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Liberalizing Foreign Direct Investment Restrictions in Canada: A Multi-Country Computable General Equilibrium Analysis

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Abstract

This paper develops a multi-country multi-sector static general equilibrium model to assess the economic effects of liberalizing FDI restrictions in Canada, either unilaterally, bilaterally (with the US), or multilaterally. From a strict economic point of view, removing barriers to inward FDI could reap great benefits to all regions of the world, and in particular to the ones in which the restrictions are initially severe. Our simulation results show that the benefits of fewer restrictions on FDI stem mainly from a better resource reallocation across the world and an increased capital stock in foreign-owned firms accompanied by a positive spillover effect on total factor productivity. Up to 80% of the welfare increase resulting from liberalizing FDI restrictions is due to increased total factor productivity.

JEL classification: F15; F21; F23
Key Words: Foreign Direct Investment; Multinational Corporations; Restrictions to Foreign Investment

1. Introduction

Attitudes and policies towards liberalization of foreign direct investment (FDI) have been subject to considerable controversy. Alleged economic benefits from inward FDI sometimes clash with concerns about loss of national sovereignty and other possible adverse consequences. FDI has historically given rise to these conflicting views, because FDI involves a controlling stake by often large multinational corporations (MNCs) over which domestic governments, it is feared, have little power.

As reported by the Thériault and Beckman (2008) growth in international flow of capital has been significantly above the growth of trade and GDP over the past two decades. This suggests that despite the remaining concerns about the adverse effects of FDI, the general trend has been towards liberalization. It seems that throughout the world, policymakers have increasingly been persuaded of the merits of inward FDI in terms of employment, capital and particularly transfer of technology. Consequently, many countries have reduced restrictions on FDI and adopted incentives to encourage

FDI (UNCTAD 1996). In Canada, this shift was reflected in the transformation of the Foreign Investment Review Agency (FIRA), created in 1974, into the Investment Canada Act of 1985, which liberalizes somewhat the foreign investment reviewing process. Still, in Canada and in other countries that generally welcome FDI, some restrictions remain in place, especially in the services sector.[1]

Given the presence of investment restrictions (and the growing importance of services relative to trade and GDP), the services sector has been on the table of the more recent international trade negotiations. For instance, as part of the Uruguay Round of global trade negotiation, contracting parties to the General Agreement on Tariffs and Trade (GATT) signed the General Agreement on Trade in Services (GATS). This Treaty of the World Trade Organization (WTO) entered into force in 1995 and is the first binding multilateral agreement covering trade in services. Although the GATS could theoretically have a significant impact on FDI barriers, it appears limited in practise. Indeed, barriers to commercial presence and FDI in many sectors are not covered by the Agreement because countries have chosen not to include these sectors in their schedule. And in those sectors where some commitments are made, restrictions on market access or national treatment for commercial presence are frequently listed as 'unbounded' or exempt.

As a result, it is recognized that most economies currently use restrictions on inward FDI and Canada is no exception.[2] At the same time many economies offer incentives to attract foreign investment, often on an ad hoc basis and often with conditions attached. These policies distort the market signals that drive foreign investment, and could potentially have a direct impact on trade in services, but also an indirect impact on the rest of the economy. For instance, services are often inputs for all aspects of processing and production, and hence provide much of the necessary infrastructure for investment and economic growth. Consequently, restricting foreign investment in services may result in less competition, less diversity and innovation in the services sector, but also indirectly increase the cost of production in other sectors, slow down the transfer of

[1] In Canada, the Conservative government has set up an independent panel to examine competition and investment policies in the wake of a recent spike in mergers and acquisitions activity.
[2] As we will see in more detail below, two recent studies conclude that Canada is a highly protectionist country for inward FDI.

technology and hence delay productivity progress. It thus eventually decelerates economic growth.

Gauging the economic impact of FDI liberalization is made difficult due to a lack of measures of the nature and extent of FDI barriers, and the challenge of building an analytical framework for assessing their implications, not only for services trade, but for overall economic performance. Decisions to liberalize FDI regimes often involve complex tradeoffs between economic and other considerations such as national sovereignty. Therefore, governments need to have a good factual and analytical basis for decision making.

Previous studies, which have identified and analyzed trade barriers, have highlighted the need for additional analysis on the impact of FDI restrictions on the economy. Our purpose in this study is to pursue that investigation. We consider as FDI barrier or impediment any government policy measure that distorts decisions about where to invest and in what form. Therefore, higher costs which are incurred in managing businesses from a distance, or higher market prices for inputs in one economy compared with another, are not barriers to FDI. In contrast, policy measures such as limits on the level of foreign investment, or the need to go through costly and time-consuming screening or reviewing processes to convince authorities that a project will be in the national interest, are considered barriers to FDI.

In this study, we are particularly interested by the resource allocation and productivity implications of FDI barriers. Barriers to FDI may distort international patterns and modes of trade. They may also distort allocation of capital between different economies, between foreign and domestic investment, between different sectors, and between portfolio and direct investment. As a result, assets may not be used in the most productive way. The costs of FDI barriers may flow through the economy through a variety of channels, such as higher prices, less consumer choice, smaller stock of capital and even lower productivity.

The remainder of the paper is as follows. In the next section, we review FDI facts and issues in Canada as well as the impact of the North-American Free Trade Agreement (NAFTA) on FDI. Section 3 reviews the literature on the existing modeling efforts on

FDI while Section 4 presents the model developed for this project and Section 5 discusses some aspects of the data. We report and discuss our simulation results in Section 6, and Section 7 concludes and discusses directions for future research.

2. FDI in Canada

Facts

As it is conventionally defined, we consider *FDI* as ownership that gives investors a significant voice in the management of an enterprise outside their country. For operational purposes, a direct investor usually has at least 10% ownership of the voting in an enterprise. Firms operating in Canada are considered *foreign-controlled* if foreigners have a majority (50% or more) of voting ownership. A foreign affiliate is a business in which there is FDI that gives at least 10% voting.

FDI and foreign-controlled enterprises are important in Canada. For instance, referring to Baldwin and Gellatly (2005) and to Chiara (2005), Canada leads the G7 countries in terms of the value added share of foreign affiliate in the manufacturing sector, while the output share of foreign ownership in the services sector in Canada is 20%, which constitutes the second highest share in the G7. As reported in Thériault and Beckman (2008), the ratio of inward FDI stock to GDP in Canada reached almost 30% in 2006 compared to less than 20% in 1985. Similarly, Canada's outward FDI stock to GDP reached 35% in 2006, compared to 12% in 1985. The US share of Canada's inward FDI stock has remained stable at above 60% since 1990.

Benefits of Inward FDI

Inward FDI will be beneficial to a country when it raises its productivity and its stock of capital, or if it stimulates trade. Inward FDI may also stimulate trade and generate less tangibles externalities such as better management practices. Here we quickly review some of the evidences.

Borensztein, De Gregoria and Lee (1998) using data for 69 countries from 1983 to 1995, find that FDI has a positive effect on a country's total factor productivity (TFP) and

growth. Gera, Gu and Lee (1999) using data for Canada over the period 1973-1992 find that one percent increase in FDI will raise total factor productivity by 0.16 percent. Rao and Tang (2002) show that foreign-controlled firms in Canada have higher levels of total factor productivity. Haskel, Pereira and Slaughter (2002) using UK plant level manufacturing data from 1973 through 1992 find that a 10 percentage-point increase in foreign presence in a UK industry raises TFP of that industry's domestic plant by about 0.5%.

Rao and Wang (2004) demonstrate that, compared to the U.S., labour productivity performance in Canada in industries with foreign ownership restrictions is weaker, while relatively more productive industries have a somewhat higher share of foreign ownership. Wages in foreign-controlled firms are higher than in Canadian-controlled firms in 20 out of 22 manufacturing industries, and this advantage for foreign-controlled plants seems to be due to the fact that they belong to multinational enterprises (MNEs) (Statistics Canada, 1997). Chiara (2005) shows that in most cases, foreign affiliates have higher labour productivity level than the national average and hence contribute to increase the host country's labour productivity level. Baldwin and Gu (2005), using data on manufacturing plants, show that in Canada foreign-controlled manufacturing plants have higher labour productivity than domestic-controlled plants. This could again be a MNEs advantage.

One potential advantage of inward FDI is the intra-firm technology transfer from foreign parent companies to domestic subsidiaries. Baldwin and Sabourin (2005) find that foreign-controlled manufacturing plants use more advanced technologies than Canadian-controlled plants and Baldwin and Gu (2005) claim that the foreign-ownership advantage in technology adoption is associated with MNE.

Hejazi and Pauly (2002) finds that overall, a one-dollar increase in FDI increases domestic capital formation in Canada by about 45 cents in non-services industries. Lipsey (2000), using data for 22 OECD countries from 1975-1995, finds that the ratio of inward FDI flows to GDP is significantly related to the next year's capital formation ratio in eight countries, including Canada. In six countries, the relationship is negative – that is to say, FDI does not lead to increased capital formation.

Finally, it is believed that large FDI flows could stimulate trade when for instance multinational firms establish foreign affiliates as part of their corporate strategy to globally integrate their production chains. Hence, inward FDI would lead to further global integration of both capital and product markets. This leads us to discuss links between free trade agreements, such as NAFTA, and FDI.

NAFTA and FDI

On January 1st 1989, Canada and the United States signed a free trade agreement (CUSFTA). CUSFTA was incorporated into the North American Free Trade Agreement (NAFTA) in January 1994, which extended the free trade arrangements to Mexico. Almost all tariffs on goods originating in Canada, U.S., and Mexico have been eliminated since January 1, 2008. However, barriers to trade in services and FDI remain, particularly in communication services, banking, and other financial services, and preclude control by foreigners.

The impacts and benefits for Canada of the two North-American agreements are still debated. The impact of CUSFTA and NAFTA on FDI is ambiguous both theoretically and in terms of empirical evidence. First, the creation of large, tariff-free markets should promote new FDI from countries outside the agreement seeking to access a larger market. As for new FDI originating form member countries, because the need to circumvent tariffs dissipates with free trade, trade could displace inward FDI from partners. Trade and FDI are then substitutes, and FDI is typically horizontal, that is, the foreign production of goods and services is roughly similar to those the firm produces for its home market. However, vertical FDI, which fragments the production process by stages is likely to be encouraged if tariffs are liberalised, stages of production differ in factor intensities, and member countries differ in relative factor endowments. The net effect of these opposite outcomes is uncertain, particularly for Canada, who has relied extensively on U.S. FDI.

New trade theories incorporate factors besides tariffs that may affect the decision between serving a local market through trade or through foreign direct investment. These factors relate to proximity to final consumers that may motivate serving a local market

through affiliates rather than trade. The factors include transportation costs, transaction costs, linguistic or cultural differences, and slow responsiveness to consumers. According to the proximity-concentration theory (Krugman, 1983; Helpman, 1984; Helpman and Krugman 1985; Horstman and Markusen 1992; Brainard, 1993), in oligopolistic markets with increasing returns to scale and differentiated goods, firms incur a fixed cost at the corporate level (headquarters) to open a new production facility, in the form of R&D, advertising, or services such as personnel, treasury, and planning. At the plant level, they face variable costs that decline with the expansion of corporate activity, and are a function of shipping costs, linguistic or cultural differences. Consequently, the imposition of a tariff raises transport costs, and makes multinational production more attractive, while a tax on earning of intangibles (profits) has the reverse effect. Consequently, a tariff reduction policy like the one implied by NAFTA could displace inward FDI in Canada coming from the US and Mexico.

Feinberg and al. (1998) find that as tariff rates fell, US MNCs increased their capital and employment in Canada, thus contradicting the view that tariff liberalization would lead to an exit of US firms from Canada. Mirus and Scholnic (1998) suggest that trade creating and FDI enhancing effects of the CUSFTA have prevailed over the rationalization of tariff-jumping production. They also suggest that US FDI in Canada has deepened in technology intensive sectors where the US has a relative comparative advantage. This suggests a positive transfer of technology for Canada.

Current Canadian policy towards FDI

In Canada, Foreign Investment is overseen by Investment Canada Act, the Bank Act, and the provisions in the WTO and NAFTA. Under the Investment Canada Act, Canada maintains an open environment for foreign investment, subject to some restrictions. With the exemption of a few sectors, a non-resident (originating from a WTO country) with more than $295 million to invest, can establish a new firm in Canada or directly acquire a Canadian firm, if he/she demonstrates the net benefit of the proposed investment for Canada. Smaller investments require only notification. Most sectoral

restrictions apply to financial, and communications services, oil and gas, while foreign investment in the cultural industry is prohibited.

The CUSFTA distinguishes between US and non-US investments as far as the Investment Act is concerned. Thus, review was required only for direct U.S. acquisitions in Canada of (then) C$150 million or more. The CUSFTA also extended national treatment and rights to establishment to US investors in non-exempt sectors. NAFTA extended the provisions of CUSFTA to Mexico. NAFTA however, goes beyond the CUSFTA to include substantially expanded coverage of government procurement (to services and construction), intellectual property and investor rights (introducing binding investor-state arbitration). It also extended the definition of investment to portfolio investments. It strengthened some of the CUSFTA provisions by enforcing states and provinces to grant national treatment to investors (and investments of investors) of the signatory parties. NAFTA reinforced national treatment in the investment services, and financial services chapters, including common norms for the treatment of investments and investors, with the exception of sectoral exclusions in air transport and agricultural sectors for all participants, rail and energy sectors in Mexico and the maritime transport sector in the USA. National treatment was further strengthened by Most Favoured Nations (MFN) and Minimum Standard of Treatment (MST) provisions that grant investors of the signatory parties, a treatment no less favourable that that granted to non-signatory parties. In addition, national treatment is granted to foreign controlled firms of the signatories parties. NAFTA also added the Investor-State Dispute Settlements Mechanism as an avenue for dispute settlement.

In addition to NAFTA, Canada's trade in services and investment has to comply with WTO provisions of the Trade Related Investment Measures (TRIMS) of the GATT, and provisions of the General Agreement on Trade in Services (GATS). However, the non-discrimination principle of NAFTA for services and investment applies only to the extent they are specified in a country's schedule of commitments, or not exempted in the agreements' annexes. Under WTO's MFN treatment, a country cannot discriminate between foreign services suppliers from WTO member countries, insofar as these services are not in the list of the country's exempt sectors. The principle of national treatment does not allow the discrimination between domestic and foreign suppliers of

services included in the countries list of commitments, if no restrictions are specified. With respect to practices that restrict market access, such as limitations to the number of suppliers, service operations or limitations in the participation of foreign capital, the same rules of non-discrimination apply, unless restrictions are specified.

Foreign direct investment in banking falls outside the Investment Canada Act and is regulated by the Bank Act. Under NAFTA, US and Mexican investors are *collectively* permitted to own more than the 25% voting share restriction granted by the Bank Act for schedule A banks. However, the Bank Act restriction to a 10% ownership of any (domestic or foreign) *individual* shareholder, precludes control of a schedule A bank by a foreign bank. The Bank Act limits the operations of foreign banks operating in Canada through their subsidiaries (Schedule B banks) by restricting their ownership to a maximum of 12% of total domestic assets of banks. This restriction under NAFTA is removed, but other restrictions continue to apply such as the rule restricting foreign subsidiaries to own more than 10% of a non-bank corporation incorporated in Canada.

Loan, Trust and Insurance companies are governed by both federal and provincial regulations. Though in most cases the same rules apply as in the banking sector, some provinces dare to differ. In Quebec, non-residents can acquire 30% of a voting share and up to 50% of the voting share via authorization. In communications services, a 33% restriction is applied for foreign ownership for cable and broadcasting companies. In the sector of oil and gas, acquisitions of over $5million are only permitted for firms in clear financial difficulties, and a 50% Canadian ownership rule is maintained.

3. Modeling FDI in a CGE Framework

Little modeling work has been done to examine the impact of reducing barriers to investment in either goods or services. And only a few studies have been made to model the impacts of liberalizing investment in a general equilibrium framework. The approaches adopted in these studies can be divided broadly into three groups. The first group does not model FDI explicitly, but when examining the impact of services trade liberalization they implicitly include the reduction of FDI barriers. The second group of

studies does not explicitly model FDI and does not explicitly model the reduction of investment barriers. They simulate the effects of investment liberalization by making assumptions about which variables are affected by increased capital mobility. The third group of studies explicitly model FDI and capture many of the important economic characteristics of FDI that are not included in the other studies. While those in the third group have some shortcomings, they provide a sound basis for examining the implications of investment liberalization.

There are a number of problems with the first group of studies (Dee, Geisler and Watts (1996), Brown et al. (1996a, b), Robinson et al. (1999), Francois et al. (1996), Tamms (1999), Hertel (2000), and Chadha et al. (2000)), the most important being that the models do not capture the important economic characteristics of FDI. Hence, the demand and production characteristics of foreign affiliates are not modeled as distinct activities from other production activities in both the host and home economies. This approach to modeling FDI liberalization has some appeal, as it does not require a restructuring of most general equilibrium models. Barriers to FDI are combined with barriers to cross-border trade in services and their removal results in cheaper services and increased trade in services for the liberalizing economy. However, some important effects in the host economy via FDI are not captured. For instance, removing impediments to FDI does not result in higher levels of FDI in the liberalizing country as would be expected.

In the second group of studies (Martin and Yanagishima 1993, Donovan and Mai 1996, McKibbin and Wilcoxen 1996, Bora and Guisinger 1997), FDI is not modeled explicitly and barriers to FDI are not incorporated explicitly. Investment liberalization is assumed to affect certain parameters and variables, such as the extent of capital mobility, and the effects of this are then simulated. For example, Bora and Guisinger (1997) use a general equilibrium model that incorporates international capital mobility. No distinction is made between portfolio investment and FDI. Investment liberalization is modeled by increasing capital inflows to liberalizing economies by varying degrees.

The third group of studies explicitly incorporates FDI into a CGE model with an appropriate recognition of the relationship between parents and subsidiaries. Two distinct approaches in linking the activities of parents and affiliates can been found in the

literature. A first approach follows the pioneering work of Petri (1997). Petri introduces a model of foreign direct investment into a standard applied general equilibrium model using a nested utility function. An essential assumption of the model is that multinational firms headquartered in each country produce a good that is differentiated from goods produced by firms headquartered in other countries. Thus, at a first stage, consumers allocate expenditures between an aggregate of goods produced by firms headquartered domestically and an aggregate of those goods produced by firms headquartered in foreign countries. At a second stage, the aggregate good produced by firms headquartered in foreign countries is split between their specific countries of ownership, and at a third stage the aggregate good produced by firms of a specific nationality is split across plant (subsidiary) location (that is, across host countries where the production is effectively done).

Production in each host country requires inputs of capital, labour, intermediate inputs produced locally and intermediate inputs imported from the headquarter. In this model, consumption of non-tradable services by the host country through FDI would have a significant impact on the demand system across host and home (parent) countries. Markets in the Petri model are perfectly competitive. Goods are aggregated into three sectors: primary, secondary (manufacturing) and services. Parent firms are linked with their subsidiaries in terms of their inputs requirements – value added inputs, inputs sourced from parents and other intermediate inputs. Barriers to multinational activities are modeled as region-specific taxes on capital income derived from foreign investments. FDI liberalisation raises the after-tax return to capital, which leads to an increase in the stock of inward foreign capital.

A similar approach is used by Lee and van der Mensbrugghe (2001) to study trade and FDI between U.S., Japan, and APEC countries. One important difference of their model with respect to the model of Petri is the order of the demand nesting. Agents first allocate expenditure between an aggregate of goods *produced* domestically, including those produced by foreign plants located in the domestic economy, and an aggregate of all imports. At this stage therefore, consumers are not concerned with the nationality of each firm's headquarters, but with the country where production is done. It is only at the third stage, and after expenditures towards imports from each trade partner are decided,

that imports from each trade partner are allocated across the nationality of various multinational firms. According to Lee and van der Mensbrugghe, this reversed demand nesting appears to be closer to reality, particularly in the services sector. Dee and Hanslow (1999) and Verikios and Zhang (2000), follow the Lee and van der Mensbrugghe methodology, but also incorporate imperfect competition

An alternative approach, in the third group of studies, has been developed Markusen, Rutherford and Tarr (1999), and Markusen *et al*. (2006). They have developed a stylized small country two good model with two primary factors. Business services are treated as an intermediate input in the foreign invested production. A foreign firm that seeks to enter the market for services must first make a fixed investment and incurs variable costs reflecting the use of capital, labour, and intermediate inputs imported from headquarters. Free entry and exit of firms guarantee zero profits. Their theoretical model suggests that the liberalization of FDI in services could raise welfare by increasing total factor productivity, and proves the complementary relationship between foreign imported inputs and domestic inputs.

Brown and Stern (1999) incorporate features of both types of approaches to modeling barriers to services and FDI in a model that has 18 countries and three sectors, primary, secondary and services. They also perform sensitivity analysis with regards to the specification of the aggregate demand: the structures in Petri and Dee and Hanslow are considered alternatively. In addition, they examine scenarios with alternative assumptions regarding the degree of capital mobility, whether the world stock of capital is fixed (alternatively it is increased by 10%), and whether free entry and exit of firms is permitted. Their findings suggest that in all cases, multilateral services liberalization would lead to welfare gains for those countries that manage to attract physical capital. The capital inflow is correlated with an expansion of output for most sectors in the economy. By contrast, welfare gains for countries that experience capital outflows are generally negative. They also find that gains from liberalization are significant even with low capital mobility. Their results are significantly sensitive to the assumption on the demand structure. In some cases, results are even reversed. In general, the Dee and Hanslow assumption generates larger gains in welfare from trade liberalization globally and for individual countries. As would be expected, they also find that fixing the number

of firms significantly reduces the dispersion of welfare gains among countries, as firms cannot relocate to take advantage of low cost development sites.

Quantifying Barriers to FDI

There are several issues involved in computing the restrictions on FDI. A classification of various types of restrictions and a system of weighting are needed. These tasks are greatly complicated by the disparate nature of restrictions across countries and the inconsistent reporting of these restrictions. Sometimes it is difficult to determine the exact nature and incidence of a particular restriction without detailed knowledge of a country's productive structure and regulatory environment. In this paper, we use results reported in Golub (2003) to quantify restrictions on FDI. Golub follows the methodology developed by Hardin, and Holmes (1997). The two studies focus on the measures of foreign restrictions defined as the discrimination against foreign firms through the limitations on national treatment or most favored nation (MFN).

Both studies consider three types of restrictions; restrictions on foreign ownership (which limit the shares of a company's equity in certain sectors that non-residents are allowed to hold, or even fully prohibit foreign ownerships); screening and approval procedures (which increases cost of entry and discourages capital inflows); and other restrictions, such as the numbers of nationals or residents in board of directors or managers, foreign employment restriction and input/operational restrictions. Golub reports that manufacturing are almost unrestricted compared to other services. The sensitive sectors, such as electricity, telecommunications, transport and finance are often highly restricted.

An index value of 1.00, which in this methodology reflects either a total prohibition on FDI or a highly restricted sector, could be translated for modeling purpose into a tax rate on foreign capital of, say, 100 per cent. An FDI regime involving only screening with approval unless the investment is contrary to the national interest would translate into a tax rate of 7.5 per cent. Hence foreign suppliers would face lower returns as a result of the restrictions on foreign investment as they bear part of the tax equivalent of the restrictions on foreign capital. In a portfolio model, this also implies that foreign capital supply would be an increasing function of the net rate of return on this investment.

We discuss in further detail the tax rate equivalence in Section 5, but it is worth noting that according to the study of Golub, Canada holds the second highest rank among OECD countries for his baseline index of FDI restriction. Excluding the screening requirements, the differences among countries are reduced, but Canada still has higher levels of FDI restrictions than others. Canada has in fact higher levels of restrictions under each sector than the OECD average.

4. Description of the FDI-Model

This section provides a brief description of the model. Appendix 1 gives further details on the equations. We present a multi-region multi-sector static general equilibrium model that features production activities and consumption in each region as well as the flow of investment among regions. The representative household in each region decides, on the one hand, about the allocation of its total spending among different commodities and, on the other hand, about the allocation of its wealth (capital) among different activities. A peculiar characteristic of the model is the distinction between the activities of domestic and foreign-owned firms at the microeconomic level, both in terms of demand and production characteristics, inspired by similar approaches by Petri (1997) and Verikios and Zhang (2001).

4.1 Capital Allocation

A key feature of the model is the determination of FDI investment, or more broadly the regional allocation of wealth. The investment decision is modeled in an optimizing framework that allocates wealth to the highest return activities, but also takes into account investor preferences (or bias) for a particular mix of instruments (portfolio approach to investment decision). The parameters that account for these preferences are calibrated from initial capital stock data, much the same way as the parameters of consumer preferences are calibrated from observed demand.

As illustrated in Figure 1, total or aggregate physical wealth (assets) of country i is assumed fixed (at $TTWealth0_i$). Aggregate wealth, however, is allocated across all sectors s and all countries j. The allocation is done such as to maximize returns on

wealth; changes in relative returns bring about changes in the composition of the portfolio.

We use a three-level nested constant elasticity of transformation (CET) function to represent the allocation of aggregate wealth. With finite elasticities of transformation, capital is less than perfectly mobile across sectors and regions. At the first level, aggregate wealth of country *i* is allocated to physical capital across different sectors *s* as a function of the relative rate of returns on capital invested in various sectors (equation 1). At the second level, physical capital in sector *s* is allocated between capital supplied in the domestic economy (*i*) (equation 4) and an aggregate of capital invested in all foreign countries *j* ($j \neq i$) in the same sector *s* -- outward foreign direct investment from *i*'s perspective -- (equation 3). Finally, at the third level, the stock of FDI outflows from country *i* to the sector *s* is allocated among subsidiaries located across specific countries *v* (= *j*), ($WEALTH_{i,v,s}$ in equation 6).

At each step, a revenue-maximizing rule is used to determine the allocation of the index of physical capital into each of its components. Basically, the relative supply of capital in two competing destinations within a nest depends on their relative returns ($R_{i,v,s}$). The higher the relative return in one destination the higher the share of physical capital in that destination. The return to physical capital in a given sector/destination takes into consideration existing restrictions to FDI. Any change in these restrictions would translate into a change in the relative returns and consequently into a change in FDI in the given sector or country. Technically, this is implemented through a change in the parameter $CTAX_{i,v,s}$ at the third level of the nested CET (equations 6 and 7). This parameter is the tax rate that the government of a country *v* would impose on foreign capital originating from country *i*. As such, this rate is a tax equivalent of FDI restrictions imposed by country *v* and a policy change which partially liberalizes FDI is modeled as a change in $CTAX_{i,v,s}$, which will affect both the net returns on assets, $R_{i,v,s}$ ($1\text{-}CTAX_{i,v,s}$) in equation 7, and the allocation of assets, $WEALTH_{i,v,s}$ in equation 6.

4.2 Household consumption demand

In each region *j*, the representative consumer derives income from labour, net of tax returns to capital invested in the domestic economy and abroad, and (because

household and governments accounts are consolidated), tariff revenue collected by the government and tax revenue perceived on capital incomes accruing to domestic and foreign subsidiaries located in *j* (equation 35). The representative consumer does not value leisure so that the supply of labour in each region is fixed.

We assume that the representative household cares about the nationality *and* the place of production of the good produced in a given sector. To account for this differentiation, we represent its preferences by a series of nested utility functions as illustrated in Figure 2. At the first level, total utility or aggregate consumption (CON_j in equation 8) is a Cobb-Douglas index of consumption of different sector-goods *s* ($CONS_{j,s}$) At the second level, consumption of good *s* is a CES aggregate of the index of goods produced domestically (including those produced by foreign-nationality subsidiaries located in the domestic economy), $ECDOM_{j,s}$ in equation 10, and of the index of those produced in foreign countries and imported, $ECFOR_{j,s}$ in equation 11. At the third level, consumption of good *s* (by households of country *j*) produced domestically (in *j*), is another CES aggregate of consumption of good *s* produced by subsidiaries (located in *j*) of different nationality *v*, including firms of domestic-nationality *v=j*, ($ECV_{v,j,j,s}$ in equation 13). In another nest (the Armington assumption), the index of imported good *s* is a CES aggregate of imported goods from geographical origin *i*, ($ECIJFOR_{i,j,s}$ in equation 15). Finally, in the fifth nest, the import into *j* of good *s* from a specific country *i* is a CES aggregate of goods produced by subsidiaries of different nationalities *v* located in *i*, $ECV_{v,i,j,s}$ in equation (17).

Utility maximization subject to budget constraint allows the determination of the demand for each commodity. In particular, a multi-step budgeting process in which the representative household minimizes expenditures allows the derivation within each nest of the expression of its components. In particular, the ratio of the demand for two competing goods within a nest is inversely related to their relative prices (see equations 8, 10, 11, 13, 15 and 17).

4.3 Investment demand

Final demand is made of household demand and investment demand. Aggregate investment demand in country *j* (INV_j) is a Cobb-Douglas index of different investment

goods *s* produced by different subsidiaries *v*, independently on their geographical location, $INVVS_{v,j,s}$ in equation 19. The second (CES) level describes from which country *i* the investment good *s* produced by subsidiary *v* is bought, $EVV_{v,i,j,s}$ in equation 21 (the Armington assumption).

4.4 Supply side

In each country *j*, the representative firm of nationality *v*, operating in sector *sd*, combines local labour, capital (of ownership *v*) and intermediate inputs to produce an output using a constant-returns-to-scale technology. It operates in a competitive setting where it considers factor and output prices as given. It determines the optimal level of output by maximizing profits and using a marginal-cost pricing rule (equation 23). We assume that the production function is a Cobb-Douglas function of capital, labour and the index of intermediate inputs. Because of the constant-returns-to-scale property of the technology, the cost function is linear in output and thus the marginal cost is equal to average cost and is independent of the level of production (equation 27). It follows that the optimal level of inputs can be determined from a cost-minimization rule (equations 24, 25, 26). At each node of the technology representation, the demand for each input increases with the price of the good produced ($PV_{v,j,sd}$) and decreases with its own price.

Finally, the aggregate intermediate input *s* used in sector *sd*, $EI_{v,j,s,sd}$, is a multi-level Leontief function of goods produced by subsidiaries of different nationality *vo* and located in different countries *i*, $EIVV_{vo,v,i,j,s,sd}$, all complements in the aggregation index $EI_{v,j,s,sd}$ (equation 28).

4.5 Equilibrium conditions

A general equilibrium of this model economy is represented by a set of endogenous real and nominal variables such that all economic agents maximize their objective functions while respecting their budget constraints, and all factor and good markets clear. In particular, in each region *j*: 1. The wage rate would adjust so as to equate total demand for (local) labour with the total fixed supply of labour (equation 30); 2. The return to capital should adjust such as to equate the supply of capital for subsidiary *v* located in country *j* in sector *sd* with the demand for capital in the same sector, by the

same subsidiary *v* in country *j*, (equation 31) and: 3. Good prices should adjust such as to equalize the supply of each good produced in sector *s* by subsidiary *v* to total demand for consumption, investment and intermediate uses, by domestic and foreign agents (equations 33-34).

4.6 Total factor productivity spillover

Finally, note the enhancement to total factor productivity resulting from increased foreign capital used in the domestic country *j*. We first define the ratio of the stock of *foreign* capital used in sector *s* of country *j* to the *total* stock of capital used in sector *s* of country *j*. Any increase in that ratio would increase total factor productivity of all plants *v* producing *s* in country *j* according to equation 38.

5. Data

The aggregate variables and trade flows of the model were calibrated to GTAP 6. In Table 1 of Appendix 2, we provide the regional and sectoral aggregation mapping from GTAP to the Model. The GTAP Armington elasticities and tariffs rates are also reported (Tables 2 and 3).

In Table 5.1 below we report the FDI ownership ratio that we use to dissagregate the GTAP data. In other words, we use the ratios of the table below to add a nationality dimension to sectoral and regional production activities that were obtained from GTAP. In the second column, the number 0.73 for CAN.CAN.PRIM indicates that 73% of the capital stock in the primary sector in Canada is owned by Canadian firms. The number 0.10 for US.CAN.PRIM indicates that 10% of the capital stock in the primary sector in Canada belongs to American firms located in Canada. Finally the number 0.17 for ROW.CAN.PRIM indicates that 17% of the capital stock in the primary sector in Canada belongs to rest-of-the-world firms located in Canada. Note that these three ratios sum to 100%. To build this matrix, we had access to data for Canada and the U.S, but not for ROW. Thus for the rest-of-the-world, we impose a structure of ownership of the capital stock which is similar to the U.S. The level of production for subsidiary of different nationality was calibrated accordingly to the ratios of this matrix.

Table 5.1: FDI ownership ratio[1]

Countries *v.i.*	PRIM	IND	UTL	CNS	TRD	TRP	CMN	OFI	ISR	OBS	OTH
CAN.CAN	0.73	0.47	0.93	0.91	0.60	0.86	0.93	0.85	0.85	0.83	0.89
US.CAN	0.10	0.34	0.05	0.05	0.27	0.13	0.04	0.07	0.07	0.13	0.07
ROW.CAN	0.17	0.19	0.02	0.04	0.13	0.01	0.03	0.07	0.07	0.04	0.04
CAN.US	0.01	0.02	0.01	0.03	0.01	0.01	0.01	0.04	0.03	0.01	0.01
US.US	0.91	0.72	0.99	0.75	0.86	0.86	0.87	0.71	0.56	0.81	0.94
ROW.US	0.09	0.26	0.01	0.21	0.14	0.12	0.12	0.24	0.41	0.18	0.06
CAN.ROW	0.01	0.02	0.01	0.04	0.01	0.02	0.01	0.04	0.03	0.01	0.01
US.ROW	0.09	0.26	0.01	0.21	0.14	0.12	0.12	0.24	0.41	0.18	0.06
ROW.ROW	0.91	0.72	0.99	0.75	0.86	0.87	0.87	0.71	0.56	0.81	0.94

[1] *v* is the nationality of the owners of a firm operating in sector *s* of country *i*

Source: For Canada: Corporation Return Act, Statistics Canada and Direct Investment of Canada Abroad and Foreign Direct Investment in Canada, Statistics Canada. For the U.S.: Bureau of Economic Analysis

The other indicator that will matter a lot for the simulations results is the initial tax rate on foreign assets. The numbers in Table 5.2 report the initial tax rate on foreign asset in each of the three regions and for each of the eleven sectors of the economy. The rates were retrieve from the study of Golub (2003), whose methodology was largely inspired by Arden and Holmes (1997). The rates for Canada and the U.S. are explicit in the study of Golub. For the rest-of-the-world, we calculate the rates as a weighted average of the rates available for other countries in the study of Golub. It is worth noticing that the degree of restrictions for inward FDI (equivalent to the tax rates of Table 5.2) is mostly larger in Canada than in other regions of the world. Also the tax rates are larger in sectors *Utilities (UTL), Transportation (TRP), Communications (CMN), and Banking Services (OFI)*. Therefore, a multilateral liberalization of FDI restrictions across all sectors should have larger effects in these specific sectors and in Canada.

Table 5.2: Tax on foreign assets ($CTAX_{i,j,s}$)[1]

Countries *i.j*.	PRIM	IND	UTL	CNS	TRP	TRD	CMN	OFI	ISR	OBS	OTH
CAN.CAN	-	-	-	-	-	-	-	-	-	-	-
US.CAN	0.23	0.23	0.73	0.23	0.59	0.23	0.53	0.58	0.28	0.23	0.23
ROW.CAN	0.23	0.23	0.73	0.23	0.59	0.23	0.53	0.58	0.28	0.23	0.23
CAN.US	0.05	0.05	0.50	0.05	0.54	0.05	0.40	0.15	0.15	0.05	0.05
US.US	-	-	-	-	-	-	-	-	-	-	-
ROW.US	0.05	0.05	0.50	0.05	0.54	0.05	0.40	0.15	0.15	0.05	0.05
CAN.ROW	0.15	0.15	0.80	0.15	0.50	0.13	0.40	0.20	0.15	0.15	0.10
US.ROW	0.15	0.15	0.80	0.15	0.50	0.13	0.40	0.20	0.15	0.15	0.10
ROW.ROW	-	-	-	-	-	-	-	-	-	-	-

[1] Country *j* imposes a tax on foreign assets originating from country *i*

Source: Golub (2003)

6. Simulation Results

We report in this section seven simulation scenarios related to a partial removal of FDI restrictions in various regions. The scenarios differ by, on the one hand, the degree of liberalization considered and, on the other hand, the regions that undertake that policy. The first two scenarios are called Global A and Global B as they refer to a liberalization of foreign direct investment across the three regions of the world. In the scenario Global A barriers to FDI are reduced by 20%. In Global B scenario, barriers to FDI are reduced by 40% except for sectors *Utilities*, *Communications*, and *Financial Services* sectors. The next two scenarios pertain to FDI liberalization between the U.S. and Canada. In the scenario Bilateral A, barriers between the two countries are reduced by 20%, while in Bilateral B they are reduced by 40% in all sectors except *Utilities*, *Communications*, and *Financial Services*. The next two scenarios (Unilateral A and B) refer to unilateral liberalization of FDI by Canada. In Unilateral A, Canada liberalizes FDI restrictions by 20% in all sectors, while in the scenario Unilateral B, 40% of the barriers are reduced, except for the sectors *Utilities*, *Communications,* and *Financial Services*. Finally, in the last scenario, we run again the scenario Global A, while keeping total factor productivity constant at the level before liberalization. This makes it possible to provide a decomposition of the overall result in two components.

Scenario Global A

Table 6.1 reports for the three regions of the world the impact of a 20% liberalization of FDI across all regions and all sectors. The aggregate results are remarkable thanks to the increase in the capital stock brought about by the increase in FDI. For instance, total revenue increases by 1.9% and 2.4% in the U.S. and Canada respectively. This result is mainly due to a significant raise in the wage rate, 1.7% and 2.6% respectively (the wage rate in the rest-of-the-world is the numeraire in the model). As the capital stock increases, the marginal product of labour goes in the same direction and thereby the wage rate rises. Welfare increases in all regions of the world, but significantly in the U.S. with a rise of 1.3% and an amazing 3.0% rise in Canada.[3]

Table 6.1 Impact on aggregate variables in Scenario Global A
Percentage change from base run

	Revenue	Wage	Welfare
Canada	2.43	2.57	2.99
US	1.88	1.68	1.30
ROW	-0.15	0.00	0.34

Source: Simulation results

In Table 6.2, we report the percentage changes in the real production activities by sectors, regions, and nationality of the firms. Observe that production increases in every sectors and regions, whatever the nationality of the representative firm. However, real output increases more significantly for foreign firms located in Canada. Production of foreign firms located in Canada increases the most in sectors with the highest restrictions on foreign investment prior to their partial removal. For example, in Canada, foreign production in the *Utilities* sector by foreign firms increases by around 30%. It is also interesting to note that, in general, production by foreign firms in Canada increases by more than that of Canadian firms abroad.

[3] Note that we use the equivalent variation as percentage of base national income as the measure of welfare change in this study.

The differences in output increases across sectors and regions are mainly brought about by the changes in the stock of capital used for production activities. As shown in Table 6.3, we observe that following the liberalization of FDI, capital stock declines in local firms. If at a first glance, this result might be startling, it is in reality not. Indeed, thanks to the reduction in FDI restrictions, everything equal, capital stock increases in foreign-owned firms that naturally expand by drawing resources from local firms. As labour moves from the latter firms, the marginal product of capital declines, justifying the reduction in capital stock in locally-owned firms. It thus appears that reducing restrictions on foreign investment would trigger a reallocation of wealth away from local and toward foreign opportunities. It is worth mentioning that because of the multi-country framework we use, we are able to capture the terms-of-trade effects of the liberalization scenario. Indeed, as output increases in a given region, it might suffer from a negative terms-of-trade effect due to the decline in the prices of the goods it exports. Still, the positive impacts we obtain here, on welfare, suggest that the positive resource reallocation effects dominate the negative terms-of-trade effects.

Table 6.2 Impact sectoral output in Scenario Global A

Percentage change from base run

Nationality	Location	prim	ind	utl	cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	1.97	2.10	2.71	0.20	1.82	2.71	1.49	3.04	0.96	0.95	1.25
CAN	US	0.99	0.07	7.30	0.41	0.73	6.14	7.12	1.79	2.00	0.62	0.82
CAN	ROW	0.61	0.77	29.08	0.16	0.28	5.78	5.23	0.89	0.62	0.54	-0.22
US	CAN	3.84	3.62	31.17	0.43	3.82	11.57	9.25	5.47	1.93	1.95	6.63
US	US	0.84	0.37	0.52	0.38	0.59	2.31	1.50	0.96	1.98	0.49	0.57
US	ROW	0.83	0.93	29.14	0.22	0.57	5.96	5.60	1.00	0.81	0.76	0.15
ROW	CAN	4.49	3.56	34.08	0.46	4.49	12.37	10.07	5.68	2.18	2.24	8.42
ROW	US	1.96	0.59	8.86	0.68	1.67	6.71	8.56	2.65	2.02	1.54	2.42
ROW	ROW	0.33	0.65	0.62	0.09	0.26	1.56	0.84	0.58	0.41	0.26	0.12

Source: Simulation results

Table 6.3 Impact on capital stock in Scenario Global A

Percentage change from base run

Nationality	Location	prim	ind	utl	cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	-0.58	-0.71	-0.77	-1.18	-0.44	-0.76	-0.42	-0.37	-0.46	-0.48	-0.13
CAN	US	-0.01	-0.79	11.90	-0.48	-0.08	12.84	8.59	1.42	1.47	-0.12	0.17
CAN	ROW	0.40	0.38	50.07	0.06	-0.11	10.24	6.79	1.03	0.29	0.33	-0.61
US	CAN	3.66	3.62	37.92	2.42	4.13	19.15	15.45	15.34	4.64	3.23	6.26
US	US	-0.31	-0.80	-0.38	-0.72	-0.38	-0.73	-0.62	-0.46	-0.21	-0.38	-0.20
US	ROW	0.82	0.79	50.18	0.41	0.36	10.68	7.39	1.44	0.72	0.73	-0.09
ROW	CAN	5.13	4.79	41.87	3.65	5.68	21.00	17.16	16.74	6.02	4.47	8.39
ROW	US	1.94	0.98	14.74	1.16	1.90	14.84	10.96	3.35	3.06	1.64	2.49
ROW	ROW	-0.12	-0.06	-0.18	-0.34	-0.15	-0.28	-0.33	-0.13	-0.17	-0.17	-0.12

Source: Simulation results

Scenario Global B

In this simulation scenario, FDI liberalization is still global across regions of the world. The degree of liberalization is increased from 20% to 40% in eight out of the eleven sectors. However, given that FDI liberalization in the *Utilities*, *Communications*, and *Financial Services* is less likely, we now assume that FDI restrictions in these three sectors are fully maintained.

Despite the fact that the FDI is not liberalized in three sectors, we do observe a larger increase in aggregate variables in comparison to the preceding scenario. Indeed, revenue increases by more than 3.5% in U.S. and 3.8% in Canada as reported in Table 6.4. The wage rate is again the main factor driving these results, as it increases by more than 3% and 4%, respectively, in the U.S. and in Canada. The positive changes in welfare increase further accordingly. In Canada, welfare increases by as much as 4.6%.

Table 6.4 Impact on selected aggregate variables in Scenario Global B

Percentage change from base run

	Revenue	Wage	Welfare
Canada	3.76	4.18	4.60
US	3.49	3.11	2.23
ROW	-0.28	0.00	0.51

Source: Simulation results

In Table 6.5, we observe increases in production in all sectors but *Utilities*, *Communications*, and *Financial Services* sectors. Foreign output in other sectors actually increases by more than in the scenario Global A. Table 6.6 shows that, as in the previous simulation, the stock of capital in local firms declines in all sectors and regions, but, unlike Global A scenario, the stocks of foreign capital in the sectors that are not liberalized also decline in many cases.

Table 6.5 Impact on sectoral output in Scenario Global B

Percentage change from base run

Nationality	Location	prim	ind	utl	cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	3.29	3.75	1.09	0.22	2.85	4.76	0.75	1.15	1.46	1.44	1.85
CAN	US	2.10	0.21	0.55	0.75	1.55	11.86	0.78	0.79	3.55	1.36	2.01
CAN	ROW	1.54	1.54	-1.35	0.40	0.94	11.30	-1.95	-1.06	1.30	1.34	0.15
US	CAN	6.81	6.69	1.40	0.65	6.57	21.52	0.95	1.20	3.24	3.31	11.91
US	US	1.52	0.64	0.70	0.60	1.00	4.33	0.93	0.90	3.50	0.84	1.02
US	ROW	1.68	1.77	-1.18	0.44	1.14	11.43	-1.75	-0.99	1.43	1.47	0.40
ROW	CAN	8.06	6.55	3.46	0.71	7.84	23.19	2.24	1.53	3.71	3.91	15.36
ROW	US	3.65	1.07	2.20	1.18	3.05	12.85	2.71	2.04	3.59	2.84	4.55
ROW	ROW	0.57	1.18	0.28	0.17	0.37	2.87	-0.09	-0.43	0.53	0.37	0.15

Source: Simulation results

Table 6.6 Impact on capital stock in Scenario Global B

Percentage change from base run

Nationality	Location	Prim	ind	utl	cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	-0.85	-0.97	-0.16	-1.92	-0.78	-1.35	-0.17	-0.23	-0.74	-0.74	-0.32
CAN	US	0.63	-0.91	-0.85	-0.35	0.51	25.33	-0.71	-0.81	3.44	0.36	1.10
CAN	ROW	1.61	1.42	-3.07	0.79	0.67	20.42	-3.15	-2.57	1.36	1.42	-0.21
US	CAN	7.01	7.11	0.27	4.70	7.66	36.51	0.25	0.08	8.78	6.12	11.57
US	US	-0.52	-1.45	-0.58	-1.27	-0.65	-1.31	-0.45	-0.57	-0.33	-0.64	-0.32
US	ROW	1.88	1.77	-2.76	1.04	1.00	20.74	-2.82	-2.32	1.65	1.69	0.15
ROW	CAN	9.82	9.31	3.13	7.00	10.62	40.46	2.86	2.24	11.42	8.51	15.68
ROW	US	3.72	1.92	2.11	2.26	3.66	28.88	2.45	2.02	5.99	3.17	4.77
ROW	ROW	-0.20	-0.10	-0.15	-0.62	-0.26	-0.51	-0.12	-0.20	-0.33	-0.29	-0.21

Source: Simulation results

Scenario Bilateral A

In this scenario, we assume that Canada and the U.S. make a bilateral agreement to reduce FDI restriction by 20% in all sectors. As shown in Table 6.7, changes in revenue, wage rate, and welfare are now smaller in comparison to the preceding scenarios where the restrictions were removed in all regions. Welfare even declines in the rest-of-the-world as this region is left out of the liberalization agreement. Percentage changes in Canada are still, however, substantially positive. Revenue increases by 0.5%, the wage rate raises by almost 1% and welfare increases by more than 1.3%. These results point to the overall benefit of global liberalization over a bilateral one.

Table 6.7 in Impact on selected aggregate variables in Scenario Bilateral A
Percentage change from base run

	Revenue	Wage	Welfare
Canada	0.56	0.93	1.35
US	0.10	0.09	0.09
ROW	0.01	0.00	-0.02

Source: Simulation results

As shown in Table 6.8, in Canada, U.S. firms increase their activity substantially, especially in the *Utilities*, *Transportation*, and *Communication* sectors. Canadian firms in the U.S. become significantly more active in the same three sectors. The rise in the stock of capital confirms the results on output. Notice from Table 6.9 that the stock of capital of U.S. firms installed in Canada in the *Utilities*, *Transportation*, and *Communication* sectors would increase by 40%, 20% and 16% respectively.

Table 6.8 Impact on sectoral output in Scenario Bilateral A

Percentage change from base run

Nationality	Location	prim	ind	utl	cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	1.01	1.77	2.02	0.09	0.96	2.28	0.74	1.40	0.39	0.64	0.50
CAN	US	0.28	-0.11	7.44	0.09	0.25	4.13	5.95	0.99	0.15	0.23	0.39
CAN	ROW	-0.24	-0.16	-0.37	-0.05	-0.28	-0.22	-0.38	-0.12	-0.19	-0.23	-0.36
US	CAN	2.85	3.18	31.54	0.35	2.90	11.29	8.54	3.79	1.34	1.70	5.71
US	US	0.06	0.05	0.05	0.03	0.04	0.24	0.14	0.09	0.13	0.03	0.04
US	ROW	-0.06	-0.05	-0.31	-0.01	-0.07	-0.06	-0.06	-0.04	-0.04	-0.05	-0.09
ROW	CAN	1.18	2.22	2.33	0.13	1.14	2.49	0.97	1.46	0.45	0.77	0.99
ROW	US	0.10	0.08	0.10	0.04	0.08	0.27	0.19	0.13	0.13	0.07	0.11
ROW	ROW	-0.01	-0.03	-0.02	0.00	-0.01	-0.02	-0.01	-0.02	-0.01	-0.01	-0.01

Source: Simulation results

Table 6.9 Impact on capital stock in Scenario Bilateral A

Percentage change from base run

Nationality	Location	prim	ind	utl	cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	0.05	0.29	-0.24	-0.36	-0.07	-0.28	-0.04	0.05	0.02	-0.02	-0.04
CAN	US	0.42	0.18	13.50	0.32	0.42	14.07	9.64	2.02	1.79	0.36	0.51
CAN	ROW	-0.43	-0.39	-0.64	-0.32	-0.45	-0.49	-0.60	-0.39	-0.40	-0.41	-0.51
US	CAN	4.29	4.56	40.35	3.24	4.42	20.14	16.08	15.78	5.10	3.70	6.19
US	US	-0.01	-0.04	-0.02	-0.05	-0.02	-0.05	-0.05	-0.03	-0.01	-0.02	-0.01
US	ROW	-0.09	-0.09	-0.52	-0.06	-0.10	-0.12	-0.09	-0.07	-0.07	-0.08	-0.12
ROW	CAN	0.45	0.88	0.18	-0.03	0.34	0.16	0.43	0.43	0.39	0.34	0.54
ROW	US	0.07	0.04	0.06	0.02	0.06	0.03	0.04	0.05	0.06	0.05	0.09
ROW	ROW	-0.01	-0.01	-0.01	0.01	0.00	-0.01	0.00	-0.01	0.00	0.00	0.00

Source: Simulation results

Scenario Bilateral B

This time FDI liberalization is pushed up to 40% in eight out of eleven sectors with no FDI liberalization in the sectors *Utilities*, *Communications*, and *Financial Services*. It is worth noting from Table 6.10 that revenue, wage rate and welfare improve for Canada and the U.S. relative to the Bilateral A scenario. As restrictions remain in some sectors, the U.S. output and stock of capital in Canada increase the most in the

Transportation sector (see Table 6.11 and 6.12), thanks to the interindustrial spillover effects.

Table 6.10 Impact on selected aggregate variables in Scenario Bilateral B

Percentage change from base run

	Revenue	Wage	Welfare
Canada	0.70	1.45	2.00
US	0.20	0.19	0.16
ROW	0.01	0.00	-0.04

Source: Simulation results

Table 6.11 Impact on sectoral output in Scenario Bilateral B

Percentage change from base run

Nationality	Location	prim	ind	utl	cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	1.59	3.17	0.83	0.13	1.52	4.15	0.20	0.53	0.54	1.04	0.68
CAN	US	0.69	-0.12	-0.13	0.21	0.62	7.95	-0.16	-0.09	0.28	0.58	1.04
CAN	ROW	-0.31	-0.25	-0.32	-0.07	-0.36	-0.32	-0.33	-0.14	-0.24	-0.31	-0.45
US	CAN	5.14	5.92	1.13	0.62	5.23	21.41	0.39	0.58	2.34	3.07	10.70
US	US	0.12	0.07	0.07	0.05	0.06	0.46	0.06	0.06	0.23	0.05	0.07
US	ROW	-0.12	-0.09	-0.12	-0.02	-0.13	-0.12	-0.11	-0.06	-0.08	-0.11	-0.17
ROW	CAN	1.81	3.97	1.25	0.20	1.75	4.44	0.46	0.60	0.62	1.22	1.28
ROW	US	0.19	0.14	0.15	0.07	0.14	0.52	0.16	0.12	0.23	0.12	0.21
ROW	ROW	-0.03	-0.06	-0.03	0.00	-0.02	-0.03	-0.01	-0.03	-0.01	-0.02	-0.01

Source: Simulation results

Table 6.12 Impact on capital stock in Scenario Bilateral B

Percentage change from base run

Nationality	Location	prim	Ind	utl	cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	0.17	0.66	0.42	-0.54	-0.14	-0.50	0.21	0.33	0.07	0.02	-0.12
CAN	US	1.14	0.65	-0.39	0.88	1.15	27.56	-0.39	-0.36	3.79	0.99	1.39
CAN	ROW	-0.55	-0.53	-0.53	-0.41	-0.58	-0.70	-0.53	-0.41	-0.49	-0.52	-0.64
US	CAN	8.33	8.91	0.84	6.32	8.47	38.95	0.59	0.64	9.84	7.16	11.88
US	US	-0.02	-0.08	-0.03	-0.08	-0.03	-0.09	-0.02	-0.03	-0.01	-0.03	-0.02
US	ROW	-0.18	-0.17	-0.18	-0.12	-0.19	-0.23	-0.17	-0.14	-0.15	-0.16	-0.24
ROW	CAN	0.67	1.56	1.01	-0.12	0.38	0.05	0.74	0.77	0.52	0.50	0.58
ROW	US	0.14	0.07	0.12	0.05	0.13	0.07	0.15	0.12	0.12	0.11	0.18
ROW	ROW	-0.01	-0.02	-0.02	0.01	0.00	-0.01	-0.01	-0.01	0.01	0.00	-0.01

Source: Simulation results

Scenario Unilateral A

The results of the simulations above clearly indicate that Canada would benefit significantly from a partial FDI liberalization with its trading partners. This is not surprising, since referring to the Golup (2003) study, Canada is one of the most restrictive countries toward inward FDI among industrialized countries. Taking into account the general equilibrium impact, we expected that a reduction in these distortions would indeed lead to a more efficient allocation of resources.

Still, as agreements on FDI seem to be difficult to reach through international negotiations, one may wonder if Canada would reap any benefit by removing unilaterally restrictions on inward FDI. We therefore analyze an additional scenario, Unilateral A, where Canada alone liberalizes its FDI by reducing restrictions by 20% on inward FDI coming from the U.S. and the rest-of-the world. The expected results in such a unilateral move are less clear, however, because the negative terms-of-trade effects might be stronger than in a bilateral or multilateral move and therefore might more than offset the expected benefits from a more efficient reallocation of resources.

Results in Table 6.13 indicate that in this scenario, the gains in Canada are still significant as, for instance, welfare improves by more than 1.4%. In Table 6.14 and 6.15, we can note that this improvement stems mainly form large investment from the U.S. and the rest-of-the-world in the *Utilities*, *Transportation*, *Communications* and *Others* sectors.

Table 6.15 shows that, in contrast to the "Global" and "Bilateral" scenarios, Canadian outward FDI declines in the Unilateral scenario while Canadians capital owners reallocate some of their capital towards local firms. This result shows an important feature of our model, in particular the potential spillover effect of inward FDI on total factor productivity of foreign owned firms but also local firms. This also induces Canadian capital owners to reallocate some of their capital from foreign to domestic use.

Table 6.13 Impact on selected aggregate variables in Scenario Unilateral A
Percentage change from base run

	Revenue	Wage	Welfare
Canada	0.28	0.99	1.44
US	0.11	0.09	0.07
ROW	0.01	0.00	0.00

Source: Simulation results

Table 6.14 Impact on sectoral output in Scenario Unilateral A
Percentage change from base run

Nationality	Location	Prim	ind	utl	cns	trd	trp	cmn	ofi	isr	obs	Oth
CAN	CAN	1.95	2.85	2.90	0.12	1.15	2.41	1.09	2.50	0.60	0.81	0.48
CAN	US	0.02	-0.48	-0.01	0.01	0.01	-0.02	0.01	0.02	0.06	-0.01	0.01
CAN	ROW	-0.09	-0.14	-0.08	-0.01	-0.08	-0.05	-0.07	-0.02	-0.04	-0.07	-0.09
US	CAN	3.70	4.48	32.14	0.37	2.97	11.27	8.70	4.85	1.50	1.82	5.32
US	US	0.05	0.01	0.01	0.02	0.03	0.02	0.03	0.04	0.06	0.02	0.04
US	ROW	-0.05	-0.05	-0.30	0.00	-0.05	-0.05	-0.05	-0.01	-0.02	-0.04	-0.07
ROW	CAN	3.72	4.50	32.45	0.43	3.01	11.35	8.74	4.86	1.51	1.98	5.41
ROW	US	0.07	0.02	-0.09	0.03	0.06	0.04	0.08	0.06	0.06	0.05	0.09
ROW	ROW	-0.01	-0.03	-0.02	0.01	0.00	-0.01	0.00	0.00	0.01	-0.01	0.00

Source: Simulation results

Table 6.15 Capital Stock in Scenario Unilateral A

Percentage change from base run

Nationality	Location	Prim	Ind	utl	cns	trd	trp	cmn	ofi	isr	obs	Oth
CAN	CAN	0.34	0.83	-0.12	-0.30	0.02	-0.13	0.07	0.23	0.16	0.15	-0.03
CAN	US	-0.07	-0.39	-0.06	-0.07	-0.06	-0.08	-0.06	-0.06	-0.04	-0.06	-0.05
CAN	ROW	-0.15	-0.18	-0.13	-0.10	-0.13	-0.12	-0.13	-0.10	-0.12	-0.13	-0.14
US	CAN	4.33	5.04	39.89	3.07	4.21	19.94	15.79	15.67	4.98	3.64	5.77
US	US	-0.01	-0.05	-0.02	-0.04	-0.02	-0.04	-0.01	-0.02	-0.01	-0.02	-0.01
US	ROW	-0.09	-0.10	-0.52	-0.07	-0.09	-0.12	-0.09	-0.07	-0.07	-0.08	-0.11
ROW	CAN	4.37	5.11	40.31	3.15	4.29	20.07	15.86	15.73	5.03	3.80	5.87
ROW	US	0.03	0.00	-0.20	0.02	0.05	0.02	0.06	0.05	0.04	0.04	0.06
ROW	ROW	-0.01	-0.03	-0.02	-0.01	-0.01	-0.02	-0.01	-0.01	0.00	-0.01	-0.01

Source: Simulation results

Scenario Unilateral B

Under the Unilateral B scenario, Canada reduces FDI restrictions by 40% except for *Utilities*, *Communications*, and *Financial Services*. In comparison to the Unilateral A scenario, average wage rate, revenue and welfare improve substantially (see Table 6.16). The difference with respect to Unilateral A scenario is almost 1% point for welfare. From a policy perspective this suggests the desirability of a sectoral liberalization of inward FDI, when across the board liberalization is not politically feasible because of the resistance in some sectors. Tables 6.17 and 6.18 indicate that the Canadian *Transportation* sector would benefit the most in this scenario in terms of inward FDI from both the U.S. and the rest of the world.

Table 6.16 Impact on selected aggregate variables in Scenario Unilateral B

Percentage change from base run

	Revenue	Wage	Welfare
Canada	0.47	1.79	2.27
US	0.20	0.16	0.13
ROW	0.02	0.00	0.00

Source: Simulation results

Table 6.17 Impact on sectoral Output in Scenario Unilateral B

Percentage change from base run

Nationality	Location	prim	Ind	utl	Cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	3.25	5.04	1.30	0.18	1.88	4.40	0.08	0.61	0.89	1.28	0.68
CAN	US	0.01	-0.84	-0.05	0.01	0.00	-0.04	-0.01	0.02	0.11	-0.02	-0.01
CAN	ROW	-0.17	-0.25	-0.17	-0.02	-0.16	-0.11	-0.15	-0.06	-0.09	-0.14	-0.18
US	CAN	6.77	8.24	1.43	0.66	5.47	21.50	0.14	0.63	2.66	3.25	10.36
US	US	0.08	0.01	0.03	0.02	0.04	0.03	0.06	0.06	0.11	0.03	0.07
US	ROW	-0.10	-0.09	-0.10	-0.01	-0.10	-0.09	-0.08	-0.03	-0.04	-0.08	-0.13
ROW	CAN	6.81	8.29	1.53	0.76	5.54	21.67	0.20	0.64	2.67	3.54	10.52
ROW	US	0.12	0.03	0.10	0.04	0.10	0.06	0.15	0.12	0.11	0.09	0.15
ROW	ROW	-0.02	-0.06	-0.02	0.01	0.00	-0.02	0.00	-0.01	0.02	-0.01	0.01

Source: Simulation results

Table 6.18 Impact on capital stock in Scenario Unilateral B

Percentage change from base run

Nationality	Location	prim	Ind	utl	Cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	0.55	1.45	0.84	-0.53	-0.05	-0.31	0.41	0.67	0.23	0.26	-0.16
CAN	US	-0.14	-0.70	-0.17	-0.16	-0.13	-0.17	-0.14	-0.13	-0.09	-0.13	-0.12
CAN	ROW	-0.29	-0.34	-0.30	-0.20	-0.27	-0.24	-0.27	-0.21	-0.24	-0.25	-0.29
US	CAN	8.51	9.83	1.02	6.12	8.28	38.78	0.55	0.79	9.78	7.20	11.43
US	US	-0.02	-0.10	-0.04	-0.08	-0.04	-0.07	-0.03	-0.03	-0.01	-0.04	-0.02
US	ROW	-0.17	-0.17	-0.17	-0.12	-0.17	-0.22	-0.15	-0.13	-0.13	-0.15	-0.21
ROW	CAN	8.59	9.96	1.16	6.29	8.42	39.08	0.67	0.89	9.87	7.48	11.63
ROW	US	0.05	0.00	0.09	0.03	0.09	0.03	0.11	0.09	0.07	0.08	0.11
ROW	ROW	-0.03	-0.05	-0.03	-0.02	-0.02	-0.03	-0.02	-0.03	-0.01	-0.02	-0.02

Source: Simulation results

Scenario Global-No Productivity Change

In our last scenario, just like Global A scenario, FDI restrictions are cut by 20% across sectors and across regions. However, we now assume that productivity remains unchanged following inward FDI. Therefore, comparing both scenarios permits to gauge the impact of the spillover effect of inward FDI on total factor productivity. Tables 6.19, 6.20, and 6.21 report the simulated results when productivity is not enhanced by

increased FDI. The most interesting comparison is thus with Global A simulation results (Tables 6.1, 6.2, and 6.3).

Table 6.19 Impact on selected aggregate variables in Scenario Global, No Productivity Change

Percentage change from base run

	Revenue	Wage	Welfare
Canada	1.38	1.29	0.64
US	1.70	1.49	0.42
ROW	-0.17	0.00	-0.23

Source: Simulation results

Table 6.20 Impact on sectoral output in Scenario Global, No Productivity Change

Percentage change from base run

Nationality	Location	prim	Ind	utl	cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	-0.37	-0.53	-1.02	0.14	-0.36	-0.77	-0.30	0.10	-0.18	-0.04	-0.27
CAN	US	0.38	-0.34	6.90	0.13	0.32	3.47	5.37	0.81	0.30	0.21	0.67
CAN	ROW	0.45	0.44	28.53	0.14	0.23	4.04	4.27	0.38	0.22	0.44	-0.08
US	CAN	1.25	0.53	25.81	0.35	1.40	7.54	7.06	2.38	0.70	0.86	4.47
US	US	0.02	-0.39	-0.10	0.04	-0.02	-0.36	-0.43	-0.18	0.27	-0.11	0.06
US	ROW	0.44	0.48	28.20	0.15	0.24	4.04	4.35	0.39	0.22	0.43	-0.08
ROW	CAN	1.84	0.40	28.49	0.37	2.02	8.27	7.82	2.57	0.94	1.15	6.13
ROW	US	1.09	-0.24	8.14	0.33	1.01	3.87	6.43	1.45	0.31	0.89	1.84
ROW	ROW	-0.11	0.17	-0.16	0.01	-0.12	-0.31	-0.41	-0.04	-0.22	-0.11	-0.17

Source: Simulation results

Table 6.21 Impact on capital stock in Scenario Global, No Productivity Change
Percentage change from base run

Nationality	Location	prim	Ind	utl	cns	trd	trp	cmn	ofi	isr	obs	oth
CAN	CAN	-0.80	-0.98	-1.14	-0.57	-0.76	-1.07	-0.75	-0.58	-0.68	-0.54	-0.59
CAN	US	0.34	-0.20	12.34	0.13	0.32	13.24	9.02	1.79	1.70	0.23	0.57
CAN	ROW	0.89	0.93	50.90	0.72	0.42	10.77	7.32	1.43	0.74	0.82	-0.06
US	CAN	2.98	2.73	36.61	2.72	3.32	18.22	14.54	14.67	4.01	2.81	5.10
US	US	-0.39	-0.73	-0.42	-0.45	-0.40	-0.75	-0.67	-0.49	-0.31	-0.40	-0.31
US	ROW	0.88	0.96	50.31	0.74	0.44	10.76	7.45	1.50	0.75	0.82	-0.05
ROW	CAN	4.37	3.78	40.38	3.89	4.78	19.96	16.14	15.99	5.32	3.99	7.09
ROW	US	1.77	0.95	14.60	1.37	1.79	14.71	10.80	3.24	2.88	1.54	2.28
ROW	ROW	-0.14	0.03	-0.18	-0.07	-0.16	-0.28	-0.36	-0.13	-0.22	-0.15	-0.19

Source: Simulation results

For Canada, comparing Tables 6.1 and 6.19, we observe that of the 3% increase in welfare obtained under the Global A scenario, 80% comes from an increased total factor productivity and 20% comes from a better reallocation of resources. In the case of the U.S., of the 1.3% increase in welfare, two-third comes from an increase in productivity and one-third from improved resource reallocation. Finally, for the rest-of-the world, the whole improvement in welfare stems from the increase in total factor productivity. Interestingly, in all three regions, improvement in resource allocation contributes more than productivity enhancement, to the increase in revenues and average wage rates.

7. Conclusion

This paper presents a multi-region multi-sector static general equilibrium to assess the aggregate and sectoral economic effects of liberalizing inward FDI restrictions in Canada, the U.S. and the rest of the world. We have simulated a wide range of scenarios with various degrees of FDI liberalization and various degrees of sectoral coverage, while taking into account the positive spillover effect on total factor productivity. The liberalization scheme has been proxied by a reduction in the implicit tax equivalent on foreign capital returns.

Our simulation results suggest that, from a strict economic point of view, removing barriers to inward FDI could reap great benefits to all regions of the world, and

in particular to the ones in which the restrictions were initially severe. For example for Canada, achieving a global reduction of 20% of existing restrictions on inward FDI in all sectors would translate into a welfare increase that is as large as 3% of GDP.

The benefits of fewer restrictions on FDI stem mainly from better resource reallocations across the world, increased capital stock in foreign-owned firms and positive spillover effect on total factor productivity. As capital stock and productivity increase, real wages increase and households are therefore able to enjoy higher income and welfare. Increased total factor productivity is a key factor driving our results since up to 80% of the increase in welfare is attributed to the positive impacts of additional FDI on productivity.

As expected, our results also indicate that in all regions, foreign-owned firms would experience the highest increase in their production activities in comparison to the locally-owned ones. Besides, the benefits of reducing restrictions on FDI, although less strong, still hold when liberalization is partial (*i.e.*, when it occurs in selected sectors only). In a context where across-the-board FDI liberalization is not feasible, our simulation results casts light on the desirability of pursuing partial liberalization as its benefits are not negligible.

It is well known from trade theory that multilateral trade liberalization is Pareto efficient and superior to a unilateral one, which itself is also typically welfare improving, especially for a small country which takes the terms of trade as given or cannot much influence it. This also appears to be the case in our model when Canada performs a unilateral liberalization of inward FDI. Not surprisingly, the benefits are positive since Canada has quite stringent restrictions to inward FDI among industrialized countries.

With regards to bilateral FDI liberalization, which occurs between two partners and excludes other parties, we have obtained ambiguous results on welfare as it involves both negative terms-of-trade and positive growth effects. We are tempted to make a parallel with the well-known welfare ambiguity resulting form both trade creation and trade diversion effects that occur in free trade areas where groups of countries implement discriminatory tariff liberalization policies among themselves. However, only further investigations would shed a definitive light on the true mechanisms involved in this scheme.

Finally, as with any new modeling framework, the results presented in this report should be seen as work in progress that deserves further refinements of the modeling assumptions. Further research would also benefit from an improvement in the quality of the data at the sectoral and regional level, on the ownership of the stock of capital, and on FDI restrictions. Finally, the current model is static and does not account for global capital accumulation. Therefore, an important extension that is worth studying carefully is the intertemporal dimension in FDI decisions.

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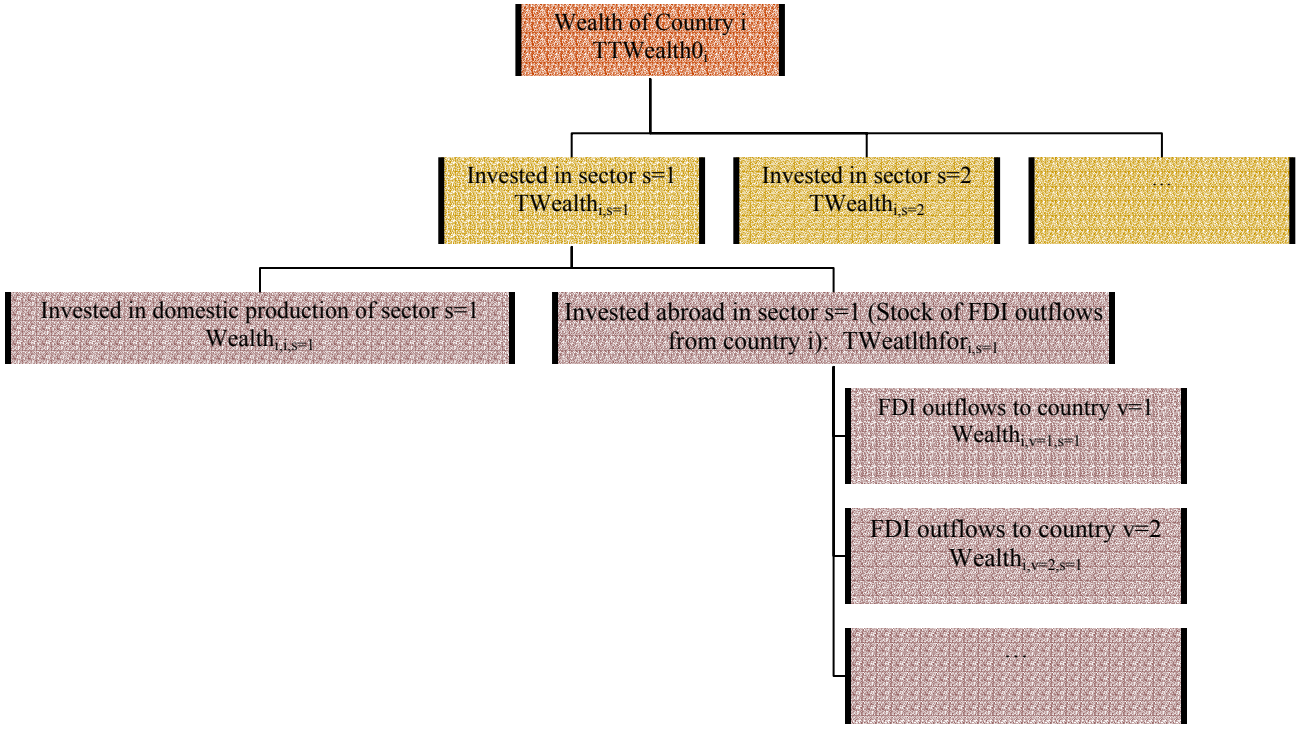
Appendix: Equations and notation of the FDI model

1. Wealth allocation structure and notation

Figure 1. Allocation of wealth (assets)



First level CET

(1) $$TWEALTH_{i,s} = ETAW_{i,s}\left(\frac{RTW_{i,s}}{RTTW_i}\right)^{\sigma TTW_i} TTWEALTH0_i$$

(2) $$\left(RTTW_i\right)^{1+\sigma TTW_i} = \sum_s ETAW_{i,s}\left(RTW_{i,s}\right)^{1+\sigma TTW_i}$$

Second level CET

(3) $$TWEALTHFOR_{i,s} = ETAWFOR_{i,s}\left(\frac{RWFOR_{i,s}}{RTW_{i,s}}\right)^{\sigma TW_{i,s}} TWEALTH_{i,s}$$

(4) $$WEALTH_{i,i,s} = ETAWDOM_{i,s}\left(\frac{R_{i,i,s}}{RTW_{i,s}}\right)^{\sigma TW_{i,s}} TWEALTH_{i,s}$$

(5) $$\left(RTW_{i,s}\right)^{1+\sigma TW_{i,s}} = ETAWFOR_{i,s}\left(RWFOR_{i,s}\right)^{1+\sigma TW_{i,s}} + ETAWDOM_{i,s}\left(R_{i,i,s}\right)^{1+\sigma TW_{i,s}}$$

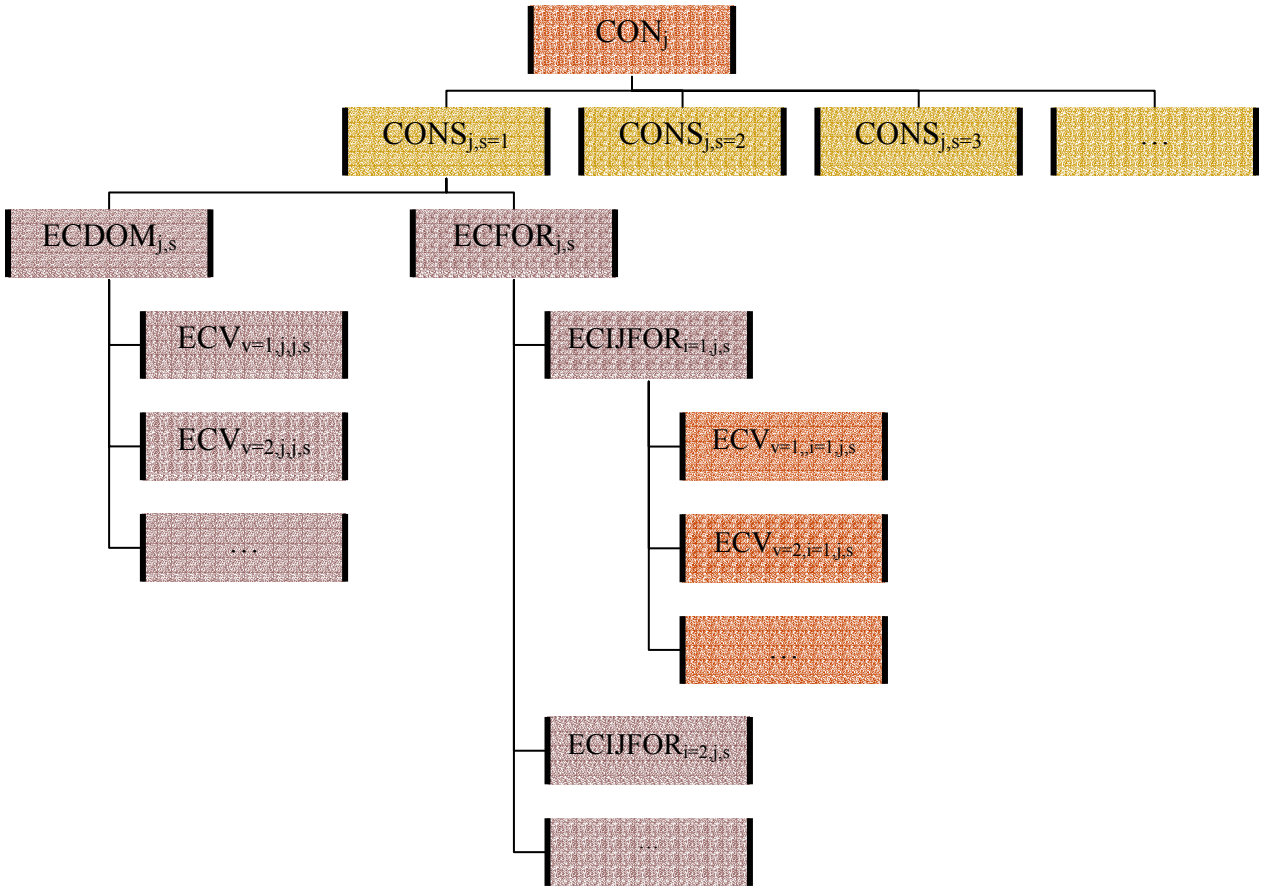
Third level CET

(6) $$WEALTH_{i,v,s} = ETAWW_{i,v,s}\left(\frac{R_{i,v,s}\left(1-CTAX_{i,v,s}\right)}{RWFOR_{i,s}}\right)^{\sigma W_{i,s}} TWEALTHFOR_{i,s}$$

(7) $$\left(RWFOR_{i,s}\right)^{1+\sigma W_{i,s}} = \sum_{v} ETAWW_{i,v,s}\left[R_{i,v,s}\left(1-CTAX_{i,v,s}\right)\right]^{1+\sigma W_{i,s}}$$

2. Consumption structure and notation

Figure 2. Structure of final consumption demand



First level Cobb-Douglas

(8) $$CONS_{j,s} = \frac{\rho_{j,s} CON_j PCON_j}{PCFC_{j,s}}$$

(9) $$Log\left(PCON_j\right) = \sum_s \rho_{j,s} \log\left(PCFC_{j,s}\right)$$

Second level CES

(10) $$ECDOM_{j,s} = ETADOMC_{j,s}\left[\frac{PCFC_{j,s}}{PDOM_{j,s}}\right]^{\sigma FORC_{j,s}} \underbrace{\frac{\rho_{j,s} PCON_j CON_j}{PCFC_{j,s}}}_{CONS_{j,s}}$$

(11) $$ECFOR_{j,s} = ETAFORC_{j,s}\left[\frac{PCFC_{j,s}}{PFOR_{j,s}}\right]^{\sigma FORC_{j,s}} \underbrace{\frac{\rho_{j,s} PCON_j CON_j}{PCFC_{j,s}}}_{CONS_{j,s}}$$

(12) $$\left(PCFC_{j,s}\right)^{1-\sigma FORC_{j,s}} = \left[ETADOMC_{j,s}\left(PDOM_{j,s}\right)^{1-\sigma FORC_{j,s}} + ETAFORC_{j,s}\left(PFOR_{j,s}\right)^{1-\sigma FORC_{j,s}}\right]$$

Third level CES

(13) $$ECV_{v,j,j,s} = ETADOMV_{v,j,j,s}\left[\frac{PDOM_{j,s}}{PV_{v,j,s}}\right]^{\sigma DOMV_{j,s}} ECDOM_{j,s}$$

(14) $$\left(PDOM_{j,s}\right)^{1-\sigma DOMV_{j,s}} = \sum_v ETADOMV_{v,j,j,s}\left(PV_{v,j,s}\right)^{1-\sigma DOMV_{j,s}}$$

Fourth level CES

(15) $$ECIJFOR_{i,j,s} = ETAFC_{i,j,s}\left[\frac{PFOR_{j,s}}{PIJ_{i,j,s}(1+TAR_{i,j,s})}\right]^{\sigma_{j,s}} ECFOR_{j,s}$$

(16) $$\left(PFOR_{j,s}\right)^{1-\sigma_{j,s}} = \sum_i ETAFC_{i,j,s}\left(PIJ_{i,j,s}(1+TAR_{i,j,s})\right)^{1-\sigma_{j,s}}$$

Fifth level CES

(17) $$ECV_{v,i,j,s} = ETAFORV_{v,i,j,s}\left[\frac{PIJ_{i,j,s}}{PV_{v,i,s}}\right]^{\sigma FORV_{j,s}} ECIJFOR_{i,j,s}$$

(18) $$\left(PIJ_{i,j,s}\right)^{1-\sigma FORV_{j,s}} = \sum_{v} ETAFORV_{v,i,j,s}\left(PV_{v,i,s}\right)^{1-\sigma FORV_{j,s}}$$

3. Investment demand

In the first level, there is a demand in country *j* for different (investment) goods *s* produced by different subsidiaries *v*. The second level describes from which country the agent of country *j* buys the (investment) good.

First level Cobb-Douglas

(19) $$INVVS_{v,j,s} = \frac{\gamma_{v,j,s} INV_j PINV_j}{PCFV_{v,j,s}}$$

(20) $$\log PINV_j = \sum_{v}\sum_{s} GAM_{v,j,s} \log PCFV_{v,j,s}$$

Second level CES

(21) $$EVV_{v,i,j,s} = ETAFV_{v,i,j,s}\left[\frac{PCFV_{v,j,s}}{PV_{v,i,s}(1+TAR_{i,j,s})}\right]^{\sigma_{j,s}} \underbrace{\frac{\gamma_{v,j,s} INV_j PINV_j}{PCFV_{v,j,s}}}_{INVVS_{v,j,s}}$$

(22) $$\left(PCFV_{v,j,s}\right)^{1-\sigma_{j,s}} = \sum_{i} ETAFV_{v,i,j,s}\left[PV_{v,i,s}\left(1+TAR_{i,j,s}\right)^{1-\sigma_{j,s}}\right]$$

4. Supply side

The firm operates in sector *sd* of country *j* and is of nationality *v* (*i.e.*, a subsidiary originating from country-*v*). From profit maximisation, we obtain the marginal cost pricing:

(23) $$PV_{v,j,sd} = \nu_{v,j,sd}$$

where $v_{v,j,sd}$ is the unit (average and marginal) cost.

Conditional factor demands from cost minimization:

(24) $$L_{v,j,sd} = \frac{\alpha_{L\,v,j,sd} PV_{v,j,sd} Z_{v,j,sd}}{W_j}$$

(25) $$K_{v,j,sd} = \frac{\alpha_{K\,v,j,sd} PV_{v,j,sd} Z_{v,j,sd}}{R_{v,j,sd}}$$

(26) $$EI_{v,j,s,sd} = \frac{\alpha_{X\,v,j,s,sd} PV_{v,j,sd} Z_{v,j,sd}}{PCI_{v,j,s,sd}}$$

Unit cost function is:

(27) $$\log PV_{v,j,sd} = \alpha_{L\,v,j,sd} \log\left(W_j\right) + \alpha_{K\,v,j,sd} \log\left(R_{v,j,sd}\right) + \sum_s \alpha_{X\,v,j,s,sd} \log\left(PCI_{v,j,s,sd}\right)$$

Nationality/ownership and geographic origin of the intermediary good:

(28) $$EIVV_{vo,v,i,j,s,sd} = ETAII_{vo,v,i,j,s,sd} \underbrace{\frac{\alpha_{X\,v,j,s,sd} PV_{v,j,sd} Z_{v,j,sd}}{PCI_{v,j,s,sd}}}_{EI_{v,j,s,sd}}$$

(29) $$PCI_{v,j,s,sd} = \sum_i \sum_{vo} ETAII_{vo,v,i,j,s,sd} PV_{vo,i,s} \left(1 + TAR_{i,j,s}\right)$$

5. Equilibrium conditions

Labour market equilibrium

(30) $$\sum_v \sum_{sd} \frac{\alpha_{L\,v,j,sd} PV_{v,j,sd} Z_{v,j,sd}}{W_j} = LSUP0_j$$

Capital market equilibrium

(31) $$\frac{\alpha_{K\,v,j,sd} PV_{v,j,sd} Z_{v,j,sd}}{R_{v,j,sd}} = KSUP_{v,j,sd}$$

where we assume no cross-ownership:

(32) $$KSUP_{v,j,sd} = WEALTH_{v,j,sd}$$

Good market equilibrium

(33) $$E_{vo,i,j,s} = ECV_{vo,i,j,s} + EVV_{vo,i,j,s} + \sum_{sd}\sum_{v} EIVV_{vo,v,i,j,s,sd}$$

(34) $$\underbrace{Z_{vo,i,s}}_{\substack{\text{supply of good s by subsidiary vo}\\ \text{located in country i}}} = \underbrace{\sum_{j} E_{vo,i,j,s}}_{\substack{\text{demand for good produced by subsidiary vo located in country i}\\ \text{and expressed by all countries j (including country i)}}}$$

6. Revenue equation

(35) $$\begin{aligned} REV_i = &\sum_{v}\sum_{sd} \alpha_{L\,v,i,sd} PV_{v,i,sd} Z_{v,i,sd} + \sum_{v}\sum_{sd} R_{i,v,sd} WEALTH_{i,v,sd} (1 - CTAX_{i,v,sd}) \\ &+ \sum_{vo}\sum_{sd}\sum_{j} E_{vo,j,i,sd} PV_{vo,j,sd} TAR_{j,i,sd} + \sum_{v}\sum_{sd} R_{v,i,sd} WEALTH_{v,i,sd} CTAX_{v,i,sd} \end{aligned}$$

7. Steady state

In the steady state, investment equals depreciation of the stock of capital and the current account of each country is in equilibrium so that trade balance deficit equals interest receipt on foreign (financial) assets.

(36) $$INV_i = \frac{\sum_{v}\sum_{s} DEPR_{i,v,s} KSUP_{i,v,s}}{SCR_i}$$

(37) $$ESC.DET_j = CON_j PCON_j + INV_j PINV_j - REV_j$$

8. Total factor productivity spillover

(38) $$B_{v,j,s}^{NEW} = B_{v,j,s}^{OLD\,\beta(NEW\_FDI\_RATIO_{j,s} - OLD\_FDI\_RATIO_{j,s})}$$

where $B_{v,j,s}$ is the total factor productivity of a plant v located in country j and producing good s. The "old" FDI ratio is the benchmark foreign stock of capital used in sector s of country j as a proportion of the total stock of capital used in sector s of country j. Any increase in that proportion due to FDI liberalization would increase total factor productivity of all plants v producing s in country j, including the productivity of domestically owned firms.

Appendix 2

Table 1: Aggregation mapping from GTAP to Model

A. Regions of the Model	Regions/countries in GTAP database
Canada (CAN)	Canada
USA (US)	USA
Rest of the World (ROW)	Australia, New Zealand, Rest of Oceania, China, Hong Kong, Japan, Republic of Korea, Taiwan, Rest of East Asia, Indonesia, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Rest of Southeast Asia, Bangladesh, India, Sri Lanka, Rest of South Asia, Mexico, Rest of North America, Colombia, Peru, Venezuela, Rest of Andean Pact, Argentina, Brazil, Chile, Uruguay, Rest of South America, Central America, Rest of FTAA, Rest of the Caribbean, Austria, Belgium, Denmark, Finland, France, Germany, United Kingdom, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, Switzerland, Rest of EFTA, Rest of Europe, Albania, Bulgaria, Croatia, Cyprus, Czech Republic, Hungary, Malta, Poland, Romania, Slovakia, Slovenia, Estonia, Latvia, Lithuania, Russian Federation, Rest of Former Soviet Union, Turkey, Rest of Middle East, Morocco, Tunisia, Rest of North Africa, Botswana, South Africa, Rest of SACU, Malawi, Mozambique, Tanzania, Zambia, Zimbabwe, Rest of SADC, Madagascar, Uganda, Rest of Sub Saharan

B. Sectors of the Model	Sectors in GTAP database
Primary (PRIM)	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, forestry, fishing, coal, oil, gas, minerals nec, 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
Manufacture (IND)	Textiles, wearing apparel, leather products, wood products, paper products, publishing, petroleum, coal products, chemical, rubber, plastic products, mineral products nec, ferrous metals, metals nec, metal products, motor vehicles and parts, transport equipment, electronic equipment, machinery and equipment nec, manufactures nec
Services, of which:	
Utilities (UTL)	Electricity, gas manufacture, distribution, water
Construction (CNS)	Construction
Trade (TRD)	Trade
Transport (TRP)	Transport nec, water transport, air transport
Communication (CMN)	Communication
Financial Services (OFI)	Financial services nec
Insurance (ISR)	Insurance
Business services (OBS)	Business services nec
Others (OTH)	Recreational and other services, public admin. and defence, education, health, ownership of dwellings

Source: Authors own classification

Table 2: Armington elasticities[1]

	Canada	USA	ROW
Primary	8.5	8.5	5.6
Manufacture	8.1	8.1	5.4
Utilities (UTL)	6.3	6.3	4.2
Construction (CNS)	4.3	4.3	2.9
Trade (TRD)	4.3	4.3	2.9
Transport (TRP)	4.3	4.3	2.9
Communication (CMN)	4.3	4.3	2.9
Financial Services (OFI)	4.3	4.3	2.9
Insurance (ISR)	4.3	4.3	2.9
Business services (OBS)	4.3	4.3	2.9
Others (OTH)	4.3	4.3	2.9

[1] The Armington elasticity value for each sector is an average of its top (between domestic and composite imports) and bottom level (between different sources of imports) elasticity values obtained from GTAP 6. For obtaining country specific numbers, these are multiplied by 1.5 for Canada, and U.S., and by 1 for other regions, as per convention (Dimaranan, B., and McDougall R., 2002).

Sources: GTAP6

Table 3: Bilateral Tariff[1]

Countries I.J	PRIM	IND	UTL	CNS	TRD	TRP	CMN	OFI	ISR	OBS	OTH
CAN.CAN	-	-	-	-	-	-	-	-	-	-	-
US.CAN	0.071	0	0	0	0	0	0	0	0	0	0
ROW.CAN	0.053	0.030	0	0	0	0	0	0	0	0	0
CAN.US	0.005	0	0	0	0	0	0	0	0	0	0
US.US	-	-	-	-	-	-	-	-	-	-	-
ROW.US	0.012	0.023	0	0	0	0	0	0	0	0	0
CAN.ROW	0.151	0.038	0	0	0	0	0	0	0	0	0
US.ROW	0.237	0.036	0	0	0	0	0	0	0	0	0
ROW.ROW	-	-	-	-	-	-	-	-	-	-	-

[1] Tariff imposed by country *j* on goods originating from country *i*

Source: GTAP6