Why do countries pursue reciprocal trade agreements? A case study of North America

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Abstract

Trade theory has long argued that while it may be in the best interests of large a country to pursue reciprocal trade agreement to escape from a terms-of-trade driven prisoners' dilemma, the best course of action for a small country is always unilateral trade liberalization. This prediction is inconsistent with the growing number of reciprocal agreements involving a small country and large country/region. Using simulation results from a quantitative trade model of North America I am able to shed light on why small and large countries pursue reciprocal trade agreements. I show that the non-cooperative and cooperative payoffs implicit in recent North American trade agreements between a small country and a large country/region (that is, the CFTA and NAFTA) take on the form of the well-known prisoners' dilemma. In particular, I find that irrespective of country size unilateral liberalization makes the liberalizing country worse off, while making its regional trading partner better off, and that cooperative agreements make all liberalizing partners better off.

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1 Introduction

Despite the considerable effort that has gone into global trade agreements, such as the General Agreement on Tariffs and Trade, much of the trade liberalization achieved in the postwar era has in fact come from far-reaching reciprocal regional trade agreements that have involved just a few players. Early regional trade pacts, such as the European Union (EU), involved countries of roughly equal size, while the trend over the last decade has been for regional agreements that bring together one or more small countries and a large country or an established free-trade zone. [1] This trend has captured the attention of trade theorist because while trade theory argues that the best course of action for large countries is reciprocal trade agreements, it also argues that the best course of action for a small country is always unilateral trade liberalization.[2]

The theory underlying reciprocal trade liberalization agreements evolved from the optimal tariff literature, which dates back to Scitovsky (1942). The basic idea is that governments maximize their nations' welfare by unilaterally setting trade barriers so as to exploit their country's monopoly and monopsony power in world markets. A well-known implication of this theory is that countries that set their trade barriers optimally are made worse off by unilateral trade liberalization, while binding reciprocal trade agreements between countries makes them better off. Many trade theorists have gone on to argue that the cooperative and non-cooperative payoffs from trade liberalization implied by the optimal tariff literature take on the form of a classic prisoner's dilemma. In that setting, the dominant strategy of countries acting unilaterally is to pick the inefficient outcome of maintaining their trade barriers, while the efficient outcome of jointly eliminating trade barriers can only be achieved through a binding reciprocal trade agreement between countries.

[1] Prominent examples of this type of agreement are: the Canada-United States Free Trade Agreement (CFTA) involving the United States (U.S.) and Canada; the North American Free Trade Agreement (NAFTA) involving the CFTA and Mexico; and the European Union (EU) expansion involving the EU, Austria, Finland, Sweden and more recently Mexico.

[2] Some small countries, such as Mexico undertook some unilateral liberalization before negotiating a regional free trade agreement with a large trading partner. These unilateral programs were limited to the partial reduction of import taxes on goods. This pales in comparison to the trade liberalization undertaken in the regional agreements, which is designed to eliminate all tariff and non-tariff barriers to not only goods trade, but also services trade and international capital flows. Adding to this is empirical work by Roland-Host, Reinert and Sheills (1994) which found the pre-liberalization levels of North American import protection provided by actual import tariffs in 1988 were extremely low when compared with the protection levels implied by tariff-equivalent estimates of non-tariff barriers.

Fluctuations in the terms of trade drive the prisoners' dilemma theory of reciprocal trade liberalization. Unilateral liberalization creates an excess supply of the country's exportable and an excess demand for the country's importable, which leads to a deterioration of their terms of trade and a fall in their real income. The loss of real income typically outweighs the gains from removing the deadweight losses associated with trade barriers, so the liberalizing country is made worse off. At the same time the trading partners of the liberalizing country are made better off by because their terms of trade improve. In contrast, reciprocal agreements have a negligible impact on the terms of trade of all trading partners, so all countries gain by the size of the deadweight losses associated with trade barriers. This comes about because one country's excess supply of exportables satisfies another country's excess demand for importables. It is easy to see this in the simple case of symmetric trading partners where a reciprocal trade agreement would leave the terms of trade of all countries unchanged.

A key assumption supporting this theory is that countries can influence their terms of trade through their trade policies. This has led economists to question the relevance of the prisoners' dilemma theory in explaining the recent shift to reciprocal agreements involving small and large countries/regions, since the actions of small countries are assumed to have little influence on their own terms of trade. Others have responded to this by arguing that the process of reciprocal liberalization is purely motivated by political considerations, such as regional defense. Bagwell and Staiger (1998) evaluate these competing views within the context of a theoretical model in which governments are motivated by political and terms-of-trade considerations. Within their framework they show that more general government objectives do not change the view that reciprocal trade agreements provide an escape from a terms-of-trade driven prisoner's dilemma, and that this is all that reciprocal agreements do.

This paper examines the issue in another way by directly estimating the cooperative and non-cooperative payoffs implicit in actual free trade agreements negotiated between small and large countries to see if they take the form of the prisoners' dilemma. My analysis lends support to the terms-of-trade driven prisoners' dilemma theory of reciprocal trade liberalization. Using simulation results from a quantitative trade, model calibrated to North American data, I show that the Canadian-US Free Trade Agreement (CFTA) and North American Free Trade Agreement (NAFTA) take on the two essential elements of the terms-of-trade driven prisoners' dilemma. First, I show that if the countries/regions involved in these agreements had unilaterally liberalized their trade by the same amount specified by the CFTA and NAFTA they would have been made worse off, while their regional trading partners would have been made better off. Next, I show that the countries/regions involved in these agreements are indeed better off by pursuing reciprocal trade liberalization along the lines specified by the CFTA and NAFTA.

The method used in this paper to measure welfare gains from trade liberalization is quite different from earlier quantitative analyses of the CFTA and NAFTA. Previous analysis relied on static computable general equilibrium (SCGE).[3] Despite their complexity these models ignore three important dynamic consequences of trade liberalization which causes them to misestimate the welfare gains from trade liberalization.

First, static models limit the world supply of capital to that available in the pre-liberalized steady state. Therefore, static welfare and output gains associated with liberalization come from a reallocation of capital across sectors and countries. This ignores the fact that capital accumulation is generally more efficient under liberalized trade, because trade barriers on durable goods are essentially a tax on investment, and therefore understates the potential welfare and output gains that accrue from liberalization.

Some static researchers have attempted to rectify this weakness by incorporating exogenous increases in the supply of capital and/or total factor productivity in their quantitative analysis (see, for examples, the NAFTA studies of Brown, Deardorff and Stern (1992) and Sorbazo (1994)). In the absence of a fully specified dynamic model it is impossible to quantify the appropriate size of the capital accumulation and its likely effect on consumption, labor effort and ultimately welfare, so despite claims to contrary these studies offer no guide to the dynamic consequences of trade liberalization.

Second, static trade models also potentially underestimate the gains from liberalization by not allowing for trade in financial assets, which is a by-product of restricting national current accounts to zero. This comes about because capital flows serve three basic (although not mutually exclusive) purposes, which directly raise national and international welfare. By trading international assets agents can achieve a higher level of welfare by maintaining smooth consumption paths while undertaking major capital investment and sectoral reallocation of factors following liberalization. Next, international capital flows raise welfare by allowing for a more rapid adjustment to the new policy environment. Finally, by trading international assets agents can achieve a more efficient allocation of resources across countries.

[3] See, for examples, conference volumes by Greenway and Whalley (1992), Lustig, Bosworth and Lawerence (1992), Francois and Shiells (1994), Kehoe and Kehoe (1995), and Francois and Reinert (1997).

Third, the appropriate measure of the change in welfare from liberalization is the permanent change in pre-liberalization steady state consumption that has the same present value as the consumption path that agents experience along the transition path to the post-liberalization steady state. There is no transition path in static models because they explicitly assume that trade liberalization agreements are fully implemented at the date they are signed and that factors of production are perfectly mobile. In other words, static models assume that the economy jumps from the pre-liberalized to the post-liberalized steady state at the time the agreement is signed. In this setting the change in welfare from liberalization is simply measured as the difference between the post- and pre-liberalized consumption. This approach potentially overstates the welfare gains from liberalization if there are significant costs associated with reallocating factors of production or if trade policies are phased-in over a long period of time.

I overcome these limitations and in the process more accurately measure the welfare effects of trade liberalization by utilizing a dynamic computable general equilibrium model (DCGE). The model developed in this paper incorporates, capital accumulation, trade in financial assets, costs of reallocating factors of production and a slow phase-in of trade policy changes. In a companion paper, Kouparitsas (1998) I analyze the dynamic gains from trade. I show that ignoring capital accumulation and trade in financial assets reduces the welfare gains of trade liberalization, while ignoring the costs of reallocating factors of production and the slow phase-in of policies overstates the welfare gains of trade liberalization.

The remainder of the paper is organized as follows. The North American trade model is described in detail in section 2. Model parameterization and the method used generate the model’s transitional dynamics are discussed in section 3. Section 4 reports the papers main results on unilateral vs. reciprocal liberalization. The paper concludes in section 5 by way of a brief summary of the papers main results and suggestions for future empirical research.

2 A model of North American trade

The model developed in this paper is similar to earlier DCGE studies of U.S. unilateral trade liberalization by Goulder and Eichengreen (1992) and multilateral liberalization of the Asia Pacific region by McKibbin and Wilcoxen (1995). The main difference between the present paper and these earlier studies is that I am interested in the consequences of unilateral and reciprocal liberalization across North American countries. I follow these earlier studies by modeling the countries/regions of interest individually (U.S. and Canada in the case of the CFTA analysis, and the CFTA region and Mexico in the case of the NAFTA analysis), while consigning the remaining countries to a residual rest of the world (ROW). All countries/regions, including the ROW, are fully specified in the sense that production, consumption, investment, work effort and trade decisions are the result of explicit optimization decisions.

The inclusion of a fully specified ROW ensures that all quantities and prices are determined within the model. This avoids the need for ad hoc residual ROW supply and demand equations and constant import prices that are used in partial equilibrium dynamic studies, such as, Keuschnigg and Kohler (1997) and Jorgenson and Ho (1994). This feature of the model is an important part of the present study, and arguably all trade liberalization analysis, since I am interested in the effects of unilateral and reciprocal trade liberalization on the liberalizing countries' terms of trade.

Figure 1 provides a summary of the domestic and international goods and factor flows in the model. Each country/region has five production industries: primary raw materials, non-durable manufactures, durable manufactures, construction, and services. Primary raw materials, non-durable manufactures and durable manufactures are traded goods, while construction and services are non-traded goods. Primary goods include agriculture and mining. These goods are largely used as intermediate inputs in the production of non-durable and durable manufactured goods. Non-durable manufactures include food processing, beverages, chemicals, textiles, paper and apparel. Non-durable manufactures are used as an intermediate input in the production of other goods and a non-durable consumption good. Durable goods include basic metal and non-metal products, wood and furniture products, machinery and transportation equipment. Construction includes residential and non-residential structures. The production and household capital stocks are made up from investment of durable manufactures, construction goods and service sector inputs. Services cover utilities, finance, insurance, real estate, transportation, and retail and wholesale activities. Services are largely used as a non-durable consumption good. In the following discussion industries are indexed by *i* or *j*, while countries/regions are indexed by *h* or ℓ.

2.1 Preferences

Each country ℓ has a single infinitely lived representative household that maximizes its lifetime utility U_ℓ from consuming a composite consumption good $c_{\ell t}$ and leisure $L_{\ell t}$:

$$U_\ell = \sum_{t=0}^{\infty} \beta^t \frac{\left(c_{\ell t}^{\theta_{c\ell}} L_{\ell t}^{1-\theta_{c\ell}}\right)^{1-\sigma}}{1-\sigma} \text{ for } \sigma > 0 \text{ and } \sigma \neq 1,$$

and

$$U_\ell = \sum_{t=0}^{\infty} \beta^t \left(\theta_{c\ell} \ln(c_{\ell t}) + (1-\theta_{c\ell})\ln(L_{\ell t})\right) \text{ for } \sigma = 1, \tag{1}$$

where $0 < \beta < 1$, $0 < \theta_{c\ell} < 1$ for all ℓ. β denotes the household's subjective rate of time discount and $1/\sigma$ is the household's intertemporal elasticity of substitution.

Consumption is an aggregate of non-durable consumption goods $nd_{\ell t}$ and the service flow from the household durable goods, which is assumed to be proportional to the stock of household durable goods $d_{\ell t}$. Non-durable goods and the flow of services from household durable goods are aggregated according to a constant elasticity of substitution (CES) function:

$$c_{\ell t} = \left(\omega_{c\ell} nd_{\ell t}^{1-\eta} + (1-\omega_{c\ell}) d_{\ell t}^{1-\eta}\right)^{\frac{1}{1-\eta}}, \tag{2}$$

where $0 \leq \omega_{c\ell} \leq 1$ and $\eta > 0$ for all ℓ. The elasticity of substitution between non-durable consumption goods and durable services is $1/\eta$. Different varieties of non-durable consumption goods $c_{j\ell t}$'s are also aggregated by a CES function:

$$nd_{\ell t} = \sum_j \left(\omega_{cj\ell} c_{j\ell t}^{1-\kappa}\right)^{\frac{1}{1-\kappa}}, \tag{3}$$

where $0 \leq \omega_{cj\ell} \leq 1, \sum_j \omega_{cj\ell} \leq 1$ and $\kappa > 0$ for all ℓ. The elasticity of substitution between different varieties of non-durable consumption goods is $1/\kappa$.

2.2 Production technology

Following the static CGE literature I make the standard multi-sector assumption that sector *j*'s gross production $y_{j\ell t}$ is described by a two-level CES function (see, for example, Shoven and Whalley, 1992):

$$y_{j\ell t} = \left(\omega_{yj\ell} va_{j\ell t}^{1-\varepsilon_j} + (1-\omega_{yj\ell}) m_{j\ell t}^{1-\varepsilon_j}\right)^{\frac{1}{1-\varepsilon_j}}, \tag{4}$$

where $0 \le \omega_{yj\ell} \le 1$ and $\varepsilon > 0$ for all j, ℓ. The first level of production involves a “value-added” term $va_{j\ell t}$ and an “intermediate goods” term $m_{j\ell t}$. The elasticity of substitution between the value-added and intermediate inputs in sector j is $1/\varepsilon_j$.

The value-added term is described by Cobb-Douglas technology, which uses capital $k^{s}_{j\ell t}$ and labor services $N^{s}_{j\ell t}$:

$$va_{j\ell t} = k^{s\theta_{j\ell}}_{j\ell t} N^{s1-\theta_{j\ell}}_{j\ell t} \ , \tag{5}$$

where $0 < \theta_{j\ell} \le 1$ for all j, ℓ.

The other factor of production is the intermediate goods term, which is a composite of intermediate inputs from all five sectors. In the following discussion $m_{ij\ell t}$ denotes the flow of intermediate goods from sector i to sector j in country ℓ. These different types of intermediate inputs are aggregated according to the following CES function:

$$m_{j\ell t} = \sum_i \left(\alpha_{ij\ell} m^{1-\psi_j}_{ij\ell t}\right)^{\frac{1}{1-\psi_j}} \ , \tag{6}$$

where $0 \le \alpha_{ij\ell} \le 1$, $\sum_i \alpha_{ij\ell} = 1$ and $\psi > 0$ for all i, j, ℓ. The elasticity of substitution between different types intermediate inputs in sector j is $1/\psi_j$.

2.3 Investment behavior

There are two types of physical investment in this model. First, firms and households invest in physical capital goods that are either used as inputs in the production of goods or household services. Production capital $x_{\ell t}$ and household durable $s_{\ell t}$ investment is a composite of durable manufactures $z_{3\ell t}$, construction $z_{4\ell t}$ and service $z_{5\ell t}$ goods. The three types of investment goods are aggregated according to a CES function:

$$x_{\ell t} + s_{\ell t} = \sum_j \left(\omega_{zj\ell} z^{1-\upsilon}_{j\ell t}\right)^{\frac{1}{1-\upsilon}} \ , \tag{7}$$

where $0 \le \omega_{zj\ell} \le 1$, $\sum_j \omega_{zj\ell} = 1$ and $\upsilon > 0$ for all j, ℓ. The elasticity of substitution between different varieties of investment goods is $1/\upsilon$.

I assume that production and household capital goods depreciate at a rate δ. Another feature of the dynamic model is that it allows for costs of adjusting sectoral and aggregate capital stocks. I use a quadratic aggregate cost of adjustment function in which the size of the adjustment costs is determined by the parameter ξ. Higher values of ξ imply greater adjustment costs. Using this notation I can describe the accumulation of production capital $k_{j\ell t}$ and household durable goods $d_{j\ell t}$ in country ℓ by the following:

$$k_{\ell t+1} = x_{\ell t} - \frac{\xi}{2}\left(\frac{x_{\ell t}}{k_{\ell t}} - \frac{x_{\ell}}{k_{\ell}}\right)^2 k_{\ell t} + (1-\delta)k_{\ell t}, \tag{8}$$

$$d_{\ell t+1} = s_{\ell t} - \frac{\xi}{2}\left(\frac{s_{\ell t}}{d_{\ell t}} - \frac{s_{\ell}}{d_{\ell}}\right)^2 d_{\ell t} + (1-\delta)d_{\ell t}, \tag{9}$$

where $0 < \delta \leq 1, \xi > 0$ and x_{ℓ} / k_{ℓ} and s_{ℓ} / d_{ℓ} denote the steady state investment to capital stock and household durable investment to durable stock ratios, for all ℓ.

I also allow for costs of adjusting sectoral capital stocks. I employ a similar convex sectoral cost of adjustment function. Sector *j*'s service flow from capital is described by the following:

$$k_{j\ell t}^{s} = k_{j\ell t} - \frac{\xi_j}{2}\left(\frac{k_{j\ell t}}{k_{\ell t}} - \frac{k_{j\ell}}{k_{\ell}}\right)^2 k_{\ell t}, \tag{10}$$

$$k_{\ell t} = \sum_{j} k_{j\ell t} \tag{11}$$

where $\xi_j > 0$ and $k_{j\ell} / k_{\ell}$ denotes the steady state ratio of sector *j* to aggregate capital for all j, ℓ.

Second, firms store goods for later use as intermediate inputs in the production of future goods. The time period in the model is a quarter. Empirical evidence from Ramey (1989) suggests that intermediate goods require one quarter to put in place. Based on this finding I assume that period *t+1* intermediate inputs $m_{ij\ell t+1}$ are produced in period *t*.

2.4 Trade flows

The model allows for trade between the North American countries of interest and the ROW. Where the ROW is a composite of Canadian and U.S. (CFTA area and Mexican) trading partners in the case of the CFTA (NAFTA). Let $f_{jh\ell t}$ denote country ℓ 's private use of good *j* produced in country *h*. For $h \neq \ell$, $f_{jh\ell t}$ denotes country ℓ 's private imports of good *j* from country *h*. Private final expenditure for good *j* is described by the following using a CES aggregation function for foreign and home goods:

$$c_{j\ell t} + z_{j\ell t} + \sum_i m_{ji\ell t+1} = \sum_k \left(\omega_{jh\ell} f_{jk\ell t}^{1-\mu_j}\right)^{\frac{1}{1-\mu_j}} , \tag{12}$$

where $0 \le \omega_{jh\ell} \le 1$, $\sum_h \omega_{jh\ell} = 1$ and $\mu_j > 0$ for all j, ℓ.[4] Recall $c_{j\ell t}$ describes non-durable consumption of good *j*, $z_{j\ell t}$ describes investment using good *j*, and $m_{ij\ell t}$ denotes the flow of intermediate goods from sector *i* to sector *j* at time *t*. The elasticity of substitution between home produced and all imported varieties of good *j* is $1/\mu_j$.

2.5 Government

Each country has a government that imposes tariffs and non-tariff barriers on imported goods. The tariff rate in country ℓ for good *j* imported from country *h* is $\tau_{jh\ell t}$. It is difficult to model non-tariff barriers (NTBs) directly so I take the standard approach of using so-called tariff equivalent NTBs. A tariff equivalent NTB is simply the level of tariff protection that would yield the same allocation of output, expenditure and factors of production as the NTB in the pre-liberalized steady state. The country ℓ tariff equivalent NTB for good *j* imported from country *h* is $\rho_{jh\ell t}$. The revenue from the tariff and the quota rents from the NTBs are rebated by lump-sum payments, denoted by $TR_{\ell t}$ and $QR_{\ell t}$ respectively. The government also levies a lump-sum tax $LT_{\ell t}$ to finance its current spending. Let p_{jht} to denote the price of country *h*'s good *j* in terms of the numeraire good. Using this notation country ℓ's government budget constraint is given by the following:[5]

$$\sum_h \sum_j p_{jht} g_{jh\ell t} + TR_{\ell t} + QR_{\ell t} = \sum_{h \ne \ell} \sum_j \left(\tau_{jh\ell t} + \tau_{jh\ell t}\right) p_{jht} f_{jh\ell t} + LT_{\ell t} , \tag{13}$$

$$TR_{\ell t} = \sum_{h \ne \ell} \sum_j \tau_{jh\ell t} p_{jht} f_{jh\ell t} , \tag{14}$$

$$QR_{\ell t} = \sum_{h \ne \ell} \sum_j \rho_{jh\ell t} p_{jht} f_{jh\ell t} , \tag{15}$$

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[4] Differentiating goods by location is necessary to rule out complete specialization. See Baxter (1992) for a discussion of how complete specialization, along the lines of Ricardian comparative advantage, emerges in a dynamic Heckscher-Ohlin-Samuleson model where goods are not differentiated by production location.

[5] I maintain ROW non-durable manufactured goods as the numeraire throughout the analysis.

where $g_{jh\ell t}$ is the country ℓ 's government consumption of good *j* from country *h*. Combining these results implies $LT_{\ell t} = \sum_h \sum_i p_{iht} g_{ih\ell t}$. For simplicity I assume that the public sector and the private sector have the same aggregation function for all goods, so real government spending on good *j* is:[6]

$$g_{j\ell t} = \sum_h \left(\omega_{jh\ell} g_{jh\ell t}^{1-\mu_j}\right)^{\frac{1}{1-\mu_j}} \quad , \tag{16}$$

Real government spending is held constant in the trade policy simulations.

2.6 Resource constraints

Labor $N_{\ell t}$ is a non-reproducible factor of production. Labor is mobile between sectors $N_{j\ell t}$ within in a country, subject to small adjustment costs. Following my approach to sectoral capital adjustment costs I employ a quadratic cost of adjustment function where the costs of adjusting labor in sector *j* are governed by a parameter φ_j , where higher levels imply higher adjustment costs. Using this notation sector *j*'s effective input of labor is:

$$N_{j\ell t}^{s} = N_{j\ell t} - \frac{\varphi_j}{2}\left(\frac{N_{j\ell t}}{N_{\ell t}} - \frac{N_{j\ell}}{N_{\ell}}\right)^2 N_{\ell t}, \tag{17}$$

$$N_{\ell t} = \sum_j N_{j\ell t} \ , \tag{18}$$

where $\varphi_j > 0$ for all j, ℓ. The household's endowment of total hours is normalized to unity, which imposes the following constraint on labor and leisure:

$$1 - L_{\ell t} - N_{\ell t} = 0 \text{ for all } \ell . \tag{19}$$

Household trade one period bonds $b_{\ell t}$. The price of these assets in terms of the numeraire good is p_{bt} . With this notation in hand country ℓ 's representative household's intertemporal budget constraint is:

$$\sum_j p_{j\ell t} y_{j\ell t} + b_{\ell t} + QR_{\ell t} + TR_{\ell t} = \sum_h \sum_j \left(1 + \tau_{jh\ell t} + \rho_{jh\ell t}\right) p_{jht} f_{jh\ell t} + LT_{\ell t} \text{ for all } \ell . \tag{20}$$

Each regional economy is also subject to the following sectoral resource constraints:

[6] Backus, Kehoe and Kydland (1995) make a similar assumption in their dynamic one-sector model of international trade.

$$y_{j\ell t} = \sum_h x_{jh\ell t} + g_{jh\ell t} \text{ for all } \ell . \tag{21}$$

Finally, regional economies are subject to an international bond market constraint:

$$\sum_\ell b_{\ell t} = 0 . \tag{22}$$

2.7 Equilibrium and model solution

The representative household in each country/region owns all productive inputs. Each period households maximize their utility by selling their capital services, labor services and intermediate goods to firms in the same country on the competitive market, taking prices as given, and buying goods from domestic and foreign firms on the competitive market, taking prices as given. Households also trade assets internationally with foreign residents on the competitive market, taking the price as given. Firms maximize profits by selling their goods on the competitive market, taking prices as given, to both domestic and foreign residents and buying capital services, labor inputs and intermediate goods from households in the same economy on the competitive market, taking prices as given. The competitive equilibrium is described by the sequences of capital, labor, consumption, investment, bonds and their associated prices that satisfy the regional representative household's and firm's optimization problems and the market clearing conditions.

I assume that the agents have perfect foresight which allows me to follow Mendoza and Tesar (1998) in solving for the model's post-liberalization steady state and transitional dynamics using a linearized version of the shooting algorithm proposed by Lipton, Poterba, Sachs, and Summers (1982). This approach is necessary because the solution of the transitional dynamics of trade liberalization requires the simultaneous solution of the paths of foreign debt accumulation and the net foreign asset positions in the post-liberalization steady state.

Following Mendoza and Tesar (1998) I take an initial guess of the long-run bond positions to which countries converge after trade liberalization and solve for the post-liberalization steady state. I then use the linear approximation algorithm of King, Plosser and Rebelo (1988) to generate the transitional dynamics around this new steady state. Using this approximation I simulate the transitional dynamics for 2,500 periods by setting the initial conditions to the pre-liberalization values of the state variables. The simulations produce a path of foreign debt dynamics that converges to some long-run position. If this long-run position differs from the initial guess the post-liberalization debt positions are updated and the process is repeated. The number of iterations it takes to converge depends on the non-linearity of the model. For example, this method converges in just a few iterations if household preferences and production functions are assumed to be Cobb-Douglas.

3 Benchmark parameters

The model must be parameterized before I can apply numerical solution methods. Direct estimation of all the model's parameters is ruled out by the fact that there is insufficient international data to estimate all preference, production, and trade parameters. Researchers working with SCGE models have overcome this problem by using model calibration (see, for example, Shoven and Whalley 1992). More recently this approach has been extended DCGE models of international trade (see, for example, Backus, Kehoe and Kydland (1995)). Calibration essentially involves two steps. First, the researcher chooses a set of elasticities that describe the degree of substitution in consumption, production, and trade. Second, given this set of elasticities the researcher chooses shares in preference, production, and trade aggregation functions so that the model's steady state matches actual expenditure, output, production, and trade shares estimated from data at a specific point in time (or the base year).

In my case I draw on the SCGE and DCGE literatures whenever possible. Multi-sector features of the dynamic model are calibrated using elasticities from well-known static studies: Roland-Holst, Reinert, and Shiells (1994); Brown, Deardorff and Stern (1992); Sorbazo (1994) and Whalley (1985). Similarly, dynamic features of the model are calibrated by drawing on the parameter set used in the international DCGE literature. I follow most SCGE studies of the CFTA and NAFTA in calibrating the model's base years or pre-liberalization steady states to data from 1988. Table 1 summarizes the model's parameters.

3.1 Preference parameters

I follow the DCGE literature in specifying that the intertemporal elasticity of substitution $1/\sigma$ is 0.5 and that the consumption/leisure share parameter $\theta_{c\ell}$ is consistent with 20 percent of the agent's total time being devoted to market activity. This is more general than the utility functions used in Goulder and Eichengreen (1992) and McKibbin and Wilcoxen (1995). They assumed a fixed supply of labor by imposing that $\theta_{c\ell} = 1$. The subjective discount factor β is set to 0.9852, which implies an annual interest rate of about 5 percent. My benchmark elasticities of substitution for household durable $1/\eta$ and non-durable $1/\kappa$ goods are set to unity (that is, nested household preferences are Cobb-Douglas), which is typical in SCGE studies. Finally, $\omega_{c\ell}$ and $\omega_{cj\ell}$ are calibrated so that they match national accounts estimates of household non-durable and durable expenditure shares for 1988.

3.2 Production and investment parameters

The description of production in the previous section follows the static CGE literature by assuming a two level CES structure, with a Cobb-Douglas value-added component and intermediate goods aggregated by a CES function. I rely on Bruno's (1984) estimate of the elasticity of substitution between value-added component and intermediate goods aggregate. He finds that across industrial countries this elasticity is 0.5. This suggests that there is greater substitution possibilities in my dynamic model than is typical in static CGE studies which assume production is Leontief by imposing zero elasticities of substitution. I follow the static literature in assuming that the elasticity of substitution between different types of intermediate goods is the same as the elasticity of substitution between value-added and intermediate inputs. All other production parameters are derived from cost shares estimated from the input-output tables of Canada, Mexico and the U.S. The ROW is largely made up of large industrial countries, so I model their production functions using U.S. input-output data.

The quarterly depreciation rate δ is set at 3 percent and the aggregate capital adjustment parameter ξ is set to 10, which is consistent with most quarterly DCGE studies. My estimates of the sectoral labor and capital adjustment costs function parameters are based on the multi-sector international real business cycle analysis of Kouparitsas (1996). I show in that paper that the observed volatility of U.S. sectoral investment and labor hours is implies relatively higher adjustment costs in the primary sector, which is consistent with the view that primary sector factors of production are more industry specific.

There is a scant empirical literature on the degree of substitution between different types of household and industrial durable goods. In light of this, I follow the SCGE literature's approach to non-durable aggregation by setting the elasticity of substitution between different types of durable goods to unity. The $\omega_{xj\ell}$'s are calibrated so that they match estimates of expenditure shares for investment goods from national account data for 1988.

3.3 Trade flow and policy parameters

Explicit tariff rates are readily available from various national and international trade organizations and previous static studies. In contrast, it is difficult to incorporate NTBs such as quotas and other non-price restrictions in SCGE models, so researchers use so-called tariff equivalent measures of NTBs in their quantitative analysis. A tariff equivalent NTB is simply the tariff that would be necessary to generate the same sectoral and international distribution of output, expenditure and factors of production as the NTB in the pre-liberalized steady state. Table 2 provides an overview of Roland-Host, Reinert and Shiells' (1994) comprehensive estimates of the levels of tariff and tariff equivalent NTB protection that existed prior to the signing of the CFTA and NAFTA in 1988. For comparability with earlier static analyses I set the pre-CFTA and NAFTA levels of protection in my model to match Roland-Holst et al.'s estimates. The resulting sectoral and international distribution of output, expenditure and factors of production are close to the base year data. This suggests that the alternative strategy of estimating the tariff equivalent NTB's directly from the dynamic model using the actual sectoral and international distribution of output, expenditure and factors of production would yield values similar to those estimated by Roland-Holst et al.

The CFTA was signed in 1988 and was designed to eliminate all trade barriers between Canada and the U.S., described in Table 2. The majority of the tariff reductions were phased in over a 10 to 15 year period, starting the first quarter of 1989 and ending in 2004. NAFTA followed the signing of the CFTA in 1992, so I model NAFTA as the joint free trade agreement between the CFTA area and Mexico. In practical terms NAFTA, it involves the removal of barriers to Mexican exports to CFTA area, and CFTA area exports to Mexico. Like the CFTA, the majority of tariff reductions are expected to be phased-in over 10 to 15 years, starting in the first quarter of 1994 and ending in 2009. All policy simulations begin in the period following the signing of the initial trade agreement (first quarter of 1988 for CFTA and first quarter of 1993 for NAFTA). I conduct the simulations as if agents in the world economy perfectly anticipated the path of trade liberalization described above. This assumes that agents knew at the date of the initial signing that the CFTA and NAFTA would be implemented one year after the signing and phased-in over a 15 year period.

There is a wide range of values for the elasticity of substitution between home and foreign goods $1/\mu_j$ used in the quantitative trade literature. I consider a range of values. My benchmark model adopts an elasticity of 1.5 for all goods, which is widely used in the international DCGE literature (see, for example, Backus, et al (1995)) and multi-country static CGE studies of trade liberation, such as Whalley (1985). My lower bound estimates are based on the empirical studies of Shiells and Reinert (1993) for Canada and the U.S., and Sobarzo (1994) for Mexico, which were used by Roland-Host, Reinert and Shiells' (1994) in their analysis of the CFTA and NAFTA. They find the elasticity of substitution is closer to unity. My upper bound is based on Brown, Deardorff, and Stern's (1992) trade liberalization analysis, which uses an elasticity of substitution of 3. My sensitivity analysis suggests that the welfare gains depend critically on these elasticities of substitution: trade liberalization generates significantly lower welfare effects if there is a low degree of substitution between home and foreign goods. However, my sensitivity analysis shows that the main results reported in this paper are robust to the range of parameters used in quantitative trade liberalization analyses. Note that I adjust the $\omega_{jk\ell}$'s across these experiments so that the models' trade shares match the pattern found in trade flow data for the North American countries/regions in 1988.

4 Unilateral vs. reciprocal liberalization

Below, I report the results of simulations of the quantitative North American trade model under various unilateral and reciprocal trade liberalization scenarios. Before turning to those findings I describe the welfare measure used in this paper.

4.1 Welfare analysis

I calculate the welfare effects of liberalization by measuring the effect on country ℓ 's representative households' lifetime utility U_ℓ . For example, let λ_ℓ represent the permanent percentage change in the level of pre-liberalization consumption in country ℓ that would make households in country ℓ as well off as the path of consumption and leisure enjoyed under trade liberalization $\{\tilde{c}_{\ell t}, \tilde{L}_{\ell t}\}_{t=0}^{\infty}$, that is,

$$\sum_{t=0}^{\infty} \beta^t u\left(\bar{c}_\ell (1+\lambda_\ell), \bar{L}_\ell\right) = \sum_{t=0}^{\infty} \beta^t u\left(\tilde{c}_{\ell t}, \tilde{L}_{\ell t}\right), \tag{23}$$

where *u* is the representative household's momentary utility function and $\left(\bar{c}_\ell, \bar{L}_\ell\right)$ is country ℓ 's representative households respective steady state levels of consumption and leisure in the pre-liberalization environment. In other words, $\bar{c}_\ell \lambda_\ell$ measures the amount by which you have to change consumption in the pre-liberalized environment to make households as well off as under trade liberalization (λ_ℓ is typically referred to as the compensating variation). If $\lambda_\ell > 0$ households in country ℓ are better off than they were in the pre-liberalization steady state.

4.2 Welfare effects of reciprocal liberalization

The top row of Table 3 reports the welfare calculations from the CFTA and NAFTA experiments. The first three columns of Table 4 show that the compensating variation in consumption required to leave households indifferent between the initial steady state and the CFTA is 2.07 percent for Canada and 0.21 percent for the U.S. Based on these results, the CFTA leads to welfare improvements for Canada and the U.S. The last three columns of Table 4 report the same calculations for the NAFTA experiments. My estimates suggest that NAFTA will improve welfare of the CFTA area and Mexico. The compensating variation in consumption is 0.08 percent for the CFTA area and 1.12 percent for Mexico. In each case the welfare improvements are greater for the small country. Note also that the ROW also gains from the CFTA and NAFTA.

4.3 Aggregate effects of reciprocal liberalization

The middle panel of Table 3 reports the aggregate steady state effects of the CFTA in the first three columns and NAFTA in the last three columns. The CFTA is estimated to have had a larger effect on North America than NAFTA. Beyond this the response to the CFTA and NAFTA policies are quite similar. My estimates suggest that the reciprocal agreements will or have led to an expansion of output, investment, consumption, labor hours and trade for both liberalizing partners. The smaller countries are expected to enjoy a much larger gain in their steady state output. Under the CFTA U.S. steady state gross domestic product (GDP) is estimated to have risen by 2.04 percent, which is considerably smaller than the estimated 11.09 percent increase in Canadian steady state GDP. Similarly, under NAFTA Mexico's steady state GDP is predicted to rise by 6.87 percent, while the CFTA area's steady state GDP is expected to rise by 0.55 percent.

As predicted liberalization leads to greater capital accumulation in the liberalizing countries. The fall in the real rental rate implies that the supply of capital increases by more than the demand for capital. Labor effort rises despite the increase in wealth. This is driven by the significant rise in the real wage.

As expected bilateral trade flows increase following trade liberalization. The CFTA is estimated to have increased the level of U.S.-Canada trade flows by 60 percent. The impact of NAFTA is smaller, with CFTA-Mexico trade flows expected to rise by 40 percent.

Another feature of these simulation results is the prediction that trade liberalization between a large and small country leads to a large capital inflow to the latter country. In the case of the CFTA inflows to Canada are estimated to have increased by 5.43 percent of annual GDP, while the inflows to Mexico under NAFTA are expected to rise by 3.84 percent of annual GDP. Looking across the row it is clear that the Canadian (and Mexican) capital inflows are jointly driven by capital flows from the U.S. (CFTA) and ROW.

Finally, these reciprocal agreements are also expected to have an asymmetric impact on the terms of trade of the large and small country, with the terms of trade of the small country deteriorating by more than their larger liberalizing partners'.

4.4 Sectoral effects of reciprocal liberalization

The lower panel of Table 3 describes in detail the sectoral steady state effects of the CFTA in the first three columns and NAFTA in the last three columns. The CFTA is estimated to have expanded the steady state output of all U.S. and Canadian industries. Underlying this sectoral response is a large increase in the volume of U.S.-Canada trade in durable manufactured goods. Under NAFTA all non-primary sectors are predicted to expand in the CFTA area and Mexico in the long run. In contrast to its North American partners, Mexico's primary sector is also expected to expand under NAFTA. Sectoral changes in labor hours and capital investment tend to mimic changes in sectoral GDP.

4.5 Welfare effects of unilateral liberalization

Table 4 describes in detail the results of Canada and the U.S. (CFTA area and Mexico) unilaterally liberalizing their trade by the same level agreed to in the CFTA (NAFTA). In the upper panel I report the results of the CFTA experiments involving Canada and the U.S. In the lower panel I report the findings of the NAFTA experiments involving the CFTA area and Mexico. The Table is organized the same way as Table 3, but I limit the results to the welfare and aggregate effects of unilateral liberalization. The first three columns report the results of the smaller partner's unilateral liberalization (Canada in the upper panel and Mexico in the lower panel). The middle three columns report the results of the larger partner's unilateral liberalization (U.S. in the upper panel and CFTA area in the lower panel). The final three columns repeat the reciprocal liberalization results previously reported in Table 3.

Three basic results emerge from these experiments. First, unilateral liberalization makes the liberalizing country worse off and its regional trading partner better off. Second, the liberalizing country's terms of trade deteriorate following liberalization, while its trading partner's terms of trade improve. Finally, the trade flows between the liberalizing country and its regional trading partner rise, while trade flows between the liberalizing country and the ROW fall.

4.6 Basic intuition

Table 4 provides insight into the way that trade liberalization affects the liberalizing country and its trading partners. The intuition is essentially a dynamic analogue of the well-know unilateral liberalization analysis presented in textbook discussions of optimal tariffs. Trade liberalization creates an excess demand for the liberalizing country's imported goods and an excess supply of the liberalizing country's exported goods. This lowers the relative price of the liberalizing country goods in terms of foreign goods. In other words, it leads to a worsening of the liberalizing country's terms of trade. This lowers the income/wealth of the liberalizing country and raises the income/wealth of its trading partners.

Liberalization lowers the cost of capital (that is, it shifts the supply curve of capital to the right) for all countries/regions. This leads to greater capital accumulation, which in turn raises the demand for labor for both the liberalizing country and its trading partners. Real wages rise by relatively more in non-liberalizing country because in the liberalizing country the increased demand for labor is offset by an increased supply of labor that comes from the fall in wealth due to the deterioration of the terms of trade. Real wages rise in the non-liberalizing country because greater wealth decreases the supply of labor. In fact, the wealth effect dominates the increased demand from labor coming from cheaper capital inputs, so labor effort is reduced in the non-liberalizing country.

The asymmetric wealth effects of unilateral trade liberalization are also evident in consumption. Lower wealth in the liberalizing country lowers consumption, this is only partially offset by higher real wages, which raise consumption. In contrast, the wealth and real wage effects work in the same direction in the non-liberalizing country, which leads to a sizeable increase in consumption.

4.7 Prisoners' dilemma

Table 5 summarizes the welfare data from Table 4 in the form of a standard two agent non-cooperative game in which the choices are to unilaterally liberalize trade or maintain trade barriers. The upper panel describes the game underlying the CFTA and the lower panel describes the game underlying NAFTA. The lower left element in each cell is the payoff to the large country while the upper right element is the payoff to the small country. Both games take on the form of the classic prisoners' dilemma. In each case liberalization is strictly dominated, so that in the absence of cooperation the outcome is the inefficient maintenance of barriers. In other words, the model predicts that in the absence of enforceable reciprocal agreements, such as the CFTA and NAFTA, the North American countries would maintain their trade barriers.

4.8 Sensitivity analysis

There is a wide range of estimates of the elasticity of substitution between home and foreign goods used in the quantitative trade literature. Table 6 adds to the analysis of Table 5 by looking at the payoff structure using different trade elasticity estimates from two well-known static CGE studies of the CFTA and NAFTA. The low elasticity panel refers to payoffs when the model is simulated with the elasticities used by Roland-Host, Reinert and Shiells' (1994). The high elasticity panel refers to the payoffs when the model is simulated with the elasticities used by Brown, Deardorff and Stern (1992). They estimate the elasticity of substitution between home and foreign goods to be 3, which compares with the benchmark model elasticity of 1.5, and Roland-Host et al estimate of around 1.

Although the magnitudes are different the results of these experiments are qualitatively identical to those from the benchmark model. The most obvious quantitative difference is that the welfare gain (loss) from reciprocal (unilateral) liberalization is much greater (smaller) with higher elasticities of substitution. This comes about because relative prices are less responsive under higher elasticities of substitution, so the negative wealth effects of unilateral trade liberalization are reduced as elasticities rise. Plus, the deadweight losses associated with trade barriers rise as demand curves become more elastic.

5 Conclusion

Trade theory has long argued that while it may be in the best interests of large a country to pursue reciprocal trade agreements to escape from a terms-of-trade driven prisoners' dilemma, the best course of action for a small country is always unilateral trade liberalization. This prediction is inconsistent with the growing trend toward reciprocal trade agreements involving a small country and large country/region. Using simulation results from a quantitative trade model I am able to shed light on why small and large countries pursue reciprocal trade agreements. I show that the payoffs from unilateral and reciprocal trade liberalization implicit in recent North American trade agreements between a small country and a large country/region take on the form of the well-known prisoners' dilemma. In particular, I find that irrespective of country size unilateral liberalization makes the liberalizing country worse off, while making its regional trading partner better off, and that cooperative agreements make all liberalizing partners better off. These estimates run counter to the prediction of trade theory because my model violates the key assumption that small countries can not influence their terms of trade. In fact, I show that trade liberalization can have a significant impact on a small country's terms of trade for a wide range of estimates of the elasticity of substitution between domestic and foreign goods.

My quantitative analysis is limited to two recent North American trade agreements. An interesting extension of this paper, and a further test of the prisoners' dilemma theory of reciprocal trade liberalization, would be to estimate the payoffs implicit in other regional trade agreements involving small and large countries, such as the recent expansion of the European Community.

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Table 1							
Benchmark parameters							
	CFTA			**NAFTA**			**All**
	Canada	**US**	**ROW**	**Mexico**	**CFTA**	**ROW**	
Preferences							
β							0.98
σ							2
θ_c							0.18
$1/\eta$							1
ω_c							0.80
$1/\kappa$							1
ω_{c1}	0.01	0.01	0.01	0.08	0.01	0.01	
ω_{c2}	0.17	0.17	0.17	0.24	0.17	0.17	
ω_{c5}	0.82	0.82	0.82	0.68	0.82	0.82	
Investment							
δ							0.03
$1/\upsilon$							1
ω_{i3}	0.52	0.52	0.52	0.41	0.52	0.52	
ω_{i4}	0.39	0.39	0.39	0.47	0.39	0.39	
ω_{i5}	0.09	0.09	0.09	0.12	0.09	0.09	
ξ							10
Production							
$1/\varepsilon$							0.5
$1/\psi$							0.5
Primary							
θ_1	0.35	0.35	0.35	0.35	0.35	0.35	
ω_{y1}	0.70	0.43	0.34	0.96	0.35	0.27	
α_{11}	0.29	0.32	0.36	0.31	0.31	0.35	
α_{21}	0.05	0.06	0.07	0.38	0.07	0.07	
α_{31}	0.01	0.01	0.01	0.04	0.01	0.01	
α_{41}	0.00	0.00	0.00	0.00	0.00	0.00	
α_{51}	0.64	0.61	0.56	0.27	0.61	0.57	
ξ_1							100
φ_1							100
Non-Durable Man.							
θ_2	0.48	0.48	0.48	0.63	0.48	0.48	
ω_{y2}	0.64	0.36	0.32	0.74	0.33	0.27	
α_{12}	0.13	0.13	0.13	0.36	0.12	0.13	
α_{22}	0.51	0.56	0.59	0.44	0.57	0.58	
α_{32}	0.01	0.01	0.01	0.00	0.01	0.01	
α_{42}	0.00	0.00	0.00	0.00	0.00	0.00	
α_{52}	0.36	0.30	0.27	0.19	0.30	0.28	
ξ_2							10
φ_2							10
Durable Man.							
θ_3	0.32	0.32	0.32	0.57	0.32	0.32	
ω_{y3}	0.63	0.32	0.22	0.78	0.23	0.16	
α_{13}	0.00	0.00	0.00	0.03	0.00	0.00	
α_{23}	0.03	0.03	0.03	0.03	0.03	0.03	
α_{33}	0.55	0.60	0.68	0.51	0.63	0.68	

Table 1 (cont.)							
Benchmark parameters							
	CFTA			**NAFTA**			**All**
	Canada	**US**	**ROW**	**Mexico**	**CFTA**	**ROW**	
α_{43}	0.00	0.00	0.00	0.00	0.00	0.00	
α_{53}	0.42	0.37	0.29	0.42	0.34	0.29	
ξ_3							10
φ_3							10
Construction							
θ_4	0.34	0.34	0.34	0.30	0.34	0.34	
ω_{y4}	0.65	0.37	0.27	0.75	0.27	0.21	
α_{14}	0.00	0.00	0.00	0.00	0.00	0.00	
α_{24}	0.01	0.02	0.02	0.02	0.02	0.02	
α_{34}	0.30	0.35	0.44	0.60	0.37	0.43	
α_{44}	0.00	0.00	0.00	0.00	0.00	0.00	
α_{54}	0.68	0.63	0.54	0.37	0.61	0.55	
ξ_4							10
φ_4							10
Services							
θ_5	0.33	0.33	0.33	0.60	0.33	0.33	
ω_{y5}	0.81	0.58	0.51	0.98	0.49	0.42	
α_{15}	0.00	0.00	0.00	0.00	0.00	0.00	
α_{25}	0.01	0.02	0.02	0.04	0.02	0.02	
α_{35}	0.00	0.00	0.00	0.00	0.00	0.00	
α_{45}	0.01	0.01	0.01	0.02	0.01	0.01	
α_{55}	0.97	0.97	0.97	0.93	0.97	0.97	
ξ_5							10
φ_5							10
Trade							
Primary							
$1/\mu_1$							1.5
ω_{1can}	0.62	0.11	0.06				
ω_{1usa}	0.23	0.66	0.18				
ω_{1mex}				0.72	0.12	0.05	
ω_{1cfta}				0.17	0.66	0.22	
ω_{1row}	0.15	0.22	0.76	0.10	0.22	0.72	
Non-Durable Man.							
$1/\mu_2$							1.5
ω_{2can}	0.66	0.08	0.02				
ω_{2usa}	0.25	0.78	0.12				
ω_{2mex}				0.73	0.04	0.02	
ω_{2cfta}				0.18	0.79	0.15	
ω_{2row}	0.09	0.15	0.86	0.09	0.17	0.84	
Durable Man.							
$1/\mu_3$							1.5
ω_{3can}	0.44	0.14	0.02				
ω_{3usa}	0.41	0.62	0.18				
ω_{3mex}				0.52	0.06	0.01	
ω_{3cfta}				0.32	0.65	0.20	
ω_{3row}	0.15	0.24	0.80	0.17	0.29	0.78	

Table 2

Levels of protection in North America prior to implementation of CFTA and NAFTA

Tariff rates

Primary products				
	Exporter			
Importer	**Canada**	**Mexico**	**U.S.**	**ROW**
Canada		0.01	0.01	0.00
Mexico	0.00		0.02	0.00
U.S.	0.01	0.01		0.01
Non-durable manufactured goods				
	Exporter			
Importer	**Canada**	**Mexico**	**U.S.**	**ROW**
Canada		0.18	0.07	0.14
Mexico	0.04		0.05	0.10
U.S.	0.04	0.05		0.10
Durable manufactured goods				
	Exporter			
Importer	**Canada**	**Mexico**	**U.S.**	**ROW**
Canada		0.04	0.02	0.04
Mexico	0.01		0.03	0.02
U.S.	0.01	0.03		0.03

Composite protection rates (tariffs and NTBs)

Primary products				
	Exporter			
Importer	**Canada**	**Mexico**	**U.S.**	**ROW**
Canada		0.20	0.61	0.27
Mexico	0.80		0.81	0.72
U.S.	0.61	0.88		0.77
Non-durable manufactured goods				
	Exporter			
Importer	**Canada**	**Mexico**	**U.S.**	**ROW**
Canada		0.68	0.34	0.44
Mexico	0.78		0.41	0.47
U.S.	0.16	0.22		0.20
Durable manufactured goods				
	Exporter			
Importer	**Canada**	**Mexico**	**U.S.**	**ROW**
Canada		0.25	0.26	0.31
Mexico	0.01		0.13	0.22
U.S.	0.39	0.07		0.28

Notes: Roland-Holst et al. (1994) report estimates for 26 sectors. Sectoral aggregates reported in this article are weighted by 1988 import shares. ROW is rest of the world.

Source: Roland-Holst, Reinert and Shiells (1994)

Table 3

Long-run effects of North American Bilateral Trade Agreements

(percentage deviation from pre-liberalization steady state)

	CFTA			**NAFTA**		
Variable	**Canada**	**U.S.**	**ROW**	**Mexico**	**CFTA**	**ROW**
Welfare effects	2.07	0.21	0.06	1.12	0.08	0.03
Aggregate effects						
Real GDP	11.09	2.04	-0.02	6.87	0.55	-0.01
Real consumption	8.45	1.67	0.17	5.36	0.45	0.06
Labor hours	3.42	0.50	-0.11	3.28	0.17	-0.03
Real wage	8.28	1.67	0.13	5.08	0.48	0.04
Capital stock	19.17	3.68	0.13	8.40	0.66	0.02
Real rental rate	-6.31	-1.42	-0.10	-1.38	0.01	-0.01
Total imports	42.57	11.95	1.98	26.07	3.44	0.62
Exports to World	47.39	12.93	-0.68	29.64	3.71	-0.12
to Canada		60.93	2.51			
to U.S.	56.50		1.94			
to Mexico					41.08	1.29
to CFTA				38.38		0.60
to ROW	3.36	-1.05		2.27	-0.24	
Terms of trade	-0.90	-0.74	1.39	-0.78	-0.29	0.45
Net foreign assets/GDP	-5.43	-0.15	0.64	-3.84	0.04	0.19
Sectoral effects						
Primary						
Output	17.33	2.32	-0.22	19.39	-0.50	-0.56
Labor hours	9.43	0.77	-0.34	15.74	-1.17	-0.60
Capital stock	26.47	3.92	-0.11	23.32	-0.71	-0.55
Exports	46.51	9.96	-0.83	73.22	5.70	-3.29
Nondurable mfg.						
Output	9.62	3.28	0.02	7.10	1.43	-0.04
Labor hours	0.28	1.39	-0.12	1.48	0.73	-0.10
Capital stock	15.89	4.56	0.11	8.12	1.21	-0.04
Exports	23.27	13.99	0.24	25.43	5.32	-0.25
Durable mfg.						
Output	27.79	3.64	-0.23	7.13	1.00	0.05
Labor hours	18.48	1.95	-0.35	2.14	0.70	0.02
Capital stock	36.92	5.14	-0.12	8.82	1.17	0.08
Exports	56.55	13.16	-0.92	12.13	2.66	0.37
Construction						
Output	9.80	1.65	0.06	6.10	0.37	0.01
Labor hours	2.20	0.29	-0.06	2.62	0.12	-0.02
Capital stock	18.11	3.43	0.17	9.33	0.59	0.03
Services						
Output	6.23	1.21	0.05	3.98	0.28	0.01
Labor hours	0.60	0.06	-0.04	-0.08	0.05	-0.01
Capital stock	16.26	3.19	0.19	6.45	0.52	0.04

Table 4

Long-run effects of unilateral and bilateral liberalization

(percentage deviation from pre-liberalization steady state)

	CFTA								
	Removal of barriers to U.S. exports in Canada			**Removal of barriers to Canadian exports in U.S.**			**Removal of barriers to Canadian and U.S. exports**		
Variable	**Canada**	**U.S**	**ROW**	**Canada**	**U.S**	**ROW**	**Canada**	**U.S**	**ROW**
Welfare effects	-5.48	1.33	0.00	7.56	-1.09	0.07	2.07	0.21	0.06
Aggregate effects									
Real GDP	6.15	0.54	-0.02	4.44	1.35	0.02	11.09	2.04	-0.02
Real consumption	-0.28	1.42	0.04	8.69	0.18	0.15	8.45	1.67	0.17
Labor hours	4.58	-0.37	-0.04	-1.23	0.81	-0.07	3.42	0.50	-0.11
Real wage	0.72	1.18	0.03	7.35	0.40	0.12	8.28	1.67	0.13
Capital stock	5.60	1.79	-0.01	12.66	1.65	0.17	19.17	3.68	0.13
Real rental rate	-0.13	-0.97	0.01	-6.23	-0.38	-0.12	-6.31	-1.42	-0.10
Total imports	8.85	7.87	0.77	30.31	2.46	1.95	42.57	11.95	1.98
Exports to World	32.28	2.46	-0.37	11.43	9.40	-0.13	47.39	12.93	-0.68
to U.S.		32.65	31.02		21.39	-21.58		60.93	2.51
to Canada	18.65		-1.63	31.57		3.81	56.50		1.94
to ROW	-18.73	1.29		26.75	-2.57		3.36	-1.05	
Terms of trade	-17.16	5.54	0.62	19.33	-6.45	1.38	-0.90	-0.74	1.39
Net foreign assets/GDP	-1.43	-0.26	0.26	-3.64	0.13	0.35	-5.43	-0.15	0.64

	NAFTA								
	Removal of barriers to CFTA exports in Mexico			**Removal of barriers to Mexican exports in CFTA**			**Removal of barriers to Mexican and CFTA exports**		
Variable	**Mexico**	**CFTA**	**ROW**	**Mexico**	**CFTA**	**ROW**	**Mexico**	**CFTA**	**ROW**
Welfare effects	-2.65	0.37	0.00	3.83	-0.29	0.04	1.12	0.08	0.03
Aggregate effects									
Real GDP	3.11	0.16	-0.01	3.61	0.36	0.01	6.87	0.55	-0.01
Real consumption	-0.32	0.39	0.01	5.66	0.04	0.06	5.36	0.45	0.06
Labor hours	2.94	-0.10	-0.01	0.19	0.25	-0.02	3.28	0.17	-0.03
Real wage	-0.07	0.33	0.01	5.09	0.12	0.04	5.08	0.48	0.04
Capital stock	1.81	0.47	-0.02	6.47	0.15	0.05	8.40	0.66	0.02
Real rental rate	0.81	-0.22	0.02	-2.21	0.23	-0.04	-1.38	0.01	-0.01
Total imports	5.80	2.25	0.16	18.88	0.80	0.65	26.07	3.44	0.62
Exports to World	20.00	0.74	-0.11	7.97	2.75	0.03	29.64	3.71	-0.12
to CFTA		20.05	19.90		17.43	-15.48		41.08	1.29
to Mexico	15.78		-0.61	19.17		1.28	38.38		0.60
to ROW	-13.48	0.51		18.32	-0.82		2.27	-0.24	
Terms of trade	-11.51	1.58	0.14	12.08	-2.01	0.46	-0.78	-0.29	0.45
Net foreign assets/GDP	-0.67	-0.09	0.08	-2.93	0.13	0.10	-3.84	0.04	0.19

Table 5

Welfare payoffs from unilateral and bilateral liberalization

	CFTA	
Canada / **U.S.**	Liberalize trade	Maintain barriers
Liberalize trade	2.07 / 0.21	7.56 / -1.09
Maintain barriers	-5.48 / 1.33	0.00 / 0.00

	NAFTA	
Mexico / **CFTA**	Liberalize trade	Maintain barriers
Liberalize trade	1.12 / 0.08	3.83 / -0.29
Maintain barriers	-2.65 / 0.37	0.00 / 0.00

Table 6

Welfare payoffs from unilateral and bilateral liberalization

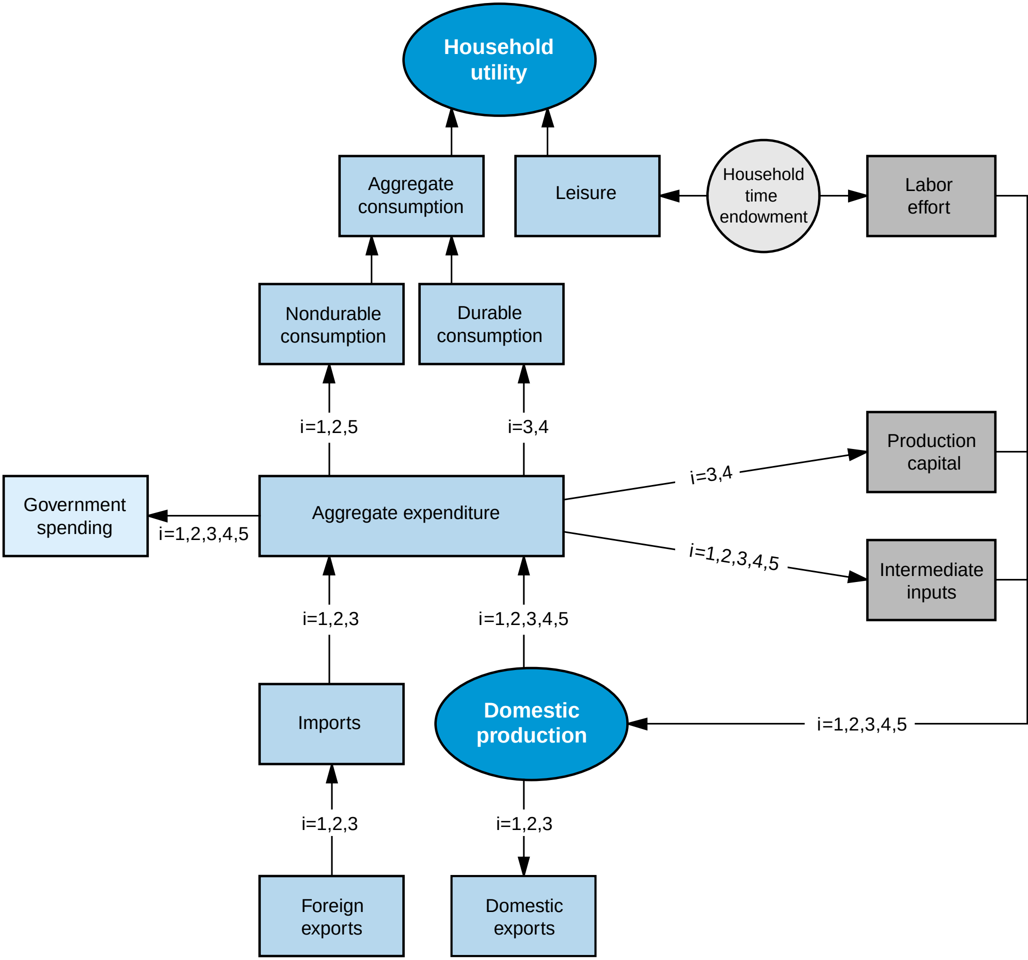
CFTA

Canada / **U.S.**	**Low elasticity model**: Liberalize trade	**Low elasticity model**: Maintain barriers	**Benchmark model**: Liberalize trade	**Benchmark model**: Maintain barriers	**High elasticity model**: Liberalize trade	**High elasticity model**: Maintain barriers
Liberalize	0.10	7.72	2.07	7.56	5.57	8.85
trade	0.10	-1.40	0.21	-1.09	0.47	-0.81
Maintain	-7.89	0.00	-5.48	0.00	-3.11	0.00
barriers	1.43	0.00	1.33	0.00	1.42	0.00

NAFTA

Mexico / **CFTA**	**Low elasticity model**: Liberalize trade	**Low elasticity model**: Maintain barriers	**Benchmark model**: Liberalize trade	**Benchmark model**: Maintain barriers	**High elasticity model**: Liberalize trade	**High elasticity model**: Maintain barriers
Liberalize	0.11	3.77	1.12	3.83	3.50	5.11
trade	0.02	-0.40	0.08	-0.29	0.26	-0.16
Maintain	-3.67	0.00	-2.65	0.00	-1.49	0.00
barriers	0.40	0.00	0.37	0.00	0.42	0.00

Model flow diagram for a representative country



Notes: i denotes industry—primary, i=1; nondurable manufacturing, i=2; durable manufacturing, i=3; construction, i=4; services, i=5.