which can be estimated straightforwardly:

$$\ln(s_j) - \ln(s_0) = \sum_{k=1}^{K} x_{jk}\beta_k - \alpha p_j + \sum_{g=1}^{5} d_{[j \in g]}\sigma_g \ln(\bar{s}_{j|g}) + \xi_j .$$

The natural logarithm of the market share of vehicle *j* relative to the market share of the outside good is explained by *K* characteristics, the price, the conditional market share of vehicle *j* within its segment *g* and term for the unobserved quality of the good, which takes the role of the error term in the equation.

To obtain consistent parameter estimates, we need to take into account that firms will set prices knowing the value for ζ_j. Vehicles that are very desirable, e.g. because of attractive styling or reliability, will attract more consumers and firms can raise the price. To break this link between the error term and the price variable, we use the standard instruments, see Berry, Levinsohn, and Pakes (1995). In the specific context of a nested logit model with nest-specific market shares, the problem carries over to the within-nest market share variable, and Brenkers and Verboven (2006) discuss optimal instruments.[8]

In Table 4, three sets of estimates are presented. In the first two columns, all 2,262 observations are included in the sample, i.e. all models in all 11 years. In the third column, models for which the real price (in 1998 Canadian dollar) exceeded $50,000 are excluded, which is approximately $61,000 in 2008 current dollars. In all estimations, year and year-squared are included as control variables. In the first column, a common substitution parameter is assumed, while it is allowed to vary across nests in columns (2) and (3).

As a benchmark, we first estimated the model with common substitution parameter, which yields good results, but is relatively restrictive on the cross-vehicle substitution patterns it allows—which is undesirable for the trade policy simulations. This is relaxed in the next columns.

The results are quite robust across the next two specifications with one important difference. The price coefficient is a lot smaller in absolute value in column (2). The reason for this is that the more expensive vehicles are selling more than would be expected based on this limited set of observables. As the instruments are not sufficient to break the correlation between the error term—unobserved vehicle quality or attractiveness—the price coefficient will still be upwardly biased, i.e. towards zero.

The problem with the lower estimate on the price coefficient is that the cheapest vehicles are predicted to have an own price elasticity of less than unity in absolute value. A profit maximizing firm would never price vehicles this low and to rationalize the observed price the first order condition for optimal price setting would predict a negative marginal cost,

[8] Instruments should be uncorrelated with unobservable aspects of a vehicle's quality, broadly defined, and only predict sales through their correlation with the vehicle's price. The average characteristics for competing manufacturers should do the job. In a competitive market setting these characteristics will definitely influence the pricing decision of other firms.

which makes no sense. The higher estimate for the substitution parameters compensates for this to some extent, but in the first segment it is still problematic for cheaper vehicles. About 10% of the vehicles in the first segment are subject to this problem.

Table 4: Demand coefficient estimates

	Full sample	Full sample	Exclude models with P > $50,000
	(1)	(2)	(3)
Price	-0.053	-0.038	-0.071
	(.003)***	(.004)***	(.005)***
Power/weight	0.028	0.063	0.086
	(.019)*	(.017)***	(.018)***
Liter/100 km	-0.083	-0.070	-0.041
	(.014)***	(.014)***	(.013)***
Size	0.134	0.104	0.167
	(.014)***	(.015)***	(.016)***
Domestic	0.206	0.122	-0.004
	(.060)	(0.054)**	(.055)
σ_1	0.134	0.213	0.253
	(.039)***	(.035)***	(.033)***
σ_2	$= \sigma_1$	0.517	0.509
		(.047)***	(.045)***
σ_3	$= \sigma_1$	0.309	0.372
		(.038)***	(.036)***
σ_4	$= \sigma_1$	0.346	0.556
		(.047)***	(.046)***
σ_5	$= \sigma_1$	0.275	0.383
		(.038)***	(.036)***
Observations	2262	2262	1992
Adjusted R^2	0.496	0.656	0.658

Note: * significant at the 10% level, ** at the 5%, at the 1%

There are many possible solutions, but the most straightforward is to simply drop the highest priced observations. This eliminates 12% of the observations, but they only account for 1.2% of total sales. In more recent years, even fewer vehicles break the threshold. For 2008 we keep all models in the sample as we will need them for the counterfactual simulations, but this has only a minor impact. Only 9% of the 2008 observations break the threshold and they account for only 0.6% of sales.

On the limited sample, results in column (3), the absolute value of the price coefficient is a lot higher. Now, no model has an estimated own-price elasticity above -1 anymore,

which is consistent with theory. All coefficient estimates still have the same sign and are similar in magnitude. Consumers dislike high prices and low fuel efficiency. They prefer vehicles with a higher power to weight ratio and a larger size. The domestic brand dummy is positive, but only significantly different from zero in the first column. If we allow this coefficient to change over time we find it to be significant and positive initially, but declining over time—as could be expected as foreign brands expand their dealership network.

Finally, all the nesting parameters are estimated positive and between zero and one, in line with economic theory. The higher the nesting parameter, the more likely it is that consumers will substitute between models in the same nest, rather than across nests. The results suggest that substitution is a lot more limited to models within the same nest for the "luxury and sporty car" segment and the "pickup truck" segment, while cross-nest substitution is more likely for buyers of regular cars, all of which make intuitive sense.

In the remainder of the analysis, we work with the estimates from column (3).

5.3 Calculate marginal costs from demand elasticities

If we augment the demand parameter estimates with a model of optimal price setting behavior, we can uncover the implied marginal costs that make the observed prices optimal for profit maximizing firms. The standard assumption in the literature is to assume that firms strategically set prices taking into account the differentiated good nature of the products, the fact that they produce multiple products, and the optimal responses of competitors to their pricing decisions—which is called differentiated product Bertrand Nash pricing.

A crucial underlying ingredient in these calculations are the demand elasticities, i.e. the sales quantity responses associated with price changes, as they determine the optimal price-cost markups.

In the one-level nested logit model, these demand elasticities, both for own-price changes, and cross-product elasticities for price changes of other models in the same and other segments can be calculated analytically. They are given by the following formulas:

$$\varepsilon_{jj} = -\frac{\partial q_j}{\partial p_j}\frac{p_j}{q_j} = \alpha p_j \left[\frac{1}{1-\sigma} - \frac{\sigma}{1-\sigma}\frac{q_j}{Q_g} - \frac{q_j}{L} \right] \qquad j \in \text{nest } g$$

$$\varepsilon_{jk} = \frac{\partial q_k}{\partial p_j}\frac{p_j}{q_k} = \alpha p_j \left[\frac{\sigma}{1-\sigma}\frac{q_j}{Q_g} - \frac{q_j}{L} \right] \qquad \text{both } j \text{ and } k \in \text{nest } g$$

$$\varepsilon_{jk'} = \frac{\partial q_{k'}}{\partial p_j}\frac{p_j}{q_{k'}} = \alpha p_j \left[\frac{q_j}{L} \right] \qquad j \in \text{nest } g, k' \in \text{nest } g' \neq g$$

Table 5: Own & cross-price elasticities for select number of models from two nests

	Honda Civic	Hyundai Accent	VW Golf	Toyota RAV4	Hyundai Santa Fe	BMW X3
Honda Civic	-1.380	0.043	0.047	0.008	0.008	0.014
Hyundai Accent	0.078	-1.091	0.068	0.003	0.003	0.006
Volkswagen Golf	0.013	0.010	-1.288	0.002	0.002	0.003
Toyota RAV4	0.002	0.002	0.002	-2.037	0.052	0.129
Hyundai Santa Fe	0.001	0.001	0.001	0.074	-2.056	0.091
BMW X3	0.000	0.000	0.000	0.012	0.012	-3.650

We calculated the own and cross-price elasticities between all models, *J*(J+1)/2* elasticities (28,680 in 2008), as they are used to uncover the marginal costs the model implies. To provide some intuition for the demand estimation results, the elasticities for a few select models are reported in Table 5. In particular, we show the best selling Japanese, Korean, and European vehicles from the first (cars) and third (SUVs) segments.

Within each nest, the absolute value of the own-price demand elasticity is an increasing function of a model's price, therefore the own price elasticities of this top selling vehicles tend to be relatively low, especially in the lower-priced car segment (#1). Within each segment, all vehicles share the same demand curve, except for the random individual-model specific logit error draw. As a result, more expensive models will be priced higher up on the demand curve, where consumers are more elastic.

The good news is that all elasticities are estimated below -1. For the Accent, the -1.091 estimate implies that a 10% price increase would lower sales by only 10.9%. A similar price increase for the much more expensive BMW X3 would lower its sales by 36.1%. For more expensive vehicles and for vehicles with lower market shares, notably vehicles from segments 2 (luxury and sporty cars) and 5 (minivans), elasticities are a lot higher.

The cross-model elasticities of substitution are much higher for models in the same nest, which is driven by the positive estimate for σ. Furthermore, in nests with higher σ estimates (#3), competition is more intense. For example, the 0.074 estimate for the Hyundai Santa Fe implies that if the Toyota RAV4 price would increase by 10%, sales of the Santa Fe would increase by 0.74%.

Another factor to take into account is that more crowded segments, in particular the one of luxury and sporty cars, will have higher cross-price elasticities, as a price increase of one model leaves consumers with a lot of choices within the segment to substitute towards.

Finally, substitution patterns towards vehicles in other nests are estimated rather low. The same 10% price increase of the RAV4 would boost Honda Civic sales by only 0.08%, an order of magnitude smaller than the effect on the Santa Fe.

Using optimal price setting and these demand substitution patterns, we are able to infer optimal price-cost markups and hence the marginal costs that rationalize the observed prices. As mentioned before, we assume that firms compete in prices and that observed prices are equilibrium in a differentiated product (Bertrand) pricing game. Firms are explicitly modeled as multi-product firms, which take the effect of the price of each model on all the other models in their own portfolio into account.[9] For a derivation of the first order condition, we refer the interested reader to Berry (1994) or Berry, Levinsohn, and Pakes (1995).

One should bear in mind that the economic marginal cost of a vehicle will differ tremendously from the accounting costs. A large number of costs, which accountants treat as variable, tend to be fixed from a firm's perspective in the medium to short run and as a result they will not enter optimal pricing decisions. For example, the labor contracts in the automotive industry make most of the labor costs fixed rather than variable. The corollary is that our demand estimation will impute rather low marginal costs, which are only the costs saved if one vehicle would not be produced, i.e. it excludes most of the labor costs, marketing and advertising expenditures, tooling and maintaining an assembly plant, design and engineering costs, costs of the dealership network, etc. All of these are largely independent of the number of vehicles sold (at least in the short run).

Table 6 contains the median, the 25th, and 75th percentile of the Lerner index by market segment. This index is defined as *(price-MC)/price* and is the standard measure of monopoly power. Higher values reflect higher variable-profit markups, with the caveat that the interpretation will also differ a lot from accounting profits.

We now have all the ingredients – a demand system, imputed marginal costs for each model, and a market equilibrium assumption – to turn to the counterfactual policy experiments.

Table 6: Quartiles of the Lerner index by market segment

	25th percentile	Median	75th percentile
Regular cars	0.434	0.549	0.779
Luxury & sporty cars	0.173	0.222	0.291
SUVs	0.274	0.345	0.480
Pickup trucks	0.286	0.418	0.539
Minivans	0.403	0.435	0.543

[9] We aggregated brands into corporate groups – denominated by "firms" in the paper. For example, even though Ford does not own Mazda outright, we assume their ownership share gives Ford enough influence to make sure externalities of Mazda pricing on Ford vehicles is included in Mazda's decision making.

6 Benchmark simulation results

6.1 Starting point: the observed market situation in 2008

The trade simulations record the hypothetical changes in prices, quantities and variable profits, relative to the observed situation on the Canadian automotive market in 2008. Total sales that year were 1.61 million vehicles, cars and light trucks combined, and approximately one quarter of these vehicles were assembled domestically. The vast majority of cars assembled in Canada are exported, and there is no reason to expect Canadian exports to be affected by trade policy changes.

Canadian imports totaled 1.23 million units and 60% of these come from the U.S. or Mexico, entering the country duty-free under NAFTA. The market share of cars made in Korea is 8.0% and the market share of vehicles imported from E.U. countries was 4.9% in quantity, but 7.6% by value.

Now, we will look at the impact of four trade policy changes on four variables: price, quantity sold, Canadian production, variable profits. We average all results by four country-of-ownership groups. The policy changes that we consider are:

- FTA (only) with South Korea
- FTA (only) with the E.U.
- Simultaneous FTAs with both South Korea and the E.U.
- Multilateral elimination of Canadian import tariff on finished vehicles

Currently, Canada imposes a 6.1% import duty on finished vehicles. In each of these four scenarios we will investigate how the market equilibrium would have looked differently if vehicles imported from one or more countries would be exempt from the import duty.

For the affected models,[10] the new trade policy lowers the marginal costs by 5.75% and the firms will split this into a higher profit margin and lower price for consumers. Competitors will respond, also lowering their prices slightly, at the expense of profit margin and a new market equilibrium will result. As we keep model offerings and production locations constant in this analysis, but prices can adjust fully, the results should be interpreted as medium-term effects.

[10] To determine whether a model is affected, we look at the assembly location of the base variety, as discussed in the data section. All vehicles produced in North America are assumed not to be affected, whether the model meets the NAFTA domestic content requirements or not. Currently only three vehicles do not satisfy the NAFTA domestic content requirements and incur duties when imported into Canada (BMW X5 and Mercedes-Benz G-class and M-class). Under an FTA with Europe or under unilateral free trade by Canada it would be reasonable to assume these vehicles would also become exempt from duty (as their joint E.U. and North American domestic content will far exceed any plausible threshold). For now, we have still considered them as unaffected by any trade policy change. Note that they represent only 0.3% of the Canadian market.

6.2 Trade policy simulations: effects on prices

Table 7 contains the estimated price changes, always relative to the 2008 baseline case, both in absolute levels (in current 2008 Canadian dollars) and in percentage changes. In the first column, the new price equilibrium is for the situation where Korean imports are not subject to the 6.1% import tariff anymore, and other trade policy changes are in successive columns.

The average prices declines for the Canadian market under an FTA with South Korea are predicted to be quite modest. On a sales-weighted average, we predict a $26 decline, or 0.12% below the observed prices in 2008. Of course, the heterogeneity of the effects is crucial.

The average price decline for Hyundai, the only firm producing a wide model range (18) in Korea, is $331 or -1.50%. Declines are also noticeable for Suzuki and GM, which import respectively 1 and 4 models from Korea, representing 13.6% of Suzuki's sales in Canada, versus only 5.6% for GM.

The indirect price responses for models assembled in North America or imported from elsewhere are very small. On average, prices decline by 0.01%. Changes are largest for Chrysler (-0.02%) and GM (-0.01%). Price changes for the European producers, which have very little overlap with Hyundai, is virtually nil.

The price decline by Korean firms is slightly stronger if other countries benefit from an FTA as well. A joint FTA of Canada with Korea and with the EU, would induce an average price decrease for Hyundai of -1.51% and full tariff elimination even -1.53%. For Japanese firms, the average price adjustment in case of a joint FTAs is twice as high as for the single FTAs—note that these firms do not enjoy any tariff reduction, so the price decline comes directly out of their profits.

Table 7: Trade policy simulations: Price changes

	FTA with South Korea	FTA with E.U.	Combined FTAs Korea & E.U.	Multilateral tariff elimination
(a) Absolute change (average over all models, weighted by sales, current 2008 CAD)				
American	-3	-37	-40	-51
Japanese	-1	-1	-3	-241
European	-0	-956	-957	-992
Korean	-331	-1	-333	-336
(b) Percentage change				
American	-0.017	-0.164	-0.181	-0.231
Japanese	-0.007	-0.006	-0.013	-0.889
European	-0.001	-2.278	-2.279	-2.495
Korean	-1.502	-0.006	-1.508	-1.525

One important factor explaining the modest price responses is that the composition of sales adjusts. The price reductions make the Hyundai and Kia offerings in other segments (luxury and sporty cars, SUVs, minivans) more attractive and price-cost markups are lower there. As a result, some of the advantage generated by the FTA will be translated into improved sales in higher segments, which does not show up in the average price change. As Korean firms are not as well represented in these upper segments, they have an additional incentive to lower prices there, as it is less likely to cannibalize their own sales.[11]

If we calculate the price declines only for models that are directly affected, e.g. Korean imports in the Korean FTA case, the price changes are larger, $363, $127, $37 for Hyundai, Suzuki, and GM respectively, but even in percentage terms they are a lot lower than the 5.75% marginal cost decline, respectively -1.65%, -0.91%, -0.28%.

The smaller response for GM is intuitive, as it internalizes that more of the sales it could attract by lowering prices would come from its own other offerings, than would be the case for the other two companies. For Hyundai, the pass-through of the tariff cut is modest, because it mostly sells its vehicles in the first market segment (regular cars), where the elasticities were calculated to be relatively low (prices are already low), so there is less of an incentive to compete on price.

Table 8: Average price changes only for models directly affected by trade policy

	FTA with South Korea	FTA with E.U.	Combined FTAs Korea & E.U.	Multilateral tariff elimination
(a) Absolute change (average over all models, weigh by sales, current 2008 CAD)				
American	-37	-981	-461	-478
Japanese	-127		-127	-556
European		-1575	-1576	-1290
Korean	-363		-365	-368
(b) Percentage change				
American	-0.284	-2.934	-1.477	-1.535
Japanese	-0.905		-0.905	-2.051
European		-3.756	-3.757	-3.244
Korean	-1.647	-3.593	-1.654	-1.671

[11] For example, only 10% of the models in the small and compact SUV segment are produced in Korea, as opposed to 30% for small and compact cars.

The above discussion should make clear the different forces which will be at play in all the different trade policy scenarios. We summarize them here:

- Prices for models affected by an FTA will fall, but by less than 5.75% as some of the cost decline is taken as higher profit margin, i.e. not passed on to consumers.
- This extent of tariff pass-through is increasing in the elasticity of the model, which can be gauged from the Lerner indices in Table 6 – higher price-cost margins, e.g. in the regular car segment, lead to smaller price declines.
- An FTA will make firms affected directly more competitive in all segments, but they will be particularly prone to lower their prices in segments where they are not well represented.
- Producers that are only indirectly affected will also lower their prices. These competitive responses are relatively minor, but most pronounced for firms that produce many vehicles in the same segments as those affected by the FTA.
- These price responses will translate directly into market share changes and variable profit changes, which are illustrated in the following sections.
- Average markups increase for firms that enjoy an FTA, mainly as a result of their lower marginal cost. Other firms see their mark-ups reduced, both as a competitive response to the FTA and in the Korean FTA case also through a compositional effect as their sales become more heavily weighted towards expensive vehicles.

In light of these general effects, a couple of things are worth pointing out for the other FTA simulations.

The stronger response of firms into segments where they are ill-represented will induce compositional effects. In the Korean FTA case, it expands Hyundai's presence in upper segments, where price-cost markups are smaller, which lowers the average pass-through. In the EU FTA case, it expands the European's market presence in lower segments and it reinforces the observed pass-through. Combined with the heavy weight of the second segment (luxury and sporty cars) that had the highest price elasticity, this leads to more pronounced price declines for EU producers in the EU FTA case.[12]

Another thing to keep in mind comparing the Korean and EU FTA is that European imports come from many more firms. 18 of the 23 imported models from Korea are sold by Hyundai and Kia. Multi-product pricing considerations will refrain this firm from lowering its prices too aggressively, as it will compete against itself. In contrast, 7 firms import models from the EU, and even Volkswagen is only responsible for 12 of the 44

[12] This effect is quite strong. As it lowers prices on expensive vehicles quite a lot, we predict that average prices on the Canadian market would even increase in the case of an FTA with the EU as Canadian consumers adjust their purchasing behavior towards more expensive vehicles.

models imported, or 27%. As a result, in the case of a European FTA, multi-product considerations are not refraining firms as much from lowering their prices.

Finally, the results on the joint FTAs with Korea and the E.U. illustrate that the effects on prices would be cumulative. As models from these two regions fall to a large extent in different segments, they have independent and cumulative effects on Japanese and American firms. As a result, price declines are approximately the sum of those in independent FTAs, which will further eat into profit margins – although the absolute levels of the changes are still limited.

Before turning to the effects on quantities, it is worth highlighting that the effects differ somewhat under alternative scenarios. Results in Section 7.3 on page - 30 - will illustrate that price declines are substantially higher if we re-estimate the model excluding the segment with luxury and sporty cars, because demand will be estimated to be more elastic in that case. Furthermore, if firms do not completely internalize the effect of price declines on their sales of other models, they will also be more inclined to lower their prices. Under the assumption of single-product pricing behavior, price declines would also be more pronounced, results are in Section 7.4.

6.3 Trade policy simulations: effects on quantities

After the more detailed description of price changes, we can be briefer on quantity changes, as those are more or less a direct consequence of the price changes and the composition of the price changes across segments.

The predicted quantity changes for the four different trade policy scenarios are in Table 9. An important issue to mention up front is that in the benchmark calculations, we allow the market to expand as prices decline. The net market growth statistics, at the bottom of Table 9, suggest that much of the sales increase for firms directly affected by a FTA comes from market expansion rather than taking sales away from other firms. The price cuts of Hyundai and the EU producers draw many new consumers into the market. Total vehicle sales in Canada are predicted to grow, even by 2.05% in the case of joint Korean and EU FTAs – in column (3).

As a comparison, in the alternative scenarios in Section 8 we keep aggregate Canadian sales fixed and any sales increase by Korean or E.U. producers then has to come at the expense of Japanese or American companies. The negative effect on Japanese firms is predicted to increase dramatically under that scenario.

Here, the quantity changes are modest, except for the firms directly affected by the FTAs. Sales of Hyundai are predicted to increase by slightly more than 3,000 units. In percentage terms this amounts to 2.72%, almost twice as much as the price decline, as all vehicles are priced on the elastic portion of demand—as predicted by the theory. A 1% price decline thus results in a more than 1% quantity increase.

Table 9: Simulations results: Effects on sales quantities (direct and indirect)

	FTA with South Korea	FTA with E.U.	Combined FTAs Korea & E.U.	Multilateral tariff elimination
(a) Absolute change (sum over all models, in units)				
American	-508	-809	-1,312	-3,490
Japanese	-451	-1436	-1,883	+9,178
European	-92	+9,308	+9,209	+8,819
Korean	+3,211	-236	+2,964	+2,570
Net growth	+2,160	+6,827	+8,979	+17,077
(b) Percentage change				
American	-0.06	-0.11	-0.18	-0.46
Japanese	-0.07	-0.25	-0.32	+1.80
European	-0.10	+11.66	+11.55	+11.05
Korean	+2.72	-0.20	+2.51	+2.17
Net growth	+0.15	+1.90	+2.05	+2.51

Sales responses for E.U. firms are even more pronounced as they face more elastic demands and they produce fewer of their models in North America. The absolute sales increase for European firms under an E.U. FTA is almost three times as high as for Hyundai under the Korean FTA. The most extreme case is Tata which would sell 27% more Land Rovers and Jaguars. Its vehicles face an elastic demand and as they have low market shares, the firm is not reticent holding back price declines not to cannibalize its other sales.

The quantity declines for indirectly affected firms are modest, but they are in addition to the already lowered prices for these firms, i.e. they will hit profits extra hard. In percentage terms they are also becoming non-negligent as many of the models are estimated to be rather good substitutes, especially outside of segment 1 and 3 (regular cars and SUVs).

The average sales declines for Japanese firms are estimated to be -0.07%, -0.25%, and -0.32% for the three trade policy simulations. These translate into total unit declines of -451, -1,436, and -1,883. Again, these changes are estimated a lot more pronounced if the market had not expanded – see results in Table 14.

In addition, the 1,883 fewer sales for Japanese firms faced with joint Korea/EU FTAs are calculated relative to the status quo of no trade policy change. When comparing the joint Korea/EU FTA sales numbers with the predicted sales under multilateral free trade – results in the last column – the difference rises to 11,061 units (1,883+9.178) or 1.80% of

current sales as Japanese firms are predicted to benefit a lot from a general tariff elimination.

Effects for American firms are mixed as they also import some models from regions benefitting from the FTAs.

It is also instructive to look at the effect on Canadian production. The effects would be rather modest as the numbers in Table 10 illustrate. The tight integration of the North American market is largely responsible. Most of the output of Canadian plants is exported to the U.S. and that market would not be affected by Canadian FTAs. Even in the case of unilateral tariff liberalization, the predicted effect on local production is modest at 1,640 units.

The statistics at the bottom illustrate that U.S. and Mexico production would be somewhat harder hit than Canadian production in percentage terms in the case of free trade in Canada, but in total units of production their sales declines would be a lot higher. Moreover, while the effect of the Korean FTA on the U.S. and Mexico would be twice as high as for Canada (in units), the E.U. FTA would hit them five times as hard. The result is caused by the different composition of production, with fewer Canadian-produced models competing head-to-head with the Europeans. A corollary, however, is that the U.S.-Korea FTA—which is currently stalled—would harm the Canadian industry disproportionately.

Table 10: Simulation results: Effects on local Canadian production

	FTA with South Korea	FTA with E.U.	Combined FTAs Korea & E.U.	Multilateral tariff elimination
(a) Absolute change (sum over all models, in units)				
American	-156	-273	-427	-882
Japanese	-113	-193	-306	-758
Net growth in CA	-269	-466	-733	-1,640
Net growth in U.S. and Mexico	-518	-2,303	-2,815	-5,007

6.4 Trade policy simulations: effects on profits

Finally, Table 11 assembles the effects on the price-cost margin—costs are lowered for models that benefit from a tariff cuts and prices are reduced (to a lesser extent) both by firms directly affected and others that respond optimally—and the quantities effects into changes in total variable profits for the different groups of firms.

Note that the two effects from the previous two tables will reinforce one another. Directly affected firms only pass on a fraction of the tariff decline, which raises their profit

margin, while their lower absolute prices boosts sales. Indirectly affected firms, in particular Japanese firms, will lower their prices slightly in response, which eats into their profit margins as costs are unchanged. As their prices decline a lot less than those of directly affected firms they also lose sales, hitting their bottom line further.

In the top panel of Table 11, the effects on profits are listed in millions of Canadian dollars (in current 2008 prices). The cumulative effect for Japanese firms comes in at a loss of 6.21 million CAD in the case of a Korean FTA, increasing to $16.95 million for the E.U. FTA and even $23.11 million in the case of joint FTAs.

In addition, variable profit increases for directly affected Korean and E.U. firms are very substantial. For example, in the case of a FTA with Korea Hyundai would see its variable profits rise by $41.48 million or a full 2.85% and it could use this extra revenue to bolster demand for its vehicles further, e.g. by raising advertising expenditure. Such add-on effects are not included in the analysis.

Profit increases for the E.U. producers that sell higher margin vehicles are even more pronounced, ranging from 4.11% for Volkswagen to 26.8% for Tata in the case of the E.U. FTA. The total profit increase for European firms is estimated at $102 million.

The imports of American firms from the E.U. help cushion the impact of the E.U. FTA for them. Prices and sales on those vehicles are not changed as much as imports of European firms, as the American firms are more reluctant to lower prices, not to cannibalize their sales of their own vehicles produced in the NAFTA area. Instead, the elimination of tariffs would bolster directly their price-cost mark-up. Japanese firms do not benefit from such offsetting effects, except for Suzuki in the case of the Korean FTA.

Table 11: Simulation results: Effects on variable profit realized on Canadian market

	FTA with South Korea	FTA with E.U.	Combined FTAs Korea & E.U.	Multilateral tariff elimination
(a) Absolute change (sum over all models, in millions of CAD)				
American	-8.50	-24.34	-32.72	-67.54
Japanese	-6.21	-16.95	-23.11	+113.08
European	-1.09	+101.74	+100.56	+96.17
Korean	+41.48	-2.87	+38.48	+33.17
(b) Percentage change				
American	-0.09	-0.27	-0.36	-0.72
Japanese	-0.08	-0.24	-0.32	+1.82
European	-0.11	+11.45	+11.33	+10.83
Korean	+2.85	-0.20	+2.64	+2.28

Summing the net change in profits over the four ownership groups leads to higher overall profits in each case. To some extent this is the result of the market expansion, higher aggregate sales, but mostly this is a transfer of tariff income for the government to higher profit for benefiting firms.

We want to reiterate that one should exercise caution interpreting the absolute values of the profit changes as they will differ vastly from accounting profits. All fixed costs are excluded from our calculations, which exclude many costs that are considered variable from an accounting perspective. Many of the costs on the firms' income statements are impossible to avoidable in the short to medium run, which makes them fixed from an optimal pricing perspective. Profit maximizing firms should not take them into account when deciding on the optimal price level.

The absolute dollar amounts listed should be thought of as revenue available to cover all types of fixed costs, e.g. investments in the distribution network, marketing, design of better vehicles, capital expenditure, or to contribute to accounting profits.

The percentage changes in variable profits, as reported in panel (b) of Table 11 are much less affected by the distinction between variable and fixed costs. Percentage changes in accounting profits should be similar to those in panel (b). Accounting profit changes are even likely to be somewhat higher in absolute terms, because profit increases go together with higher sales volumes and fixed costs can be spread out over higher volumes.

7 Sensitivity analysis

In the above analysis, a number of assumptions had to be made and for some we verified explicitly whether alternative assumptions yielded the same results. The discussion here is limited as the results mostly speak for themselves.

7.1 Using a random model-variety

Instead of using the specifications of the lowest-price variety of each model in the estimation of the demand system, we have also done the analysis where one variety is chosen entirely randomly for each model. The demand estimation results were extremely similar, as were the price responsiveness estimates that determine the effect of trade policies.

7.2 Excluding large pickup trucks

Large vans and light commercial vehicles have been omitted throughout as their consumers are likely to have different demands. Large pickup trucks were left in the sample as substitution between them and small pickup trucks or large SUVs is not negligible. As a robustness check, we also performed the analysis dropping the entire large pickup truck segment.

The demand estimation results were again extremely similar. The price responsiveness of consumers is estimated to be slightly lower, which leads to slightly lower percentage adjustments to the different trade policies.

No large pickup trucks are imported and thus directly affected by the trade policies. Moreover, substitutions between other segments are low. As a result, sales and profit changes in the counterfactual trade policy calculations are virtually unchanged. Average price decreases are somewhat more pronounced as zero price changes on pickup trucks are omitted, which outweighs the slightly lower price responsiveness of consumers.

7.3 Drop luxury and sporty cars (segment 2)

We have also performed the analysis dropping all models in the second segment, which are cars classified as luxury, near luxury, sporty, or sports. Summary statistics in Table 3 indicate that in 2008 they account for 24% of all models, but less than 9% of total sales.

Importantly, before recalculating the trade policy simulations, the demand system is re-estimated. It turns out that the price-quantity relationship is a less tight in this segment. Dropping all these models raises the point estimate on the price coefficient substantially in absolute value, from -0.071 to -0.093, with little change on any of the other demand coefficient estimates. As a result, the demand estimation results now predict that consumers are more sensitive to price changes, i.e. demand is more elastic.

In the trade simulations, firms benefitting from an FTA will now pass a larger share of their cost reduction on to consumers. As competition for consumers is more intense, competitors will also follow these price reductions to a greater extent. Therefore, the price decline for each model, directly or indirectly affected, should be more pronounced.

Table 12 contains the new results for prices (sales weighted averages in percentage), quantities (absolute changes in units), and profits (percentage changes). To conserve space, only the results for the joint Korean and E.U. FTAs are shown.[13] Columns (1), (3), and (5) repeat the results from the earlier tables and in the columns next to them we show the corresponding results without luxury and sporty cars.

Without the second segment, demand is estimated to be more elastic and price responses should be more pronounced. This is, very strongly, what we find for Korean firms. A much greater fraction of the tariff decline is now passed on to consumers. The price decline in the second column of Table 12 is now -2.56% compared to -1.51% in Table 7. Japanese firms also lower their prices almost twice as much: -0.024% versus -0.013%.

[13] In percentage terms, the differences in results with or without segment 2 models are similar for the separate FTAs.

Table 12: Simulation results without segment 2 (luxury & sporty cars)
(Re: Joint FTA with South Korea & E.U.)

	Average price change (sales weighted)		Total change in sales (in units)		Total profit change (in percentages)	
Segment 2 included?	Yes (Table 7)	No	Yes (Table 9)	No	Yes (Table 11)	No
American	-0.181	-0.161	-1,312	+447	-0.36	+0.05
Japanese	-0.013	-0.024	-1,883	-2,708	-0.32	-0.36
European	-2.279	-1.684	+9,209	+4,954	+11.33	+12.21
Korean	-1.508	-2.559	+2,964	+8,984	+2.64	+5.95

However, this is not what we find for the two other groups, where price declines are estimated to be less pronounced. The reason is that American and European firms have a lot of entries in the second segment. The high prices combined with many vehicles offered, made price responses most pronounced in this segment in the benchmark case, even though average price responsiveness was lower.

Eliminating all these models from the analysis now shows a lower average price reduction for American and European firms, even though on a vehicle-by-vehicle basis the price responses are stronger.

The sales adjustment is also a combination of more pronounced responses on a model-for-model basis for all firms, but with the large adjustment in segment two eliminated from the total.

Especially eye-catching is the three times as strong sales response for Korean firms, 8,984 more units sold, and the almost 50% larger sales decline for Japanese firms, 2,708 fewer vehicles sold. Note that these changes are even incurred on a lower base, i.e. without the second segment.

The profit change also becomes a lot more pronounced for Hyundai, which now sees its profits rise by 5.95% compared to 2.64% before. Most Japanese firms see larger profit declines under this scenario.[14]

7.4 Single product pricing behavior

In the above results, we always assumed that firms optimally take the effect of any price decline on the sales of their other models into account. Now we perform a robustness check where we assume that prices for each model are set entirely independent of prices of other vehicles sold by the same firm. Firms ignore that decisions for one model have implications on the profits they make on other models. This assumption of single-product

[14] Somewhat remarkable is that the large boost that GM receives from some of the vehicles it imports from the E.U. and Korea makes its profit change now switches to positive.

pricing behavior, of course, changes the implied marginal costs that make the observed 2008 prices optimal, but those calculations are updated as well.

The results in Table 13 suggest that, certainly in percentage terms, this assumption does not have a large influence on the effects. For the firms with the most models and the largest market shares (notably GM, Toyota, Ford, and Hyundai), profit declines are muted and profit increases slightly more pronounced, but the changes are modest.

Table 13: Multi-product (benchmark) versus single-product pricing behavior
(*Re: Joint FTA with South Korea & E.U.*)

	Effects on variable profit realized on Canadian market			
	(Absolute change)		(Percentage change)	
	Multi-product pricing	Single-product pricing	Multi-product pricing	Single-product pricing
American	-32.72	-28.34	-0.36	-0.33
Japanese	-23.11	-22.27	-0.32	-0.32
European	+100.56	+100.03	+11.33	+11.40
Korean	+38.48	+39.39	+2.64	+2.77

8 Three features leading to increasingly more pronounced effects

The four sensitivity checks above illustrate that the results are robust and that the changes in the results are predictable if a number of assumptions are changed. The results in Tables 7-10 can be considered reliable and conservative estimates of the likely effects of the different trade policies. In this section, we now zoom in on a situation where the impact on Japanese firms will be most pronounced.

This is done in three, cumulative steps. First, we do not allow the market to expand anymore in response to lower prices (Section 8.1). In spite of price reductions, aggregate sales are held constant such that any sales increase for Korean or European firms can only come at the expense of American and Japanese firms' sales. Next, we limit attention to entry-level vehicles (Section 8.2). Here, the Korean and Japanese firm firms have a much larger market share and we also estimate substitution within segments to be a lot stronger. Finally, we assume that firms set prices to maximize sales rather than profits (Section 8.3). This will induce firms that benefit from a FTA to lower prices exactly in line with the tariff decline.

8.1 Fixed aggregate sales

First, we hold total sales on the Canadian market constant. This restrains firms directly benefitting from a FTA to reduce prices too aggressively, as they now do not have the incentive to draw additional consumers into the market. In addition, it strengthens the competitive pricing response of indirectly affected firms as all additional sales for Korean

or European firms will now come at the expense of lost sales for indirectly affected firms. This indirect price response will restrain the directly affected firms' pricing even more.

In spite of the more aggressive defense of market share by Japanese and American firms, we find that their sales decline is more pronounced than before as the Koreans and Europeans now can only take sales from them anymore and not from the outside good.

Table 14: Sales and profit responses with fixed aggregate Canadian sales
(*Re: Joint FTA with South Korea & E.U.*)

	(Absolute change)		(Percentage change)	
	Allow growth in total sales (Table 7 & 9)	Fixed Total Canadian sales	Allow growth in total sales (Table 7 & 9)	Fixed Total Canadian sales
(a) Effects on quantities sold				
American	-1,312	-5,065	-0.18	-0.66
Japanese	-1,883	-5,037	-0.32	-0.85
European	+9,209	+8,324	+11.55	+10.67
Korean	+2,964	+1,778	+2.51	+1.51
Net growth	+8,979	0	+2.05	0
(b) Effects on variable profit realized on Canadian market				
American	-32.72	-102.55	-0.36	-0.95
Japanese	-23.11	-72.13	-0.32	-0.90
European	+100.56	+92.80	+11.33	+10.51
Korean	+38.48	+26.09	+2.64	+1.69

Results in Table 14 reveal much larger sales decline for Japanese firms, a total of 5,037 units compared to only 1,833 before. This decline is 2.7 times higher, even though the sales increase of Hyundai and the E.U. firms is smaller. In percentage terms, the average effects for Japanese firms approach 1% lower sales in this scenario.

The effect on profits is similar to the effect on sales. For the directly affected Korean and European firms, the percentage increase in profits is a lot lower than with the market expansion, as they are not able to improve their sales to the same extent. Because they keep their profit margin higher—as they anticipate a stronger defense by Japanese and American firms—the reduction in profit growth is slightly smaller than the reduction in sales growth.

On the other hand, the indirectly affected firms see their profit decline almost triple. In addition to the greater sales losses, they also have to cut their prices more to defend market share, which eats further into their profits. For Japanese firms, the profit reduction increases almost threefold from 0.32% to 0.90%. For American firms, who benefit from some EU and Korean sourced vehicles, the increase is only slightly lower.

In absolute terms, the American and Japanese firms see their combined variable profits slump by $175 million, while the combined effect on Korean and European firms is a profit gain of $118 million.

Finally, the total effect on Canadian production is a lot more pronounced if the local market does not expand—results are in Table 15. In the benchmark situation, we assumed that the total number of households represent the potential market, which means that 87% of the consumers are observed not to purchase a vehicle. As a result, the scope for market enlargement was quite large. Combined Korean and E.U. FTAs were found to boost net sales by 8,979 units or 2.05%, which should be considered an upper bound.

The results in Table 14 and Table 15 are lower bounds as they assume no market expansion at all. In this case, Canadian production also suffers a lot more. Total production decline would be 3.5 times higher without the market expansion for a total of 2,601 fewer vehicles produced every year in the case of combined Korean and E.U. FTAs.

Furthermore, the effects of the sensitivity check in Section 7.3 (estimate without luxury and sporty vehicles) suggest that the effect could be even larger if consumers would have a larger price sensitivity than found in our benchmark results.

Table 15: Effects on local Canadian production without market expansion

	FTA with South Korea	FTA with E.U.	Combined FTAs Korea & E.U.	Multilateral tariff elimination
(a) Absolute change (sum over all models, in units)				
American	-317	-1,045	-1,359	-2,519
Japanese	-282	-964	-1,243	-2,564
Total without expansion	-599	-2,009	-2,601	-5,083
Total with expansion (Table 10)	-269	-466	-733	-1,640

8.2 Focus on entry-level segment

We now keep the assumption of the fixed market size, and look in particular at the segment of entry-level vehicles, which is extremely important for Canada, as illustrated in Table 2.

For these new simulations the demand system is first re-estimated. There are a couple of changes in the parameter estimates of the control variables, but they are all sensible. The point estimate on the power-per-weight variable almost doubles. This is due to the vehicles being a lot more alike, making direct comparisons of such a performance

variable across different vehicles more relevant. The sensitivity to fuel efficiency also doubles, which is consistent with consumers shopping for smaller and cheaper cars being more environmentally concerned or simply being more frugal. The domestic dummy remains insignificant and is even estimated somewhat lower, in line with the lower market share of the American firms in the entry-level segment.

The more important changes are in the price coefficient and segment substitution variables. The point estimate on price is lower in absolute value, -0.054 instead of -0.066 before, leading to *lower* demand elasticities. However, the σ estimate, capturing the substitutability within a segment, increases from an average of 0.37 to 0.70, suggesting that vehicles in the same nest are now much closer substitutes.[15] This provides an opposing effect, leading to to *higher* own- and cross-price elasticities.

On balance, comparing the estimates in the third column of Table 16 for the combined FTA with Korean and the EU with the earlier results in Table 14, we see that the effects on sales of Japanese vehicles is heightened: a reduction of -0.99% versus -0.85% before. American firms, on the other hand, only lose -0.57% of sales versus -0.66% before.

The reason for this difference is the importance of Korean and Japanese firms in the entry-level segment. Hyundai and Kia see their Canadian sales increase by 5.54%,

Table 16: Effects on prices, quantities, and profits for entry-level models (without market expansion)

	FTA with South Korea	FTA with E.U.	Combined FTAs Korea & E.U.	Multilateral tariff elimination
(a) Percentage change in average price				
American	-0.22	-0.09	-0.30	-0.49
Japanese	-0.08	-0.02	-0.10	-1.63
European	-0.01	-0.85	-0.86	-2.04
Korean	-2.49	-0.02	-2.51	-2.71
(b) Percentage change in average price only for affected vehicles				
American	-2.09	-3.01	-2.36	-2.53
Japanese	-2.88		-2.89	-2.98
European		-3.85	-3.85	-3.28
Korean	-2.49		-2.51	-2.71
(c) Percentage change in total sales				
American	-0.54	-0.04	-0.57	-3.09
Japanese	-0.73	-0.26	-0.99	+2.51
European	-0.87	+9.33	+8.35	+7.52
Korean	+5.78	-0.23	+5.54	+2.97

[15] On this limited sample of just 57 models we enforced equality of the σ variables across the segments.

(d) Percentage change in total profit				
American	-0.68	-0.03	-0.70	-3.69
Japanese	-0.83	-0.30	-1.12	+2.48
European	-0.89	+9.36	+8.36	+7.60
Korean	+6.38	-0.27	+6.10	+3.13

even though the total entry-level segment sales are held constant. All of this increase comes at the expense of American and, especially, Japanese firms. Even a single FTA with Korea would have effects on Japanese sales that are almost equally large.

Finally, adding the heightened price effects to the sales effects is estimated to lead to a reduction in variable profits for Japanese firms of 1.12% and an increase of Korean profits of 6.1% in the joint FTA situation.

8.3 Sales maximizing behavior

Finally, in addition to the assumption of a fixed market size and the concentration on the entry-level segment, we now also assume that firms set prices to maximize sales rather than profit. This assumption is most relevant for the entry-level segment, as firms have an incentive to tie new customers to their brands, hoping that loyalty will bind new customers in subsequent years. The importance of consumer loyalty leads firms to pay disproportionate attention to the entry-level segment, in spite of the low profit margins.

The potential of repeat purchases by customers entering the car market can make firms compete extremely aggressively in this segment. To pin down prices under the sales maximization assumption, we assume that firms apply a fixed mark-up of 20% to cover fixed costs. If we express the results in percentages, all changes would be identical for any mark-up we apply, as long as it is a fixed percentage of the underlying costs.

A corollary of sales maximizing behavior is that the entire tariff cut will be passed on to customers. The average price declines that we found in the first panel of Table 17 simply represent the fraction of sales coming from imported vehicles. The percentage price change for affected vehicles, in the second panel, is always -5.75%.

Sales and profit changes are now even larger than in the previous section. In particular, Japanese firms are predicted to lose 2.04% of sales when faced with joint FTAs and their profits decline even by 2.2%. The profits of the firms benefitting from the FTAs do not change very much from the previous section. They now choose to pass on the entire tariff cut to consumers, keeping their profit margins constant at 20%, and the only source of increased profits is increased sales.

Relative market share changes become extremely large under this scenario. Korean and European firms increase sales by 12.6% and 12.5% if they alone benefit from an FTA. The decline of Japanese sales is a lot stronger under the Korean than under the E.U. FTA.

When both FTAs would come in force at the same time, the effect would be almost the sum of the effects of either FTA separately.

Table 17: Effects on prices, quantities, and profits assuming sales maximization (limited to entry-level models)

	FTA with South Korea	FTA with E.U.	Combined FTAs Korea & E.U.	Multilateral tariff elimination
(a) Percentage change in average price				
American	-0.42	-0.16	-0.58	-0.58
Japanese	-0.03	0.00	-0.03	-3.00
European	0.00	-1.27	-1.27	-3.61
Korean	-5.75	0.00	-5.75	-5.75
(b) Percentage change in average price only for affected vehicles				
American	-5.75	-5.75	-5.75	-5.75
Japanese	-5.75		-5.75	-5.75
European		-5.75	-5.75	-5.75
Korean	-5.75		-5.75	-5.75
(c) Percentage change in total sales				
American	-0.92	+0.11	-0.81	-5.62
Japanese	-1.63	-0.43	-2.04	+3.95
European	-1.77	+12.53	+10.49	+9.45
Korean	+12.60	-0.39	+12.18	+6.60
(d) Percentage change in total profit				
American	-1.60	-0.09	-1.68	-6.67
Japanese	-1.80	-0.42	-2.20	+0.74
European	-1.67	+10.17	+8.30	+5.43
Korean	+7.43	-0.38	+7.03	+1.41

While this scenario is particularly extreme, the results illustrate that a 5.75% cut in the marginal costs for a firm benefiting from an FTA, could have quite sizeable effects on its competitors. Consider, in particular, that Korean firms have a market share of only 7.3% (10.3% in the entry-level segment), but a FTA with Korea would reduce the combined profits of the other firms that together command a 90% market share by 1.75%, or ratio of almost 1 to 3 in absolute profit changes (1 up for the Koreans versus 3 down for the others).

9 Trade-related non-FTA issues

9.1 Exchange rate effects

The average exchange rate between the Canadian dollar and the South Korean won over the entire year was 865 in 2007 and 1021 in 2008, i.e. an appreciation of 18% for the dollar. As a result, if all costs would have been locally incurred in Korea for vehicles imported from there, their landed cost would have been 15.1% (1/1.18) lower in 2008 than in 2007. Given that the Japanese yen over the same time period appreciated from 109.6 yen per dollar to 96.4, or a 14% appreciation, it is clear that exchange rate movements are extremely important as well.

As an illustration of the magnitude of these exchange rate movements for the price, sales, and profit evolutions we present the results of one scenario in Table 18. We include two sets of results in the table. First, we repeat the effects of the FTA with Korea (taken from the earlier tables). This implies a cost advantage of 5.75% for Korean vehicles. In the next columns, we show how equilibrium prices, sales, and profits would have evolved if both the Japanese yen and the Korean won had remained at their 2007 levels in 2008. This would have meant a cost increase for Korean vehicles, but a cost reduction for Japanese vehicles.

For simplicity, we kept the exchange rates between the Canadian dollar and the euro (the euro appreciated 6.2%) and between the Canadian and U.S. dollar (which depreciated by 1%) at their 2008 values. This means that the 2008 costs of these firms were unchanged, but the firms would adjust their prices, when faced with different pricing behavior of Japanese and Korean competitors.

The results clearly reveal that exchange rate changes had an important impact on the market. Absent the actual exchange rate evolution, our model predicts that Korean prices would have been 3.92% higher and Japanese prices 2.07% lower. The impact this would have had on unit sales for Japanese firms, +29,334 units, is larger than any change we have seen in the preceding tables.

Table 18: Simulation results for Japanese yen and Korean won at 2007 levels

	Average price change (sales weighted)		Total change in sales (in units)		Total profit change (in percentages)	
	FTA with Korea (Table 7)	FX rates at 2007 level	FTA with Korea (Table 9)	FX rates at 2007 level	FTA with Korea (Table 11)	FX rates at 2007 level
American	-0.02	-0.10	-508	-4,422	-0.09	-0.72
Japanese	-0.01	-2.07	-451	+29,334	-0.08	+5.17
European	-0.00	-0.51	-92	-742	-0.11	-0.84
Korean	-1.50	+3.92	+3,211	-8,625	+2.85	-7.13

9.2 Tariff jumping FDI

One possible advantage of import tariffs already mentioned in the introduction is that it provides incentives for firms to establish local production capacity and thus avoid import duties. The current 6.1% tariff in the automotive industry is unlikely to be sufficiently large to materially affect such an important investment decision. Moreover, U.S. trade policy would be even more important for location decisions as the automotive industry is highly integrated in the three NAFTA countries.

In order to briefly gauge the likelihood of new capacity expansions in North America, a number of statistics are assembled in Table 19. In the first column are the import volumes from outside NAFTA into the Canadian market, and firms have been sorted along this dimension. Hyundai (combining its Hyundai and Kia brands) was the largest importer into Canada, from outside of NAFTA, and its lead has only grown over the 2008-09 crisis. It is notable that in terms of total North American imports, including the U.S. and Mexico, Hyundai imports only about two thirds as much as Toyota and they import only 60% more than Honda, versus 160% more in Canada.

Total import volumes are only part of the picture. Imports are made up of individual models and scale economies are important in production. Total sales of the two models with highest imports provide a better gauge for the ability of a firm to operate a new plant efficiently in North America than total imports. These numbers are shown in the fifth column of Table 19. Only four firms now reach 200,000 sales with two models.[16]

Table 19: Sales of imported vehicles within the NAFTA area (2008)

	Canada	USA	Mexico	Total	Top 2 models	share of total sales
HYUNDAI	107,854	550,341		658,195	186,716	83.0%
HY. at full capacity				193,006		
TOYOTA	84,203	844,382	37,523	966,108	326,573	38.6%
TO. w/o RAV4				802,877	320,528	32.1%
MAZDA	69,501	196,884	10,654	277,039	204,756	74.6%
HONDA	40,486	364,133	9,595	414,214	321,148	25.0%
HO. w/o CR-V				190,621	133,288	13.3%
VOLKSWAGEN	33,266	186,865	68,021	288,152	81,889	57.7%
GM	28,939	100,090	77,198	206,227	110,444	5.9%
NISSAN	28,838	250,440	40,805	320,083	167,784	25.8%
BMW	23,919	265,783	7,622	297,324	188,128	87.3%
DAIMLER	20,182	184,356	7,123	211,661	124,705	75.0%
MITSUBISHI	15,664	41,337	15,667	72,668	69,843	54.5%
SUBARU	14,877	109,846	812	125,535	125,535	60.1%

[16] BMW, next with 188,000 units, would have a hard time assembling its 3 series and Mini in the same plant.

SUZUKI	13,409	62,298	7,930	83,637	58,772	78.6%
FORD	6,507	73,102	55,903	135,512	37,095	5.8%
TATA	3,057	44,542	992	48,591	22,173	100.0%
CHRYSLER	119	2,021	27,001	29,141	18,419	1.6%

Note: Fiat, Isuzu, PSA & Renault are omitted because of low sales in the NAFTA area.

In addition, the high imports for Hyundai and Honda are already outdated as both firms will reduce their imports sharply once their new North American operations will be producing at full capacity. An additional line is added for three of the firms to reflect better the current situation (in 2010).

Based on these statistics, the firm with perhaps the greatest need for a new North American plant seems to be Toyota, who imports more than 150,000 vehicles annually of both its Yaris and Prius models. Given the tightening of emission standards and a general need for North America to do its part to combat global warming, these vehicles certainly have a good future. However, as the recent recalls have been blamed on too rapid expansion, new Toyota investments are not expected any time soon.

The only other firm that would be able to fill one plant with just two models is Mazda, who imported almost 205,000 units of the Mazda3 and Mazda5 models which are conveniently based on the same platform. The overcapacity of Ford, which is still collaborating on several models with Mazda, makes it unlikely that a new plant will be announced any time soon.

10 Conclusions

We have quantified the likely effects of the selective elimination of the current Canadian import tariff of 6.1% on light duty vehicles, which amounts to a 5.75% cost reduction for the affected firms. Detailed results for the different policy scenarios on several economic outcomes of interest under various assumptions are presented in Tables 7 to 17.

As FTAs are inherently discriminatory, it is not surprising that different firms are affected differently. A number of patterns are worth highlighting:

- The combined effect of Canadian FTAs with both South Korea and the EU would be more harmful to Japanese firms than both of these FTAs in isolation
- The sensitivity of the benchmark effects to a few important modeling assumptions is non-negligible:
    - Effects are more pronounced if consumers are estimated to be more price sensitive. If “luxury and sporty cars” (representing 8.9% of sales) are eliminated, the estimated effects of the trade policy simulations are more damaging for Japanese firms.

    - If the total Canadian market would not expand in response to the price declines, i.e. no new customers would flock to the market, the effects of the trade policy simulations are again found to be a lot more damaging for Japanese firms.
    - The effects on prices and sales are a lot more pronounced if firms are assumed to set prices in a sales maximizing fashion rather than to maximize profits. The effects on profits are less pronounced.
- Effects are larger on the segment of entry-level vehicles. Korean firms gain a lot more there and Japanese firms, which are sales leaders in this segment, incur more damage than American firms.
- While Japanese firms are harmed most by joint FTAs with Korea and the EU, they would benefit most from full tariff elimination as well. The discriminatory nature of the various FTAs lead to the counterintuitive situation that full tariff elimination is less beneficial for the firms that import most.
- Effects on sales for firms benefitting directly from an FTA will be muted because firms will likely only pass a portion of the tariff decline on to consumers.
- Effects on sales will be further muted as other firms, which are only indirectly affected by the FTAs due to changes in the competitive environment, will defend market share by lowering their own prices.
- Profit margins of directly benefiting firms will increase, as only a fraction of the cost reduction is passed on, and those of other firms will decrease, as prices are reduced without any cost savings.
- As a result, the effect on total profits for the firms benefiting from the FTAs can be quite substantial and they could use these profits in a variety of ways to improve their competitive position for the longer run.

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