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ECONOMIC IMPACTS OF A POSSIBLE CANADA-U.S. CUSTOMS UNION: SIMULATION RESULTS FROM A DYNAMIC CGE MODEL[1]

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Abstract

In this paper we analyze the implication of a possible Canada-U.S. *customs union* on trade flows, real output and investment both at the aggregate and industry levels in Canada, using a multi-sector, multi-region dynamic computable general equilibrium model. The model is calibrated to the GTAP Database (version 5, 1997). Our scenario for a possible Customs Union with the U.S. assumes the harmonization of Canadian and U.S. tariffs against the non-NAFTA countries (common external tariffs) as well as the elimination of the *Rules of origin* provisions of the NAFTA. Our simulation results suggest that the overall economic gain to Canada from a Customs Union between Canada and the U.S. could be as much as 1% of GDP. Canada's trade could expand by almost 20 %. American trade also increases significantly, but at a slower pace than that of Canada. Much of the increase in trade flows and GDP are the result of the elimination of the *Rules of origin* provisions. All Canadian industries, except food and beverages, gain from a Canada-U.S. Customs Union. The big beneficiaries are transportation equipment, electronics, and machinery and equipment. Services and resource-based industries gain the least.

Key words: Customs union, Dynamic general equilibrium, Rules of origin.
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1. Introduction

Almost all world economies are increasingly integrated with one another. Dramatic reductions in transportation and communication costs, rapid technological changes in production processes, fierce international competition for markets and factors of production, bilateral, regional and multilateral trade agreements have all contributed to the increased economic interdependence among the national economies.

Canada too actively participated in the globalization process. Canada is one of the most open economies in the OECD. At present, exports account for more than 40 percent of Canada's real GDP. Similarly, imports represent about 40 percent of GDP. Furthermore, since 1990 Canada's export intensity and import penetration have increased considerably. For instance, between 1990 and 2002, the ratio of exports to GDP in Canada increased by more than 10 percentage points. Inward and outward direct investment orientation also increased significantly. Canada is a net exporter of capital, and the gap is widening, a dramatic reversal of the situation 20 years ago, when Canada used to be a large net importer of capital.

The increased outward orientation of the Canadian economy is largely the result of increased economic linkages with the U.S. Currently, more than 85 percent of Canada's exports are destined to the U.S., compared to about 70 percent in 1990. However, the U.S. share in our imports increased only marginally. The booming U.S. economy, the depreciation of the Canadian dollar vis-à-vis the American dollar and the two free trade agreements (FTA and NAFTA) contributed to the increased economic integration between the two economies in the 1990s (Acharya, Sharma and Rao (2003)). Canada is also an important trading partner for the U.S. Canada accounts for about 20 percent of U.S. exports and imports. Canada is the largest trading partner of 39 U.S. states. In addition, Canada is the largest supplier of U.S. energy requirements.

The increased economic linkages between Canada and the U.S. were beneficial to Canada. For instance, close to 80 percent of the growth in Canadian manufacturing shipments in

the 1990s was driven by the growth in exports to the U.S. Research done for Industry Canada strongly suggest that FTA and NAFTA have also contributed positively to Canada's productivity performance. The available research also show that both inward and outward direct investment exerted a significant positive impact on the Canadian economy.

Despite a high degree of interdependence between the two economies, there is a great deal of uncertainty about future Canada-U.S. economic linkages because of a number of factors: U.S. concerns about future terrorist threats and the security at the Canada-U.S. border; softwood lumber dispute and other trade irritants; trade frictions associated with the mad cow disease; and the growing protectionism in the U.S., largely the result of a huge and growing U.S. trade deficit.

There has been a great deal of public discussion and debate in Canada about future Canada-U.S. economic relations. A number of researchers and commentators have suggested various measures to broaden and deepen the NAFTA[2]. These include: harmonization of border measures and procedures with regard to customs, refugees and immigration; increased cooperation in countering terrorist threats; mutual recognition by Canada and the U.S. of each other's regulatory procedures and practices; free movement of labour between the two countries; replacement of anti-dumping and countervailing in the two countries by competition laws; a monetary union or common currency; harmonization of Canadian and U.S. tariffs against the non-NAFTA countries (common external tariffs); and the elimination of the rules of origin provisions of the NAFTA[3].

But, to date, there is not much research on the economic impact of these various NAFTA deepening proposals.[4] The objective of our paper is to make a modest contribution towards narrowing this knowledge gap. We estimate the general equilibrium economic impacts of a

[2] See Harris (2003), Goldfarb (2003) for example. See also C.D. Howe Institute Border papers commentary series.
[3] For a good overview of Rules of origin and its implications for regional integration please see, Brenton (2003).
[4] Appiah (1999) looks at Rules of Orign but it is based on 1988 data.

Customs Union between Canada and the U.S on the Canadian economy, disaggregated by major industries.

This scenario assumes common external tariffs by Canada and the U.S. as well as the elimination of the rules of origin provisions of the NAFTA. Products qualified under the rules of origin face no duties when traded between Canada and the U.S., and pay either very low or no duties when traded between Mexico and the U.S. To qualify for the preferential duties, the importer must submit to the customs authorities a NAFTA Certificate of Origin. If a product does not qualify for the NAFTA tariff rate, it pays the MFN rate. The rules of origin provisions, in short, could impose a significant economic cost on Canadian exporters and importers. They could also introduce trade distortions by discouraging imports from non-NAFTA countries and increasing trade among NAFTA members.

We use a multi-region/country and multi-industry dynamic CGE model for simulating the economic impacts of a Customs Union between Canada and the U.S. on Canadian industries. This model, unlike the static CGE models, allows us to track the time path of the impacts. We also check for the sensitivity of the size of the impacts to changes in the size of the key parameters of the model, such as the substitution elasticities.

The simulation results suggest that a Customs Union with the U.S. will provide significant economic benefits to Canadian producers and consumers. Canadian real GDP could increase by as much as 1 percent, and the trade flows could increase by about 20 percent. All Canadian industries, except food and beverage, will gain. Transportation equipment, electronics and machinery and equipment industries will be the big beneficiaries.

The paper is organized in the following way. In section 2, we outline the structure of the dynamic CGE model. In section 3, we discuss data sources and the main characteristics of the Canadian and U.S. economies in the base year (1997), the year for which the model is calibrated. We discuss the design of the Customs Union simulations and the results in section 4. In this

section we also provide sensitivity analysis. Finally, in section 5, we summarize the main findings of our paper and discuss their research and policy implications.

2. The Model Structure

We simulated the economic impacts of a Canada-U.S. Customs Union using an enlarged version of the prototype CGE model developed by Lavoie, Merette and Soussi (2001).[5] It is a multi-region/country, multi-industry dynamic model. The model is disaggregated into seven regions/countries and eight major industries (see Appendix 1 for details). Unlike static models, a dynamic CGE model enables us to track the time path of all variables. The model is calibrated to the benchmark GTAP data in 1997. [6]

We assume full employment in our model. Furthermore, labour supply in the model is exogenous and does not respond to changes in real wages. This implies total employment at the economy level does not deviate from the base case level in the simulations. But, the industrial structure of employment and capital respond to changes in economic variables in the simulations. Capital accumulation is also endogenous in the model. CGE models are better suited to capture adequately the inter-industry shifts in capital and labour inputs to policy shocks than in econometric models. On the other hand, the CGE models are not able to handle cyclical impacts on product and labour markets.

Monetary variables do not play a role in the model, because all the variables are expressed in real terms. Nevertheless, CGE models do a good job of capturing the influence of trade and investment policies, and fiscal incentives on the re-allocation of capital and labour inputs among industries. CGE models are also capable of capturing adequately the aggregate efficiency gain from the re-allocation of factor inputs among industries. In the model total factor productivity (TFP) growth at the industry level, however, is exogenous.

There are two types of agents in the model, households and firms. The households exhibit forward-looking behaviour with certainty. The households have access to world capital markets

[5] In many ways, this model draws upon the contributions of dynamic CGE modeling by Mercenier (1995).
[6] Global Trade Analysis Project (GTAP, 2001) Database, maintained at the Purdue University is a multi-country database compiled from national sources of each country and also other international sources of data.

where they can lend or borrow at a constant real rate of interest. There is no explicit representation of government as an optimizing agent in the model. The government's role, in this model, is to simply collect tariff revenues that are given back to the household sector as lump-sum transfer. In the following sub-sections, a non-technical description of the model is provided. Interested readers can consult Appendices 2-4 for the detailed algebraic structure of the model.

The households

We assume that in each region a representative, infinitely lived household owns all primary factors, namely labour, and physical capital, which are rented to domestic firms at competitive prices. In each region, while the endowment of labour is assumed fixed, the supply of capital in each period, is however, augmented through investment. The representative household in each region chooses the levels of consumption and investments, in each period, that maximizes an intertemporally additive utility function, which is discounted by a constant rate of time preference subject to intertemporal budget and capital accumulation constraints. In making these decisions, households have access to international capital markets, where they can borrow and lend at an exogenously given real rate of interest. Each period, the representative household receives, income from the factors it supplies to firms, dividends and the proceeds of tariff revenues as a lump-sum transfer from the government.

The household optimization exercise can be broken into a few stages. First, they determine the time path for both consumption and investment. In other words, first they decide on intertemporal values for total consumption and investment in each period.[7] In second stage, they decide on the industrial distribution of their total consumption and investment in each period. For example, households decide how they want to allocate their spending between food, clothing, vehicles etc in each period. The third and final stage involves the determination of the

[7] See Equation (8) in Appendix 2.

geographic distribution of consumption and investment in each period.[8] The representative household considers products of competitive industries from different geographic origin as imperfect substitutes (Armington (1969)). Relative prices and substitution elasticities play the key role in each period allocating consumption and investment among industries, and regions/countries.

Along the lines followed by Abel (1980) and Hayashi (1982), investment expenditures include acquisition costs as well as adjustment costs. Adjustment costs are assumed to be quadratic in investment and depreciation.[9] The long-run rate of return to investment net of adjustment cost and depreciation is equalized across regions in the model since households are permitted to borrow and lend internationally at the exogenously given world real rate of interest.[10]

Firms

All industrial sectors in each region are characterized by perfectly competitive. Firms, across all sectors employ capital, labour and intermediate inputs to produce output. Labour and capital are assumed to be homogeneous and mobile between sectors within national/regional boundaries. There is no international mobility of labour or capital. This implies that while the wage and rental rates are same between sectors within a country/region they may differ across national/regional boundaries.[11]

We also assume that each firm produces a single output. With Armington (1969) product differentiation, this implies that there are, 7 (regions) times 8 (goods), i.e., 56 differentiated goods in the model. Firms are price-takers in both the product and the factor markets. Production in each sector consists of constant returns to scale (CES) function of labour, capital and

[8] See Equations (9) – (11) in Appendix 2.
[9] See the last term, right hand side of Equation (2) in Appendix 2.
[10] See Equations (12) - (14) in Appendix 2.
[11] However, we assume that capital is firm specific in the first period. Therefore, rental rates are not equalized in the first period.

composite intermediate inputs[12]. Composite intermediate inputs are CES functions of commodities differentiated by industries and regions. The Armington (1969) specification of substitution between goods produced in different regions is adopted for intermediate use as it is in household preferences.

Firm's objective in each period is to minimize costs. Taking prices of goods as well as factors as given, the firms choose the optimal levels of labour, capital and intermediate inputs so as to minimize total cost.[13]

Equilibrium

There are two sets of equilibrium conditions in the model; intra-temporal and inter-temporal. Intra-temporal equilibrium requires that three conditions must hold in each time period.[14] First, in each region, demand for primary factors must equal their supply. Second, total global demand for each good must equal its global supply and third, the sum of global lending must equal global borrowing. Inter-temporal equilibria are further constrained by the requirement that in the steady-state (i) investment just covers the depreciation and the adjustment costs so that the stock of capital remains constant and finally, (ii) accumulation of foreign assets must be constant, implying that the future trade deficits must be covered by interest earnings on foreign assets held.[15]

[12] For simplicity we choose Cobb-Douglas functional form.
[13] See Equations (15) – (21) in Appendix 2.
[14] See Equations (25) – (29) in the Appendix 2.
[15] See Equations (3) and (7) in Appendix 2.

3. Data, Parameters and Main Features of the Base Case

In the simulation results discussed in the next section, we present the percent difference of all the economic variables in the shocked solutions from their Base Case levels. In addition to the structure of the model and the size of its key parameters, many characteristics of the Base Case data affect simulation results. This includes the industrial structure of output and trade, trade orientation, and the level and structure of tariff protection in Canada and its trading partner countries. In this section, we will discuss the salient features of the Canadian and other major global economies.

As mentioned in the previous section, we used the GTAP database to calibrate the model to the benchmark data. The GTAP database provides data on value added, gross output, trade flows and tariff rates by region/country and by industry for 1997. We also obtained from them the values for the elasticities of substitution between imports and domestic goods.

The GTAP data is available for 65 countries/regions, disaggregated by 54 industrial sectors. Nevertheless, to keep the model to a more manageable level, we aggregated the GTAP data into 7 regions/countries and 8 major industries (Appendix 1). The 7 regions/countries are: Canada, the USA, Mexico, Mercosur (MER), the rest of Latin America, (LAT), Europe and the rest of the world (ROW)[16]. The 8 major industries are: agriculture, food processing, resource-intensive industries, textiles, manufacturing, automotive, machinery and electronics, and services. Each of these industries is assumed to produce a single composite commodity.

Canada, followed by Mexico and Latin America (excluding Mercosur countries), is much more dependent on trade than U.S.A., Europe, Mercosur and ROW. For instance, exports account for more than 40 percent of GDP in Canada, compared to less than 14 percent in the U.S. (see Table 2).

[16] MERCOSUR in our case include, Urgentina, Brazil and Uruguay (Paraguay is not included as data on this economy is not available in the database).

Table 2 Industrial distribution of value added (%)

Industries	CAN	*USA*	MEX	MER	LAT	EUR	*ROW*
Agriculture	2.0	1.2	8.3	9.9	13.0	2.2	6.2
Resources	4.4	0.9	6.4	2.0	7.5	1.1	4.7
Food	2.6	2.2	5.4	5.3	6.7	3.2	3.5
Textiles	1.1	0.9	3.4	4.2	3.6	1.3	2.3
Manufacturing	11.9	8.4	11.7	13.5	12.0	15.0	16.0
Technology	4.0	5.4	5.6	3.6	2.0	5.2	5.9
Automotive	2.6	1.9	2.7	1.9	1.2	2.1	1.9
Services	71.4	79.0	56.5	59.7	58.4	74.4	64.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Trade-to-gross-output (%)	42.1	13.7	33.0	9.0	29.2	14.2	12.7

*Source***:** Computed from GTAP version 5 Data Base.

The industrial structure of output is broadly similar in Canada, the U.S. and Europe. Nevertheless, primary industries are more important to Canada than to the U.S. and Europe (see Table 2). On the other hand, service industries play a bigger role in the U.S. and Europe than in Canada. For instance, in the U.S. services represent 79 percent of the total value added, compared to only 71 percent in Canada. Within the manufacturing, technology intensive industries play a bigger role in the U.S. and Europe than in Canada. Not surprisingly, the industrial composition of output is similar in Mexico, MER and ROW. In these countries, agriculture and primary industries still play an important role.

Table 3: Regional shares in total exports and imports (%)

	CAN		USA		MEX		MER		LAT		EUR		ROW	
	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp
CAN	-	-	16	16	3	1	2	2	3	2	3	3	3	3
USA	72	61	-	-	75	66	18	25	40	33	24	25	38	30
MEX	1	2	8	8	-	-	2	2	2	5	1	1	1	1
MER	1	1	3	1	2	1	-	-	6	8	4	2	2	2
LAT	1	1	5	4	5	2	14	6	-	-	3	3	3	2
EUR	11	17	29	25	8	15	30	37	27	24	-	-	53	62
ROW	15	18	40	45	8	14	35	28	23	28	65	66	-	-
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: Computed from GTAP version 5 Data Base.

Inter-country/regional trade flows also play an important role in driving the simulation results. For both Canada and Mexico, U.S. is the dominant trading partner. In 1997, the U.S. accounted for more than 70 percent of Canadian and Mexican total exports. Similarly, these two countries imported more than 60 percent of their total imports from the U.S (see Table 3). Mexico accounted for only about 1 percent of total Canadian exports, but it imported two percent of its total imports from its other NAFTA partner. MERCOSUR and other Latin America each accounted for about 1 percent of Canada's exports and imports. Europe and ROW (mostly Asia Pacific) each take about 10 to 15 percent of Canada's exports and supply between 15 to 20 percent of its imports.

Canada accounted for 16 percent of U.S. exports and imports in 1997 (see Table 3). Mexico, Mercosur and other Latin America are more important trading partners to the U.S. than they are to Canada. For instance, Mexico took 8 percent of U.S. exports in 1997, compared to only 1 percent of Canadian exports. Almost 70 percent of U.S. exports and imports are with Europe and ROW (mostly Asia Pacific).

The average, imported-weighted bilateral protection rates computed from GTAP database and reported in Tables 4 and 5 do not include equivalents for non-tariff barriers (NTBs) except for agriculture and food products. Tariff data in GTAP 5 database combines merchandise tariffs from the World Integrated Trade Solutions (WITS) system of the World Bank and UNCTAD and tariffs on food and agriculture from the Agricultural Trade Policy Database of the USDA/ERS (see Chapter 4, GTAP (2001)). The latter database is based largely on the Agricultural Market Access Database (AMAD).

Canada's average tariff rate vis-à-vis the U.S. and Mexico are less than 1 percent (see Table 4). But, Mexico's tariffs on Canadian imports average 8.6 percent. Canada's average tariff protection against non-NAFTA countries varies between 3.3 and 5.6 percent. The regional structure of the U.S. tariff protection is similar to that of Canada. Non-NAFTA countries impose,

on average, significantly higher tariffs on imports from Canada and the U.S. compared to those they face on their exports to these two countries.

Another key determinant of the simulation results is the industrial structure of tariff protection in Canada, the U.S. and other countries. As seen from Table 5, there is a great deal of variance in tariff protection across major industries in all countries. For instance, in Canada the average tariff rate varies from zero in resource industries to a high of 28.9 % in food and beverage industry. Both in Canada and the U.S. tariff protection is lower in resources, autos, technology-intensive manufacturing, and other manufacturing industries in agriculture, food and beverage, and textiles. Mexico too imposes high tariffs in agriculture and food and beverage. The variation across countries/regions in industry tariff rates is also very large (see Appendix 5). For instance, the U.S. imposes an average tariff rate of 4.4 % on agricultural imports from Canada but an average rate of the imports from ROW. Mexico's average tariff rate on agricultural imports from Canada is 66 %, compared to 17 % from the U.S.

Table 4: Import weighted average protection rates (%)
(importing country in first column)

	CAN	USA	MEX	MER	LAT	EUR	ROW
Canada	-	0.4	8.6	6.7	11.2	3.1	11.7
United States	0.8	-	1.8	10.0	10.9	2.6	7.9
Mexico	0.5	0.5	-	14.5	10.3	3.2	5.1
Mercosur	5.6	5.0	10.0	-	11.4	9.4	17.6
Latin America	4.1	6.3	9.3	6.6	-	7.0	7.8
Europe	3.3	1.9	6.4	9.8	7.8	-	7.8
Rest of the World	4.2	3.2	8.4	9.0	10.2	4.2	-
Average	1.93	2.34	3.76	9.45	9.99	3.97	8.17

Source: Computed from GTAP version 5 Data Base.

Table 5: Average import weighted protection rates by commodities by regions (%)

	AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
Canada	3.8	0.0	28.9	10.6	1.1	0.6	0.7	-
United States	11.1	0.3	11.1	11.2	2.0	1.4	1.3	-
Mexico	17.3	3.9	31.6	4.7	2.5	2.6	2.6	-
Mercosur	7.9	3.6	17.0	18.5	10.3	14.0	23.1	-
Latin America	10.5	6.6	16.9	17.7	9.9	9.3	14.6	2.2
Europe	10.9	0.1	37.2	10.4	3.5	3.7	5.3	
Rest of the World	41.8	2.3	37.3	14.5	7.5	6.1	8.8	0.2

Source: Computed from GTAP version 5 Data Base.

The tariff preferences of each NAFTA member countries vis-à-vis the other two NAFTA countries, disaggregated by industry, are displayed in Appendix 6. They are computed as the difference between the average non-NAFTA tariff rates and the NAFTA member tariff rates. For example, the Canadian tariff preference in textiles vis-à-vis the U.S. is 12.9 percent, which means that the average non-NAFTA rate in this industry is 12.9 percentage points higher than the rate U.S. pays on its textile exports to Canada. Canada also provides the U.S. a large tariff preference in agriculture. The U.S. too provides large tariff preference to Canada in textiles and food and beverage industry.

The substitutability between domestic goods and imports in different industries in Canada and other countries or substitution elasticities, are the key parameters of the model. We obtained the values of substitution elasticities from the GTAP database (Table 6).[17] They differ across industries in developed and developing regions. The value of elasticity of substitution by commodity and regions varies - in the developed countries/regions it is between 5.2 in agriculture to 11.7 in autos, while, in the developing regions, it varies between 3.5 and 7.8. To check for the robustness of the simulation results, we examined the sensitivity of the results to the values of the substitution elasticities. The simulation results and the their sensitivity to the values of the substitution elasticities are presented in the next section.

The other two key parameters of the model are world rate of interest, and the rate of consumer time preference. These are assumed to be the same for all regions to 5%. Following literature the inverse of intertemporal elasticity of substitution is assumed to be 1.51 (see e.g., Hall (1988) and Diao and Somwaru (2001) for its application in a CGE model similar to the paper).

[17] Elasticity value for each commodity is an average of its top (between domestic and composite imports) and bottom level (between different sources of imports) elasticity values obtained from GTAP database. For obtaining country specific numbers we multiply these by 1.5 for Canada, U.S. and Europe and by 1 for regions as per conventions, see Perroni and Whalley (1996).

Table 6: Base case values for elasticity of substitution between domestic goods and imports

	AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
A. Elasticity of Substitution in preferences								
Canada	5.2	6.3	5.3	7.6	5.2	6.3	11.7	4.3
United States	5.2	6.3	5.3	7.6	5.2	6.3	11.7	4.3
Mexico	3.5	4.2	3.6	5.0	3.5	4.2	7.8	2.9
Mercosur	3.5	4.2	3.6	5.0	3.5	4.2	7.8	2.9
Latin America	3.5	4.2	3.6	5.0	3.5	4.2	7.8	2.9
Europe	5.2	6.3	5.3	7.6	5.2	6.3	11.7	4.3
Rest of the World	3.5	4.2	3.6	5.0	3.5	4.2	7.8	2.9
B. World rate of interest 5%								
C. Rate of time preference 5%								
D. Inverse of intertemporal elasticity of substitution 1.51								

Source: GTAP Data Base and authors assumptions. Value of intertemporal elasticity of substitution from Hall (1988).

4. Simulation Results

In this section, we will first discuss the design of the Customs Union scenarios. Next, we will discuss the macro and industry effects of the alternate scenarios in Canada and other countries, especially the U.S. Finally, we will examine the sensitivity of the simulation results to changes in the values of the substitution elasticities. In simulating the impacts of different Customs Union scenarios, we assume perfect competitive markets. The modeling and simulations are performed in GAMS software (due to Brooke, Kendrik and Meeraus 1996).

The design of simulations

Formation of a customs union or a Free Trade Area (FTA) is allowed as an exception to the basic principle of non-discrimination in the GATT under article XXIV[18]. A customs union is a group of countries that eliminate all tariffs on trade among themselves but maintain common external tariffs on trade with countries outside the union (thus technically violating the most favored nation (MFN) principle). Historically, the exception was designed in part to accommodate the formation of the European Economic Community (EC) in 1958, and it was based on the understanding that although these are discriminatory associations, they may not pursue policies that increase the level of discrimination practiced by these countries beyond that which existed prior to the formation of the preferential arrangements; and that preference has to cover "substantially all trade" between the participants.[19]

In this paper, we simulate three variants of a Canada-U.S. Customs Union between Canada and the U.S. We analyze the impact of common external tariffs by Canada and the U.S. against the non-NAFTA member countries, and the elimination of tariffs between NAFTA member countries. In designing the CET we honour GATT's MFN principle. We run two

[18] Regional Trading Arrangements for international integration may take a variety of forms. The most common forms are, preferential trading arrangements (PTA), free trade area (FTA), customs union (CU), common market (CM), and economic union (EU).

[19] This article is a major exception to GATT's fundamental MFN principle and the principal article dealing with CU and FTAs.

alternate scenarios on common external tariffs. In the first scenario, the minimum of U.S. and Canadian non-NAFTA tariff rate in each major industry is adopted as the common external tariff rate. In the second scenario, U.S. non-NAFTA tariff rates are used as the common external tariff rates by the two countries vis-à-vis the non-NAFTA member countries.

In the third scenario, we simulate the impacts of the elimination of the rules of origin provisions of the NAFTA for duty-free entry into Canada and the U.S. from the non-NAFTA countries. The rules of origin specify the condition under which such privilege is granted. Under the NAFTA an importer must submit to the customs authorities a NAFTA certificate of origin completed by importers in order to be eligible for the preferential tariff rates. Products that qualify under the rules of origin face zero duties when traded between the U.S. and Canada, and pay low or zero tariffs when traded between the U.S. and Mexico. If a product does not qualify for NAFTA tariff preferences, the Certificate will *not* be completed, then that product is usually subject to the Most Favored Nation (MFN) tariff rate.[20]

The economic justification for the rules of origin is that they are needed to prevent trade deflection and protect domestic industries from non-members. However, the rules of origin provisions will divert trade from non-NAFTA member countries to NAFTA countries, leading to misallocation of productive resources in NAFTA member countries. For example, the tariff preferences in favor of NAFTA countries might distort the input choices of firms from a low cost non-NAFTA source to a high cost NAFTA source, leading to production inefficiencies. In

[20] *Methods used in determining "origin":* Governments in practice apply three main methods of determining when imports are not to be granted national treatment and conditions under which it will be considered as originating in a preference receiving country (Falvey and Reed 2002).

1. Percentage criterion (Value-added test): It requires that a minimum ratio of total cost of production be of domestic origin.
2. The change in tariff heading test: Processing of foreign inputs must be such that the new product have a new tariff classification (HS) – this is applied at a specific product level
3. Substantial transformation: A new and different article must emerge, from the original imported intermediate input or set of inputs, having a distinct name, character and use.
   Change in character – a change in chemical or physical composition e.g. bauxite (Jamaica) – aluminum (Ghana) – cooking utensils (USA). This would be deemed originating.
   Change in use - the use of the product would be radically different from the original use.

addition to the allocative inefficiencies, these trade restrictions also impose a significant cost of paper work on importers and exporters. Administering the rules of origin requirements also involves costs to the governments.[21]

The costs of rules of origin under the European Commission, estimated by the EC Free Trade Association ranges from 1.4% to 5.7% of the value of export transactions (from Goldfarb 2003). If these rates are applied to Canada's exports to the U.S. alone, Canada could benefit by $4 to $18 billion annually by eliminating the NAFTA rules of origin. Appiah (1999) estimates that the welfare cost of rules of origin under the NAFTA for Canada ranges from 0.3% to 3% of GDP depending the structure of the model used.[22] A model of economic integration that does not capture these costs would therefore, seriously underestimate the benefits from integration.

The model we use is capable of capturing the allocative inefficiencies resulting from the trade diversion effects of the tariff preferences. In an effort to capture the gains from the reduction of paper work to Canadian and U.S. importers, in the shocked scenario, we reduce the MFN rates to the NAFTA rates in Canada and the U.S. The rationale for this assumption is the observation made by many analysts that most of the importers and exporters simply pay the differential tariff rather than go through the paperwork[23]. We, however, recognize that our assumption of uniformly lowering the MFN rates to the NAFTA rates might overestimate the gains from the elimination of the rules of origin provisions. Therefore, the simulated gains and inter-industry shifts in employment and capital could be considered as the upper bound estimates. However, we do not explicitly model the possible improvements in production

[21] Canada customs and revenue agency (CCRA), however, argues that these are practically very small. They maintain about 50 staff for this matter in Canada (?).

[22] These estimates are, however, based on 1988 data after which substantial bilateral and multilateral tariff reductions have taken place. This paper uses the latest available data.

[23] For example, Brenton (2004) argues, "Preferential **rules** of **origin** should be treated as commercial policy instruments. The specification and implementation of **rules** of **origin** can be a major determinant of the impact of free trade and preferential trade agreements. In practice **rules** of **origin** are controversial since the available evidence suggests that the utilisation of preferences tends to be substantially less than full. That is, a substantial proportion of actual exports which are eligible for preferences do not enter the partners market with zero or reduced duties but actually pay the MFN tariff" (http://www.iadb.org/intal/foros/LAbrenton_paper.pdf accessed on February 27, 04).

efficiencies from the removal of distortions in the input choices of firms, because of the lack of detailed micro data on imports from NAFTA and non-NAFTA member countries. For instance, the GTAP database provides information on 57 aggregated sectors. We find that at this level of aggregation all commodities qualify for the NAFTA preferences.

Utilization rates of tariff preferences under the NAFTA may also give a good indication of the attractiveness of a preferential trade agreement vis-à-vis MFN treatment.[24] Implicitly it also gives an idea of how restrictive are NAFTA rules of origin. A higher NAFTA utilization rate may mean the agreement is beneficial even after the cost of compliance. A lower utilization may mean it is not rewarding after paying the cost of compliance. The cost of compliance includes the paper work and procedural delay at the border involving the proof of the origin of the products. Starting in 2000, customs data on regimes used by exporters of goods entering the US market has been made available by USITC. Given that NAFTA's coverage is close to 100% (i.e., practically all goods are eligible) this data can be used to construct utilization rates. On that basis, NAFTA's overall utilization rate for 2002 is calculated to be 55% with large fluctuations across sectors and within some of them. But the utilization rate may be low also due to low or zero preference margins in NAFTA vis-à-vis MFN rates (Appendix 7). It is therefore difficult to disentangle costs associated with the rules of origin without data at a very disaggregated level. The rules of origin restrictiveness indices constructed by Cadot et al (2002) are qualitative in nature, and are not useful for us (Appendix 7).

We devise some ready and rough approach to implicitly determine the upper bound of the potential cost of the rules of origin under the NAFTA. The maximum costs of the rules of origin to the members cannot exceed the benefits derived from the NAFTA preferential vis-à-vis MFN tariff rates (Appendix 6). We compute the maximum costs of the rules of origin by simulating

[24] Utilization rate is defined as the percentage of trade utilized regional preferential tariff rates.

the effect of all partners paying their partners average MFN tariff rates rather than NAFTA rates. We found that the upper bound of the costs of rules of origin is modest but significant.

The fourth and fifth simulations combine the third scenario, the elimination of the Rules of origin provisions, with the two scenarios on common external tariffs.

Simulation results

In the shocked solutions, the key economic variables are impacted via reductions in tariff rates. The reduction in tariff rates reduces prices of imports, and stimulates trade flows and consumption in Canada and the U.S. They in turn induce inter-industry shifts in capital and labour inputs, leading to improvements in allocative efficiencies and real GDP.

Common external tariffs: As mentioned before, we ran two alternate scenarios for common external tariffs. In the first scenario, Canada and U.S. tariffs against non-NAFTA member countries are set to the minimum of Canada or U.S. external tariffs. In the second scenario, Canadian external tariffs are set to the U.S. external tariff rates.

As seen from Table 7, the macro impacts are very similar in the two simulations, because the average tariff reduction is more or less identical in the two scenarios: -0.91percentage points and -0.87 percentage points, respectively. (see Case 1a and Case 1b). Trade flows increase by between 4 and 5 percent in the two scenarios. Prices of consumer goods decline by about 1 percent, leading to a 0.1 percent increase in real consumer spending. Overall GDP or value added increases slightly, between 0.07 and 0.09 percent. Not surprisingly, the economic gains from common external tariffs to the U.S. are much smaller than to Canada, because the reduction in the average tariff rate is only between 0.08 and 0.23 percent. In addition, trade plays a much smaller role in the U.S. economy than in Canada.

Table 7
Long run Effect of a Canada-US Customs Union on Aggregate Variables
(% Change over the Base Case)

Region	Tariff rate % point difference	Exports	Imports	Value added	Consum-ption	Invest-ment	Terms of trade	Price of cons.	Price of invt.
Case 1a: CET is set to the min of Canada and US external tariff									
CAN	-0.91	4.52	4.27	0.071	0.10	-0.08	-0.51	-1.04	-0.48
USA	-0.23	1.01	0.82	0.002	0.00	-0.03	-0.08	-0.18	-0.15
MEX	0.00	-0.04	0.10	0.005	0.04	-0.02	0.11	0.01	-0.01
MER	0.01	0.64	0.54	0.057	0.05	0.09	0.16	0.12	0.10
LAT	0.00	1.09	1.14	0.236	0.23	0.26	0.42	0.34	0.27
EUR	0.00	0.17	0.22	0.013	0.01	0.02	0.04	-0.01	-0.01
ROW	0.01	0.14	0.20	0.012	0.02	0.01	0.06	-0.01	-0.02
Case 1b: CET is set to US external tariff									
CAN	-0.87	4.45	4.23	0.088	0.13	-0.04	-0.48	-0.94	-0.40
USA	-0.08	0.60	0.53	0.015	0.01	0.02	0.03	-0.07	-0.07
MEX	0.00	-0.06	-0.06	-0.015	-0.01	-0.02	-0.01	-0.07	-0.07
MER	0.00	-0.04	-0.02	-0.004	0.00	-0.01	-0.01	-0.04	-0.04
LAT	0.00	-0.10	-0.07	-0.023	-0.01	-0.03	-0.03	-0.07	-0.06
EUR	0.00	0.17	0.23	0.011	0.01	0.02	0.04	0.00	0.00
ROW	0.00	0.07	0.11	0.004	0.01	0.00	0.03	-0.01	-0.01
Case 2: Upper bound calculation of the gains from elimination the rules of origin									
CAN	-2.11	12.32	12.93	1.00	0.45	1.22	0.12	0.35	0.21
USA	-0.60	4.87	4.33	0.11	0.10	0.18	0.17	0.05	-0.03
MEX	-5.72	23.72	18.79	4.25	1.32	4.98	-1.09	-0.08	-1.47
MER	0.01	-0.22	-0.01	-0.01	0.01	-0.03	0.00	-0.01	-0.01
LAT	0.01	-0.13	0.06	-0.02	0.05	-0.05	0.05	0.01	-0.01
EUR	0.00	-0.22	-0.10	-0.01	0.02	-0.02	-0.02	0.00	0.00
ROW	0.00	-0.31	-0.19	-0.02	0.01	-0.04	-0.05	-0.02	-0.02
Case 3a: Combined effect of 1a and 2									
CAN	-3.02	17.40	17.76	1.07	0.55	1.13	-0.40	-0.69	-0.27
USA	-0.83	5.93	5.18	0.11	0.09	0.15	0.09	-0.13	-0.18
MEX	-5.72	23.65	18.90	4.25	1.36	4.96	-0.96	-0.06	-1.48
MER	0.02	0.42	0.52	0.04	0.06	0.07	0.16	0.11	0.09
LAT	0.01	0.96	1.20	0.22	0.28	0.21	0.47	0.35	0.25
EUR	0.00	-0.05	0.12	0.00	0.03	0.00	0.02	-0.01	-0.02
ROW	0.01	-0.18	0.01	-0.01	0.03	-0.03	0.01	-0.03	-0.03
Case 3b: Combined effect of 1b and 2									
CAN	-2.98	17.32	17.71	1.09	0.58	1.18	-0.36	-0.59	-0.18
USA	-0.68	5.50	4.89	0.12	0.11	0.20	0.20	-0.02	-0.10
MEX	-5.72	23.65	18.72	4.24	1.31	4.96	-1.10	-0.15	-1.54
MER	0.01	-0.26	-0.03	-0.02	0.01	-0.03	-0.01	-0.04	-0.05
LAT	0.01	-0.23	-0.01	-0.04	0.04	-0.08	0.02	-0.06	-0.08
EUR	0.00	-0.05	0.13	0.00	0.03	0.00	0.02	0.01	0.00
ROW	0.00	-0.24	-0.08	-0.02	0.02	-0.04	-0.02	-0.03	-0.03

Elimination of the rules of origin provisions of NAFTA*:* As discussed earlier, the elimination of the rules of origin (ROO) under NAFTA is implemented by equating MFN tariff

rates to the NAFTA rates. This implies an average tariff reduction of 2.11 percentage points in Canada, 0.6 percentage points in the U.S. and 5.72 percentage points in Mexico (see Case 2 in Table 7). Consequently, the gains from the elimination of ROO are considerably larger than the gains from common external tariffs to Canada and the U.S. Canada's trade flows increase by about 13 percent, leading to a 1 percent gain real GDP or value added. The U.S. GDP increases by over 0.1 percent. On the other hand, Mexico's GDP by over 5 percent from the elimination of ROO.

Customs Union: This scenario combines common external tariffs with the elimination of ROO. *The* combined macro-economic effects of the two Customs Union simulations are shown in Case 3a and Case 3b. As expected, the simulation results are almost linear. For instance, the increase in real GDP or value added in Case 3a is equal to the increase in Case 1a and Case 2. The same is true for Case 3b.

The simulation results suggest that a Customs Union between Canada and the U.S. will increase Canada's real GDP by 1.1 percent, compared to 0.1 percent in the U.S. and over 5 percent in Mexico (see Case 3a and Case 3b in Table 7). As expected, domestic supply of Canadian consumption declines because of increased import penetration. (see Table 8). On the other hand, U.S. exports to Canada increase by over 25 percent. Similarly, U.S. imports to Canada increase by almost 26 percent, while Mexico's imports to Canada increase by over 40 percent in the two simulations.

Tables 9 and 10 show the impact of a Customs Union on exports and imports by major industry groups in Canada and other countries. There is a great deal of variation in industry impacts. For instance, the impact on Canadian exports from a small increase (1.3 to 1.4 percent) in resources to almost 118 percent in textiles (Table 9). Similarly, the impact on Canadian

Table 8
Effect of a Canada-US Customs Union on
Aggregate Bilateral Trade

(% change in supply of goods and services by region over benchmark)

	CAN	USA	MEX	MER	LAT	EUR	ROW
Export/importing region							
CET is set to min of Canada and US external tariff							
CAN	-1.76	25.44	4.66	1.92	3.76	0.52	0.76
USA	25.84	-0.24	35.56	0.74	1.29	0.51	0.33
MEX	41.13	30.86	1.74	6.20	6.11	1.80	1.11
MER	-3.48	5.16	-6.09	-0.01	0.35	-0.64	-0.54
LAT	-2.87	4.74	-1.56	-0.90	-0.06	-1.93	-1.37
EUR	9.19	-1.07	-3.81	0.33	0.84	0.00	-0.13
ROW	4.55	-0.82	-5.75	0.43	0.70	0.05	-0.03
CET is set to the US external tariff							
CAN	-1.72	25.53	4.27	1.03	2.10	0.11	0.44
USA	25.76	-0.20	35.19	-0.13	-0.21	0.06	-0.04
MEX	41.95	30.79	1.80	5.91	5.23	2.34	1.43
MER	-5.61	-0.85	-5.45	-0.02	-0.20	0.30	0.05
LAT	-6.20	-0.48	-0.21	0.04	-0.03	0.37	0.11
EUR	9.41	-0.82	-3.85	-0.25	-0.35	-0.01	-0.15
ROW	4.56	-0.96	-5.71	-0.11	-0.41	0.11	-0.02

Note: Same region cells represent domestic supply.

Table 9
Effect of a Canada-US Customs Union on
Export by Sector

(% change over benchmark)

	AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
CET is set to the min of Canada and US external tariff								
CAN	19.10	1.38	60.60	118.28	12.13	11.57	48.70	-1.35
USA	-0.19	1.77	21.73	25.61	7.71	4.39	15.11	0.28
MEX	37.75	3.53	7.23	111.39	15.93	20.88	60.74	-1.33
MER	8.96	-0.24	-0.83	-1.87	-0.53	-1.43	-4.01	-0.41
LAT	18.87	-0.92	-2.38	-4.63	-0.68	-3.15	-2.89	-1.52
EUR	2.59	1.12	6.66	-0.36	-0.12	-0.59	-2.64	0.12
ROW	8.86	0.60	0.15	-0.66	-0.01	-0.93	-1.66	0.23
CET is set to US external tariff								
CAN	21.16	1.42	60.78	116.65	11.98	11.36	48.52	-1.62
USA	-0.66	1.41	20.64	24.70	7.31	4.05	14.50	-0.06
MEX	11.89	4.48	8.33	113.23	16.43	21.71	62.66	-0.85
MER	-0.37	0.11	-0.20	-0.79	0.03	-0.75	-2.62	0.28
LAT	-1.17	0.30	-0.16	-1.70	-0.14	-0.89	0.06	0.36
EUR	-0.57	0.00	6.82	-0.37	-0.10	-0.56	-2.53	0.15
ROW	-0.67	0.10	0.52	-0.56	0.16	-0.73	-1.37	0.34

Table 10
Effect of a Canada-US Customs Union on
Imports by Sector

(% change over benchmark)

	AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
CET is set to the min of Canada and US external tariff								
CAN	5.70	2.53	171.24	32.07	14.20	4.97	24.33	1.88
USA	56.56	1.50	14.06	3.89	3.40	2.29	14.24	-0.22
MEX	-10.20	14.30	-0.29	50.59	15.65	9.26	39.28	3.86
MER	0.31	0.15	0.41	0.67	0.46	0.51	1.69	0.34
LAT	1.80	1.20	1.64	1.27	1.35	0.79	1.27	1.23
EUR	-0.01	0.00	0.31	0.13	0.11	0.18	0.91	-0.02
ROW	0.30	-0.19	0.26	-0.02	-0.03	-0.02	0.34	-0.11
CET is set to US external tariff								
CAN	-1.74	1.55	171.52	32.58	14.28	5.01	24.34	2.21
USA	12.04	1.05	15.46	4.53	3.67	2.64	14.84	0.21
MEX	-10.96	14.30	-0.94	49.84	15.49	9.24	39.36	3.62
MER	-0.01	-0.09	-0.04	-0.02	-0.01	-0.07	0.59	-0.16
LAT	-0.16	0.10	-0.03	-0.08	0.06	-0.01	0.23	-0.19
EUR	0.35	0.10	0.49	0.19	0.12	0.10	0.78	-0.03
ROW	0.05	0.03	0.14	-0.07	-0.08	-0.12	0.14	-0.17

imports also varies a great deal across major industries (see Table 10). The same is true for the U.S. and Mexico. The differential impact on industry exports and imports are the result of differential impact on tariff reductions by industry. For instance, the big increase in food imports in Canada is the result of a 20-25 percentage point reduction in tariff rates (see Appendix 8).

The value added impacts by industries reflect the industry impacts on exports and imports. In the two Customs Union simulation value added increases in all Canadian industries, except food (see Table 11). The big increase in food imports is responsible for the decline in the value added of food industry in Canada. On the other hand, the big beneficiaries are autos and technology-intensive manufacturing industries. In the U.S., value added in agriculture and autos decline, while the manufacturing and service sectors gain. Textiles, autos and technology-intensive industries are going to be the big beneficiaries in Mexico. Industry shifts in employment in the simulations respond to changes in value added as well as changes in real wages (Table 12). In Canada, employment will increases significantly in autos, and technology-

Table 11
Effect of a Canada-US Customs Union on Value added

(% change over benchmark)

	AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
CET is set to the min of Canada and US external tariff								
Canada	1.32	1.70	-9.31	2.37	3.29	5.99	27.82	-0.03
United States	-3.22	0.02	0.86	0.82	0.57	0.76	-0.27	0.05
Mexico	5.85	3.39	1.62	14.13	4.68	14.42	21.59	2.13
Mercosur	0.69	-0.09	-0.02	-0.10	-0.06	-0.22	-0.52	0.02
Latin America	4.20	-0.58	-0.06	-1.60	-0.26	-0.98	-1.60	-0.07
Europe	0.44	0.07	0.51	-0.11	-0.07	-0.26	-0.65	0.02
Rest of the World	0.24	0.08	0.02	-0.19	-0.05	-0.29	-0.44	0.01
CET is set to the US external tariff								
Canada	3.10	1.81	-9.26	1.80	3.22	5.84	27.67	-0.03
United States	-0.59	0.11	0.71	0.43	0.48	0.56	-0.50	0.06
Mexico	3.67	3.86	1.59	14.55	4.87	15.12	22.56	2.19
Mercosur	-0.04	0.00	-0.01	-0.05	-0.03	-0.07	-0.30	0.00
Latin America	-0.27	0.10	-0.01	-0.50	-0.08	-0.20	-0.30	0.03
Europe	0.30	-0.08	0.50	-0.13	-0.06	-0.23	-0.62	0.02
Rest of the World	-0.01	0.00	0.02	-0.16	-0.02	-0.22	-0.35	0.01

Table 12
Effect of a Canada-US Customs Union on
Labour Demand

(% change over benchmark)

	AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
CET is set to the min of Canada and US external tariff								
Canada	-0.36	0.30	-11.91	-0.38	1.72	4.06	23.89	-1.07
United States	-3.46	-0.12	0.49	0.58	0.40	0.60	-0.50	-0.06
Mexico	2.60	-1.34	-2.08	9.04	-0.82	7.91	13.60	-1.84
Mercosur	0.68	-0.10	-0.04	-0.12	-0.09	-0.26	-0.57	0.00
Latin America	3.88	-0.98	-0.45	-2.02	-0.68	-1.43	-2.13	-0.39
Europe	0.45	0.08	0.52	-0.10	-0.06	-0.25	-0.65	0.03
Rest of the World	0.26	0.10	0.04	-0.18	-0.03	-0.28	-0.43	0.02
CET is set to the US external tariff								
Canada	1.42	0.40	-11.81	-0.89	1.65	3.90	23.72	-1.07
United States	-0.77	-0.03	0.48	0.18	0.32	0.38	-0.74	-0.04
Mexico	0.60	-0.72	-1.93	9.62	-0.45	8.79	14.75	-1.63
Mercosur	-0.02	0.03	0.01	-0.03	-0.01	-0.05	-0.29	0.02
Latin America	-0.23	0.15	0.03	-0.47	-0.04	-0.16	-0.28	0.06
Europe	0.31	-0.06	0.52	-0.12	-0.05	-0.23	-0.61	0.03
Rest of the World	0.01	0.03	0.04	-0.14	0.00	-0.20	-0.33	0.03

intensive and other manufacturing industries, while employment will decline in food, agriculture, services and textiles. In the U.S., on the other hand, employment will increase in all manufacturing industries, except autos. In Mexico, employment will shift from services, food and resources to autos, textiles and technology-intensive manufacturing industries. The inter-industry shifts in capital input are very similar to the employment shifts in the three NAFTA countries (see Table 13).

Table 13
Effect of a Canada-US Customs Union on
Capital Demand

(% change over benchmark)

	AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
CET is set to the min of Canada and US external tariff								
Canada	1.24	1.92	-10.49	1.23	3.36	5.74	25.89	0.53
United States	-3.29	0.06	0.68	0.76	0.59	0.78	-0.32	0.13
Mexico	7.89	3.74	2.97	14.66	4.29	13.47	19.46	3.22
Mercosur	0.69	-0.09	-0.03	-0.11	-0.08	-0.25	-0.56	0.01
Latin America	4.33	-0.56	-0.02	-1.60	-0.26	-1.00	-1.71	0.04
Europe	0.42	0.05	0.49	-0.13	-0.09	-0.28	-0.68	0.00
Rest of the World	0.23	0.07	0.01	-0.21	-0.06	-0.31	-0.46	-0.01
CET is set to the US external tariff								
Canada	3.06	2.03	-10.38	0.72	3.30	5.59	25.73	0.54
United States	-0.58	0.16	0.68	0.37	0.51	0.58	-0.55	0.15
Mexico	5.58	4.20	2.92	15.04	4.48	14.17	20.43	3.24
Mercosur	-0.05	-0.01	-0.03	-0.06	-0.04	-0.09	-0.33	-0.02
Latin America	-0.30	0.07	-0.04	-0.54	-0.11	-0.23	-0.35	-0.01
Europe	0.28	-0.09	0.48	-0.15	-0.09	-0.26	-0.64	0.00
Rest of the World	-0.03	-0.01	0.00	-0.18	-0.04	-0.23	-0.37	-0.01

Time-path of adjustment: Simulation results on the time-path of adjustments to key macro-economic variables in the Canadian economy due to a Canada-U.S. customs union is displayed in Table 14. Most of the adjustments to the steady-state takes place within the first two periods.

Sensitivity analysis: The size as well as the direction of the impacts in the shocked solutions depend critically on the magnitude of substitution elasticities. The higher the substitution between domestic goods and imports, the higher is the impact of tariff cuts on trade flows, output, employment and capital accumulation and vice versa. To check for the sensitivity of the Customs Union simulations, we ran two alternate simulations. In the first simulation, the Customs Union simulation (common external tariffs set at the minimum of U.S. and Canadian rates plus the elimination of the ROO) is run with the base case substitution elasticities reduced across the board by 25 percent. In the second simulation, the Customs Union simulation is run with a 25 percent increase in the base case substitution elasticities.

As expected, the increase in trade flows (exports as well as imports) is almost 25 percent higher in the higher substitution elasticities case than in the Customs Union simulation with the base case substitution parameters, the opposite is true in the case of lower substitution parameters (see Table 15). Similar pattern is displayed for consumption. But, the value added response does not vary with the substitution parameters, because of the offsetting impacts on capital accumulation. In short, the simulation impacts are fairly robust.[25]

[25] We also performed sensitivity analyses on the value of the real rate of interest (not reported here). As expected, magnitudes of the effects are very marginally affected except that with a higher real rate of interest adjustments are quicker and variables obtains their steady-state values faster.

Table 14
Time-path of Aggregate Variable: Canada

	Period 1	Period 2	Period 3	Period 4	Period 5
Exports	16.15	16.87	17.25	17.39	17.40
Imports	18.34	18.00	17.82	17.76	17.76
Value added	0.60	0.84	0.98	1.06	1.07
Consumption	0.03	0.27	0.43	0.54	0.55
Investment	3.57	2.23	1.49	1.13	1.13
Price of consumption	-0.35	-0.51	-0.61	-0.69	-0.69
Price of investment	0.05	-0.09	-0.19	-0.26	-0.27

Table 15
Sensitivity Analyses of Long run Effect of a Canada-US Customs Union on Aggregate Variables with respect to key Parameters of the Model

(% Change over the Base Case)

Region	Exports	Imports	Value added	Consum-ption	Invest-ment	Terms of trade	Price of cons.	Price of invt.
Central Case: Combined Effect of the CET and the Rules of Origin is (CET rates are set to the minimum of Canada and U.S. external tariffs)								
CAN	17.40	17.76	1.07	0.55	1.13	-0.40	-0.69	-0.27
USA	5.93	5.18	0.11	0.09	0.15	0.09	-0.13	-0.18
MEX	23.65	18.90	4.25	1.36	4.96	-0.96	-0.06	-1.48
MER	0.42	0.52	0.04	0.06	0.07	0.16	0.11	0.09
LAT	0.96	1.20	0.22	0.28	0.21	0.47	0.35	0.25
EUR	-0.05	0.12	0.00	0.03	0.00	0.02	-0.01	-0.02
ROW	-0.18	0.01	-0.01	0.03	-0.03	0.01	-0.03	-0.03
Value of Elasticity parameters are increased by 25% at all levels								
CAN	21.49	22.18	1.05	0.70	1.06	-0.37	-0.70	-0.23
USA	7.14	6.17	0.10	0.09	0.12	0.06	-0.14	-0.18
MEX	27.36	22.10	4.39	1.33	5.15	-0.73	0.17	-1.26
MER	0.57	0.64	0.05	0.07	0.08	0.16	0.12	0.10
LAT	1.16	1.41	0.20	0.28	0.17	0.48	0.37	0.27
EUR	-0.04	0.15	0.01	0.04	0.01	0.02	-0.01	-0.02
ROW	-0.21	-0.01	-0.01	0.03	-0.03	0.01	-0.04	-0.04
Value of Elasticity parameters are reduced by 25% at all levels								
CAN	13.42	13.46	1.07	0.40	1.17	-0.47	-0.73	-0.35
USA	4.69	4.17	0.12	0.10	0.18	0.13	-0.13	-0.19
MEX	19.56	15.43	3.99	1.33	4.62	-1.28	-0.41	-1.79
MER	0.30	0.43	0.04	0.05	0.06	0.17	0.11	0.09
LAT	0.78	1.02	0.24	0.28	0.25	0.46	0.32	0.23
EUR	-0.04	0.11	0.00	0.03	0.00	0.03	-0.01	-0.01
ROW	-0.13	0.03	-0.01	0.03	-0.02	0.02	-0.03	-0.03

5. Conclusions

A multi-country/region, multi-sector dynamic CGE model was used to simulate the economic impacts of a Customs Union with the U.S. on Canadian industries. Our Customs Union simulation assumes common external tariffs by Canada and the U.S. against the non-NAFTA countries and the elimination of the rules of origin provisions of NAFTA by Canada, the U.S. and Mexico.

The simulation results suggest that a Customs Union between Canada and the U.S. will increase Canada's trade flows by close to 20 percent, and raise real GDP (value added) by as much as 1.1 percent. However, much of the impact on trade flows, consumption and real GDP come from the elimination of rules of origin. As a matter of fact, the gains from common external tariffs are very small, only 0.1 percent increase in real GDP. Mexico gains the most from the elimination of rules of origin. Its GDP increases by over 5 percent. On the other hand, U.S. GDP increases by only about 0.1 percent.

As expected, the trade, output and employment effects vary considerably across major industries in the three NAFTA countries. For instance, in Canada, the big beneficiaries of a Customs Union with the U.S. would be autos and high-tech manufacturing industries. On the other hand, food industry would face significant adjustment challenges. In Mexico autos, high-tech manufacturing industries and textiles would gain the most. On the other hand, the industry impacts are also small in the U.S., except a significant negative impact on agriculture industry.

The simulation results are robust to the variations in the magnitude of substitution parameters in the model. Our results imply that common external tariffs and the elimination of the rules of origin will deepen the economic linkages between the three NAFTA countries and will be beneficial to all three countries.

The reliability of simulation results critically depend on the accuracy of the MFN and NAFTA tariff rates by industry. We plan to re-run the simulations using the GTAP version 6

2001 database, expected to be released in the next six months. In addition, we are also planning to check for the sensitivity of the simulation results to the market structure assumptions. In this paper we imposed the competitive market assumption.

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Appendix 1: Mapping Scheme Followed in Aggregating Data and Parameters of the Model

A. Regions of the Model	Regions/countries in GTAP database
Canada	Canada
USA	The United States of America
Mexico	Mexico
Latin America	Central America and Caribbean, Colombia, Peru, Venezuela, rest of Andean Pact, Chile, rest of South America
Mercosur	Argentina, Brazil, Uruguay
Europe	Austria, Belgium, Denmark, Finland, France, Germany, United Kingdom, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, Switzerland, rest of EFTA
Rest of the World	Australia, New Zealand, China, Hong Kong, Japan, Korea, Republic of Taiwan, Indonesia, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Bangladesh, India, Sri Lanka, rest of South Asia, Hungary, Poland, rest of Central European Associates, former Soviet Union, Turkey, rest of Middle East, Morocco, rest of North Africa, Botswana, rest of SACU, Malawi, Mozambique, Tanzania, United Republic of Zambia, Zimbabwe, rest of southern Africa, Uganda, rest of sub-Saharan Africa, rest of world
B. Sectors of the Model	Sectors in GTAP database
Agriculture	Paddy rice, wheat, cereal grains nec., vegetables, fruit, nuts, oil seeds, sugar cane, sugar beet, plant-based fibers, crops nec., bovine cattle, sheep and goats, horses, animal products nec., raw milk, wool, silk-worm cocoons
Resource based industries	Forestry, fishing, coal, oil, gas, minerals nec.
Food	Bovine cattle, sheep and goat meat products, meat products, vegetable oils and fats, dairy products, processed rice, sugar, food products nec., beverages and tobacco products
Textiles	Textiles, wearing apparel, leather products
Manufacturing	Wood products, paper products, publishing, petroleum, coal products, chemical, rubber, plastic products, mineral products nec., ferrous metals, metals nec., metal products manufactures nec.
Automotive	Motor vehicles and parts, transport equipment nec.
Technology	Electronic equipment, machinery and equipment nec.
Services	Electricity gas manufacture, distribution, water, construction, trade, transport nec., water transport, air transport, communication, financial services nec., insurance, business services nec., recreational and other services, public admin. and defence, education, health, ownership of dwellings

Source: Authors Own Classification.

Appendix 2: List of Equations in the Model

Note: Unless otherwise stated subscripts, *i* and *j* stand for regions, *s*, *sd* and *sn* represent industrial sectors and *t* symbolizes time dimensions of the model. Full abbreviations of the acronyms are provided in Appendices 2 and 3.

Households

$$\text{Maximize } U_i = \int_0^{\infty} e^{-\psi_i . t} \frac{TC_{i,t}^{1-\theta_i}}{1-\theta_i} dt \qquad (\theta_i > 0,\ \psi_i > 0), \tag{1}$$

subject to

Accumulation of foreign asset/debt – Balance of payment constraint

$$DEBT_{i,t+1} - DEBT_{i,t} = r.DEBT_{i,t} + INC_{i,t} - TC_{i,t}.P\_TC_{i,t} - TI_{i,t}.P\_TI_{i,t}$$
$$- TI_{i,t}.P\_TI_{i,t}.ADJ_i.\left(TI\_R_{i,t}^{\ 2} - \delta_i^{\ 2}\right) \tag{2}$$

Steady-state condition

$$r.DEBT_{i,T} + INC_{i,T} - TC_{i,T}.P\_TC_{i,T} - TI_{i,T}.P\_TC_{i,T} = 0 \qquad (T = \text{terminal year}) \tag{3}$$

Equation of motion for aggregate capital stock

$$\frac{TK_{i,t+1} - TK_{i,t}}{r.(1+2.ADJ_i.\delta_i^{\ 2}) + \delta_i} = \left[TI_{i,t} - \frac{\delta_i}{r.(1+2.ADJ_i.\delta_i^{\ 2}) + \delta_i}.TK_{i,t} \right] \tag{4}$$

Arbitrage condition

$$\left(1+r\right).P\_TI_{i,t-1}.\left(1+3.ADJ_i.TI\_R_{i,t-1}^{\ 2} - ADJ_i.\delta_i^{\ 2}\right) =$$
$$\left[RENT_{i,t}.\left\{r.(1+2.ADJ_i.\delta_i^{\ 2}) + \delta_i\right\} + 2.ADJ_i.P\_TI_{i,t}.TI\_R_{i,t}.TI\_R_{i,t}^{\ 2} \right] \tag{5}$$
$$+ \left(1-\delta_i\right).P\_TI_{i,t}.\left(1+3.ADJ_i.TI\_R_{i,t}^{\ 2} - ADJ_i.\delta_i^{\ 2}\right)$$

where $TI\_R_{i,t}$ (rate of investment)

$$TI\_R_{i,t} = \frac{TI_{i,t}\left(r.(1+2.ADJ_i.\delta_i^{\ 2}) + \delta_i\right)}{TK_{i,t}} \tag{6}$$

Steady-state condition

$$TI_{i,T} = \frac{\delta_i}{r.(1+2.ADJ_i.\delta^2)+\delta_i}.TK_{i,T} \qquad (T = \text{terminal year}) \qquad \textbf{(7)}$$

Consumption

The time path of aggregate consumption is given by

$$\frac{TC_{i,t-1}}{TC_{i,t}} = \left[\frac{P\_TC_{i,t}(1+\psi_i)}{P\_TC_{i,t-1}(1+r)}\right]^{\frac{1}{\theta_i}} \qquad \textbf{(8)}$$

Price of aggregate consumption

$$\log\left(P\_TC_{i,t}\right) = \sum_s \rho_{i,s}.\log\left(P\_FC_{i,s,t}\right) \qquad \textbf{(9)}$$

Consumption demand for goods from each firm

$$C_{i,j,s,t} = \left(\beta\_FC_{i,j,s}.\left\{\frac{P\_FC_{j,s,t}}{P_{i,j,s,t}.\left(1+TAR_{i,j,s,t}\right)}\right\}^{\sigma_{j,s}} \rho_{j,s}.TC_{j,t}.P\_TC_{j,t}\right) \Big/ P\_FC_{j,s,t} \qquad \textbf{(10)}$$

Price of composite final consumption

$$\left(P\_FC_{j,s,t}\right)^{\left(1-\sigma_{j,s}\right)} = \sum_i NF_{i,s,t}.\beta\_FC_{i,j,s}.\left[P_{i,j,s,t}.\left(1+TAR_{i,j,s,t}\right)\right]^{\left(1-\sigma_{j,s}\right)} \qquad \textbf{(11)}$$

Investment

Price of aggregate investment

$$\log\left(P\_TI_{i,t}\right) = \sum_s \gamma_{i,s}.\log\left(P\_FI_{i,s,t}\right) \qquad \textbf{(12)}$$

Price of investment goods by sectors

$$\left(P\_FI_{j,s,t}\right)^{\left(1-\sigma_{j,s}\right)} = \sum_i NF_{i,s,t}.\beta\_FI_{i,j,s}.\left[P_{i,j,s,t}.\left(1+TAR_{i,j,s,t}\right)\right]^{\left(1-\sigma_{j,s}\right)} \qquad \textbf{(13)}$$

Investment demand for goods from each firm

$$I_{i,j,s,t} = \left(\beta\_FI_{i,j,s}.\left\{\frac{P\_FI_{j,s,t}}{P_{i,j,s,t}.\left(1+TAR_{i,j,s,t}\right)}\right\}^{\sigma_{j,s}} \gamma_{j,s}.TI_{j,t}.P\_TI_{j,t}\right) \Big/ P\_FI_{j,s,t} \qquad \textbf{(14)}$$

Firms

Unit cost function

$$UC_{j,sd,t} = \frac{1}{A_{j,sd}}\left(W_{j,t}^{\alpha_{L,j,sd}} . R_{j,sd,t}^{\alpha_{K,j,sd}} . \prod_{sd} P\_I_{j,s,sd,t}^{\alpha_{j,s,sd}}\right), \quad \textbf{(15)}$$

where,

$$A_{j,sd} = \left(\alpha_{L,sd}^{\alpha_{L,sd}} . \alpha_{K,sd}^{\alpha_{K,sd}} . \prod_{sd} \alpha_{j,s,sd}^{\alpha_{j,s,sd}}\right) \text{ are constants} \quad \textbf{(16)}$$

$$P_{i,j,sc,t} = \frac{UC_{i,sc,t}}{G_{i,j,sc}} \quad \forall\ sc = \text{competitive sector} \quad \textbf{(17)}$$

Demand for labour by sector

$$LDEM_{i,s,t} = NF_{i,s,t} . \left(\frac{\alpha_{L,i,s} . UC_{i,s,t} . Z_{i,s,t}}{W_{i,t}}\right) \quad \textbf{(18)}$$

Demand for capital by sector

$$KDEM_{i,s,t} = NF_{i,s,t} . \left(\frac{\alpha_{K,i,s} . VUC_{i,s,t} . Z_{i,s,t}}{R_{i,s,t}}\right) \quad \textbf{(19)}$$

Price of composite intermediates from sector *s* used in sector *sd*

$$\left[P\_INT_{j,s,sd,t}\right]^{\left(1-\sigma_{j,s}\right)} = \sum_{i} NF_{i,s,t} . \beta\_INT_{i,j,s,sd} . \left[P_{i,j,s,t}\left(1 + TAR_{i,j,s,t}\right)\right]^{\left(1-\sigma_{j,s}\right)} \quad \textbf{(20)}$$

Intermediate demand for goods from each firm

$$INT_{i,j,s,sd,t} = \left(\beta\_INT_{i,j,s,sd} . \left\{\frac{P\_INT_{j,s,sd,t}}{P_{i,j,s,t} . \left(1 + TAR_{i,j,s,t}\right)}\right\}^{\sigma_{j,s}} \alpha_{j,s,sd} . VUC_{j,sd,t} . Z_{j,sd,t}\right) \Big/ P\_INT_{j,s,sd,t} \quad \textbf{(21)}$$

Profit equation

$$\pi_{i,sn,t} = \sum_{j} P_{i,j,sn,t} . E_{i,j,sn,t} - UC_{i,sn,t} . Z_{i,sn,t} \quad \textbf{(22)}$$

Closure

Total income by region

$$INC_{i,t} = \sum_{s} \alpha_{w,i,s} . UC_{i,s,t} . NF_{i,s,t} . Z_{i,s,t} + \sum_{sn} NF_{i,sn,t} . \pi_{i,sn,t} + REV_{i,t} \qquad (w = L, K, J) \qquad \textbf{(23)}$$

$$REV_{i,t} = \sum_{s,j} NF_{j,s,t} . E_{j,i,s,t} . TAR_{j,i,s,t} . P_{j,i,s,t} \qquad \textbf{(24)}$$

Equilibrium conditions

Capital market clearing condition

$$TK_{i,t} = \sum_{s} KDEM_{i,s,t} \qquad \textbf{(25)}$$

$$\overline{L}_{i,t} = \sum_{s} LDEM_{i,s,t} \qquad \textbf{(26)}$$

$$\sum_{i} DEBT_{i,t} = 0 \qquad \textbf{(27)}$$

Total demand for each firm's product

$$E_{i,j,s,t} = C_{i,j,s,t} + I_{i,j,s,t} + \sum_{sd} INT_{i,j,s,sd,t} \qquad \textbf{(28)}$$

Goods market clearing condition

$$Z_{i,s,t} = \sum_{j} \frac{E_{i,j,s,t}}{G_{i,j,s}} \qquad \textbf{(29)}$$

Rental rates are equalized across sectors in the Steady-state

$$RENT_{i,t} = R_{i,s,t} \qquad \textbf{(30)}$$

Welfare index (ϕ)

$$\sum_{t=1}^{40} (1+\psi)^{-t} \frac{\left[\hat{TC}_t . (1+\phi)\right]^{1-\theta}}{1-\theta} = \sum_{t=1}^{40} (1+\psi)^{-t} \frac{TC_t^{1-\theta}}{1-\theta} \qquad \textbf{(31)}$$

Where $\hat{TC}_t$ and TC_t are, respectively, the benchmark and new, post-shock composite consumption streams. The welfare gains resulting from the policy change are equivalent to the change in the reference consumption profile by ϕ %.

Appendix 3: List of Variables of the Model

	Variable Name	Notation
1.	Variable unit cost of good *s* produced in region *i* at time *t*	$UC_{i,s,t}$
2.	Price of composite intermediate good *s* used in *ss* in region *i* at *t*	$P\_INT_{i,s,ss,t}$
3.	Net of tariff price in region *j* of good *s* produced in *i,* at *t*	$P_{i,j,s,t}$
4.	Profit in sector *s*, in region *i* at time *t*	$\pi_{i,s,t}$
5.	Number of firms in sector *s* in region *i* at *t*	$NF_{i,s,t}$
6.	Income in region *i* at time *t*	$INC_{i,t}$
7.	Price of aggregate consumption in region *i* at *t*	$P\_TC_{i,t}$
8.	Aggregate consumption in region *i* at *t*	$TC_{i,t}$
9.	Price of aggregate investment in region *i* at *t*	$P\_TI_{i,t}$
10.	Aggregate investment in region *i* at *t*	$TI_{i,t}$
11.	Rate of investment in region *i* at *t*	$TI\_R_{i,t}$
12	Price of consumption of composite good s, in region *i* at *t*	$P\_FC_{i,s,t}$
13	DD for good *s* produced by each firm in region *i*, by region *j* for final cons at *t*	$C_{i,j,s,t}$
14.	Price of composite investment good s, in region *i* at *t*	$P\_FI_{i,s,t}$
15.	Demand for good *s* produced by each firm in region *i*, by region *j* for invest at *t*	$I_{i,j,s,t}$
16.	Price of composite intermediate good s, for use by *sd* in region *i* at *t*	$P\_INI_{i,s,sd,t}$
17.	Demand for good *s*, produced in *i*, for use by *ss* in region *j* at *t*	$INT_{i,j,s,ss,t}$
18.	Total demand for each firm *s* product in region *i* from *j* a*t t*	$E_{i,j,s,t}$
19.	Gross output in sector *s*, in region *i* at *t*	$Z_{i,s,t}$
20.	Wage rate in region *i* at *t*	$W_{i,t}$
21.	Rental price of capital in region *i* at *t*	$RENT_{i,t}$
22.	Supply of capital	$TK_{i,t}$
23.	Demand for capital	$K^{D}_{i,s,t}$
	Net borrowing by region *i* at *t*	$DEBT_{i,t}$

Appendix 4: List of Parameters of the Model

	Variable Name	Notation
1.	World rate of interest	r
2.	Rate of time preference in region *i*	ψ_i
3.	Inverse of intertemporal elasticity of substitution in region *i*	θ_i
4.	Rate of depreciation in region *i*	δ_i
5.	Transportation cost between pairs of regions by sectors	$G_{i,j,s}$
6.	Adjustment cost in investment in region *i*	ADJ_i
7.	Share of composite good *s* in total consumption in region *i*	$\rho_{i,s}$
8.	Share of region *j*'s good in composite consumption good *s* in region *i*	$\beta\_FC_{i,j,s}$
9.	Share of composite good *s* in total investment in region *i*	$\gamma_{i,s}$
10.	Share of region *j*'s good in composite investment good *s* in region *i*	$\beta\_FI_{i,j,s}$
11.	Share of composite good *s* in total invest in region *j* used in sector *sd*	$\alpha_{j,s,sd}$
12	Share of region *j*'s good in composite invest good *s* in *i* used in sector *sd*	$\beta\_INT_{i,j,s,sd}$
13	Share of labor in variable unit cost in sector *s*, region *i*	$\alpha_{L,i,s}$
14.	Share of capital in VUC of S	$\alpha_{K,i,s}$
15.	Share of intermediates in VUC of S	$\alpha_{j,s,sd}$
16.	Scale of VUC of S	$A_{j,sd}$
17.	Different elasticity of substitution in final demands	$\sigma_{j,s}$
18.	Endowment of labour by region	$\overline{L}_i$

Appendix 5: Benchmark Bilateral Tariff rates (%)

	AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
Tariff rates imposed on imports from Canada								
United States	4.4	0.0	8.8	0.0	0.0	0.0	0.0	0.0
Mexico	33.7	0.0	34.1	0.0	0.0	0.0	0.0	0.0
Mercosur	6.8	0.2	20.1	16.5	8.1	14.1	12.3	0.0
Latin America	12.4	8.8	17.9	15.7	7.4	9.9	25.4	1.8
Europe	31.0	0.3	48.2	8.2	2.1	3.5	3.0	0.0
Rest of the World	66.3	1.2	33.9	12.5	3.6	5.7	6.2	0.4
Tariff rates imposed on imports from United States								
Canada	4.2	0.0	25.4	0.0	0.0	0.0	0.0	0.0
Mexico	17.0	0.0	32.9	0.0	0.0	0.0	0.0	0.0
Mercosur	6.8	0.3	16.6	16.8	10.5	13.5	16.5	0.0
Latin America	10.0	7.8	17.2	22.3	9.9	9.1	12.9	2.7
Europe	12.7	0.5	27.0	8.6	3.4	3.2	3.1	0.0
Rest of the World	45.1	1.8	40.4	12.3	5.8	4.6	4.2	0.2
Tariff rates imposed on imports from Mexico								
Canada	1.9	0.0	31.8	0.0	0.0	0.0	0.0	0.0
United States	8.6	0.0	8.8	0.0	0.0	0.0	0.0	0.0
Mercosur	10.9	2.0	17.2	16.2	10.1	14.4	36.3	0.0
Latin America	12.2	4.9	16.3	12.9	9.0	10.9	16.9	1.9
Europe	18.3	0.1	31.0	9.1	3.7	3.7	5.3	0.0
Rest of the World	24.8	1.8	40.7	11.7	7.0	3.4	12.3	0.2
Tariff rates imposed on imports from Mercosur								
Canada	2.0	0.0	17.7	11.5	4.1	2.6	3.3	0.0
United States	16.2	0.5	15.5	7.5	3.0	2.4	1.7	0.0
Mexico	6.9	9.9	21.4	11.6	9.4	11.6	13.4	0.0
Latin America	10.9	10.1	14.8	13.3	10.2	9.0	16.6	2.1
Europe	7.8	0.2	31.9	5.4	4.2	3.1	6.4	0.0
Rest of the World	41.9	1.8	34.6	8.5	5.1	7.1	14.6	0.3
Tariff rates imposed on imports from Latin America								
Canada	2.2	0.0	24.0	20.1	1.8	3.7	4.6	0.0
United States	13.4	0.4	18.0	14.5	2.5	3.5	1.3	0.0
Mexico	12.0	9.5	24.4	20.8	8.1	13.6	13.2	0.0
Mercosur	7.8	3.6	15.1	17.3	7.9	18.0	18.4	0.0
Europe	10.4	0.4	42.5	9.4	2.3	3.1	1.1	0.0
Rest of the World	33.0	1.3	26.5	10.4	3.0	5.6	2.1	0.2
Tariff rates imposed on imports from Europe								
Canada	4.7	0.0	49.9	14.9	4.3	2.8	2.6	0.0
United States	10.6	0.4	8.8	9.7	3.1	2.2	2.0	0.0
Mexico	5.6	6.8	30.0	22.3	9.6	8.8	12.8	0.0
Mercosur	9.8	2.4	17.8	15.9	10.8	14.2	22.1	0.0
Latin America	7.0	7.3	18.2	14.5	9.8	9.2	11.9	2.1
Rest of the World	23.8	4.5	37.6	15.0	8.6	7.1	11.7	0.2
Tariff rates imposed on imports from Rest of the World								
Canada	3.5	0.0	22.6	18.6	4.8	2.0	6.2	0.0
United States	14.6	0.4	12.2	13.3	2.8	1.8	2.6	0.0
Mexico	10.5	6.5	31.7	21.3	10.5	10.1	14.3	0.0

	AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
Mercosur	8.8	4.4	16.7	19.8	10.4	14.2	34.4	0.0
Latin America	12.1	4.9	18.6	13.3	10.7	9.9	15.0	2.1
Europe	10.2	0.1	40.6	10.6	3.6	3.9	6.7	0.0

Source: GTAP Data Base

Appendix 6: Calculation of Tariff preferences under the NAFTA*

(percentages)

	NAFTA			MFN			PREFERENCES		
	CAN	USA	MEX	CAN	USA	MEX	CAN	USA	MEX
US tariff rates									
AGRI	4.4	0.0	8.6	13.8	0.0	13.8	9.4	0.0	5.2
RESO	0.0	0.0	0.0	0.4	0.0	0.4	0.4	0.0	0.4
FOOD	8.8	0.0	8.8	11.9	0.0	11.9	3.2	0.0	3.1
TEXT	0.0	0.0	0.0	12.9	0.0	12.9	12.9	0.0	12.9
MANU	0.0	0.0	0.0	2.9	0.0	2.9	2.9	0.0	2.9
TECH	0.0	0.0	0.0	1.9	0.0	1.9	1.9	0.0	1.9
AUTO	0.0	0.0	0.0	2.3	0.0	2.3	2.3	0.0	2.3
SERV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canadian Tariff rates									
AGRI	0.0	4.2	1.9	0.0	3.1	3.1	0.0	-1.1	1.2
RESO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FOOD	0.0	25.4	31.8	0.0	33.7	33.7	0.0	8.3	1.9
TEXT	0.0	0.0	0.0	0.0	17.7	17.7	0.0	17.7	17.7
MANU	0.0	0.0	0.0	0.0	4.4	4.4	0.0	4.4	4.4
TECH	0.0	0.0	0.0	0.0	2.3	2.3	0.0	2.3	2.3
AUTO	0.0	0.0	0.0	0.0	4.5	4.5	0.0	4.5	4.5
SERV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mexican tariff rates									
AGRI	33.7	17.0	0.0	8.9	8.9	0.0	-24.8	-8.1	0.0
RESO	0.0	0.0	0.0	8.2	8.2	0.0	8.2	8.2	0.0
FOOD	34.1	32.9	0.0	28.7	28.7	0.0	-5.3	-4.2	0.0
TEXT	0.0	0.0	0.0	20.9	20.9	0.0	20.9	20.9	0.0
MANU	0.0	0.0	0.0	9.7	9.7	0.0	9.7	9.7	0.0
TECH	0.0	0.0	0.0	9.6	9.6	0.0	9.6	9.6	0.0
AUTO	0.0	0.0	0.0	13.4	13.4	0.0	13.4	13.4	0.0
SERV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: * - Tariff preferences are computed as the difference between the non-NAFTA average tariff rates and the NAFTA member tariff rates.

Appendix 7: Attractiveness of Options Available to Canadian Exporters to the U.S.: NAFTA utilization Rates and Rules of origin Restrictiveness Index

	NAFTA Utilization Rates for Canadian Exports 2002 (%)	Rules of origin Restrictiveness Index (out of 7)
Live animals	46	6.0
Vegetables	75	6.0
Fats & Oils	98	6.0
Food, beverages & Tobacc.	59	4.7
Mineral products	49	6.0
Chemicals	32	5.3
Plastics	93	4.8
Leather	58	5.6
Wood	17	4.0
Pulp and paper	26	4.8
Textile & clothing	95	6.9
Footwear	72	4.9
Stone, glass, cement	57	4.9
Jewelry	15	5.3
Base metals	65	4.6
Machinery	41	3.2
Transport equip	88	4.8
Optics	45	4.0
Arms	26	4.7
Miscellaneous	15	5.1
OVERALL	55	5.1

Source: Adapted from Goldfarb (2003), Sources used are U.S. International Trade Commission, WTO (2001), Cadot et al. (2002).

Appendix 8

Change in Member Bilateral Tariff rates after a Customs Union (% points)

(Other tariffs remain unchanged)

(CET is set to the min of Canada and US external tariff)

		AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
	Tariff rates imposed on imports from Canada								
1	United States	-4.4	0	-8.8	0	0	0	0	0
	Tariff rates imposed on imports from United States								
2	Canada	-4.2	0	-25.4	0	0	0	0	0
	Tariff rates imposed on imports from Mexico								
3	Canada	0	0	-23	0	0	0	0	0
4	United States	-6.6	0	0	0	0	0	0	0
	Tariff rates imposed on imports from Mercosur								
5	Canada	0	0	-2.2	-4	-1.1	-0.2	-1.6	0
6	United States	-14.2	-0.5	0	0	0	0	0	0
	Tariff rates imposed on imports from Latin America								
7	Canada	0	0	-6	-5.6	0	-0.2	-3.3	0
8	United States	-11.2	-0.4	0	0	-0.7	0	0	0
	Tariff rates imposed on imports from Europe								
9	Canada	0	0	-41.1	-5.3	-1.2	-0.6	-0.6	0
10	United States	-5.9	-0.4	0	0	0	0	0	0
	Tariff rates imposed on imports from the rest of the world								
11	Canada	0	0	-10.4	-5.3	-2	-0.3	-3.6	0
12	United States	-11.1	-0.4	0	0	0	0	0	0

Appendix 9
Change in Member Bilateral Tariff rates after a Customs Union (% points)

(Other tariffs remain unchanged)

(CET is set to the US external tariff)

		AGRI	RESO	FOOD	TEXT	MANU	TECH	AUTO	SERV
	Tariff rates imposed on imports from Canada								
1	United States	-4.4	0	-8.8	0	0	0	0	0
	Tariff rates imposed on imports from United States								
2	Canada	-4.2	0	-25.4	0	0	0	0	0
	Tariff rates imposed on imports from Mexico								
3	Canada	6.6	0	-23	0	0	0	0	0
4	United States	0	0	0	0	0	0	0	0
	Tariff rates imposed on imports from Mercosur								
5	Canada	14.15	0.5	-2.2	-4	-1.1	-0.2	-1.6	0
6	United States	0	0	0	0	0	0	0	0
	Tariff rates imposed on imports from Latin America								
7	Canada	11.2	0.4	-6	-6	0.7	-0.2	-3.3	0
8	United States	0	0	0	0	0	0	0	0
	Tariff rates imposed on imports from Europe								
9	Canada	5.9	0	-41.1	-5.3	-1.2	-0.6	-0.6	0
10	United States	0	0	0	0	0	0	0	0
	Tariff rates imposed on imports from the rest of the world								
11	Canada	11.1	0.4	-10.4	-5.3	-2	-0.3	-3.6	0
12	United States	0	0	0	0	0	0	0	0

Appendix 10
Change in Average Import-weighted Bilateral Tariff rates due to Elimination of Rules-of-Origin and Customs union (3a) (% points)

	CAN	USA	MEX	MER	LAT	EUR	ROW
CAN	0.00	-2.69	-0.58	0.10	0.26	0.10	0.09
USA	-4.12	0.00	-8.80	0.01	0.01	0.01	0.02
MEX	-3.61	-2.73	0.00	0.55	0.11	-0.02	-0.02
MER	-1.62	-1.40	-0.19	0.00	0.00	0.01	0.00
LAT	-0.96	-1.77	-0.06	0.00	0.00	0.00	0.00
EUR	-1.19	-0.04	-0.30	0.00	-0.01	0.00	0.00
ROW	-1.42	-0.13	-0.31	0.00	-0.02	0.00	0.00

Appendix 11
Changes in Regional Supply due a Canada-U.S. Customs Union
(CET is set to the Minimum of Canada U.S. External Tariff Rates

	AGRI	RESO	FOOD	TEXT	MANU	TECH	TRAN	SERV
Regional supply by Canada								
Canada	-6.8	1.9	-22.4	-12.3	-1.7	-2.4	-4.8	0.0
United States	84.5	1.7	93.7	168.2	15.8	14.0	51.0	-1.7
Mexico	-46.5	41.4	-4.3	150.6	35.9	33.4	130.2	2.8
Mercosur	1.4	0.4	6.0	7.4	0.7	2.1	14.7	-0.7
Latin America	2.4	0.9	6.9	7.7	1.4	2.2	14.3	0.2
Europe	1.7	-0.2	8.5	10.4	0.6	2.6	21.8	-1.6
Rest of the World	0.9	-0.2	5.4	6.7	0.3	1.6	13.9	-1.1
Regional supply by United States								
Canada	10.4	3.0	231.9	175.5	22.9	10.5	35.5	2.1
United States	-3.7	-0.1	-0.4	-1.3	-0.2	-0.7	-3.5	0.0
Mexico	-15.0	42.0	-5.5	136.6	35.8	31.6	104.1	4.0
Mercosur	1.2	0.8	1.6	1.5	0.7	0.7	1.6	0.5
Latin America	2.2	1.4	2.4	1.7	1.3	0.7	1.3	1.4
Europe	1.3	0.5	1.8	1.3	0.5	0.5	1.7	0.2
Rest of the World	0.6	0.2	1.0	0.7	0.2	0.2	1.0	0.1
Regional supply by Mexico								
Canada	-7.1	4.9	101.2	176.8	29.3	21.0	77.3	0.3
United States	54.7	4.2	10.1	147.2	21.7	22.2	64.9	-1.7
Mexico	3.2	3.3	1.3	-3.3	2.7	-5.9	-4.6	2.3
Mercosur	-3.6	2.0	-1.7	1.8	4.1	6.9	21.6	-0.7
Latin America	-2.7	2.6	-0.9	2.0	4.8	7.0	21.2	0.2
Europe	-5.8	2.3	-3.1	1.8	5.7	10.0	33.0	-1.5
Rest of the World	-4.1	1.4	-2.3	1.0	3.7	6.4	20.8	-1.1
Regional supply by Mercosur								
Canada	-7.4	1.6	-24.0	3.5	3.0	-4.2	-5.3	1.3
United States	81.4	1.5	-2.7	-3.7	-1.4	-2.0	-6.4	-0.7
Mexico	7.7	1.0	4.2	-10.4	-1.9	-11.3	-25.2	3.5
Mercosur	0.1	-0.1	0.0	0.0	0.0	-0.2	-0.3	0.0
Latin America	1.0	0.5	0.8	0.1	0.5	-0.1	-0.7	0.8
Europe	-0.4	-0.8	-0.5	-1.0	-0.7	-0.9	-1.5	-0.5
Rest of the World	-0.5	-0.6	-0.5	-0.8	-0.5	-0.7	-1.1	-0.4
Regional supply by Latin America								
Canada	-8.9	0.3	-11.5	11.5	-3.7	-5.5	13.3	0.0
United States	55.7	-0.5	-3.9	-5.1	1.0	-3.2	-7.7	-2.0
Mexico	6.5	0.1	3.4	-11.2	-2.6	-12.0	-25.9	2.6
Mercosur	-1.0	-1.0	-0.8	-1.1	-0.8	-1.0	-1.4	-0.8
Latin America	0.2	-0.3	0.2	-0.7	-0.2	-0.7	-1.4	0.0
Europe	-2.0	-2.2	-1.7	-2.5	-1.8	-2.1	-2.8	-1.8
Rest of the World	-1.6	-1.5	-1.3	-1.8	-1.2	-1.5	-2.0	-1.3
Regional supply by Europe								
Canada	-6.7	2.4	281.9	13.2	4.2	-1.2	-14.5	1.8
United States	23.3	1.9	-2.1	-2.8	-0.7	-1.3	-5.3	-0.2

Mexico	8.2	1.5	4.7	-9.8	-1.5	-10.9	-24.6	3.9
Mercosur	0.5	0.4	0.4	0.6	0.3	0.3	0.3	0.4
Latin America	1.5	1.0	1.3	0.8	1.0	0.3	0.0	1.2
Europe	0.4	0.0	0.1	-0.1	-0.1	-0.1	-0.3	0.0
Rest of the World	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2	-0.3	-0.1
Regional supply by Rest of the World								
Canada	-6.6	2.6	11.4	12.2	8.3	-3.2	19.7	1.9
United States	57.7	1.9	-1.9	-2.6	-0.7	-1.2	-5.1	-0.1
Mexico	8.3	1.6	4.8	-9.7	-1.4	-10.8	-24.5	3.9
Mercosur	0.6	0.5	0.5	0.7	0.4	0.3	0.5	0.4
Latin America	1.6	1.1	1.4	0.9	1.0	0.4	0.2	1.3
Europe	0.4	0.1	0.3	0.1	0.0	0.0	-0.1	0.1
Rest of the World	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.2	0.0