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PERSPECTIVES ON NORTH AMERICAN FREE TRADE

CAN SMALL-COUNTRY MANUFACTURING SURVIVE TRADE LIBERALIZATION? EVIDENCE FROM THE CANADA–U.S. FREE TRADE AGREEMENT

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PERSPECTIVES ON NORTH AMERICAN FREE TRADE

CAN SMALL-COUNTRY MANUFACTURING SURVIVE TRADE LIBERALIZATION? EVIDENCE FROM THE CANADA–U.S. FREE TRADE AGREEMENT

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PREFACE

Toward the mid-1980s, as international markets and production were becoming more global in scope and outlook, Canada was in danger of being pushed to the margin of the world economy. We were not equipped to expand our participation in global markets, and we were in danger of losing our own markets. Moreover, with over two-thirds of our exports destined for the United States and the share steadily climbing, we were highly exposed to rising U.S. protectionist sentiments. In essence, our past prosperity had made us complacent about the precarious position we faced as a trading nation.

It was in such a climate that the government undertook the steps necessary to renew and strengthen the economy, rather than resist the forces of global change. The government's approach was to make the private sector the driving force of this economic renewal. Policies were adopted to encourage and reward entrepreneurship and facilitate adaptation to the changing economic environment.

As a trading nation, getting our trade relations with the United States right was an obvious goal. It was decided that a free trade agreement was needed in order to forestall protectionist tendencies in the United States, enhance Canada's security of access to the American market and improve the predictability of trade relations with our neighbour to the south.

The Canada-United States Free Trade Agreement (FTA) was implemented in 1989. Five years later, in 1994, the North American Free Trade Agreement (NAFTA) came into effect and basically extended the FTA to the fast-growing Mexican market.

These free trade agreements were expected to increase prosperity in Canada by raising the efficiency and productivity of Canadian businesses. Such agreements are known to be mutually beneficial to the economies of the parties involved, and are particularly beneficial to the relatively small economies, such as that of Canada. They first expose domestically protected firms to international competition. Second, they reward innovative and productive firms by giving them access to larger markets. This increases trade flows between participating countries and improves the overall efficiency of their economies. The FTA and NAFTA were no exception; they were signed in the hope of obtaining those benefits for the Canadian economy after an initial adjustment period. Yet concomitantly, there were legitimate concerns about possible plant closures and job losses in Canada.

More than ten years have passed since the implementation of the FTA — enough time to reliably assess the implications of the agreement for the Canadian economy. In this context, the Micro-Economic Policy Analysis Branch has asked a group of experts to examine the Canadian economy in light of the FTA. The six papers coming out of this exercise are now being published under the general heading of *Perspectives on North American Free Trade*. These papers analyse a broad spectrum of issues ranging from the impact of the FTA on interprovincial trade flows to its impact on the productivity performance of the Canadian economy. In addition, the viability of the Canadian manufacturing sector is assessed, as is the relationship between outward foreign direct investment and trade flows. The papers also explore the implications of trade for the evolution of Canada's industrial structure and skill mix along with an assessment of Canada's migration patterns with the United States.

The monograph by Keith Head and John Ries considers whether trade liberalization through agreements such as the FTA benefit or harm small country manufacturing. The authors show that the incomplete integration of North American markets for manufactured goods has so far limited the impact of tariff reductions on Canadian industry. This is attributed to the fact that non-tariff barriers have remained high, particularly in some sectors. Head and Ries present evidence that trade liberalization favours industries with a relatively low demand. They find that Canadian industries that experienced large tariff reductions and those that are natural resource-intensive registered the largest changes in output shares over the 1990s.

EXECUTIVE SUMMARY

The effects of the Canada–United States Free Trade Agreement (FTA) on Canadian manufacturing are of interest to both policymakers and academics. From a policy perspective, the Canadian experience will serve as a lesson for other small countries considering liberalizing trade with a larger trading partner. On the academic side, there are conflicting theories on whether liberalization will benefit or harm small country manufacturing. In this paper, we develop two theoretical models that offer opposing predictions about the effects of market size and tariff reductions on a country's share of production. We expand these models to include standard comparative advantage effects of trade liberalization. We evaluate the models using matched Canadian and U.S. manufacturing data at the 3-digit SIC level over the period 1990–95.

Our first empirical exercise is to estimate the "border effect" — the observed and unobserved barriers to trade that impede consumption of imported goods. We decompose this border effect into a portion attributable to tariffs and a portion resulting from non-tariff barriers. We find that non-tariff barriers have steadily fallen but remain high (exceeding 50% in tariff equivalent terms) for particular industries. These high non-tariff barriers dampen the effects of negotiated tariff reductions.

Our second empirical exercise tests the theoretical predictions of our two models. We examine the relationship between a Canadian industry's share of North American demand for that industry's goods and Canada's share of the output of that industry. In addition, we evaluate how tariffs influence this relationship. Our investigation reveals some evidence that trade liberalization favours industries with relatively low demand, a result consistent with one of our models. We also find that Canadian industries that are natural resource intensive and had large tariff reductions experienced the largest change in output shares over the 1990–95 period. Overall, we see the FTA as part of a long-term trend towards increased economic integration between the United States and Canada. While differences in changes in output share across industries were small, our results suggest that trade liberalization favoured Canadian industries with a low demand share and high natural resource intensity.

INTRODUCTION

Ten years have passed since the Canada–United States Free Trade Agreement (FTA) came into effect. During this period, Canadian manufacturing experienced a serious slump followed by a moderate rebound. From the peak in 1989 to the trough in 1993, Canadian manufacturing employment fell by 326,000 jobs and, in 1995, remained 13% below its 1989 level. On the other hand, Canada's exports boomed during the post-FTA period, with trade rising sharply as a percentage of GDP. While neither of these trends has incontrovertible welfare implications, critics and proponents of free trade with the United States have cited them to support their cases.

This paper investigates to what extent these changes are attributable to trade liberalization under the FTA. We are interested in the effect of the FTA on Canada's share of North American manufacturing and on the composition of manufacturing across industries. We develop two models of differentiated goods produced by a small and large country to investigate how tariff reductions under the FTA interact with demand, economies of scale, and comparative advantage to influence small-country relative output. We then test these predictions using matched 3-digit industry data for Canadian and U.S. manufacturing.[1]

Two features of the North American economy stand out: the United States is a much larger market than Canada and there is considerable two-way trade of products in the same industry group (intra-industry trade). Thus, the appropriate model for analyzing the effects of the FTA should incorporate intra-industry trade between countries of unequal size. We consider two models that capture both features. The first model is the monopolistic competition framework introduced by Krugman (1980) and further developed by Helpman and Krugman (1985) incorporating increasing returns to scale. We contrast it with a constant-returns, perfect competition model where goods are differentiated by country of origin (the so-called Armington assumption). Hereafter, we refer to the first model as the Krugman model and the second model as the Armington model.

The Krugman model assumes that firms each produce a unique product and consumers exhibit a demand for variety. Fixed production costs and constant variable costs for manufacturing generate increasing returns and an incentive to concentrate production in single sites. In the case where factor prices are equal in the two countries, the model predicts that the larger country will produce a relatively high share of manufacturing output and export to the small country. An increase in the demand share of one trading partner will elicit a more than one-for-one increase in that country's output share. Moreover, trade liberalization will increase the large country's production share in the manufacturing goods sector.

The intuition behind the home-market effect of Krugman's model is as follows. Consider a product subject to trade costs — tariffs, freight, delay, product modifications, etc. — on each unit of the good that crosses the border. The two markets could be served by setting up a plant in each country. This saves on trade costs but results in a duplication of fixed costs. Suppose trade costs fell to zero. Then the firm would clearly want to shut down the plant in whichever location had higher production costs, even if the difference were trivial. Now suppose instead that trade costs shrink but remain positive. The firm might consolidate production in one plant and, if one market were substantially larger, the firm would want to locate the plant there and export to the smaller market. This strategy would lead to the lowest combination of fixed costs (since there is only one plant) and trade costs (since most sales are within the market where the good is manufactured). As trade barriers declined, the small country would experience plant closings across its manufacturing sector.

In the Armington model, the results are quite different. While the large country has a large share of manufacturing, this does not necessarily translate into a trade surplus in manufactures nor does trade liberalization result in a decline in small country manufacturing. In fact, trade liberalization may have disproportionate benefits for small country manufacturing by giving its firms better access to consumers in the large country. If factor prices are equal, the small country will have a large share of production relative to its share of demand and will run a trade surplus in manufactures.

The stark prediction that each country is either a net importer or exporter of manufactures relies on the existence of other sectors that balance overall trade and equalize factor prices. Alternatively, balanced trade in manufactures can be achieved by exchange rate adjustments. In the Krugman model, the large country's currency will appreciate raising its relative costs. In the Armington model, it is the small country's currency which must appreciate to eliminate the trade surplus that would arise in the context of equal factor prices. Weder (1995) shows that in the case where exchange rate adjustments must occur to balance trade in the Krugman model, industry net trade patterns within manufacturing may be systematically related to relative industry demand. He develops Krugman's (1980) formulation that a nation's consumers have idiosyncratic preferences. Positive idiosyncratic demand exists when consumers in one country have stronger preferences for an industry's goods than consumers in other countries. He shows that relative production and trade surpluses depend on relative spending patterns. Namely, a country will be a net exporter in industries where it has a relatively strong taste (high relative demand) for that industry's goods.

A number of recent empirical papers have tested the influence of idiosyncratic demand on production levels or trade flows. Weder (1997) evaluates U.S–U.K. trade for 26 products over the period 1970–87 and finds support for the notion that idiosyncratic demand has a positive relationship to net exports. Davis and Weinstein (1996, 1998*a,b*) have also tested whether trade patterns are systematically related to differences in spending patterns across countries. Davis and Weinstein argue that as a benchmark, a country allocates resources to produce goods in the same proportions as other countries. Production deviates from this benchmark level due to differences in endowment and idiosyncratic demand. Davis and Weinstein (1998*b*) analyze 1985 production and trade data at the 4-digit level for OECD countries. They find that relative differences in spending patterns across countries translate into differences in relative production. Specifically, if a nation spends a higher proportion of its income on a good, it will produce more of that good. Furthermore, the increase is more than proportional for many industries. Davis and Weinstein interpret this as evidence in favour of increasing returns. The Davis and Weinstein (1998*a*) examination of Japanese regional data also reveals the importance of differences in spending patterns on production patterns.

Previous empirical analysis of the FTA has focused on its trade creation effects or the impact of tariff reductions on manufacturing employment. Both Clausing (1997) and Schwanen (1993) conclude that the FTA expanded trade between Canada and the United States. Clausing conducts regression analysis to relate trade for different goods to tariff changes under the FTA for the period 1989 to 1993. She estimates that the FTA led to a 16% increase in Canadian exports to the United States and an 18% increase in Canadian imports from the United States. Schwanen does not explicitly relate tariff reductions to changes in trade levels. Instead, he divides Canadian industries into those liberalized by the FTA and those not liberalized under the agreement. He compares percentage changes in Canadian trade with the United States and the rest of the world (ROW) for liberalized and nonliberalized sectors over the years 1989–92. He finds that trade with the United States grew faster in liberalized sectors than non-liberalized sectors. Moreover, trade in liberalized sectors grew faster with the United States than with the rest of the world. Thus, Clausing and Schwanen both show trade creation effects of the FTA. These results indicate opposing effects on Canadian manufacturing — higher exports but greater U.S. import penetration. Thus, the net effects on production, employment, and investment in Canada are unclear.

Previous work also suggests that Canadian tariff reductions had the effect of reducing Canadian manufacturing activity. Head and Ries (1997) analyze 128 4-digit SIC industries and relate bilateral tariff reductions to changes in the ratio of Canadian to U.S. shipments from 1987 to 1992. Gaston and Trefler (1997) conduct a similar exercise but focus on employment levels and wage levels and examine 2-digit industries over the period 1980–93. The small and only marginally significant effects of tariff reductions detected in both these studies may be attributable to the time period analyzed or to the limitations of the data. A primary limitation in our earlier study was that we evaluated relative manufacturing performance over a period where Canada suffered a much greater macroeconomic downturn. Moreover, we did not have data on relative spending that might have controlled for the business cycle effect. Gaston and Trefler find that tariffs play a very small role in explaining employment and wage changes in Canada. Perhaps the weakness of the tariff results is due to the inclusion of imports and exports in the regression: tariffs influence the Canadian economy by changing trade and once trade is controlled for, then tariffs may have no independent effect. Another problem with their study is the limited inter-industry tariff variation that exists at the 2-digit industry level.

The focus of our work is to test whether a large or relatively large demand at home translates into a production advantage that gets magnified by trade liberalization. We also consider natural resource intensity as a basis for expansion of particular Canadian manufacturing industries in response to tariff reductions. We do not examine other potential consequences of the FTA. The Eastman-Stykolt hypothesis proposed that decreased import barriers in Canada would increase plant scale, thereby generating efficiency gains in Canada. In an earlier paper, Head and Ries (forthcoming), examine the relationship between Canadian output per firm and bilateral tariff reductions under the FTA. We find that Canadian tariff reductions are not associated with increases in firm scale, thereby contradicting the hypothesis. In concentrating on the role played by demand size in production, we will make a number of simplifying assumptions to facilitate the analysis.

In the first section, we develop two alternate models that generate competing predictions for the effects of trade liberalization on the distribution of North American production. In the second section, we present the empirical results of the paper using data on Canadian and U.S. manufacturing. In the first sub-section, we provide an estimate of the "border effect" impeding consumption of goods produced outside the home country. We decompose the border effect into a portion attributable to tariffs and a portion resulting from non-tariff barriers, and we show that it has declined over time. The analysis indicates that the role tariff reductions can play in re-shaping North American manufacturing is limited by the presence of high non-tariff barriers in many industries. The second and third sub-sections look at how deepening economic integration reallocated manufacturing production between Canada and the United States. In the second sub-section, we explore trends in the performance of the whole sector, while in the third sub-section, we investigate differential effects across industries within Canadian manufacturing, including an industry-level regression analysis relating production shares to demand shares, tariffs, and comparative advantage. The final section offers concluding remarks and provides our answer to the question posed in the title.

TWO COMPETING MODELS OF TRADE

In this section, we derive the theoretical relationships that form the basis of the empirical exercises we conduct in the following section. We begin by specifying consumer preferences which are common to both the Krugman model and the Armington model. We show how market share information can be used to obtain an estimate of the border effect — the tariff and non-tariff barriers that cause consumers to purchase a disproportionate share of home goods. Next, we derive the linear relationship between production and demand shares. We show that Krugman's model predicts a slope that is greater than one. In contrast, the Armington model yields a slope that is less than one. The models also differ in their predictions of the effects of tariff reductions. In the Krugman’s model, lower tariffs favour production in the large market whereas manufacturing in the small market is favoured in the Armington model. In deriving these predictions, we begin with a general formulation and then derive the Krugman and Armington models as specific.[2]

Consider a representative consumer in the small country (Canada) who allocates an exogenous level of expenditures *E* to each industry.[3] Similarly, the representative consumer in the large country (the United States) spends *E** on the industry's goods.

We represent preferences for differentiated products in each industry using a constant elasticity of substitution sub-utility function:

$$u = \left(\sum_{j=1}^{N} C_j^{\frac{s-1}{s}} \right)^{\frac{s}{s-1}}, \tag{1}$$

where C_j is consumption of variety *j*, *N* is the number of varieties, and → is the elasticity of substitution. This description of preferences contains the Krugman and Armington models as special cases. Krugman's model follows Dixit and Stiglitz in associating each variety *j* with one of the *n* Canadian firms or *n** U.S. firms ($N = n + N^*$). The number of firms depends on the size of the market (*E* and *E**) relative to the level of fixed costs per variety (firm). The Armington assumption specifies that goods are differentiated solely by nation of origin. Thus, there are American and Canadian widgets but no individual varieties of widgets at the subnational level ($N = 2$). Firms in each country are assumed to supply their nation's variety according to a perfectly elastic supply curve.

Let *x* equal the share of Canadian expenditures devoted to Canadian-made varieties and *x** the share of U.S. expenditures on U.S.-produced varieties. The value of total shipments from each country, *V* and *V** is obtained from the following accounting identities:

$$V = xE + (1 - x^*)E^*, \tag{2}$$

$$V = x^* E^* (1 - x)E, \tag{3}$$

In each case, total shipments comprise production for the home market (the first term) and exports (the second term). The allocation of expenditures between domestic and imported varieties depends on the prices consumers face. We assume that trade barriers which create spreads between the price paid for locally produced and imported products are common on either side of the border. Consumers in Canada pay *p* for Canadian goods and *p**↔ for imports (where ↔ µ 1) from the United States. Similarly, consumers in the United States pay *p** for U.S.-made goods and *p*↔ for goods they import from Canada. This implies that τ – 1 is the tariff equivalent of the trade barrier between the two countries. The assumption of symmetric barriers simplifies the model. It is also important at the estimation stage because it reduces the number of interactions to be estimated. In 1988, tariffs in the United States and Canada were highly correlated (about 0.66) but higher in Canada — across 110 3-digit industries, average Canadian and U.S. tariffs were 7.1% and 3.9%, respectively. To the extent that Canadian tariff reductions are greater than U.S. tariff reductions, liberalization is less beneficial to Canadian production.

The market shares implied by the preferences represented by equation (1) are given by

$$x = \frac{np^{1-s}}{np^{1-s} + n^*(p^*t)^{1-s}}, \tag{4}$$

$$x^* = \frac{n^* p^{*1-s}}{n(pt^*)^{1-s} + n^* p^{*1-s}}. \tag{5}$$

Each share function depends on trade barriers, τ, relative prices, p / p^*, and the relative number of varieties, n / n^*.

The Dixit-Stiglitz version of monopolistic competition assumes that each firm maximizes its profits with respect to a perceived elasticity of demand equal to σ.[4] Denoting marginal costs with c, the constant-markup pricing rule for Canada is given by

$$p = \frac{sc}{s-1}, \tag{6}$$

with a similar equation for p^*, the U.S. producer price. Under perfect competition with Armington preferences, prices equal marginal costs. In either model, therefore, relative prices (at the factory door) equal relative marginal costs, i.e., $p / p^* = c / c^*$. Now we may define two useful parameters. Let $a = c^*/c)^{(\sigma - 1)}$ represent the marginal cost advantage of a Canadian firm. Let $b = \tau^{\sigma - 1}$ represent the "border" effect, i.e. the advantage domestically manufactured goods have over imports in either country.[5] We now re-express the share equations as

$$x = \frac{na}{na + n^*/b}, \tag{7}$$

$$x^* = \frac{n^*}{na/b + n^*}. \tag{8}$$

These market share equations can be used to infer the value of b pertaining to each industry.

$$b = \sqrt{\frac{x}{1-x}\frac{x^*}{1-x^*}}. \tag{9}$$

Thus, the border effect, *b*, is the geometric mean of domestic firms' success relative to foreign firms' success in each home market. It measures the bias in favour of domestically produced goods exhibited by the average consumer in North America. The other parameter, *a*, is given by

$$a = \sqrt{\frac{x}{1-x}\frac{1-x^*}{x^*}} \div \frac{n}{n^*}. \tag{10}$$

a is the geometric mean of the home firms' success (odds-ratio) in their domestic market and the home firms' success in the foreign market scaled by the relative number of varieties. A high value of *a* corresponds to relatively low marginal costs in Canada. Note that *a* cannot be inferred from the market share data without first determining , n / n^*.

This section has demonstrated how we can use market share information to estimate the common border effect *b*, which biases consumption towards home varieties, and *a*, which is a measure of cost differences. In the next two subsections, we show how the relationship between production shares, demand, and tariffs depends on the model structure. Ultimately, we derive two specifications where a country's share of production is a function of its share of demand, trade costs, and preference parameters.

The Production-Demand Relationship in the Krugman Model

In the Krugman model, firms specialize in the production of a single good in a single location.[6] With free entry, the producer prices in each country are driven to average cost. This implies that each firm will produce an output of

$$q = \frac{(s-1)F}{c}. \tag{11}$$

We assume that fixed costs consist primarily of capital and that the cost of capital is equal in the two countries. Hence, relative per-firm outputs will be $q / q = c^* / c$. As a result, the value of shipments per firm will be equal in the two countries: $pq = p^*q^*$. This result is useful because it implies that $V / n = V^* / n^*$. Using this equality, dividing equation (2) by *n* and equation (3) by n^*, and substituting for *x* and x^* using equations (7) and (8) we obtain a single equation:

$$\frac{E(a-1/b)}{na+n^*/b} = \frac{E^*(1-a/b)}{na/b+n^*}. \tag{12}$$

Now multiply both sides by $n + n^*$ and divide both sides by $E + E^*$. Since the value of shipments of each variety is the same, $shr(V) = V / (V + V^*) = n / (n + n^*)$. Further, let $shr(E)$ denote Canada's share of North American expenditures in the industry, i.e. $shr(E) = E / (E + E^*)$. Using this notation, equation (12) can be simplified to

$$shr(V) = \frac{a(b^2-1)}{(b-a)(ab-1)} shr(E) - \frac{1}{ab-1}. \tag{13}$$

There are several important points to be made about this relationship between production and demand shares. First, there will be a critical home expenditure share where small shares of demand cause the disappearance of the home industry. Similarly, sufficiently large values of *shr*(*E*) will lead to *shr*(*V*) = 1. In the intermediate range, production shares are a linear function of demand shares. Furthermore, the slope of the function will be greater than one. This means increases in demand shares cause production shares to rise on a more than one-for-one basis.[7] Finally, a reduction in trade barriers, will increase the slope of the equation, implying that home market size matters more when trade barriers are lower.

Figures 1 and 2 show how changes in parameters affect the production-demand relationship described by equation (13). In each diagram, the elasticity of substitution, _, is fixed at 5. Both tariffs are set initially at 50%. A decline in tariffs to 25% increases the slope but leaves the intersection point unchanged at 0.5. Lower Canadian costs, in this case $c / c^* = 0.8$, have two notable effects: they shift the curve up and increase the slope. That is, a Canadian cost advantage now allows it to be a net exporter, $shr(V) > shr(E)$, even though it is the small country ($shr(E) < 0.5$). In addition, symmetry in costs magnifies the importance of demand on the distribution of production.

The model we have exposited is a partial equilibrium description of a monopolistic competition industry. Krugman (1980) and Weder (1995) obtain general equilibrium results by assuming that wages adjust (perhaps via the exchange rate) to eliminate trade imbalances. The smaller country must therefore have lower wages. Figure 2 illustrates the consequences of a wage reduction. In contrast, Helpman and Krugman (1985) posit a homogeneous-good sector with zero trade costs. The existence of this sector (which they refer to as agriculture) equates wages in the two countries. As a result, the small country runs a trade deficit in monopolistic competition industries that it offsets with a trade surplus in the homogeneous-goods sector.

The Production-Demand Relationship in the Armington Model

The Armington model breaks the links between firms and varieties. Instead it associates varieties with nations. Now, since $n = n^* = 1$, we obtain *x*, the Canadian producers' share of the Canadian market, and x^*, the U.S. firms' share of the U.S. market, as

$$x = \frac{a}{a + 1/b}, \tag{14}$$

$$x = \frac{1}{a/b + 1}. \tag{15}$$

Substituting the above expressions into equations (2) and (3) and solving for $shr(V) = V / (V + V^*)$, we now obtain

$$shr(V) = \frac{a(b^2 - 1)}{(a+b)(ab+1)} shr(E) + \frac{a}{a+b}. \tag{16}$$

The constant-returns Armington framework yields an equation that is quite similar to the one implied by Krugman's model of monopolistic competition (equation 13). Once again, shipment shares are linearly related to demand shares. There are some important differences. First, the slope of the equation is now less than one and the intercept is positive. This implies that the small country will produce a disproportionate share of output and run a trade surplus. Second, tariff reductions now reduce the slope of the equation. As the market becomes more integrated, the location of demand has less predictive power for the location of production. One commonality with the Krugman model is that a reduction in relative costs raises a country's share of output.

Note that the relationship between output shares and demand shares in the Armington model is qualitatively similar to a short-run version of the Krugman model where the number of firms does not adjust in response to changes in demand. We can re-express equations (2) and (3) as

$$shr(V) = [x - (1 - x^*)] \cdot shr(E) + (1 - x^*) \tag{17}$$

Where x and x^* are functions of a, b, n, and n^*, which are all exogenous in the short run. It must be the case that with positive transportation costs, the Canadian firms' share of their own market must exceed their share of the U.S. market [$(x > (1 - x^*)$]. This establishes that the coefficient of $shr(E)$ is positive and less than one and the intercept of the share equation is positive when n and n^* are fixed.

Figure 1
Tariff Reductions under Monopolistic Competition

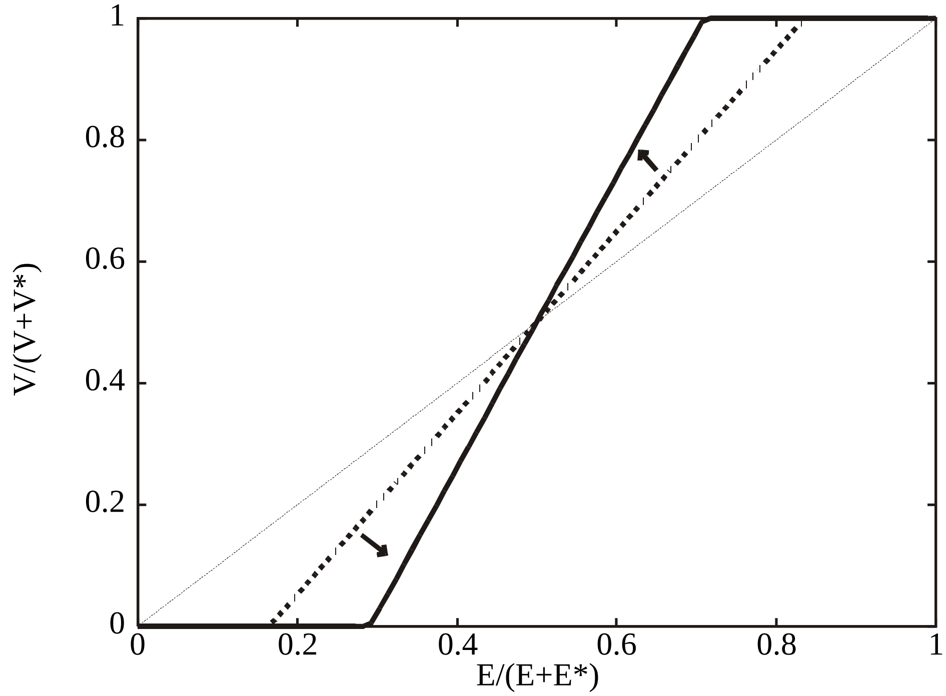
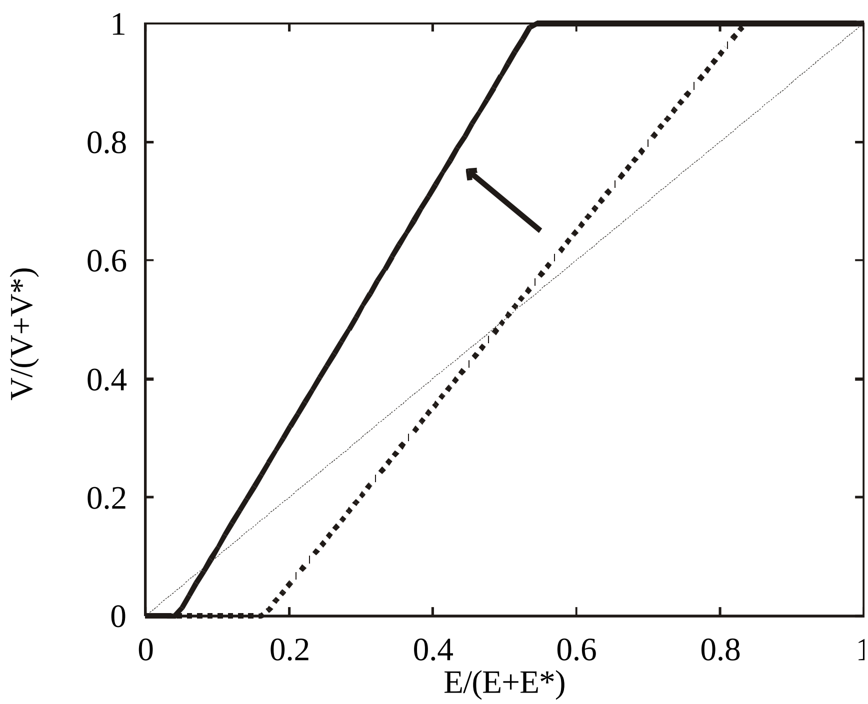


Figure 2
Relative Cost Reductions under Monopolistic Competition



EMPIRICAL ANALYSIS

In the first subsection, we show that the deeper integration of the Canadian and U.S. markets for manufactured goods that is exhibited at the aggregate level can be attributed in part to tariff reductions under the FTA. We also identify industries according to the level of non-tariff barriers and the share of demand. Our theory indicates that industries with low non-tariff barriers and either high or low shares of demand are those likely to be strongly affected by the FTA. The next subsection shows the trends in relative size and trade performance of Canada's manufacturing sector. The final subsection investigates whether trade liberalization reallocated production in favour of home market size, comparative advantage, or both.

Deepening Integration of the North American Market

The previous section demonstrated that the model provides a means of calculating the implied border effect, *b*, using data on the production and consumption of foreign and domestic manufacturers in Canada and the United States. The border effect is the ratio of the attractiveness of goods produced domestically to those produced in the foreign country as seen by domestic consumers in either country. We can also calculate the parameter *a*, which measures the advantage (or disadvantage if less than one) of Canada's products in *both* markets. We have assumed that *a* reflects marginal cost differences that lead to mill price differences. However, *a* will be greater than one for any reason that causes Canadian producers to have a higher share of the Canadian market than U.S. firms have of the U.S. market. Therefore, another reason we might observe $a > 1$ is a higher level of protection from imports in the Canadian market.

We use annual data on Canadian and U.S. shipments, bilateral exports, and world exports, to calculate annual measures of *x* and x^*. To maintain consistency with our two country model, *x* represents Canadian producers' share of the Canadian market for North American (Canadian and U.S.) goods. Correspondingly, x^* is U.S. producers' share of the U.S. market for North American goods. Canada's market for North American goods consists of purchases of Canadian goods (Canadian shipments minus world exports) plus imports from the United States. The Canadian producers' share of that market is simply the Canadian goods component. We aggregate 4-digit industry data kindly made available to us by Industry Canada to the 3-digit level to generate a panel data set of 110 manufacturing industries with a total of 629 observations.[8] It should be noted that variation in production shares may arise from errors in the concordance between the U.S. and Canadian standard industry classifications (SIC). The Industry Canada data aggregates 5-digit U.S. SICs into the corresponding 4-digit Canadian SIC. In some cases, the match is only a rough one. Aggregating to 3-digit industries appears to remove the most serious cases of mismatch. Additional concordance problems emerge when trade data are matched to industry data. We omit 9 observations where exports exceed shipments generating negative domestic consumption.

Figure 3 displays inferred annual values of b_{it} for different quartiles of our manufacturing industries over the period 1990 to 1995. Each of the three quartiles shown reveal a sharp drop in b_{it} over time. As a measure of the "odds" of purchasing from a domestic manufacturer, the range of b_{it} for the median industry — 20 in 1990 and 11 in 1995 — indicates that a consumer was 20 and 11 times as likely to purchase from local producers as foreign producers in those years. However, seven years after the signing of the FTA, the North American manufacturing sector is still quite far from frictionless integration, which would be the case when the value of *b* attains unity. Figure 4 shows that the trend towards lower border costs has been under way for two decades; it shows border effects for the manufacturing sector taken as a whole which tends to lower the calculated border effects because it gives more weight to sectors like automobiles that have among the lowest border effects. The dashed line in

Figure 4 shows inferred values of *a* based on the assumption that the relative number of U.S. varieties to Canadian varieties, n^* / n, equals the ratio of total manufacturing output in the two economies. The value of *a* exceeding one suggests a Canadian cost advantage. Its constancy throughout the period indicates that asymmetric reductions in tariff barriers were offset by changes in relative costs.

Can we attribute the decline in border effects to FTA tariff reductions? To investigate this question, we decompose the border effects as follows:

$$b \equiv t^{s-1} = \left((1+NTB)(1+TAR)\right)^{s-1}, \tag{18}$$

where *TAR* and *NTB* represent the *ad valorem* rates of tariffs and non-tariff barriers. Non-tariff barriers in this paper include government policies as well as transportation costs and any other source of bias in favour of domestically produced goods. Denoting industries with *i* and years with *t*, note that we observe TAR_{it} but must infer NTB_{it} as a residual. We assume that $(\sigma - 1)\ln(1+NTB_{it})$ can be approximated as $(\sigma - 1)\ln(1+NTB_{it}) + \varepsilon_{it}$ where ε_{it}, is an error term. Substituting, we obtain a log-linear regression equation:

$$\mathrm{1n}(b_{it}) = (s-1)\mathrm{1n}\left(1+\overline{NTB_t}\right) + (s-1)\mathrm{1n}(1+TAR_{it}) + \in_{it}. \tag{19}$$

We estimate the first term with year dummies. This formulation imposes the restrictive assumption that all industries share a common elasticity of substitution. However, it allows us to estimate that value and use it to infer a value for the average non-tariff barrier in each year. Other authors have estimated overall border effects [McCallum (1995), Helliwell (1996), and Wei (1996)] but have not been able to carry out such a decomposition. Note that almost any border effect can be obtained from tiny tariff barriers if the elasticity of substitution, σ, is high enough.

Tariffs (*TAR*) are measured as follows. Lester and Morehen (1987) calculated industry-level tariffs for Canada and the United States. We created a single tariff to reflect the average protectionist tendency of each industry. It weights the tariffs of the United States and Canada by the respective shares of their exports in bilateral trade in the industry. Thus, if most trade flows from Canada to the United States, then the American tariff is given greater weight in the average. The trade-weighted average tariff (*TAR*) is highly correlated (0.88) with both country's tariffs.

Column (1) of Table 1 presents results for OLS estimation whereas column (2) reflects results when we add industry fixed effects. The coefficient on the tariff variable implies that the elasticity of substitution between goods, σ, ranges between 11.4 and 7.9, with OLS generating the higher estimate. The OLS estimate will be upwardly biased if there is a positive correlation between tariff levels and time-invariant, unmeasured characteristics of industries that raise b_t. One the other hand, any measurement error will be exacerbated in fixed-effect estimation leading to downward bias in the fixed-effect estimation. These estimates of σ are within the range suggested by other research.[9] The year dummies indicate that non-tariff barriers have fallen steadily over the period. The coefficients for the year effects can be re-expressed in terms of average levels of non-tariff barriers in tariff equivalent terms. According to the fixed-effect regressions where these barriers are highest in 1990, column (3) shows non-tariff barriers to be 52% in 1990 and decreasing to 45% by 1995. The OLS estimates put these values at 30% and 27%.

Figure 3
Quartiles for Industry-Level Border Effects, 1990–95

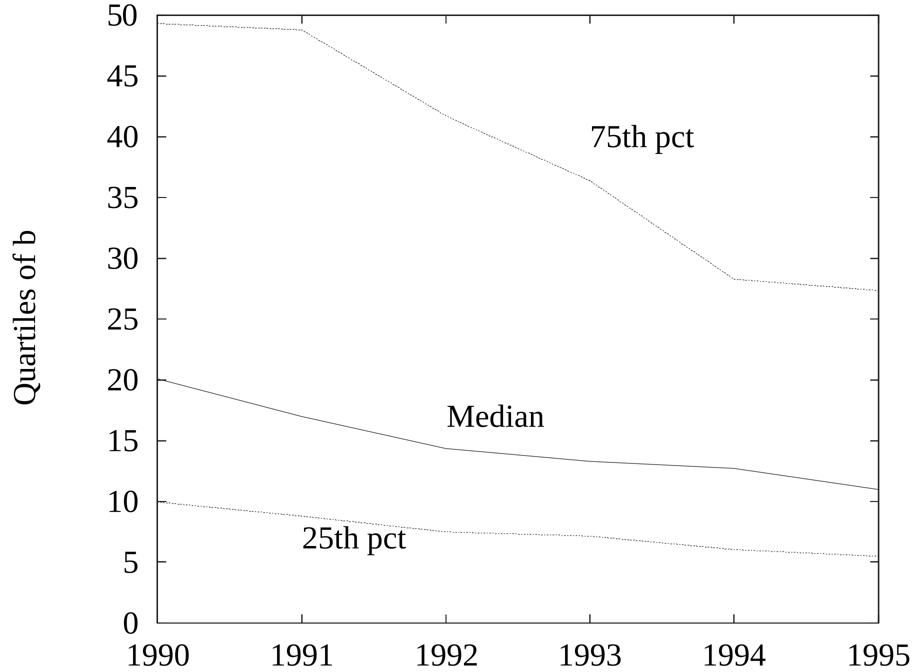


Figure 4
Border Effects for Canada's Manufacturing Sector, 1970–95

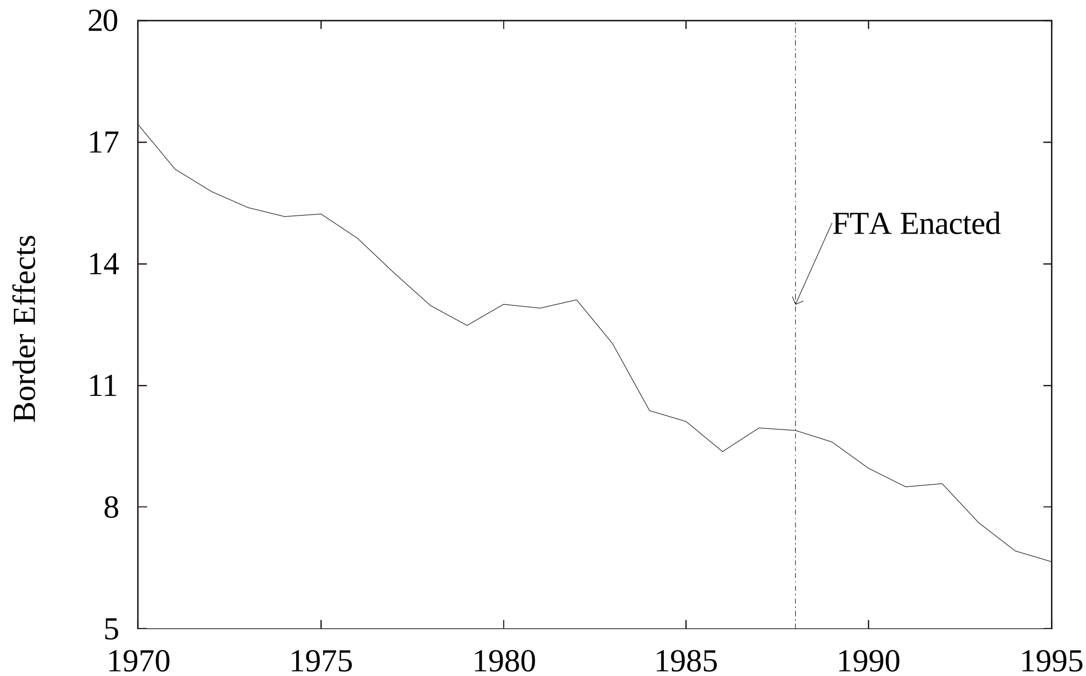


Table 1
Decomposing Changes in Trade Costs into Tariff and Non-Tariff Effects

	Dependent Variable: ln Border Effect, ln (b)			
	(1: OLS)	(2: FE)	(3: OLS NTB_t)	(4: FE NTB_t)
Ln 1 + Tariff	10.409[a]	6.882[a]		
	(1.916)	(1.532)		
Intercept (1990)	2.742[a]	2.883[a]	30.1%	52.0%
	(0.139)	(0.070)		
1991	-0.074	-0.082[b]	29.2%	50.2%
	(0.159)	(0.040)		
1992	-0.123	-0.156[a]	28.6%	48.6%
	(0.161)	(0.044)		
1993	-0.166	-0.240[a]	28.1%	46.8%
	(0.164)	(0.050)		
1994	-0.212	-0.30[a]	27.5%	45.5%
	(0.167)	(0.056)		
1995	-0.242	-0.335[a]	27.1%	44.8%
	(0.169)	(0.061)		
N	615	615		
R^2	0.073	0.387		
RMSE	1.133	.275		

Note: Standard errors in parentheses with [a] and [b] denoting significance at the 1% and 5% level. Column (1) reports OLS regressions and column (2) reports industry fixed-effect regressions. Columns (3) and (4) convert the year dummies from columns (1) and (2) into tariff equivalents.

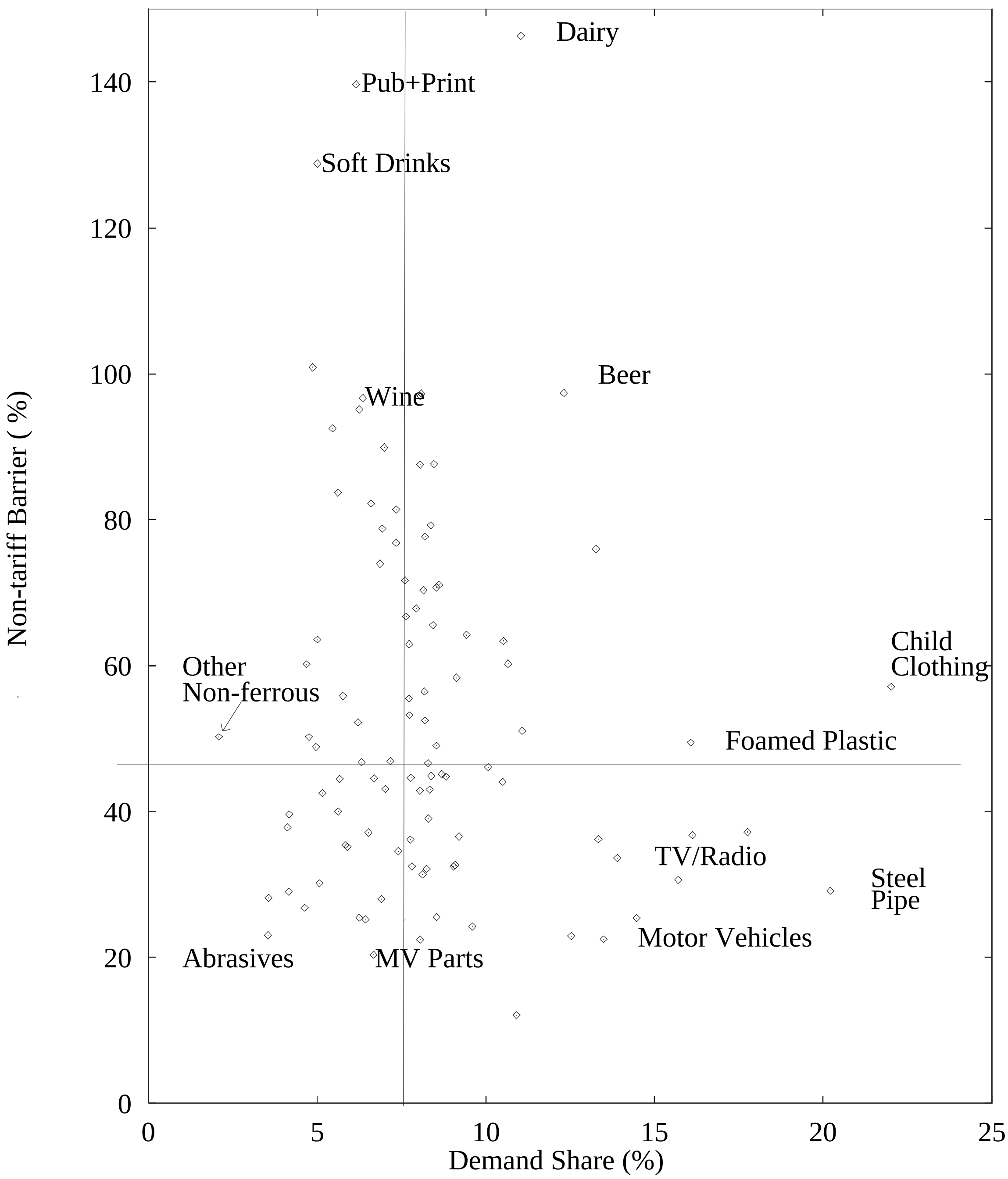
The results strongly suggest that non-tariff barriers vary substantially across industries in our sample. This is evident from the statistical significance of the fixed effects and the substantial reduction in the standard error of the regression (RMSE). Tariff reductions will have small overall effects for industries with high non-tariff barriers. Moreover, our theory indicates that the effect of tariff reductions depends on the magnitude of the industry's demand advantage or disadvantage.

Figure 5 identifies the industries most likely to experience the greatest impact from trade liberalization: i.e., those with low non-tariff barriers and either high or low demand shares (*shr*(*E*)). The horizontal axis shows *shr(E)* and the vertical axis, industry-specific non-tariff barriers. We calculate the latter variable based on the decomposition described in equation 18 and the elasticity of substitution of 6.88 estimated in column (2) of Table 1.[10] The figure is divided into quadrants based on the median values of the variable on each axis. High non-tariff barriers exist for dairy, publishing and printing, and soft drinks. Candidate industries to be strongly affected by tariff reductions are steel pipe, with a high demand share and low non-tariff barriers, and abrasives, which has a low demand share and low non-tariff barriers.

The results of the analysis in this subsection provide the following insights:

1. The fairly high elasticity of substitution implies that consumers are willing to substitute locally produced goods for foreign ones and translate generally small tariff barriers into significant impediments to trade.
2. Non-tariff barriers appear to raise the costs of imports by roughly one-third to one-half but have fallen over the post-FTA period.
3. There are few industries with low non-tariff barriers and differences in relative demand that would make them likely candidates to be strongly affected by tariff reductions.

Figure 5
Border Costs and Demand Shares



Trends in North American Manufacturing

We now examine the consistency of the Krugman and Armington models with aggregate statistics of the manufacturing sector. The Helpman-Krugman (1985) version of the Krugman model suggests the share of manufacturing shipments of the small country will be less than its share of manufacturing demand. Thus, the small country will be a net importer. Overall balance in trade and full employment are maintained in the model through an expansion in production and exports of a homogeneous, constant returns to scale (CRS) sector, such as agriculture. In the Krugman and Weder models, reallocation from manufacturing does not occur because of wage reductions in the small country that maintain balanced trade in manufactured goods. The Armington model provides a mechanism to allow the small country's share of manufacturing shipments to exceed its share of demand, generating a manufacturing trade surplus. However, exchange rate adjustments may occur to restore balanced trade.

Figure 6 presents Canada's share of GNP as well as its share of manufacturing demand and shipments over the period 1970 to 1995. It reveals that shipment shares are sensitive to changes in shares of demand and GNP. The shares are similar to one another over time with a gap between the share of shipments and demand emerging at the end of the period. Since Canada's share of demand of manufactures is between .07 and 0.1, the Helpman-Krugman model which posits a non-manufacturing, constant-returns, homogeneous goods sector would predict a Canadian trade deficit in manufacturing. However, the figure indicates the opposite: Canada's share of shipments generally exceeds its share of demand.

In fact, Figure 7 reveals that Canada has run a trade surplus in manufactures with the United States for more than a decade. As a percentage of total bilateral trade, the surplus is slightly higher than it was in 1970 and about the same as it was immediately preceding the FTA. Canada does run a substantial trade deficit in manufactures with the rest of the world. However, since about 80% of its manufacturing trade is with the United States, this results in approximately balanced trade with the world. Thus, the data clearly reject the Helpman-Krugman prediction of a small country deficit in manufacturing. The large bilateral surplus is inconsistent with any model which assumes balanced trade. Consideration of influences outside the model can help us understand the merchandise trade surplus. As a debtor nation, Canada runs a deficit in its service account. Unless capital account surpluses support a current account deficit, surpluses are necessary in other parts of the current account to maintain balance of payments equilibrium.

Not surprisingly, given its resource endowments, Canada runs a trade surplus with respect to the United States and the world in non-manufactured goods such as crude oil and wheat. During the eight years since the signing of the FTA, non-manufactured goods represented an average of 16% of its exports to the U.S and 19% of its multilateral exports. Both shares are noticeably *smaller* than they were prior to the FTA. Between 1980 and 1988, non-manufactures accounted for 19% and 25%, respectively, of Canada's exports to the United States and the world.

Figure 6
Canada's Share of North American Manufacturing Demand and Shipments

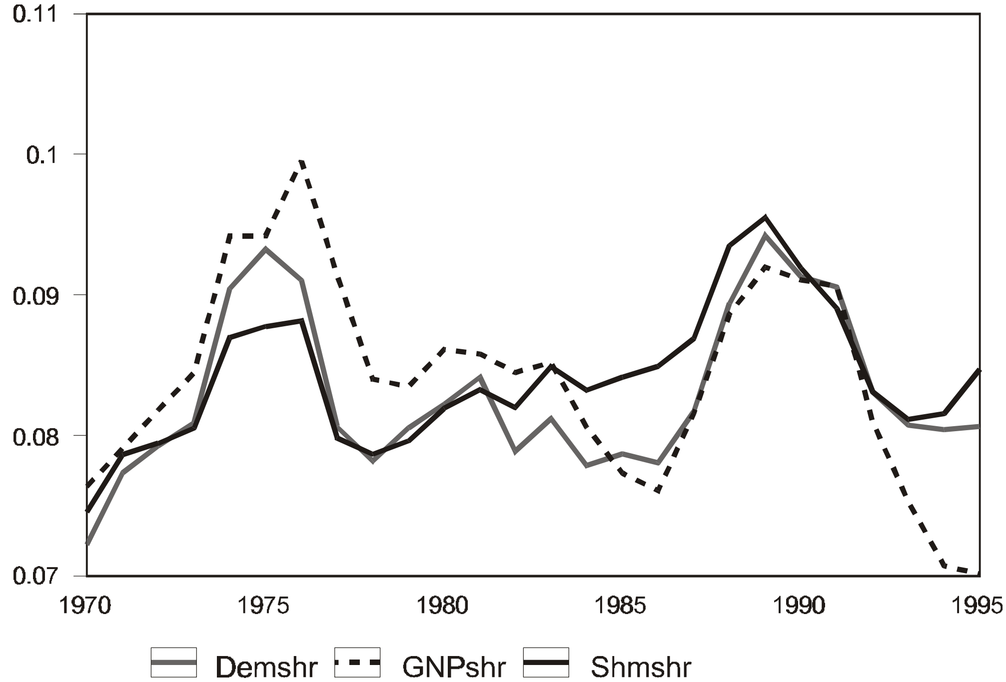
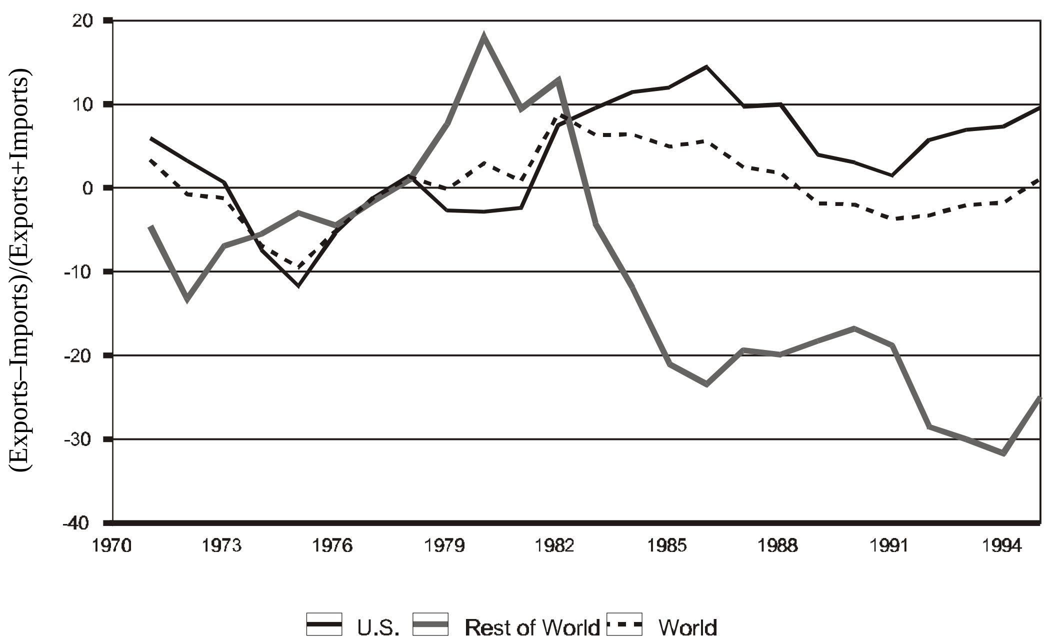


Figure 7
Canadian Trade Balances in the Manufacturing Sector



Since Canada has been running a trade surplus in manufactured goods with the United States, the Helpman-Krugman version of the Krugman model does not seem to be valid in the case of this bilateral relationship. Rather, the data are more consistent with the Armington model. However, looking at the aggregate manufacturing trade balance is not an adequate test of the Krugman and Armington models since both can be generalized to allow exchange rates to adjust to generate any required trade balance.

Regression Analysis of Canada's Share of the North American Market

The central difference between the Armington and Krugman models regards the slope of the line relating the share of production and the share of demand. Examination of 3-digit SIC industry data for Canada and the United States allows us to evaluate the relationship between the share of shipments, $shr(V)$ and the share of demand $shr(E)$. We now restate the linear relationships predicted by the Krugman and Armington models.

- Krugman: monopolistic competition and increasing returns

$$shr(V) = \frac{a(b^2 - 1)}{(b-a)(ab-1)} shr(E) - \frac{1}{ab-1}.$$

- Armington: perfect competition and constant returns

$$shr(V) = \frac{a(b^2 - 1)}{(a+b)(ab+1)} shr(E) + \frac{a}{a+b}.$$

Where $shr(V)$ is Canada's share of production, $shr(E)$ is Canada's share of demand, b reflects barriers to trade, and a indicates relative production costs. In each case, there is a linear relationship between $shr(V)$ and shr(E). Moreover, the slope and intercept of each specification are functions of cost differences (comparative advantage) and border effects (tariffs):

$$shr(V) = \mathbf{a}(a,b) + \mathbf{b}(a,b) shr(E). \qquad (20)$$

As described in the previous section, the two specifications generate disparate predictions about the slope of the demand share and how the slope and intercept are affected by tariffs. Cost reductions have similar effects in the two models. These predictions are summarized in Table 2.

As indicated, in the Krugman monopolistic competition model, the intercept of this line is negative but a country's share of production rises more than one-for-one with increases in its share of demand. However, in the constant returns, Armington model, the relationship is less than one-for-one and the intercept is positive. In the Krugman model, the slope falls with an increase in b. The opposite occurs in the Armington model. Moreover, the effect of tariffs on the intercept is opposite in the two models. As tariffs become very large, both models predict that production shares will equal demand shares (i.e. both models have the 45 degree line as a limiting value). Both models also predict that lower relative costs raise the output share.

Table 2
Comparison of Two Models' Predictions

Model:	**Krugman**	**Armington**
a (intercept)	< 0	> 0
b (slope)	> 1	< 1
Rise in Trade Barriers:		
¶ *a* / ¶ *b*	+	–
¶ *b* / ¶ *b*	–	+
Decline in Domestic Costs:		
¶shr(*v*) / ¶ *a*	+	+

Tariffs affect the slope of this line differently depending on the model. Table 2 summarizes the different predictions the models generate about this basic specification. As indicated in the table, the slope differs for each model as does the interaction between the tariff level and the slope and intercept. In this section, we test these predictions using our six-year panel of 107 3-digit industries.

Before we proceed with the formal regression analysis, note that the large values of *b* calculated in the previous section indicate that the slope of the line relating output shares and demand shares should be fairly close to one. Over the period of study, the median level of *b* ranges from 20 in 1990 to 11 in 1995. In the case of the Krugman model and no cost differences, the slope equals $(b + 1) / (b – 1)$. Using our estimates of *b*, we calculate the slope for the average industry to be 1.24. In the case of the Armington model and no cost differences, the slope is the reciprocal: $(b – 1) / (b + 1)$. Thus, our estimates of *b* imply slopes of 0.8 for the average industry.

The regressions identify relationships based on two sources of variation in our data: variation across industries ("between" variation) and time series variation ("within" variation). "Between" estimation reduces the observations to one per industry by computing average values across time for each industry. We use industry fixed effects for the estimation based on "within" variation. In the case of the "within" estimation, we add year dummies to capture changes in the macroeconomic environment that have a common influence on industries. These dummies will also reflect changes common to all industries that are caused by trade liberalization, such as a changes in relative costs due to exchange rate adjustment. The related work of Davis and Weinstein (1996, 1998*a*, *b*) and Weder (1997) employ cross-sectional information, thus "within" estimates are unique to this study. We chose not to estimate using ordinary least squares and random effects, both of which generate estimates based on both "between" and "within" variation (the techniques weight this information differently).

We begin by reporting the basic bivariate regression results relating production shares to demand shares. In addition to shipments as a measure of output, we also consider employment and value added in our first set of results. As discussed in the previous section, we subtract exports to the rest of the world from shipments to derive a measure of shipments destined for the North American market. Unfortunately, since exports are not measured in employment or value added terms, we cannot do this adjustment for these two measures of output. Thus, we will focus on the shipment share variable and consider employment and value added only in the bivariate regressions as a robustness check. Table 3 shows that the results for all three variables are extremely sensitive to the source of variation used for identifying the coefficients. The first three columns display the "between" results and the second three columns the "within" results. The "between" estimate yield slopes of 1.113, 0.993, and 1.128 for the share of shipments, value added, and employment, respectively, as the dependent variable. The intercept estimate in the "between" regression is negative in two of the three cases. Thus, the "between" results are generally consistent with the Krugman model, which predicts a slope exceeding one and a negative intercept. The slope estimates, however, are not significantly greater than one (the highest *t*-statistic for the hypothesis that the estimate exceeds one is 1.66 in the case of the shipment share) and the intercept estimates not significantly different from zero. Moreover, the slope estimate is lower then the 1.24 we expected under the Krugman model based on our estimates of *b*.

The "within" regression, however, yields estimates which are precisely reversed from the "between" estimates and support the Armington model: the intercept is positive and the slope less than one in all cases. In the case of shipments as the dependent variable, the slope is estimated to equal 0.76, which is line with what we expected based on our estimates of *b* in the case of Armington trade. The slope estimate is much lower for value added and employment as the dependent variable. The significance level of the fixed-effect regression estimates are higher than those of the "between" regressions, largely due to the greater number of observations in the former.

There are a number of reasons to interpret the estimated coefficients with caution. Concordance errors can cause output shares to be correlated with expenditure shares. Since expenditure shares are calculated directly from shipment shares, to the extent concordance overstates Canada's shipments, it will also overstate its share of expenditures. Thus, the "between" estimates could be positively biased. This source of bias is less important for the fixed effect estimation, which is based on variation within each industry. However, there are two potential sources of bias in the fixed-effect estimates. First, as stated earlier, the "within" estimation exacerbates measurement errors leading to downward bias. On the other hand, an industry-specific positive shock to production will also give rise to a positive change in expenditure share due to the construction of the data. The bottom line is that we should be careful to infer too much from the regression results presented in Table 3.

Table 3
Production Shares and Demand Shares

Model: **Dependant variable:**	**(1)** **shr(V)**	**(2)** **shr(VA)**	**(3)** **shr(emp)**	**(4)** **shr(V)**	**(5)** **shr(VA)**	**(6)** **shr(emp)**
Interpcept	-0.009	-0.006	0.004	0.023[a]	0.035[a]	0.081[a]
	(0.007)	(0.009)	(0.010)	(0.002)	(0.004)	(0.003)
shr(E)	1.113[a]	0.993[a]	1.128[a]	0.755[a]	0.559[a]	0.273[a]
	(0.068)	(0.088)	(0.108)	(0.022)	(0.036)	(0.032)
1995				-0.001	-0.006[a]	-0.006[a]
				(0.001)	(0.001)	(0.001)
N	107	107	107	626	626	626
R^2	0.718	0.547	0.511	0.793	0.51	0.304
RMSE	.028	.036	.044	.006	.009	.008

Note: Standard error in parentheses with [a] denoting significance at the 1% level. Columns (1)-(3) report "between" results and columns (4)-(6) report industry fixed-effect results.

We can subject the models to more demanding tests by considering how tariff levels influence the slope of the equation. As shown in Figure 1, these have opposite effects in each model. To assess the influence of tariffs, we divide the sample into high and low tariff industries as well as interact tariff levels with demand. The first three columns of Table 4 present "between" results and the second three columns show "within" results. In columns (1) and (2) and columns (4) and (5), the sample is split at the median tariff level in the six-year panel data set. As before, the results reveal that the "between" results support the Krugman model and the within results support the Armington model. In the "between" regression, low tariff industries have a larger slope coefficient than high tariff industries (1.165 versus 0.931). On the other hand, the slope estimate based on "within" variation is higher for high tariff industries than low tariff industries (0.946 versus 0.578). Columns (3) and (6) show results when we add the tariff level and a tariff-demand interaction variable. While the interaction assumes that tariffs have a linear effect on the slope whereas the model indicates a nonlinear effect, it allows us the test whether tariffs have a significant influence on the slope of the demand share. The interaction variable has the signs we would expect based on the results when we split the sample. In the case of the "between" estimates, the tariff level enters positively while the interaction variable is negative. For the within estimates, tariffs have a negative sign and the interaction is positive. Thus, again the results of each estimation technique accord with one model or the other. Significant tariff effects, however, are only obtained for the "within" estimates.

Overall, the results of our tests of the models are highly sensitive to whether the estimation is based on "between" or "within" variation, and thus appear inconclusive. Recall that the Armington predictions for the slope are equivalent to those of the Krugman model when the number of firms is fixed. Thus, these seemingly opposite results can be reconciled if the "between" estimates reflect a long-run equilibrium and the "within" results reflect what happens to the output share when demand changes in the short-run while the number of firms remains fixed. When interpreted this way, the results support the new trade model but the adjustment to the long-run equilibrium is not immediate.

Our next set of regressions incorporate comparative advantage considerations. Theory predicts that under both the Krugman model and the Armington model, a cost advantage will raise a country's share of output. It is possible that ignoring potential cost differences may bias the slope obtained in the "between" regression. Our models assume that the expenditure share is exogenous, which would be the case when the upper tier utility function is Cobb-Douglas. However, there may be features of industries that cause both shipments and demand to be high or low. One case where this may occur is when factor prices vary across countries and factor intensities vary across industries. Low prices for factors used intensively in the production of an industry's goods may translate to high output and high demand. Whether or not expenditures on an industry's goods rise when prices are low depends on the price elasticity of demand — if the elasticity exceeds one, expenditures will rise with a fall in prices. In this case, there may be a positive relationship between output and expenditures that arises due to endogeneity. In Table 5, we examine the robustness of our results to differences in factor abundance.

We begin by postulating that the distribution of factor endowments in North America determines the distribution of output shares for 2-digit SIC industries. Given that distribution, deviations of 3-digit industry shares from the 2-digit shares are explained by deviations of demand shares from the 2-digit share as well as tariff levels.[12] The first two columns of Table 5 portray "between" results when we reconstruct the output share and demand share variables as deviations. The results displayed in these columns reveal that the slope is robust to this new calculation of output share and demand share. In the bivariate regression, the slope equals 1.105, which is insignificantly different from the 1.113 estimate shown in Table 3. Likewise, column (2) results mirror those in the corresponding regression (column (3) in Table 4): higher demand shares raise shipment shares more than proportionately but tariffs moderate this effect. These results indicate that our previous results are not simply an artifact of correlation between demand shares and unobserved factor endowments at the 2-digit SIC level.

Table 4
Tariffs and the Production-Demand Share Relationship

	Dependent Variable: Shipments Share, shr(V)					
Model:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Tariffs:	**High**	**Low**		**High**	**Low**	
Intercept	0.000	-0.011	-0.015	-0.001	0.043[a]	0.026[a]
	(0.005)	(0.008)	(0.009)	(0.002)	(0.004)	(0.003)
shr(E)	0.931[a]	1.165[a]	1.253[a]	0.946[a]	0.578[a]	0.716[a]
	(0.045)	(0.085)	(0.097)	(0.019)	(0.043)	(0.024)
TAR			0.158			-0.115[b]
			(0.257)			(0.050)
shr(E) ∗ TAR			-4.543[c]			1.233[a]
			(2.484)			(0.356)
1995				0.000	-0.002	-0.001
				(0.001)	(0.002)	(0.001)
N	84	85	107	310	316	626
R^2	0.837	0.691	0.741	0.945	0.578	0.798
RMSE	.016	.031	.027	.003	.007	.006

Note: Standard error in parentheses with [a], [b], and [c] denoting significance at the 1%, 5%, and 10% level. Columns (1)-(3) report "between" results and columns (4)-(6) report industry fixed-effect results. "High" corresponds to industries with tariffs exceeding 2%.

Table 5
Factor Abundance and the Production-Demand Share Relationship

	Dependent Variable: Shipments Share, shr(V)			
Model:	**(1)**	**(2)**	**(3)**	**(4)**
Intercept	-0.004	-0.003	-0.012[c]	-0.016[c]
	(0.003)	(0.004)	(0.007)	(0.009)
shr(E)	1.105[a]	1.218[a]	1.096[a]	1.224[a]
	(0.065)	(0.096)	(0.067)	(0.098)
shr(E) ∗ TAR		-3.837		-4.023
		(2.503)		(2.485)
TAR		-0.034		0.148
		(0.110)		(0.255)
Resource Intensity			0.044[b]	0.032
			(0.019)	(0.019)
N	107	107	107	107
R^2	0.736	0.744	0.731	0.748
RMSE	.025	.025	.027	.027

Note: Standard error in parentheses with [a], [b], and [c] denoting significance at the 1%, 5%, and 10% level. Columns (1) and (2) express *shr*(V) and *shr*(E) as deviations from the 2-digit industry shares. All coefficients are "between" estimates.

The last two columns of the Table 5 add a measure of Canada's cost advantage, natural resource intensity. This variable is the share of natural resource (forestry, fishing, agriculture, mining, and energy) inputs in production.[13] We assume that Canada has a comparative advantage in industries that use natural resources intensively. Thus, this variable should have a positive effect on Canada's shipments share.[14] Column (3) indicates that this variable does have a positive effect in the "between" regression and it is significant at the 5% level. The intercept is estimated to be negative and significant at the 10% level in this specification. When we add tariffs and tariffs interacted with the expenditure share, column (4) reveals that the addition of a natural-resource intensity advantage has little effect on the coefficients estimated in the absence of this variable. Overall, the results contained in Table 5 indicate that incorporating comparative advantage considerations does not affect the signs and significance of the estimates obtained from the previous regressions.

The results thus far cannot support one model or the other conclusively. The "between" estimates yield a slope greater than one whereas the slope is less than one when we look at variation within industries. Likewise, tariffs interact with the slope in opposite ways depending on the estimation technique. Incorporating comparative advantage considerations do not alter the slope estimates in the "between" regressions. Further tests to discriminate between the models are required. One such test is to look explicitly at the effects of tariff reductions across industries with high and low demand. In the Krugman model, a demand advantage allows a country to be a net exporter whereas high demand implies net imports in the case of Armington preferences and constant returns. In either model, tariff reductions will benefit net export industries. This suggests a simple test: under Krugman, high demand share industries should benefit from the FTA, whereas low demand industries should benefit under Armington.

Table 6
Change in Production Shares, 1990–95

Resource Intensity:		***Low***		***High***	
Tariff Reduction:		***Low***	***High***	***Low***	***High***
Demand Share:	***Low***	0.001 (18)	0.002 (16)	0.003 (9)	0.009 (8)
	High	-0.001 (8)	-0.003 (24)	-0.006 (15)	0.005 (3)

Table 6 examines changes in output shares for 101 industries between 1990 and 1995. The industries are separated into eight groups based on demand share, natural resource intensity, and level of tariff reduction. We classified the industries to obtain an equal number of high and low demand industries based on the average expenditure share of each industry over the six-year period. We also generated an equal number of industries with high and low liberalization according to the change in tariff level over the period. There is a natural break in the natural resource intensity variable — no industries have intensities between 4.6% and 11.5%. Thus, we designated the 35 industries with natural resource intensities exceeding 11.5% as high natural resource industries and the remaining 66 as low natural resource industries. Each of the eight groups shown in Table 6 has a unique combination of attributes along the three dimensions. For example, high demand, high liberalization, and high natural resource intensity industries form one group. Each cell in the table lists the number of industries in a group (indicated by parentheses) and the average change in output share expressed as the deviation from the average across all industries.

Over the period, Canada's output share fell from 0.097 to 0.083, a decline of 0.014. This decline is largely attributable to the 15% devaluation of the Canadian dollar over the period, which makes Canadian output shares fall when expressed in U.S. dollars. The table reveals that changes in output shares from 1990 to 1995 does not vary significantly across groups. The largest deviation from the average was 0.009 and none of the differences between the groups is significantly different from zero. Nonetheless, the data exhibit some interesting patterns. The first row of data reveals that all low demand share industries have higher than average changes in output share. In contrast, the second row shows that three of the four groupings of high demand share industries have less than average changes in output. Also, natural resource industries, displayed in the last two columns, fared better than the others: in three of four cases the deviation was positive, being negative only in the case of high demand shares with low liberalization. Table 6 also reveals reasonable results regarding the extent of liberalization; high liberalization benefited industry types that did best overall — high natural resource and low demand share.

Table 7 identifies the industries that fall into each industry group and their corresponding change in output share from 1990 to 1995, expressed as deviations from the overall mean. The group that did best — low demand, high natural resource intensity industries with high liberalization — includes vegetable oil mills, paper, and tobacco. Those that did worst — high demand, low natural resource intensity industries with high liberalization — include plastic pipe, various clothing, and various electrical industries. Note that this group would have done even worse on average if it did not include the tire and tube industry, which enjoyed a relative rise in output share of 0.091, nearly double the performance of the next strongest industry. While the lack of statistical significance on performance between groups tempers the conclusions that we are able to draw from this exercise, the results indicating that low demand share industries performed better than high demand industries favours the Armington model over the Krugman model. In addition, standard comparative advantage effects are evident — trade liberalization was relatively beneficial to natural resource intensive industries in Canada.

Overall, our examination of the differential effects of the FTA across industries offers limited conclusions. The bulk of the evidence indicates that the prediction of the Krugman model — that a large market confers an advantage in export markets that is reinforced by trade liberalization — is not borne out. Rather, small demand industries tended to do better than large ones, a result consistent with our Armington model. In addition, the industries that make intensive use of Canada's abundant natural resources and which had higher than average tariff reductions enjoyed relative growth.

Table 7
Changes in Production Shares, 1990-95
Industries Organized by Demand, Resource Intensity, and Magnitude of Tariff Reduction

SIC	Name	Change	SIC	Name	Change
	Low Demand Shares			**High Demand Shares**	
Low Resource Intensity, Low Tariff Reduction.			*Low Resource Intensity, Low Tariff Reduction*		
3970	Sign and Display	-0.037	3330	Electric Lighting	-0.031
3920	Jewellery and Precious Metals	-0.031	2820	Platemaking, Typesetting	-0.023
3240	Truck and Bus Bodies and Trailers	-0.013	1120	Distillery Products	-0.022
2640	Office Furniture	-0.008	3040	Stamped, Pressed and Coated Metal	-0.011
1920	Carpets, Mats and Rugs	-0.007	3190	Other Machinery and Equipment	0.010
2840	Combined Publishing and Printing	-0.006	3720	Agricultural Chemicals	0.018
3740	Pharmaceuticals and Medicines	-0.004	1130	Brewery Products	0.024
2810	Commercial Printing	0.000	3230	Motor Vehicle	0.026
3710	Industrial Chemicals	0.000	*Low Resource Intensity, High Tariff Reduction*		
3050	Wire and Wire Products	0.003	1010	Meat and Poultry Products	-0.002
1140	Wine	0.003	1020	Fish Products	-0.035
3250	Motor Vehicle Parts and Accessories	0.005	1040	Dairy Products	-0.004
1110	Soft Drinks	0.010	1050	Flour, Prepared Cereal Foods	-0.001
3910	Scientific and Professional Equipment	0.013	1070	Bakery Products	-0.007
3110	Agricultural Implements	0.017	2510	Sawmill, Planing Mill and Shingles	0.019
3120	Commercial Refrigeration	0.019	2520	Veneer and Plywood	0.003
3210	Aircraft and Aircraft Parts	0.021	2540	Sash, Door and Other Millwork	-0.038
3360	Business Machines	0.032	2910	Primary Steel	0.020
Low Resource Intensity, High Tariff Reduction			2920	Steel Pipes and Tubes	-0.001
2720	Asphalt Roofing	-0.017	2960	Aluminum Rolling, Casting	0.017
3540	Concrete Products	-0.010	3520	Hydraulic Cement	-0.041
2560	Wooden Boxes and Pallets	-0.005	3580	Lime	-0.012
3570	Abrasives	0.002	3590	Other Non-Metallic Minerals	-0.026
2990	Other Rolled, Cast and Extrude	0.003	3690	Other Petroleum and Coal Products	0.025
3610	Refined Petroleum Products	0.010	*High Resource Intensity, Low Tariff Reduction*		
2970	Copper and Copper Alloy Rolling	0.013	1620	Plastic Pipes and Pipe Fittings	-0.050
2710	Pulp and Paper	0.015	3340	Radios and Televisions	-0.032
2590	Other Wood Products	0.022	3270	Shipbuilding and Repair	-0.030
High Resource Intensity, Low Tariff Reduction			2490	Other Clothing and Apparel	-0.026
3030	Ornamental and Architectural	-0.016	3310	Small Electrical Appliances	-0.023
2610	Household Furniture	-0.013	3070	Heating Equipment	-0.021
3020	Fabricated Structural Metal	-0.012	3380	Communications and Energy Wires	-0.020
2440	Women's Clothing	-0.012	3370	Electrical Industrial Equipment	-0.014
1990	Other Textile Products	-0.007	3260	Railroad Rolling Stock	-0.012
1630	Plastic Film and Sheeting	-0.006	2430	Men's and Boys' Clothing	-0.009
2690	Other Furniture and Fixtures	-0.006	3990	Other Manufactured Products	-0.008
1820	Spun Yarn and Woven Cloth	0.001	3750	Paint and Varnish	-0.008
1690	Other Plastic Products	0.002	3320	Major Appliances (Electrical)	-0.005
3770	Toilet Preparations	0.002	1710	Leather and Allied Products	-0.004
3760	Soap and Cleaning Compounds	0.006	1830	Broad Knitted Fabrics	-0.002
1610	Foamed and Expanded Plastics	0.007	2450	Children's Clothing	-0.002
3060	Hardware, Tool and Cutlery	0.007	3090	Other Metal Fabricating	-0.002
1910	Natural Fibres Processing	0.013	3790	Other Chemical Products	0.008
1810	Man-Made Fibre and Filaments	0.030	1930	Canvas and Related Products	0.011
3010	Power Boiler and Heat Exchange	0.033	1590	Other Rubber Products	0.014
High Resource Intensity, High Tariff Reduction			3730	Plastic and Synthetic Resins	0.017
3510	Clay Products	-0.009	3930	Sporting Goods and Toys	0.024
3560	Glass and Glass Products	-0.008	1520	Rubber Hose and Belting	0.034
1030	Fruits and Vegetables	0.000	1510	Tire and Tube	0.091
1210	Leaf Tobacco	0.001	*High Resource Intensity, High Tariff Reduction*		
2730	Paper Boxes and Bags	0.006	2940	Iron Foundries	-0.011
2790	Other Converted Paper Products	0.011	1080	Sugar and Sugar Confectionery	0.012
1220	Tobacco Products	0.018	1090	Other Food Products	0.014
1060	Vegetable Oil Mills	0.049			

CONCLUSION

The paper has investigated the impact of the Canada–United States Free Trade Agreement on North American manufacturing. We observe in the data that border costs that encourage a consumer to purchase local goods have fallen throughout the post-FTA period. However, these declines are part of a long-term reduction in border costs and an increasingly integrated North American market for manufactures. We show, however, that non-tariff barriers remain high, particular in certain industries. Our estimates put average NTBs (including transport costs) at 27% to 45%, on average, in 1995. They exceed 80% in many industries. The lack of full integration of North American markets for manufactured goods limits the impact that tariff reductions can have on industries.

The two theoretical models we consider make opposing predictions about the relationship between an industry's share of demand and its share of output. In the Krugman model, industries with relatively large home demand run a trade surplus which is expanded by tariff reductions. In the Armington model, trade liberalization expands the output share of small demand industries by giving them better access to foreign markets. Our results are not clearcut but tend to support the latter hypothesis: tariff reductions increased the share of production of Canadian industries with a relatively low share of demand. Moreover, we find some evidence that standard comparative advantage effects are at work: performance in terms of output shares tended to be better for liberalized, natural resource intensive industries over the 1990–95 period covered by the study.

Can small-country manufacturing survive trade liberalization? The evidence examined in this paper suggests the answer is yes. First, Canada continues to be a net exporter of manufactures to the United States, and primary products now account for a smaller share of total exports than they did before the FTA was enacted. Second, trade barriers other than tariffs still insulate Canadian firms significantly from import competition. Third, the home-market size effects that could, in theory, lead to the demise of Canada's manufacturing sector appear to be small or non-existent in practice.

NOTES

1 Part of the analysis presented in this paper is contained in Head and Ries (1998).

2 Our derivation of the linear result for Krugman's model closely follows the derivation in Helpman and Krugman (1985).

3 Expenditures are exogenous if the consumer spends a fixed share of income on each industry's goods (as would be the case if the upper-level utility function is Cobb-Douglas).

4 Producers assume their pricing decisions do not affect aggregate prices, which may be the case when the number of firms is large. With a small number of firms, it is likely that firms will realize that their pricing will affect overall prices. This would encourage them to price less aggressively and reduce their output.

5 Note that the more consumers are willing to substitute across varieties (high _), the greater the impact of cost differences and trade impediments on market shares.

6 This is a restrictive assumption since it appears to rule out both multi-product and multi-national enterprises. An alternative interpretation would be that each business unit maximizes its own profits without taking into account the effects of its pricing decisions on other units owned by the same parent company.

7 Thus, we have derived a relationship between production and demand that is similar to the formulation employed by Davis and Weinstein (1996, 1998*a*, *b*). Helpman and Krugman (1985) obtain a similar result except that they assume the use of a single factor, equal wages and labour productivities in the two countries (which implies $a = 1$), identical preferences, and they use a parameter p equal to the reciprocal of our b.

8 These data are graphically depicted on their Industry Canada’s Strategis website.

9 Hummels (1998) calculates _ equal to 7.6 using information on how freight cost differences affect trade. Using a methodology based on geographic variation in wages, Hanson (1998) obtained estimates of _ that ranged between 6 and 11. Eaton and Kortum (1998) estimate a model based on technology differences but obtain a value of 8.3 for a parameter that is observationally equivalent to our _.

10 The fixed effects from column (2) indicate what ln (b) would be in the absence of tariffs and temporary shocks. The ad valorem equivalent of the NTB is given by dividing by _ - 1 = 6.88, exponentiating, and subtracting one.

11 One source of declining non-tariff barriers would be the dispute resolution procedures introduced as part of the FTA. These were designed to reduce the likelihood of arbitrary rulings on anti-dumping and countervailing duties.

12 We employ this specification in part because of its similarity to the approach taken in the papers cited above by Davis and Weinstein. In each of these papers, differences with respect to a more aggregated industry are analyzed.

13 This variable is derived from input-output matrix information available at the 2-digit SIC level in Statistics Canada Cat. No. 15-201.

14 Weinstein and Davis (1998*b*) add a vector of factors to control for factor abundance.

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