General Equilibrium Assessment of the Economic Impacts of Service FDI Liberalization: The Role of Technology Parameters

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Abstract

Even if the importance of service FDI in total inward FDI is increasing in several regions of the world, some restrictions still exist on service FDI in many countries because of its countervailing effects on the host economy, especially on local employment. Using a static general equilibrium framework, this paper assesses the impact of service FDI liberalization with a special attention to the role of behavioral parameter in the context of a model economy. We compare the results of various FDI policies under different elasticity of substitution between foreign imported input and domestic factors. Our simulation results suggest that liberalization of service FDI would generate cost efficiency so as to bring overall benefits to host economy, but at the expense of a reduction in real return to some domestic factors. The results also suggest that the benefits as well as the impairment increase with the size of the elasticity. Finally, our results indicate that the impacts of service FDI on employment in the host country depend on other features of the production structure such as the degree of returns to scale in technology.

1. Introduction

With the fast pace of world economic development, the economic linkage between countries has been strengthened. Likewise trade in goods and services, foreign direct investment (FDI) contributes to the increase in the globalization of the world economy, by improving welfare, productivity, technological progress, return to factor, etc. From a historical perspective, world FDI flows, as suggested in Figure 1, experienced a cyclical pattern that could reflect the pattern of international business cycle: a continuous decline since 2000 followed by a slight recovery in 2003 (UNCTAD 2005). In addition, world's FDI stocks experienced a significant increase over the past two decades: the 2003 world inward FDI stocks increased by 11.8 times and outward FDI stocks increased by 16.4 times comparing to 1980[1] (Figure 2).

As the modern economy is developing towards a knowledge-based economy, FDI in service could have larger impact on the economy than FDI in manufacturing or other resource-based industries (UNCTAD 2004). This is attributed to the nature of service. Compared to physical good, service is more likely to encompass intangible commodities produced from knowledge-intensive industries such as finance, transportation, business activities, and public services etc. These types of services significantly contribute to the development of knowledge-based economy. Until 2003, the share of service in GDP has increased and reaches 72% of GDP in developed countries, 52% in developing countries and 57% in the central and east Europe (UNCTAD 2004). Compared to other modes such as FDI in manufacturing or trade, service FDI, which could deliver internationally non-tradable or limited-tradable knowledge products, exhibits its unmatchable role on the world economy stage. In the recent years, world FDI flows are shifting towards service FDI: service accounts for over 60% and 70% of total FDI inflows and outflows; while world inward and outward service FDI stocks increased from 1990 to 2003 by respectively, 611% and 587%[2] (UNCTAD 2003f).

[1] From UNCTAD, inward FDI stocks increase from $692.714 billion in 1980 to $8895.279 billion in 2003 while the outward FDI stocks zoom from $559.629 billion to $9732.233 billion.
[2] From UNCTAD, inward and outward service FDI stock climbed up from, respectively, $717 billion and $815 billion to $5.1 trillion and $5.6 trillion.

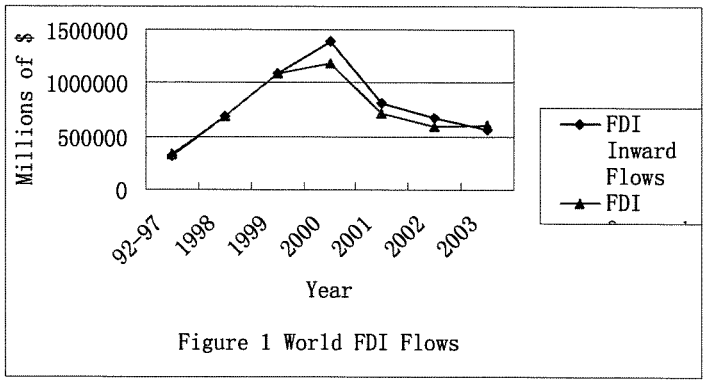


Figure 1 World FDI Flows

Source: UNCTAD, World Investment Report 2004, Table B.1, B.2, pp 367,372.

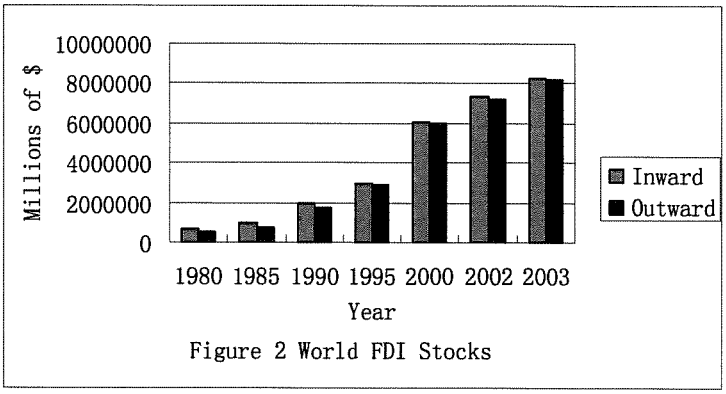


Figure 2 World FDI Stocks

Source: UNCTAD, World Investment Report 2004, Table B.3, B.4, pp 376,382.

Yet, some restrictions still exist on service FDI in many countries. There is an ongoing debate in the literature on the impacts to the host country of further liberalization of service FDI. Proponents of increased liberalization of service FDI (Blomstrom 1992, Hardin and Holmes 1997, Markusen et al. 2006, Benjamin and Diao 2000, Eckel 2003, etc) argue that this type of FDI is beneficial to the host country with regards to capital provision, technological progress, skill spillover, income, government revenue and welfare. In contrast, opponents (Kálmán and Hunya 2000, Galiani and Sanguinetti 2003, Anuatti-Neto et al. 2003, Fischer et al. 2003, Ernst 2005, etc) advocate that service FDI has substantial negative impacts on the economy, such as the crowding out of domestic firms, the loss of local employment, the decrease in local real wage and resource exploitation.

The above-mentioned two strands of literature indicate that service FDI may have two opposite effects – output effect and substitution effect on the host economy, especially on local employment. Its net effect depends on its status, substitute or complement, to

domestic production factors. On the one hand, if service FDI is a substitute to domestic production factors, as advocated by opponents to its liberalization, domestic producers would loose market shares, employment would decrease, and a significant share of the production factor return would be captured by foreign owners. The host country may lose more than gain. Even if total production increases because of higher productivity, opponents to FDI liberalization argue that this would only benefit to foreign parent firms instead of the host economy. On the other hand, if service FDI is a complement to domestic factors, liberalization could increase domestic employment, real wages and welfare. This is because the increased total factor productivity and the cost saving advantage of service FDI expand total production to increase labour demand, which compensates the initial decrease in employment.

The countervailing output effect and substitution effect of service FDI have been examined in various studies (Markusen et al. 2006, Eckel 2003, Baldwin 1994, Glass and Saggi 2001, Braconier and Ekholm 2000, among others). On the one hand, the cost-oriented and efficiency-seeking service FDI enters host markets with competitive advantages of technology-intensive and knowledge-intensive over domestic services. Since imported foreign services are more cost efficient than their domestic counterparts, they will substitute domestic labour and domestic produced service, and consequently reduce employment. On the other hand, the increase in total factor productivity induced by service FDI expands intermediates production and total output, and consequently increases domestic employment. It follows that the net impact of service FDI depends upon whether the output effect dominate the substitution effects. Using a general equilibrium model, Markusen et al. (2006) show that under certain assumptions, competitive foreign producers with advanced imported technology or skills can substitute domestic produced intermediate service, since they produce more efficiently. Still, they would reduce the cost of intermediate inputs used for final production to the extent that released labour would be absorbed by the expanded output. Similarly, Braconier and Ekhom (2000) point out that the dual effects on employment of outward FDI depend on how demand of production factors changes according to cost savings and supply of capital.

Although these studies have shown that the output effect of service FDI dominates its substitution effect, they did not address the role of the degree of substitution between

service FDI and labour. Yet, from a theoretical perspective, this substitution elasticity might play an important role in the final outcome. Further study is thus warranted in order to assess the role played by the substitution elasticity between service FDI and domestic production factors in the final impact brought by service FDI liberalization on employment.

Using a general equilibrium model, this paper investigates the impact of service FDI liberalization on the host economy with special attention to the elasticity of substitution between foreign imported input and domestic factors in the context of a model economy close to the Canadian economy[3]. The general equilibrium model used in this study builds upon the one developed by Markusen et al. (2006), from which it differs with respect to some features that will be explained in this paper. Using the model, we assess the impacts of the liberalization of service FDI on the model economy and examine the sensitivity of the results to the elasticity of substitution in production between service FDI and domestic inputs.

The remainder of paper is organized as follows. The next section provides a literature review on the impacts of FDI economy, on the recent trends and patterns of Canadian FDI, and on the modeling of FDI liberalization. Section 3 provides a description of the GE model, data and calibration. Section 4 discusses the simulation and the results. The last section concludes.

[3] It is worth mentioning that our analysis does not refer to the Canadian economy and our conclusions should not therefore be interpreted as valid for that country.

2. Literature Review

2.1. Impact of inward FDI on host economy

The economic impact of inward FDI in the host country has been investigated in several papers in the literature. This impact has been measured by the effects on various variables such as welfare, productivity, technological change, trade, capital return, labour income, etc. Some researchers (Kálmán and Hunya 2000, Galiani and Sanguinetti 2003, Anuatti-Neto et al. 2003, and Fischer et al. 2003) argue that inward FDI are impediments to growth in the host country as it leads to several problems such as resource exploitation, crowding out of domestic employment and firms, currency depreciation, loss of state capital control, etc. However, the empirical evidences observed by other researchers (MacDougall 1960, Markusen 1983 and 2004, Blomstrom 1992, Noguer and Siscart 2000, Lee and Mensbrugghe 2001, Eckel 2003, Arbenser 2004, among others) suggest that inward FDI could have positive effects on the host country depending on its characteristics and its policy environment. The benefits of inward FDI on host economy could be classified into two categories – direct effects and indirect effects.

Direct effects

According to MacDougall (1960), Zhang and Markusen (1999), Rao and Tang (2001), Baldwin and Sabouring (2001), Trefler (2004), and Arbenser (2004), inward FDI increases domestic productivity, return to labour, tax revenue, household consumption, per capita income, employment and social welfare, as it is generally regarded as more productive and cost-efficient. Moreover, Hejazi and Pauly (2003) argue that inward FDI increases the host country's long term financing ability. Foreign investment abroad allows the host country that faces liquidity constraints to borrow foreign capital and to raise its long term investment. In addition, inward FDI is a supplement rather than a substitute to domestic investment as it provides additional capital and export possibilities[4], which further improves trade pattern (Lipsey and Weiss 1981, Graham 1993, Brainard 1997, etc.).

[4] Evidence is provided in The Conference Board of Canada, *The Benefits of Foreign Direct Investment, March 2006.*

Indirect effects

Inward FDI indirectly contributes to the host country's technological progress by technology diffusion and skill spillover. Technological progress and human capital accumulation drive the endogenous growth of an economy. Technological progress may result from technology transfer from abroad. This transfer may take the form of either formal agreement of technology transfer and license sales, or spillover from FDI or international trade. As explored by Hymer (1960), Dunning (1993), Caves (1996), Hejazi and Safarian (1999), Noguer and Siscart (2000) and Markusen (2004), the entry of foreign firms inevitably brings some capital, technology or skills to host countries, and this entry would then contribute to increasing domestic firms' competitiveness, improving local market environment and eliminating under-optimal policies.

Because of these benefits from inward FDI, a country's ability to attract either FDI or multinational enterprises potentially affects its economic development. Still, as the recent trend in global FDI shifts toward services, the increase in service FDI raises some concerns among some researchers.

2.2 FDI shifts to services

2.2.1 Definition of services

Using Dunning (1993)'s definition, services encompass several items such as: (i) commodities, the sales of which depend on the presence of people, goods or other services located in the country of use, such as hotels, restaurants, car hire, construction development, etc.; (ii) transport facilities; (iii) most telecommunication and public utilities; (iv) warehousing, wholesaling and retailing services; (v) most public administration and social and community related services; and (vi) services that require face-to-face contact between buyer and seller. The importance of services has been increasing in most developed countries' economies. Furthermore, because service is featured as non-tradable or limited tradable, service FDI grows rapidly because it is a superior delivery mode of service goods. Between 1990 and 2002, world's inward service FDI stock increased from $717 billion to over $5 trillion (UNCTAD, 2005). In developed countries, both inward and outward service FDI stocks increased vigorously, respectively

by average 250% and 654% between 1990 and 2002, mainly in the sectors of finance, trade, business activities, transportation, storage and telecommunication (UNCTAD 2004).

2.2.2 Impact of Service FDI

Service FDI helps the development of the host country, since it enhances the efficiency, the productivity and the supply capacity of the industries in the host country both directly and indirectly (UNCTAD 2004). In what follows, we provide a brief summary of the impact of service FDI in the host country as suggested in UNCTAD (2004).

Financial resources

FDI in services, as well as, in manufacturing injects substantial financial resources into a host economy. The increment in financial resources includes capital inflows from international capital markets. This increase is important as it raises production capacity of the host country, particularly in developing countries. However, it could at the same time bring financial risks, such as increased interest rates and changes in the host country's financing system.

Agglomeration externalities

In a competitive market, FDI with technological, operational or managerial advantages can significantly increase the volume, the quality and the diversity of service that lower the quality-adjusted cost of downstream producers as argued by Paul and Siegel (1999), and Markusen et al. (2006). The implicit implication of this is that the diversity of non-tradable intermediate service brings agglomeration externalities such as cost reduction and quality improvement in related economic activities[5]. Recent studies by Krugman (1991), Ciccone and Hall (1996), Fujita, Krugman and Venables (1999) show that larger diversity of intermediate inputs causes larger positive externality, i.e. concentrated economic activity and increased productivity.

Technology

The most attractive benefit of service FDI to the host country is the technology transfer

[5] Corresponding literature can be traced to 1960s. Chinitz (1961), Greenfield (1966), and Jacobs (1969) confirmed that the diverse service in infrastructure industries creates agglomeration externalities.

and the spillover it creates. Following the concept of technology used in UNCTAD (2004), two kinds of technology are introduced by services: (i) hard technology, i.e. equipment, industrial processes, and (ii) soft technology, i.e. knowledge, expertise, organizational skills, management, and marketing. In manufacturing, technology and operational skills can be traded when they are incorporated into the modern equipment or computer software. However, the modern intermediate services, i.e. infrastructure, financial, professional and business services contribute to technology[6] transfer and spill over, even in a larger extent than manufacturing. In services, most required skills involve specialized professional training, education, or experience, which are non-tradable and can only be brought from the parent company through personal presence. Therefore, service FDI is a carrier of these soft technologies from foreign countries to host countries. Then, local subsidiaries can receive skill transfers from the parent company, and the advanced soft technologies will then be spilled over the host country gradually with the mobile local labour.

Trade pattern

Because of the "bridge" role of service FDI in transferring skills from parent firms to local affiliates, the host country's trade pattern could change because of a change in comparative advantage. Markusen's general equilibrium (GE) model (2006) finds that the liberalization of service FDI makes it possible for the host country to produce more efficiently and to export the good that was once imported. Real world cases provide evidence that service FDI improves domestic trade, i.e. Japan investing in air cargo transportation encourages trade by its expanded telecom services; Caribbean tourism FDI enhances Caribbean tourism in the international market.

Employment

The impact of service FDI on employment has been a subject of controversial debate in the literature. On the one hand, opponents to inward service FDI, such as Kálmán and Hunya (2000), Galiani and Sanguinetti (2003), Anuatti-Neto et al. (2003), Fischer et al. (2003), and Ernst (2005), among others, argue that the benefits brought by service FDI to the host country, such as the increased profitability, efficiency and productivity, are less than the cost of shrinking employment it involves. The case studies in Argentina (Galiani

[6] The concept of technology includes organizational, managerial, information processing and other "soft" skills and knowledge, according to Greenfield (1966), Jacobs (1969), UNCTAD 2004, Markusen et al (2006). .

and Sanguinetti (2003)), Brazil (Anuatti-Neto et al. 2003) and Chile (Fischer et al, 2003), and the survey of UNCTAD (1999) suggest that employment fell or shift from full time to part time after an increase in inward service FDI. Similarly, Ernst (2005) suggests that the economic opening in Argentina, Brazil and Mexico did not lead to an overall export surge as expected. At the exception of Mexico, the FDI liberalization in the other two countries had disappointing results on employment. Because of the rise of labour productivity induced by FDI, labour demand decreases, and wages declined consequently.

On the other hand, from a general equilibrium perspective, proponents of inward FDI, such as Eckel (2003), Eytan and López-Calva (2003), Markusen et al. (2006) suggest that FDI both in services and manufacturing increase employment in host countries, especially in the long term. As pointed out by Markusen et al. (2006), the substituted skilled and unskilled labour in one sector would be employed in other sectors, since the total production is increased by higher productivity and larger export. A similar viewpoint is shared by Eckel (2003) who suggest that the impact from the efficiency-seeking FDI on employment is more likely to rise if the output expansion induced by the cost saving is large and capital supply is elastic.

Therefore the impact of service FDI on employment depends on two factors: (i) whether FDI and trade are complements or substitutes, and (ii) whether FDI and local labour are complements or substitutes in production. Firstly, the complementary relationship between imports and inward FDI is supported by several studies (Helpman (1984), Legault and Rao (1994), Grosse and Trevino (1996), Kleinert (2002)). Employment could increase as a direct consequence of higher production in export-oriented industries induced by the increase in service FDI. Moreover, employment could rise indirectly because production in downstream industries is expanded by the increased variety in intermediate inputs. Nevertheless, Driffield and Girma (2003) warn that the net effect also depends on the extent of employment reduction by increased imports. The second factor on which the impact of service FDI on employment depends, i.e., the elasticity of substitution between production factors, has not been addressed in the literature. The net effect of service FDI on employment depends on both output effects and factor substitution effects. If the substitution elasticity between foreign input and domestic labour is high, the positive FDI output effects on labour may not be big enough to counter its negative substitution effect: the net effect of increased inward service FDI could thus

be negative.

2.3. Recent FDI trend in Canada

2.3.1 An overview of Canadian FDI pattern

In Canada the importance of FDI is also growing with the development of the world economy. Figure 3 suggests that the ratio of inward FDI stock to GDP in Canada rises as in other regions of the world. This ratio increased from 20% in 1980 to 32% in 2003. However, recent FDI trends of Canada are not delightful. Figure 4 shows that since 2000, Canada's FDI flows continuously declined, and it is more serious for inflows (at a declining speed of 20% per year). Figure 5 indicates that FDI inflows in all industries – primary, secondary, and tertiary have been decreasing since 2000. Furthermore, Canada's shares in both North American and global inward FDI stocks are decreasing, by 7.1% and 21.2% respectively, from 1980 to 2003, reported by UNCTAD (2004).

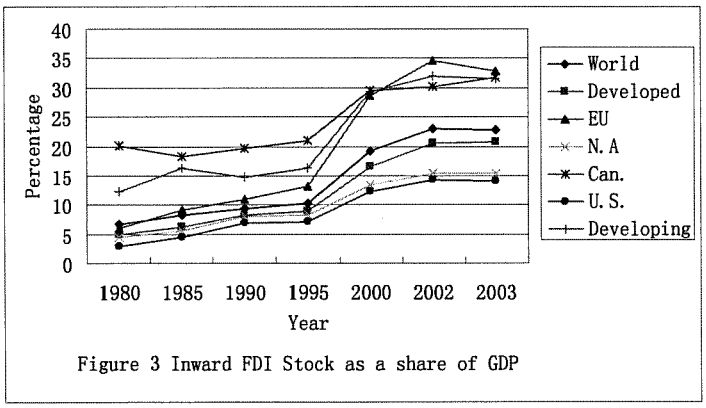


Figure 3 Inward FDI Stock as a share of GDP

Source: UNCTAD, World Investment Report 2004, Table B.6, pp399-410.

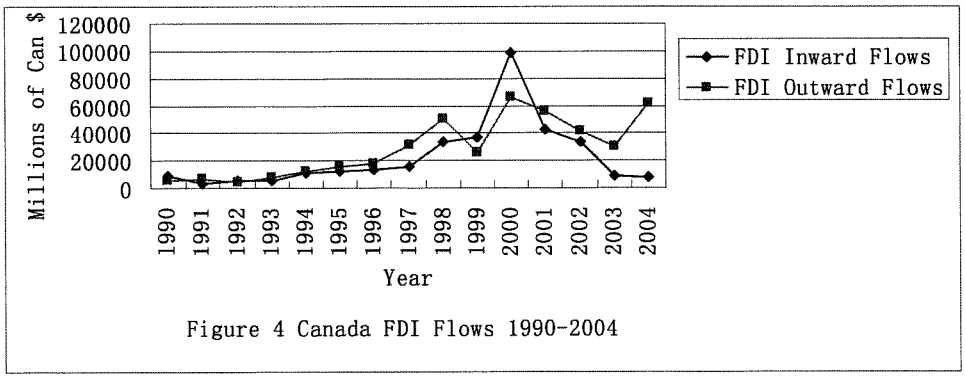


Figure 4 Canada FDI Flows 1990-2004

Source: Statistics Canada, Canada's Balance of International Payments, various issues.

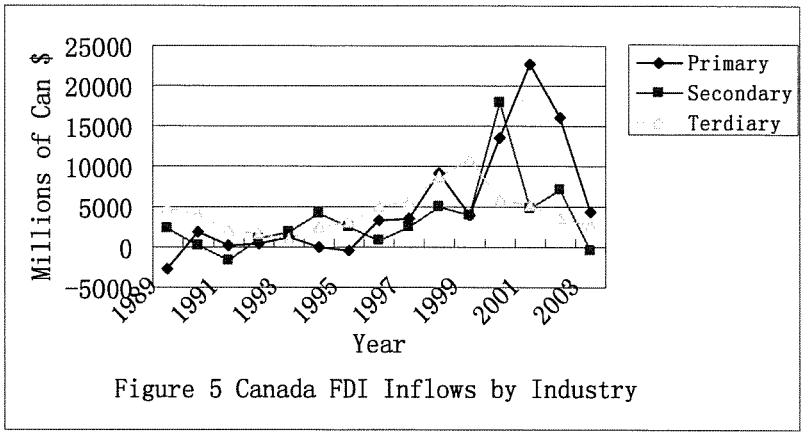


Figure 5 Canada FDI Inflows by Industry

Source: Statistics Canada, Canada's Balance of International Payments, various issues.
Notes: Primary industry includes Mining, quarrying and petroleum. Secondary industry includes Wood and wood products, Machinery and equipment. Tertiary industry includes Finance and retailing as well as other services.

According to Statistics Canada (2002), Canada's inward FDI originates from U.S. (64%), France (9%), U.K (8%), the Asia-Pacific region and Latin America. The United States has been the main source of Canada's inward FDI since 1990 (UNCTAD 2005). Regarding the composition of Canada's inward FDI, shown in Figure 5, the share of primary, secondary, and tertiary industries are not stable. The tertiary sector (including finance and other services) is relatively stable, with a share of 33%. The industry distribution of the inward FDI is highly concentrated in the largest ten industries[7] which account for 62.4% of Canada's total inward FDI stock.

2.3.2 Barriers to Canada's inward FDI

A country's attraction to FDI closely relates with its economic and political environment. Some researchers like Duffeild and Munday (2000), and Globeman (2001) attribute the decline in Canada's inward FDI mainly to its lack of agglomeration economy. Using Deardorff's (2000) definition, agglomeration economy is "Any benefit that accrues to economic agents as a result of having large numbers of other agents geographically close to them, thus tending to lead to agglomeration... a basic feature of the New Economic Geography." It brings benefits of low cost and high efficiency to multinational enterprises as it is possible for them to get cheaper resources easier. In comparison to Canada, the

[7] They include Finance, Petroleum and Natural gas, Insurers, Chemicals, Electronic Equipment and Computer Service, Motor Vehicles, Beverage, Investment Intermediaries, Wood and Paper, and Deposit accepting intermediaries. Finance (19%), Mining (16%) and Motor vehicles (11%) are with the top three shares, from UNCTAD, Canada World Investment Directory online http://www.unctad.org/Templates/Page.asp?intItemID=3198&lang=1

U.S. attracts the EU's FDI by sector and nationality-specific agglomeration economies. In what follows, we provide a literature review on the determinants of agglomeration economy characteristics that could foster FDI in Canada, which are trade regulation, taxation and general capacity to support new economic activities.

First, the effects of trade policy on FDI lie on the relationship between trade and FDI. In Canada, the complementary relationship is well exhibited: regional shares of inward FDI and imports are highly positively correlated (0.98 correlation)[8]. Therefore, free trade agreements, such as CUFTA, NAFTA, are expected to create both imports and inward FDI, as suggested by some studies (Lipsey and Weiss 1981 and 1984, Grosse and Trevino 1996, Hejazi and Safarian 2002, Arbenser 2004). Second, Canada's weak ability to attract inward FDI is also due to its relatively high personal and corporate taxation, rigid government regulation and barriers to inter-provincial trade, as argued by Globerman and Shapiro (2003). Firms emerging in the "new economy" industries might be kept away from Canada because of high tax rates. Thus, the "emigration" of knowledge and production capability would gradually reduce the profits of multinational enterprises (MNE), impair the accumulation of human capital, and consequently deteriorate Canada's agglomeration economy. Third, Martin and Porter (2001) state that microeconomic business environment affects Canada's competitiveness. For example, a country's capability to innovate and support new economic activities does affect MNE's investment decisions. Markusen (1983, 2004) and Globerman and Shapiro (2003) apply different models to illustrate the attractiveness of new economic factors to FDI, including R&D, knowledge asset production, human capital, educational infrastructure, and information infrastructure.

2.4 Review of the Modeling of Service FDI

Several papers model the liberalization of FDI in a general equilibrium framework in order to examine the impact of FDI, and to evaluate whether policies that remove barriers and attract FDI are optimal for the overall economy. Helpman (1984), Petri (1997), Chadha et al. (2000), Benjamin and Diao (2000), Markusen et al. (2006), Lee and Mensbrugghe (2001), Arbenser (2004), are few examples among many others. In their

[8] Reported by Statistics Canada 2002

review, Hardin and Holmes (1997) divide the corresponding studies into three groups. The first group (Dee, Geisler and Watts (1996), Chadha et al. (2000)) models FDI implicitly to examine the impact of services trade liberalization by simulating the reduction of FDI barriers as a decrease in tariff-equivalent rates. The shortcomings of these models are that they do not capture the important economic characteristics of FDI, such as the relationship between foreign affiliates and parent firms, the effects of diverse non-tradable services via FDI on host economy, and the local factor requirement by FDI. The second group (Martin and Yanagishima 1993, Donovan and Mai 1996, McKibbin and Wilcoxen 1996, Bora and Guisinger 1997) simulates the effects of investment liberalization in GE framework directly by assuming the variables, such as capital inflows and total factor productivity are changed by FDI, but without explicitly modeling FDI and barriers. The third group explicitly incorporates FDI into GE model with an appropriate recognition of the relationship between parents and subsidiaries, and the differentiation of goods by origin. We further divide this group into the following two sub-groups by their approaches of modeling FDI barriers, as to whether they treat FDI barriers as tariff or non-tariff equivalents.

2.4.1 General GE models

One general type of GE model by Petri (1997), Benjamin and Diao (2000), Chadha et al. (2000), and Lee and Mensbrugghe (2001) distinguishes the activities of foreign affiliates and domestic firms, and links parent companies and subsidiaries in production to examine the impact of service FDI liberalization, using the profit tax as FDI barriers. In this type of model, FDI affects production, consumer's utility that changes with product variety, investor's utility, capital returns, and labour market. For example, Petri (1997) divides production into three production sectors – primary, manufacturing and service, and links parent firms and subsidiaries in terms of their inputs requirements – value added inputs, inputs sourced from parents and other intermediate inputs. FDI barriers are set as region-specific taxes on capital returns. He assumes that product varieties are differentiated by country of ownership and country of production, so that consumption of non-tradable services by the host country through FDI would have significant impact on the demand system across host and home countries. His approach also incorporates the utility function of investors to examine the allocation of capital in terms of the changes of returns on capital by FDI liberalization.

A similar approach is used by Lee and Mensbrugghe (2001) to study trade and FDI between U.S-Japan and APEC countries. His six-region general equilibrium model distinguishes activities of domestic and foreign owned firms. FDI barriers are set as the after-tax rate of return on capital. Products are identified by the ownership of capital – variety and sector. FDI enters domestic market as joint venture – a fixed share of foreign ownership. The main difference of this model from Petri's model is that the aggregate demand structure is closer to reality, particularly in the service sector. The aggregate demand of goods is split into an aggregate of domestic products and of all imports, and they are then disaggregated by varieties, and finally by sectors. In the capital market, the aggregate capital is allocated across sectors following the division of aggregate demand of goods, while sector capital is allocated across domestic market and foreign markets, and foreign capital is allocated across sectors. Hence characters of FDI are well captured in this model: it produces by using local labour, shares of capital, and inputs sourced from domestic market and parent firms.

Beside the treatment of FDI barriers as non-tariff barriers, some researchers apply other forms of barriers in the general equilibrium model, such as restrictions on market entry, ownership and control, operations, etc[9]. Chadha et al. (2000)'s GE model uses the structure drawn from Petri (1997) and Markusen et al. (2006), but models the barrier as the tax on capital and labour. They get similar results as their precursors. Hoekman (1995) estimates the restriction of barriers to service trade using frequency ratios of service barriers as the tariff equivalent measures to mimic the restriction in market access. Benjamin and Diao (2000) model service trade and FDI liberalization in APEC by a multi-country and multi-sector GE model, setting the possibility for oligopolistic firms to price-discriminate the fixed costs of FDI between APEC host countries as the non-tariff barriers in service sector. Contrary to Markusen et al (2006)'s conclusion of trade pattern change, they find that service is relatively capital intensive, and as service working as an intermediate input in other capital intensive industries, liberalization of services will reinforce the primary factor intensity as a source of comparative advantage, and maintain the existing trade balance.

[9] Hardin and Holmes (1997), Lee and Mensbrugghe (2001) classify the FDI barriers.

2.4.2 GE model of service FDI

The incorporation of service FDI into GE is less common in comparison to other types of FDI, due to some difficulties, such as to distinguish the diverse forms of FDI, to link FDI with the other economic activities, to model FDI barriers, and to obtain data. The studies carried out by Ethier (1982), Markusen et al (2006), Francois (1990a,b), and Stibora and Aldert de Vaal (1995) could be considered as milestones on this theme. Ethier suggests that diverse services increases total factor productivity, if increasing returns to scale and endogenous intermediate inputs are assumed. Markusen et al (2006) analyzes the knowledge intensive services with increasing returns to scale technology and differentiated service in economy in a monopolistic competition environment. He finds that the imported service is complementary domestic producer services, under Armington assumption. Francois (1990) formulates a one-sector, two-country, differentiated product model characterized by Chamberlinian monopolistic competition. He shows that the liberalization of service trade reduces product prices and increases product variety. Further, he finds that the employment structure is changed due to the increased specialization in production, and reinforces the complementary role of producer services in manufacturing.

Markusen et al (2006) incorporate some important features from above studies, and formulate a small open economy with two final goods and two primary factors. Business service is treated as an intermediate input in the foreign invested production. FDI barrier falls on the cost of importing foreign services. Their theoretical model suggests that the liberalization of service FDI could raise welfare by increasing total factor productivity, and proves the complementary relationship between foreign imported input and domestic inputs.

However, their results are opposite to some evidences such as declining employment as mentioned before. Markusen et al (2006) explains that the reason why inward FDI would raise domestic overall employment is that service FDI brings dominant output effect over substitution effect. Nevertheless, their model has not investigated the role of the substitution elasticity between FDI and other domestic production factors, such as the skilled and unskilled labour, on the impacts of service FDI on overall economy. Thus is it hard to tell whether the expanded output induced by lower cost and higher productivity could still absorb the excess labour, assuming foreign import can perfectly substitute the

domestic labour.

An analogous conclusion is drawn by Eckel (2003) when he simulates the impacts of the outward FDI on the employment in the home country. He finds that the effects should be divided into two: one is the relocation effect that reduces home employment, and another is the efficiency effect that increases demand of labour. The relocation effect is minimized when capital supply is perfectly elastic, because the capital inflow expands output and increases the demand for production factors. Similarly, the countervailing effects of FDI on outsourcing are pointed out by Baldwin and Sabouring (1994), Braconier and Ekhom (2000), and Glass and Saggi (2001). Baldwin and Sabouring (1994) suggests that given the fixed money supply and exchange rate, a tariff reduction policy increases foreign imports so that they substitute the domestic goods. The resulting trade deficit causes the reduction in both income and employment, but at the same time the declined real wage reduces firms' unit cost and increases their profits. As a result, the total employment will be increased.

By imitating the analysis of the dual effects of the outward FDI on employment, the model in this paper focuses on the substitution relationship between production factors in order to examine the counteracting effects of the inward service FDI on the host economy such as output, employment, and trade pattern etc.

3. Model specification

The present model aims at assessing the impact of the removal of FDI restrictions in service in a model economy, i.e., a fictitious economy. In particular, it intends to examine the role of behavior parameters on the impact of liberalization of service FDI on the host economy. With attention to different production technology and the elasticity of substitution between foreign imported service and domestic factors, the model used in this paper shares similar features with the one in Markusen et al (2006).

Some of the assumptions in this model are similar to those of Markusen et al (2006). Business service is defined as follows: 1) it involves the exchange of knowledge such as management, financial, marketing, information services; 2) it requires non-tradable goods and personnel appearance; 3) it works as intermediate inputs in the foreign invested production. The supply of domestic skilled labour is assumed to be fixed. FDI barriers, represented by tariff, fall on the cost of importing foreign services. In contrast, the assumption of increasing returns to scale is not used in this paper. Constant returns to scale is instead assumed in all industries for convenience reasons.

We simulate a small-open economy that considers world prices as given. We use capital letter to denote commodity or production factors and small letter to denote industry. The economy has four industries, x, y, zd and zm, of which two (x and y) are traded with the rest of the world, and industries zd and zm produce non-tradable goods that are used as intermediate inputs for the production of goods X and Y. Industry y produces a final tradable good Y that is not skilled labour intensive with a CES technology, using domestic factors S – skilled labour, and L – all other factors. Sector x produces a final tradable good X that is more skilled labour intensive than y, with a CES technology, using factors S, L and Z – intermediate composite service input. The domestically owned sector zd uses S and L to produce the non-tradable intermediate good ZD, while the foreign owned sector zm uses domestic factors S, L, and the imported service V to produce the non-tradable intermediate good ZM. Industries zd and zm use both a CES technology. The intermediate service goods ZD and ZM are used by industries X in terms of a composite Z. This structure is close to the service production structure in reality, such as banks, financial institution, or insurance company. Both domestic and foreign invested firms exist in these competitive markets, and they provide services to industrial sectors in

the upper level of the production chain.

In order to simplify model and capture the distinctive impact of liberalization policies on the return to factor, we abstract from investment and thus from savings. Moreover, the only tax in the model consists of the tariffs collected on the imports of the imported service V. Household skilled labour supply is fixed and exogenous, so the changes brought by FDI liberalization would be presented on the factor return. It is worth noting that the return on imported service is acquired by foreign investors. Trade balance is maintained by export value equaling import value. The only shock in this model comes from FDI barrier – the tariff on foreign services, which changes the price of foreign imported service.

3.1 Household

The representative household consumes goods X and Y, and accrues income from the return on factor S and L. We assume that tariff proceeds collected on the imports of foreign services are returned to households. Skilled labour supply is fixed. The representative household allocates its income among commodities of X and Y so as to maximize its utility. Its preferences are represented by a CES utility function. Solving the household utility maximizing problem determines the optimal consumption allocation of X and Y. The maximizing problem is stated as follows:

$$Max \quad U(X,Y) = (a_U XC^{\rho_C} + (1-a_U)YC^{\rho_C})^{\frac{1}{\rho_C}}, s.t.$$

$$PxXC + PyYC = CH, \qquad \text{, where}$$

$$CH = RL\overline{L} + RS\overline{S} + TVP_V V$$

$\delta_C = \dfrac{1}{1-\rho_C}$ is the elasticity of substitution between XC and YC

a_U is the share parameter of XC

P_X is the price of good x

P_Y is the price of good y

P_V is the price of import V in domestic market

TV is FDI tariff rate

RS is price of S

RL is price of L

CH is the household total income

$\overline{L}$ is total supply of L

$\overline{S}$ is total supply of S

V is the volume of foreign import

XC is the volume of consumption x

YC is the volume of consumption y.

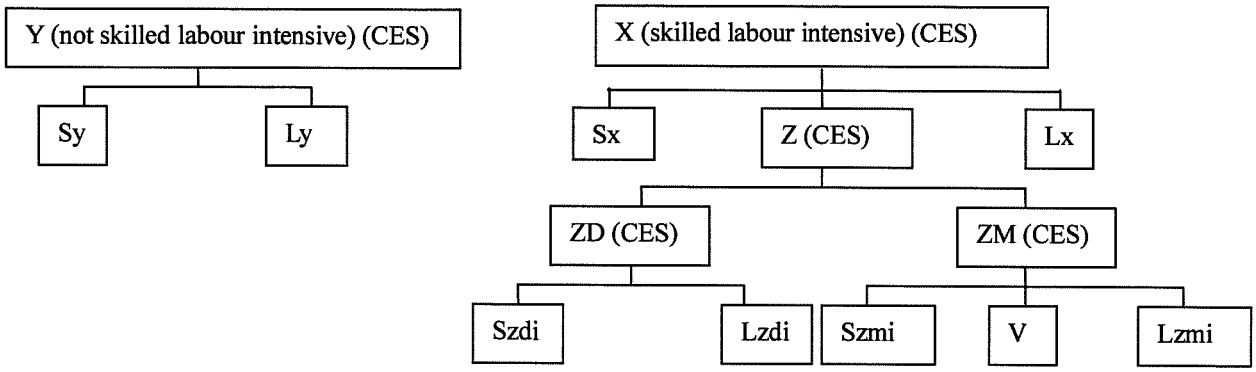
Hence, because the consumption of X and Y determines the household consumption and utility level, FDI restriction, which significantly affects product prices and factor prices, is supposed to have certain impact on household total income, consumption level and welfare.

3.2 Firms

The production structure is similar to that of Markusen et al (2006), i.e. production sector is disaggregated into skilled labour intensive sector x and non-skilled labour intensive sector y. Representative firms in industry x and y use different combinations of production factors to produce final goods X and Y, and sell them locally or internationally. Good X is more skilled labour intensive than Y. X needs not only domestic factors but also the intermediate service factor Z. Z is a composite of two intermediate products ZD and ZM. The whole production is modeled through a nested CES function. FDI is incorporated in this model by assuming that the foreign invested firm ZM imports service as its essential input at a price of Pv(1+tv). In the perfect competitive market, the price consists of two part: one is the exogenous unit price of Pv that equals the marginal cost of the service, such as expert salary, transportation cost and reallocation cost; another is the transaction costs, tvPv, which is determined by the policy or market environment of the host country, such as the restrictions on foreign ownership, constraints on the movement of foreign personnel, and the unsound law protection on intellectual property.

Figure 6 shows a schematic description of the production technology and the interrelationship between sectoral inputs and outputs, with specified elasticity of substitution among different inputs.

Figure 6 Schematic description of production interrelationship



Source: modified from the production structure in the paper of Markusen et al. (2006)

3.2.1 Description of the system - Modeling FDI in producer services

Producer service, which satisfies the definition specified above, is modeled as intermediate input in this system. As shown in above schema, if there is no imported foreign service, Z would be consisted of only domestically produced intermediate inputs. If FDI is allowed to enter into the domestic service market, Z is a CES combination of domestic produced service and foreign produce service. Producers could choose from ZD and/or ZM according to the elasticity of substitution between ZD and ZM and their relative prices.

The whole system is represented and interrelated by cost functions (unit price functions) to determine prices, factor demand and output supply. By solving each firm's cost minimization problem under perfect competition, we can derive the price of each commodity and the factor demand according to Shephard's lemma. Therefore the quantity that firm produce could be determined by the unit cost of input.

Changes in FDI cost – the cost of foreign invested firms to introduce foreign service affect other economic measurements in two ways. First, it has a direct impact on the production of foreign firm. Through the elasticity of substitution, it alters the input demand structure, consequently affects factor returns. Moreover, because foreign service is one source of the intermediate composite Z, changes in the cost of ZM indirectly affect industry z's demand for domestically produced service zd, and also its demand for factors

S and L. Second,, according to trade balance and Heckscher-Ohlin theory, the relative factor cost determines the relative price of X and Y, then determines the country's trade pattern. Therefore policy changes in the restriction of FDI could alter the trade pattern, given exogenous world's price and exchange rate.

Firms' production decisions with FDI are modeled as follows. For final good Y in the CES production function, the cost minimization problem of firm producing Y is to

$Min \quad CostY = RL * Ly + RS * Sy,$

$s.t. \quad Y = A_Y(\alpha_Y S_Y{}^{\rho_Y} + (1-\alpha_Y)L_Y^{\rho_Y})^{\frac{1}{\rho_Y}}$, where

$\delta_Y = \frac{1}{1-\rho_Y}$ is the elasticity of substitution between S_Y and L_Y

L_Y is the volume of demand L in Y

S_Y is the volume of demand S in Y

A_Y is shift parameter

α_Y is the share parameter of S_Y in Y

Since marginal cost equals unit price, the first order condition solves for P_Y, S_Y and L_Y. Other sectors production sectors have the similar structure.

For final good X in CES production function, which includes a service composite, the cost minimization problem of producing X is to

$Min \quad CostX = RL * Lx + RS * Sx + Pz * Z,$

$s.t. \quad X = A_X(\alpha_X S_X{}^{\rho_X} + \beta_X L_X{}^{\rho_X} + (1-a_X-\beta_X)Z^{\rho_X})^{\frac{1}{\rho_X}}$, where

Pz is the unit price of composite good Z

$\delta_X = \frac{1}{1-\rho_X}$ is the elasticity of substitution between S_X and L_X

α_X and β_X are the share parameters.

$\frac{\alpha_Y}{1-\alpha_Y} \prec \frac{\alpha_X}{\beta_X}$ as X is more skilled labour intensive than Y.

Sequentially, as Z is a composite of ZD and ZM in CES function, the cost minimization problem for Z is to

$$Min \quad CostZ = P_{ZD} * ZD + P_{ZM} * ZM,$$

$$s.t. \quad Z = A_Z(\alpha_Z ZD^{\rho_Z} + (1-\alpha_Z)ZM^{\rho_Z})^{\frac{1}{\rho_Z}} \quad \text{,where}$$

P_{ZD} and P_{ZM} are the unit price of goods *ZD* and *ZM*.

$\delta_Z = \frac{1}{1-\rho_Z}$ is the elasticity of substitution between *ZD* and *ZM*

Using Armington assumption, goods ZD and ZM produced respectively by domestic firms and foreign owned firms are assumed to be imperfect substitutes. At the bottom level of production ZD and ZM, the CES function allows different substitution possibilities between inputs. Firms intend to minimize their total cost to achieve the most efficient production. Hence, the changes in the price of FDI which is determined by FDI policy are expected to have some effects on the firm's input decision. The cost minimization problem of firm producing ZD is as follows:

$$Min \quad CostZD = RS * S_{ZD} + RL * L_{ZD}$$

$$s.t. \quad ZD = A_{ZD}(\alpha_{ZD} S_{ZD}^{\rho_{ZD}} + (1-\alpha_{ZD})L_{ZD}^{\rho_{ZD}})^{\frac{1}{\rho_{ZD}}}$$

The cost minimization problem of firm producing ZM is

$$Min \quad CostZM = RS * S_{ZM} + RL * L_{ZM} + (1+tv)Pv * V$$

$$s.t. \quad ZM = A_{ZM}(\alpha_{ZM} S_{ZM}^{\rho_{ZM}} + \beta_{ZM} L^{\rho_{ZM}} + (1-\alpha_{ZM}-\beta_{ZM})V^{\rho_{ZM}})^{\frac{1}{\rho_{ZM}}}$$

The price of ZM is

$$P_{ZM} = \frac{1}{A_{ZM}}(\alpha_{ZM}^{\delta_{ZM}} RS^{1-\delta_{ZM}} + \beta_{ZM}^{\delta_{ZM}} RL^{1-\delta_{ZM}} + (1-\alpha_{ZM}-\beta_{ZM})^{\delta_{ZM}}((1+tv)Pv)^{1-\delta_{ZM}})^{\frac{1}{1-\delta_{ZM}}} \quad \text{,where}$$

$\delta_{ZD} = \frac{1}{1-\rho_{ZD}}, \delta_{ZM} = \frac{1}{1-\rho_{ZM}}$ are the elasticities of substitution in the production of *ZD* and *ZM*

$\alpha_{ZD}, \alpha_{ZM}, \beta_{ZD}, \beta_{ZM}$ are the share parameters

The price of *ZD* is in the corresponding formula.

3.2.2 Modeling restriction on service FDI

As defined by Hardin and Holmes (1997), FDI barrier is "any government policy measure which distorts decisions about where to invest and in what for. ...such as limits on the level of foreign investment, or the need to go through costly and time-consuming screening processes to convince authorities that FDI in a project will be in the national interest,...". Tariff and tax are most common measures applied on imports and regular FDI. However, argued by Hoekman and Braga (1997) similar measures can not simply be applied on service FDI, because the production and consumption of service often happen simultaneously. Then suggested by Hoekman and Braga (1997), the restriction on service FDI may be formed in four types: 1) quotas, local content, and prohibitions; 2) price-based instruments; 3) standards, licensing, and procurement; 4) discriminatory access to distribution networks. Markusen et al. (2006) further suggest that the restrictions on foreign invested business service to be the cross-board movement of personnel directly affect FDI development. Due to the limitation of trade in service and intellectual property, foreign investors "import" service that is essential for the efficient production through the cross-boarder movement of expertise. The transaction cost, denoted as *Pv* in the model, is regarded as the primary unit production cost for FDI. The tariff rate *tv* then can be viewed as the policy that restricts service FDI to access the host market or FDI affiliate firms. It is added on *Pv* as part of FDI's total production cost to affect the behavior of firms.

However, the influence of *tv* on the firm's input decision varies according to different production functions. In Markusen's model, he assumes that *ZM* is produced in Cobb-Douglas function, so the unit cost of *ZM* and the demand for *L* are expressed as

$$CostZM = RL^{\theta zml} * RS^{\theta zms} * (FDI\cos t * Pv)^{\theta zmv}$$

$$L = \frac{\theta zml}{RL} Costzm = \frac{\theta zml}{RL} * RL^{\theta zml} * RS^{\theta zms} * (FDI\cos t * Pv)^{\theta zmv}$$

The unit cost of *ZM* changes positively related with FDI cost (*tv*), so as the demand of input factor *L* (or *S*). Nevertheless, the influence from tv on firm's behavior could not be assessed by changing the values of the substitution elasticity between input factors, because in Cobb-Douglas function the substitution elasticity is fixed to be one.

In this paper, when ZM uses a CES production function, FDI liberalization is expected to affect producer's behavior through different ways. Without considering output effect, the demand for factor L[10] and V to produce a given level of ZM are solved to be

$$L_{ZM} = A_{ZM}^{\delta_{ZM}-1} ZM(\frac{\beta_{ZM} P_{ZM}}{RL})^{\delta_{ZM}} \quad V = A_{ZM}^{\delta_{ZM}-1} ZM(\frac{(1-\alpha_{ZM}-\beta_{ZM})P_{ZM}}{(1+tv)Pv})^{\delta_{ZM}}$$

The restriction of FDI, tv, affects the firm's behavior in two ways. First, it has a direct effect on the unit cost of ZM. The differentiation of P_{ZM} with respect to tv gives $\frac{\partial P_{ZM}}{\partial tv} \succ 0$, i.e. tv is positively related with the unit cost of ZM. Hence, when conducting the liberalization of restriction, unit price of ZM falls accompanying with the reduction of tv. Since the unit price of ZD is independent with Pv and tv, the relative price of ZM with respect to ZD is lowered. Then firm in sector X would demand higher proportion of ZM rather than ZD to compose the composite intermediate input Z. In this case, domestic firms ZD would be crowed out by foreign invested firms due to the liberalization of FDI restriction.

Second, tv may influence firms input demand decisions. The differentiations of V and L with respect to tv show that $\frac{\partial V}{\partial tv} \prec 0$, $\frac{\partial L}{\partial tv} \prec 0$. The liberalization of FDI stimulates firms to demand more import service. Since firm's objective is to minimize its total cost given a value of elasticity substitution and a certain level of output, it will demand more foreign imports that are relatively cheaper and will use less domestic inputs (L and S). Yet, the impact of tv on L and S might be more complicate if the value of their elasticity substitution δ_{ZM} is considered. δ_{ZM} can be viewed as a magnifier of the impact of tv on the input demand. Given a level of reduction on tv, the higher is the elasticity of substitution, the higher is the firm's demand for foreign import V and the lower is its demand for other input factors. Although the liberalization of FDI restriction will bring cost benefits to firm who is able to produce more efficiently, there might be a negative impact on its demand of other domestic inputs, i.e. because firms require less domestic skilled labour as it is relatively more expensive comparing to foreign import, thus domestic skilled labour is crowed out of the labour market. The negative impact would be further aggravated if the foreign import can easily substitute domestic factors in

[10] Demand for S has the corresponding formula.

production. When the supply of domestic skilled labour and other factors is fixed, the impact on the factor demand would be shown up on the return to factors. The contractive demand for domestic inputs will inevitably reduce the real return to factor.

However, the influence of tv on the total demand of other input factors is also simultaneously determined by the changes in total output in all sectors. The reduction of tv brings cost efficiency to the sector of zm, further to the sector of x, consequently it expands the production of ZM and X. Therefore, the positive output effect reduces the impairment from FDI liberalization on the demand for domestic factors. Yet, because of the opposite output effect and substitution effect from the removal of FDI tariff, the net effect on factor demand is underdetermined. If domestic skilled labour S and all other factors L could be easily substituted by import service V[11], there is a possibility that when FDI restriction is abated in order to encourage inward FDI, domestic skilled labour would be crowd out of labour market, or real returns on domestic skilled labour would be squeezed.

3.3 Model closure

Goods market and labour market are closed by the market clear condition that supply equals demand. In all goods markets, total demand equals total supply. For the final tradable goods, total demand for x and y consists of the domestic demands and exports to the rest of the world, while their total supply consists of domestically produced good and imports from the rest of the world. On the one hand, the domestic demand for domestic goods is determined by domestic prices and consumer's total income, which comes from the returns on S and L, and the tariff revenue. Policies on FDI restriction is expected to affect factor prices, in turn, affect domestic demand for domestic goods. On the other hand, the domestic supply of products is determined by the exogenous world prices and domestic production cost. Then changes in the unit cost of the import service directly changes the unit cost of final products, in turn, changes the equilibrium quantity of domestic supply. Accordingly, the liberalization of FDI is expected to change the country's comparative advantage then to change the trade pattern, as it reduces

[11] Indicated in the advantage and effects of FDI in literature review, it is possible for FDI substituting domestic factors easily, because imported service is normally more efficient in production than domestic ones. As well, in reality, there are examples that imported service, facilities or technology crowd out domestic employment.

intermediate production cost and alters the relative price of X and Y in domestic market.

In the factor market, the total supply of skilled labour S and L is fixed. Total skilled labour demand consists of a series of labour demand from different level of production of X, Y, ZD and ZM. The effect of changes in tv, which directly influences cost of ZM, would be shown up on the returns on S and L. The supply of the import service V is determined by demand. The total demand for the import service V is $VD = CM_{pv}$, where CM_{pv}, the demand for V in ZM, is the derivative of the cost function with respect to price of *V*.

The country relates with the rest of the world by exchanging X, Y, and V. Following the "small country" assumption by Markusen et al. (2006), prices of X and Y to the model country is fixed, i.e., determined in the world market. At the same time, the total unit price of FDI service to enter domestic market, *Pv(1+tv)*, takes into account both the exogenous price Pv and tariff rate tv. The small country cannot affect the world prices but can determine import tariff on V. It trades with the rest of the world at fixed prices. Finally the model is closed by equilibrium condition of trade balance, $P_X^* TRX - P_V^* V + P_Y^* TRY = 0$, where TRX is the net export of X, TRY is the net export of Y, P_X^*, P_Y^* and P_V^* are the world prices. The trade pattern of the country depends on the relative price of X and Y. It is important to note in this Heckscher-Ohlin framework, only one good can be exported or imported at the same time. In other words, both goods cannot be simultaneously imported or exported.

3.4 Data and Calibration

The model is calibrated using the social accounting matrix (SAM) of a model economy, i.e., using fictitious data. The structure of the model economy is close to the Canadian one since the coefficients of the Canadian input-output table of 2002 have been used. Table 1 presents the SAM imitating Canadian economy in 2002. Without further notification, all values are presented in million dollars.

The calibration of the model is standard as in other general equilibrium models. Using the data from SAM and the assumed exogenous parameters, we can calibrate the share

parameters, shift parameters and other variables' benchmark value from economic agents' behavioural functions in order to replicate the initial equilibrium. Table 2 shows the values of calibrated share and shift parameters, and the assumed exogenous parameters. The values of behavioral parameters are assumed to be the same as Markusen et al. (2006). Supposing the model economy is a small open economy, any changes in the domestic market can not affect the world prices of commodities. The benchmark value of the tariff rate on imported services is of 4.8%[12]. Two sets of simulation are performed with the model. In the first set several policy shocks are performed on service FDI restriction by changing the tariff rate on the imports of services using the base initial values of substitution elasticities, in order to investigate the impacts of FDI policy on the economic variables. In the second set of simulation, the same experiments are performed with varied values of the substitution elasticities in order to check the sensitivity of the results.

[12] The tariff rate of 4.8% is calculated from the Canadian Input-Output table 2002.

Table 1 Social Accounting Matrix for Canadian economy (2002)

FDI SAM (million $)	Skilled labour S	Other factors L	Intermediate input V	Household	Firm	ROW	Sector Y	Sector X	Sector ZD	Sector ZM	Commodity Y	Commodity X
Skilled labour S							14538.0	22643.5	24676.0	16236.0		
Other factors L							17702.1	15886.6	11034.1	7260.1		
Intermediate input V										4885.6		
Household	78093.5	51882.9	224.7									
Firm												
ROW			4660.9									2789.5
Sector Y						7450.4					24789.8	
Sector X												102621.9
Sector ZD								35710.1				
Sector ZM								28381.7				
Commodity Y				24789.8								
Commodity X				105411.4								

Source: Statistic Canada (2002) Input – Output Table and Trade Table

Table 2 Parameter values and descriptions

Parameter	Description	Value
AlphaU	Share parameter in household CES utility function for commodity X	0. 618
AlphaY	Share parameter in the CES function of industry Y for skilled labour	0. 484
AlphaX	Share parameter in the CES function of industry X for skilled labour	0. 316
BetaX	Share parameter in the CES function of industry X for all other factors	0. 295
AlphaZ	Share parameter in the CES function of composite intermediate sector Z for ZD	0. 519
AlphaZD	Share parameter in the CES function of industry ZD for skilled labour	0. 54
AlphaZM	Share parameter in the CES function of industry ZM for skilled labour	0. 375
BetaZM	Share parameter in the CES function of industry ZM for all other factors	0. 319
AY	Shift parameter in the CES function of industry Y	1. 997
AX	Shift parameter in the CES function of industry X	2. 891
AZ	Shift parameter in the CES function of industry Z	1. 996
AZD	Shift parameter in the CES function of industry ZD	1. 969
AZM	Shift parameter in the CES function of industry ZM	2. 965
SigmaC	Elasticity of substitution in household CES utility function	3
SigmaY	Elasticity of substitution in the CES production function of industry Y	3
SigmaX	Elasticity of substitution in the CES production function of industry X	5
SigmaZ	Elasticity of substitution in the CES production function of composite intermediate inputs Z	3
SigmaZM	Elasticity of substitution in the CES production function of industry ZM	5
SigmaZD	Elasticity of substitution in the CES production function of industry ZD	5
ERO	Exchange rate	1
PWX	World price of X	1
PWY	World price of Y	1
PWV	World price of V	1

Source: Outcomes from the calibration in this model

4 Simulations

4.1 Description of simulations

The two sets of scenario are designed as follows. The purpose of the first stage is to verify the results that Markusen et al. (2006) got from their model, given different production functions with the SAM of the model economy. Therefore the levels of FDI tariff tv are selected to exhibit the general impact on some measurements of interest, for example, decrease FDI barrier tv to a certain extent where welfare gains would reach maximum. The benchmark value of tv 4.8% is calibrated using SAM. It is then increased by 25%, 50% and 75%, and reduced by 25%, 50% and 75%. In other three simulations the tariff rate is multiplied by respectively, -25%, -50%, and -75%, in order to represent subsidy on FDI.

In the second set of simulations, the same experiments are run with different values of the substitution elasticity between domestic factors and foreign input in the foreign-owned industry of intermediate inputs ZM. The value of substitution elasticity is changed from 5 to 7.5 and to 0.5, representing the case when the substitution of inputs becomes more elastic or inelastic. The second stage intends to analyse the role of behaviour parameters on sector zm, which uses foreign import and is affected by FDI policy directly. Although the elasticity parameter is assumed without empirical support, the experiment results could still show the possible economic trends caused by FDI policy alternatives under various behavioural features.

4.2 The results

Most results presented in the following section are expressed in percentage deviations from the benchmark. Those expressed in absolute values will be particularly mentioned

4.2.1 First set of scenarios

Some interesting results of the first set of simulations are included in Table 3 and Table 4. In this stage, the regulation on FDI is varied around benchmark value (4.8%) from positive value 8.4% to negative value – 3.6%. As foreign import is one important input for production of ZM, price of imported input V has a direct effect on the cost structure of industry zm, then consequently on the price of intermediate good ZM. It also has indirect effects on other relevant prices such as price of ZD, factor price of skilled labour S and all other factors L. Since prices of final good X and Y are supposed to be constant with world prices, the domestic demand and household utility may not be seriously affected by the input price changes. However, they may be influenced by the change in household total income in terms of the factor price changes in skilled labour and all other factors.

Returns on domestic factors

Table 3 summarizes the results of real return and aggregate effects from the FDI liberalization simulations. Figure 7.1 exhibits the graphs of the percentage deviations of returns to factor from base case with different values of tariff rate on imports. Since total factor supply of S and L is fixed, the effect of FDI liberalization on factors is shown on their price changes. On the one hand, real wage of skilled labour S increases monotonically until 1.4% at a subsidy of 3.6% on import with the liberalization. The reason for this is straight forward. With the reduction in the price of foreign import V, the unit cost of intermediate input ZM falls comparing with that of zd. Then sector z substitutes zd with zm, as the relative price of ZM over ZD[13] is lowered. Further the cost efficiency by the substitution effect is transferred from Z to final production of good X, and brings about an output expansion in sector x. The expanded output of x increases the demand for skilled labour S, which is used intensively in sector x. Consequently, the real price of S is increased given its fixed supply. This is consistent exactly with the results got by Markusen that foreign imports and skilled labour S are partial equilibrium substitutes but general equilibrium complements.

[13] Service providers ZM has the similar labour intensive ratio with ZD, so reduction of price V will economizes the production of ZM.

Table 3 Results about returns and aggregate outcomes from changes FDI restrictions at SigZM = 5

Change comparing to benchmark / Tariff		Real wage of skilled labour S (%)	Real price of all other factors L (%)	Equivalent variation (million $)	Household total income (million $)	Real GDP at market prices (million $)
Increased Tariff	8.40%	-0.4	0.4	-61.6	-61.6	-61.6
	7.20%	-0.3	0.3	-39.4	-39.4	-39.4
	6%	-0.2	0.1	-18.7	-18.7	-18.7
Benchmark	4.80%	0.0	0.0	0.0	0.0	0.0
Reduced Tariff	3.60%	0.2	-0.1	16.1	16.1	16.1
	2.40%	0.3	-0.3	28.8	28.8	28.8
	1.20%	0.5	-0.4	27.3	27.3	37.3
Subsidy	-1.20%	1.0	-0.8	36.8	36.8	36.8
	-2.40%	1.2	-0.9	24.7	24.7	24.7
	-3.60%	1.4	-1.1	2.0	2.0	2.0

Source: Results from this simulation

Table 4 Value of trade given changes in FDI restriction at elasticity of substitution ZM = 5

Change comparing to Benchmark (million $) / Tariff		Import of V	Net import of X	Net import of Y
Tariff increase	8.40%	-3718.9	-8978.6	12697.6
	7.20%	-4002.7	-7073.9	11076.5
	6%	-4315.5	-5016.7	9332.3
Benchmark	4.80%	-4660.9	-2789.5	7450.4
Tariff reduce	3.60%	-5043.0	-373.2	5416.4
	2.40%	-5467.6	2254.5	3212.6
	1.20%	-5939.8	5120.1	819.5
Subsidy	-1.20%	-7057.9	11692.2	-4634.1
	-2.40%	-7717.4	15477.0	-7754.3
	-3.60%	-8472.0	19659.4	-11186.7

Source: Results from this simulation

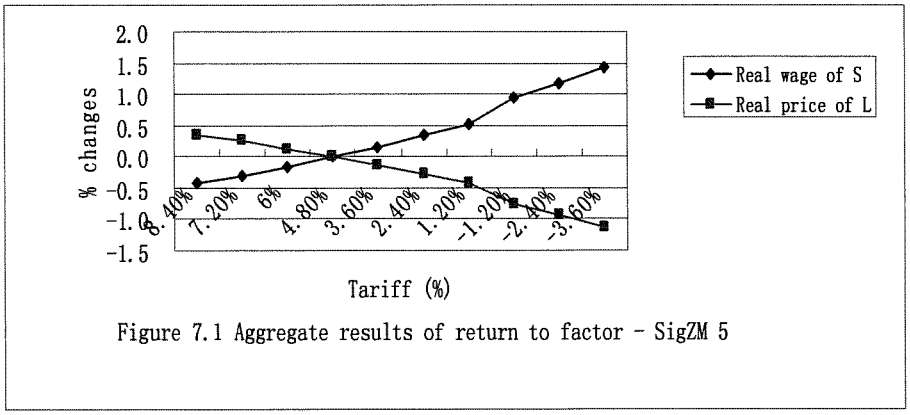


Figure 7.1 Aggregate results of return to factor - SigZM 5

Source: Results from this simulation

However, the result shows that the real price of all other factors L decreases monotonically until -1.1% at a subsidy of 3.6% on import with FDI liberalization, which is not the same with Markusen's results. Markusen suggests that there is a trade-off between the Stolper-Samuelson effect and the Dixit-Stiglitz (1977) effect on the real return on factor. From his simulation, the real prices of both domestic factors could rise because of the dominant Stiglitz price index effect under monopolistic competition. The increased variety reduces the price of final good X so much that the massive productivity increase induces expansions in both output and factor demand. Thus given the fixed factor supply, despite that factor L is not used intensively in the production of X, still the stronger output effect than substitution effect increases the real price of L given a certain low tariff.

Differently, in this paper, the model describes a perfect competitive environment with CES production function, where output effect from cost reduction may or may not be large enough to dominate Samuelson substitution effect. Figure 7.1 suggests that the real price of all other factors changes contrarily to the real wage of skilled labour. Since FDI liberalization lowers the unit cost of service composite good Z, the cost of X decreases relative to cost of Y. Although the expansion in sector x raises demand for all other factors L somewhat, experiments prove that substitution effect still dominates, which is consistent with Stolper-Samuelson theorem. Hence the FDI liberalization does have a negative impact on the return of all other factors in Canada. Similar results are drawn in literature. Empirical study from Gera, Gu and Lee (1999) shows that although inward FDI is positively related with total factor productivity, it lowers industry's demand for capital, intermediate goods and even labour given a certain level of output. Output expansion may reverse situation, but it depends on market and production structure. Hanson and Harrison (1999) finds evidence that due to the trade reform in Mexico since 1985, the wage gap between skilled and unskilled workers widened. Reduction in the protection disproportionately decreases the wages of low-skilled labour while it increases the wage of skilled labour.

Total consumption, Real GDP and Welfare

As shown in Table 3, the changes in household consumption, real GDP and welfare measured in million $ are identical. That real GDP equal to household total consumption is because in this model real GDP consists of total consumption and net export that is

zero. Further, we measure welfare change by equivalent variation, the change in household utility level comparing to its benchmark consumption expenditure[14]. Referring to Table 3, the three measurements – household consumption, real GDP, and equivalent variation increase as a result of lower restrictions on FDI even though household receives less tariff revenue, while they decline with heavier FDI tariff. This suggests that in aggregate the host country would benefit from FDI tariff reduction. Since households receive higher income from net increased return to domestic owned factor, their welfare increases. Welfare gain from FDI is also suggested in many studies, such as Lee and Mensbrugghe (2001) and Noguer (2000).

Nevertheless, welfare effect does not monotonically increase with FDI liberalization. Figure 7.2 presents a convex shape of welfare effect measured in million dollars, which is not surprising. The higher is the subsidy to FDI, the larger is the substitution effect by FDI, the largest impairment is on the return to the factor L, such as capital, and then the lower is the total income received by household. The positive output effect on factor demand could be counteracted by the negative substitution effect, if the subsidy on FDI is high enough. This result is in line with Markusen et al. (2006), but by a smaller scale. Markusen estimates that the maximum welfare gains could be as high as 0.4% to 0.5% at a subsidy of 25% on imported input V. From this model, welfare gains could only reach maximum 0.03% given a subsidy of 1.2%. The difference may be interpreted, on the one hand, by the smaller share of import V in the value of zm, i.e. share of V in good zm in Markusen's model is 40%, which is much larger than that of 17.2% in this simulation. Given the higher share of V in the value of final product, import would have greater effect on welfare. On the other hand, this model substitutes the increasing return to scale technology by constant return to scale. Therefore, although the price mark up over marginal cost is constant, the removal of the mark up would weaken the cost efficiency on the final production. Then the price reduction on imported input V has a smaller impact on consumption, GDP and welfare.

[14] EV = CH0*[Utility.l/Utility0-1], the change in utility level measured by benchmark consumption expenditure value.

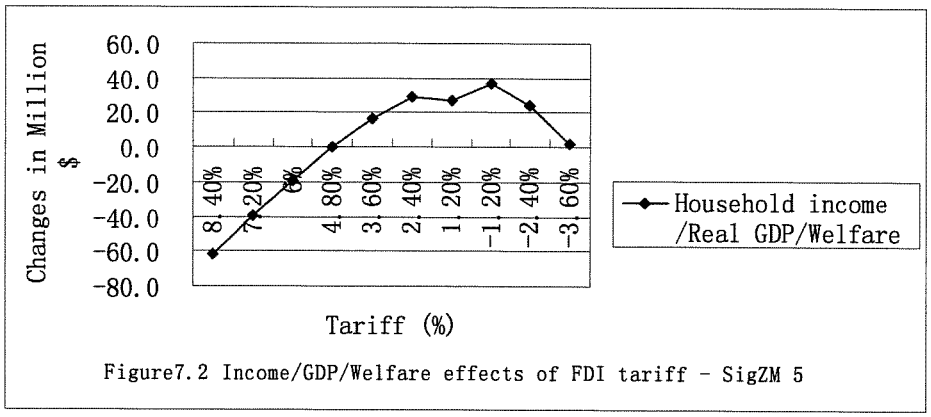


Figure7.2 Income/GDP/Welfare effects of FDI tariff - SigZM 5

Source: Results from this simulation

Trade pattern

The results reported in Table 4 suggest the trade pattern is affected by change in FDI regulation. Figure 8 presents the change of trade in final goods X, Y, and imported input V. Because of its comparative advantage, the country produces and exports the non-skilled labour intensive good Y and imports the skilled labour intensive good X at the high barrier on FDI (4.8%). Thus, when the tariff on FDI falls, the price of imported input V falls and the import of V increase. The cost of producing the intermediate service Z falls because of the lowered price of import V. The country now can produce good X at a much lower price such that it imports less X. At the same time, the relative price of producing good Y rises, so the country exports less Y according to Heckscher-Ohlin theory. As the barrier further decreases, the export of Y and the import of X fall continuously. Until tariff rate reaches around 4.2% the economy starts to export good X; and until tariff reduces to around 1.8%, the economy starts to import Y. Trade pattern reverses due to the country's reversed comparative advantage through FDI liberalization.

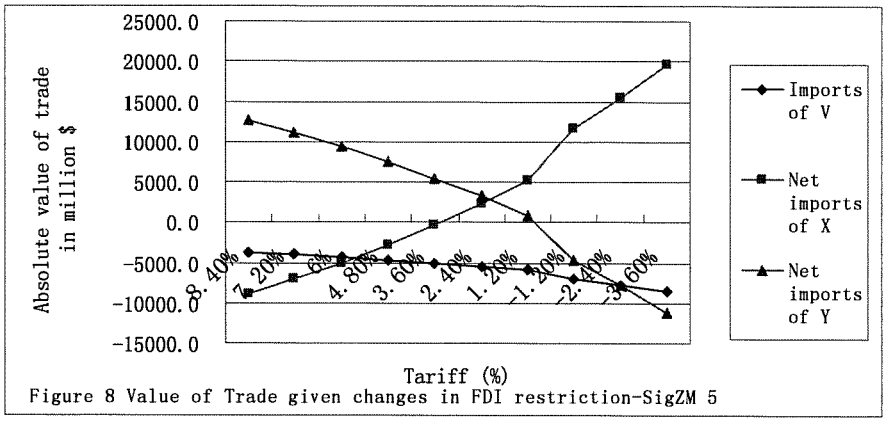


Figure 8 Value of Trade given changes in FDI restriction-SigZM 5

Source: Results from this simulation

Sectoral results

The four sectors in this model are affected by policy change differently. Table 5.1, 5.2 and 5.3 present the sectoral impacts of the FDI liberalization policies on sectoral output, prices and demand for input. Table 5.1 suggest that except the non-skilled labour intensive sector y, outputs of skilled labour intensive sector x and intermediate sector zd and zm increase monotonically with the tariff reduction. Among the three, foreign owned sector zm is the one that is mostly affected by the policy change, i.e. its impact varied from – 7.3% to 26.8%, because the foreign import V is directly used in the production of ZM.

Interestingly, although domestic sector zd does not use foreign import, it is still dramatically affected by policy change, whereas the least affected one among the three sectors – x, zd, and zm. This is because the production of ZD is indirectly affected by the price change of FDI when ZD is used in the production of X in terms of the composite Z. Price changes shown in Table 5.2 help to explain the link. With tariff abatement, the price of ZD increases, because the return on skilled labour, which has larger value share in a unit cost of ZD, increases larger than the decreases in return on other factors. At the same time, the price of ZM declines as firms could produce at a lower unit cost with the tariff abatement. Because the lowered price of ZM reduces the production cost of Z, there is an output expansion in sector z. The expanded production in z requires larger factor demand which ultimately stimulates the production of ZD. Therefore output of zd also changes in the same direction with zm due to the indirect output effect from FDI tariff reduction,

varied from – 5.7% to 20.2%. However, the scale of output increase in domestic sector zd is smaller than that in other sectors, because there is a substitution effect shifting Z away from ZD to ZM when the relative price of ZD over ZM rises.

Finally, the rise in output of sector x is the consequence of cost efficiency brought by tariff abatement. As shown in Table 5.2, price of Z, the intermediate input of X, falls with the lowered tariff. Together with the price changes in the other two factors, skilled labour and all other factors, the net effect from factor prices decreases the total cost of X. As the price of X is exogenous, the cost effect on the skilled labour intensive sector x is exhibited on its expanded output, changes varied from -6.1% to 21.9%. On the contrary, given the lessened tariff the output of non-skilled labour intensive sector y is contracting. With the cheaper production cost in X, the country tends to import Y instead of producing it domestically due to its reversed comparative advantage.

The change in factor demand in each sector is consistent with their output changes, shown in Table 5.3. Except sector y, the factor demand in the other sectors rises with the tariff liberalization, driven by their output expansion. The decline in the production of Y causes its factor demand reduction. Interestingly, the factor demand in sector zd exhibits larger absolute change than in sector zm. This is because skilled labour S and all other factors L share higher value in the production of ZD than ZM[15]. Hence, the variations in the real prices of skilled labour S and all other factors L by the policy shock induce larger change in the factor demand in producing ZD than that of ZM.

Table 5.1 Sectoral results from changes of FDI restrictions – Output at SigZM = 5

Tariff \ Change as % of benchmark		Output of X	Output of Y	Output of Z	Output of ZD	Output of ZM
Tariff increase	8.40%	-6.1	16.2	-6.4	-5.7	-7.3
	7.20%	-4.2	11.2	-4.4	-3.9	-5.1
	6%	-2.2	5.8	-2.3	-2.0	-2.6
Benchmark	4.80%	0.0	0.0	0.0	0.0	0.0
Tariff reduce	3.60%	2.4	-6.3	2.5	2.2	2.9
	2.40%	4.9	-13.1	5.2	4.6	6.0
	1.20%	7.7	-20.5	8.2	7.2	9.4
Subsidy	-1.20%	14.1	-37.5	14.9	13.1	17.3
	-2.40%	17.8	-47.2	18.8	16.5	21.8
	-3.60%	21.9	-57.8	23.1	20.2	26.8

Source: Results from this sumilation

[15] Table 2 show the share parameters in the CES function of industry ZD for labour and for capital, 0.54 and 0.46 respectively, are larger than that in ZM, 0.375 and 0.319.

Table 5.2 Sectoral results from changes in FDI restriction – output prices, at elasticity of substitution ZM = 5

Change as % of benchmark / Tariff		Output price of Z	Output price of ZD	Output price of ZM
Tariff increase	8.40%	0.1	-0.2	0.4
	7.20%	0.1	-0.1	0.3
	6%	0.0	-0.1	0.1
Benchmark	4.80%	0.0	0.0	0.0
Tariff reduce	3.60%	0.0	0.1	-0.1
	2.40%	-0.1	0.2	-0.3
	1.20%	-0.1	0.2	-0.5
Subsidy	-1.20%	-0.1	0.4	-0.8
	-2.40%	-0.2	0.5	-1.0
	-3.60%	-0.2	0.6	-1.2

Source: Results from this simulation

Table 5.3 Sectoral results from changes in FDI restriction – input demand, at elasticity of substitution ZM = 5

Change as % of benchmark / Tariff		Demand for L in X	Demand for L in Y	Demand for L in ZD	Demand for L in ZM	Demand for S in X	Demand for S in Y	Demand for S in ZD	Demand for S in ZM
Tariff increase	8.40%	-7.7	15.0	-8.2	-7.1	-4.0	17.8	-4.5	-3.4
	7.20%	-5.4	10.4	-5.7	-5.0	-2.8	12.2	-3.1	-2.3
	6%	-2.8	5.4	-3.0	-2.6	-1.4	6.3	-1.6	-1.2
Benchmark	4.80%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tariff reduce	3.60%	3.1	-5.9	3.3	2.8	1.5	-6.8	1.7	1.3
	2.40%	6.4	-12.4	6.8	5.9	3.2	-14.0	3.6	2.7
	1.20%	10.1	-19.5	10.7	9.2	4.9	-21.8	5.6	4.1
Subsidy	-1.20%	18.6	-36.0	19.9	17.0	8.9	-39.2	10.1	7.4
	-2.40%	23.5	-45.6	25.2	21.5	11.1	-49.0	12.6	9.3
	-3.60%	29.0	-56.3	31.1	26.5	13.5	-59.6	15.3	11.3

Source: Results from this simulation

4.2.2 Second set of scenarios

In comparison with the previous simulation, the second set of simulations takes the same policy changes on FDI regulation, assuming different substitution elasticity values, 7.5 and 0.5, between input factors in industry zm. The reason of assigning various substitution values is to observe the role of behaviour parameter on the impact of FDI liberalization on economic variables. The experiment is done for sector zm, because it is the only one industry that is directly affected by FDI policy. A value of 7.5 is chosen to see the impacts when foreign import and domestic factors are better substitutes than in the first stage. A value of 0.5 shows the impacts when foreign import and domestic factors are less substitutable.

Return on factor

Table 6 and 7 present some results of FDI liberalization when the substitution parameter in ZM is set to 7.5 and 0.5. Figure 9.1 compares the net effects of FDI on return to factor under three different values of substitution elasticity. The difference of factor return could be explained by the differences in the factor demand brought by the firm's varied production behaviour. Changes in behaviour parameter do have an effect on the magnitude of the change, but not on the direction of the impact of liberalization policy. It adjusts the substitution effect comparing to the output effect on factor demand, but experiments show that the output effect dominates in all cases.

Table 6 Aggregate Results from changes FDI restrictions at elasticity of substitution in ZM = 7.5

Tariff \ Change comparing to benchmark		Real wage of skilled labour S(%)	Real price of all other factors L (%)	Equivalent variation (million $)	Household total income (million $)	REAL GDP at market prices (million $)
Tariff increase	8.40%	-0.4	0.3	-80.5	-80.5	-80.5
	7.20%	-0.3	0.2	-52.2	-52.2	-52.2
	6%	-0.2	0.1	-25.2	-25.2	-25.2
Benchmark	4.80%	0.0	0.0	0.0	0.0	0.0
Tariff reduce	3.60%	0.2	-0.1	22.3	22.3	22.3
	2.40%	0.4	-0.3	40.6	40.6	40.6
	1.20%	0.6	-0.5	53.2	53.2	53.2
Subsidy	-1.20%	1.0	-0.8	52.1	52.1	52.1
	-2.40%	1.3	-1.0	31.9	31.9	31.9
	-3.60%	1.6	-1.3	-7.8	-7.8	-7.8

Source: Results from this simulation

Table 7 Aggregate Results from changes FDI restrictions at elasticity of substitution in ZM = 0.5

Tariff \ Change comparing to benchmark		Real wage of skilled labour S(%)	Real price of all other factors L (%)	Equivalent variation (%)	Household total income (million $)	REAL GDP at market prices (million $)
Tariff increase	8.40%	-0.5	0.4	-23.3	-23.3	-23.3
	7.20%	-0.3	0.3	-14.4	-14.4	-14.4
	6%	-0.2	0.1	-6.6	-6.6	-6.6
Benchmark	4.80%	0.0	0.0	0.0	0.0	0.0
Tariff reduce	3.60%	0.2	-0.1	5.3	5.3	5.3
	2.40%	0.3	-0.3	9.1	9.1	9.1
	1.20%	0.5	-0.4	11.5	11.5	11.5
Subsidy	-1.20%	0.8	-0.7	11.5	11.5	11.5
	-2.40%	1.0	-0.8	8.9	8.9	8.9
	-3.60%	1.2	-0.9	4.4	4.4	4.4

Source: Results from this simulation

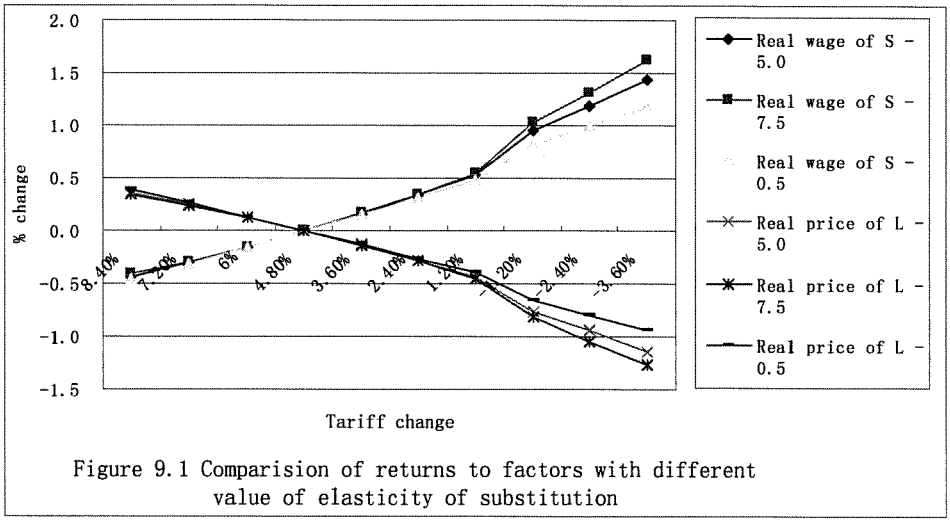


Figure 9.1 Comparision of returns to factors with different value of elasticity of substitution

Source: Results from this simulation

Taking factor S as an example, Figure 9.1 shows that, the increase in real wage of skilled labour by the tariff reduction is the largest when substitution elasticity is 7.5 and the smallest when substitution elasticity is 0.5. The reason is that the higher the elasticity value is, the further the decline in the price of import V shifts firms in industry zm away from domestic factors. The change in relative price between production factors by the lower price of import V induces both substitution effect and output effect on domestic factors. The more easily firms could substitute S with V given a level of FDI liberalization, the larger the cost efficiency it could get from the lowered price of V, and

the larger is the output. So with a high substitution possibility, the negative substitution effect on the demand for skilled labour S in sector zm is largely mitigated by the positive output effect in sector zm and x.

This result is confirmed in Figure 9.2 that compares the demand of skilled labour S in sector zm and x given three varied value of substitution elasticity. In zm, when substitution elasticity is 7.5, the demand of S changes in a more modest way comparing to that when substitution elasticity is 0.5. This is a result of the counteracting output effect and substitution effect on S. Higher substitution possibility mitigates the positive output effect on factor demand for S. Given a tariff reduction, firm in zm would more likely to choose factor L or imported input V instead of S, as L or V is relatively cheaper than S. However, on the contrary to zm, when tariff decreases, firms in sector x increase their demand for input S at a substitution value of 7.5 in comparison to the low values of 5.0 and 0.5. It follows that the output expansion in x brings larger factor demand to cover the substituted factor. In aggregate, the elasticity of substitution in sector zm magnifies the impacts of FDI policy on return to S.

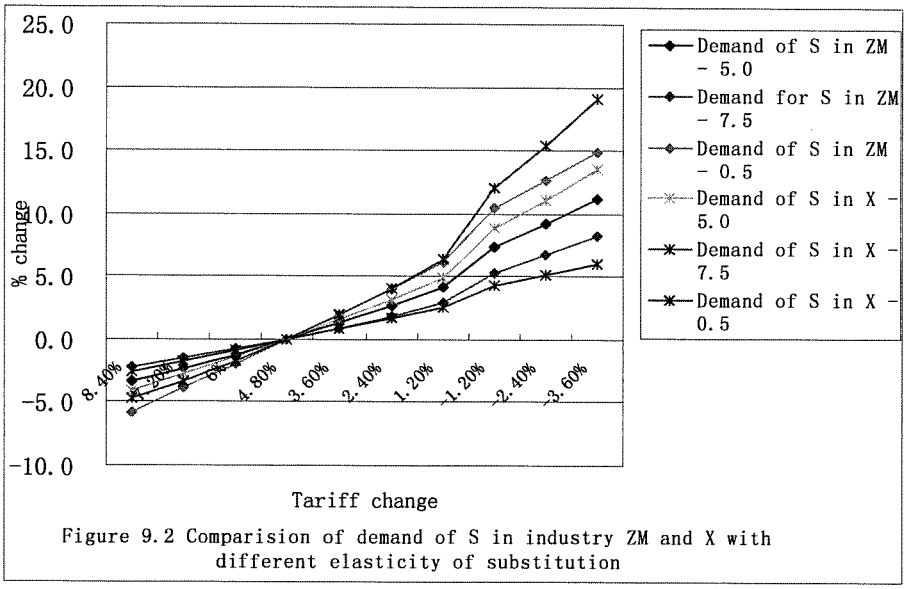


Figure 9.2 Comparision of demand of S in industry ZM and X with different elasticity of substitution

Source: Results from this simulation

The change in the price of factor L is opposite to that of factor S. Tariff alleviation induces negative output effect on L in sector y. However, the negative output effect is mitigated by a smaller value of substitution elasticity, because it is harder for firm to substitute L with V. Thus, when L is a factor that is less substitutable, the entry of foreign

import into domestic factor market would have less negative effect on demand and price of L than in the case when L could be substituted easily. Therefore, cheaper imports can substitute domestic factors, with a higher return on skilled labour S, but at the cost of lower return on all other factors L. Overall, the change of firm's behaviour does not reverse the results on factor return, but it may aggravate or alleviate the impact according to aggregate production structure. Still, FDI is generally complementary to skilled labour but substitute to all other factors.

Welfare and Output

The results in Tables 6 and 7 suggest that producer's behaviour does play an important role on welfare, real GDP and household total income. Figure 10.1 depicts the comparison of household income given different substitution value in sector zm. Results are consistent with that of return on factor. Better substitution between import and other factors induces greater cost efficiency in final production of X and greater positive net effect on return on domestic factors, as well as larger total income and welfare gains.

The sectoral output impacts are compared in Figure 10.2 and 10.3. Not surprisingly, higher elasticities of substitution magnify FDI impacts on the output of all sectors. Production of service sector zd and zm are both promoted, as firms in zm would like to choose better substitutes – foreign import to solve its cost minimization problem, and firms in zd are indirectly benefited in terms of output expansion in z from ZM's cost efficiency. In addition, the production of skilled labour intensive sector x is highly motivated when import can better substitute domestic factors, as it could enjoy higher cost efficiency from tariff abatement. At the same time, the production of non-skilled labour intensive sector y is more contracted by tariff removal given a larger value of substitution elasticity in zm, as it widens the factor price difference between skilled labour and all other factors and increases further the cost of producing Y.

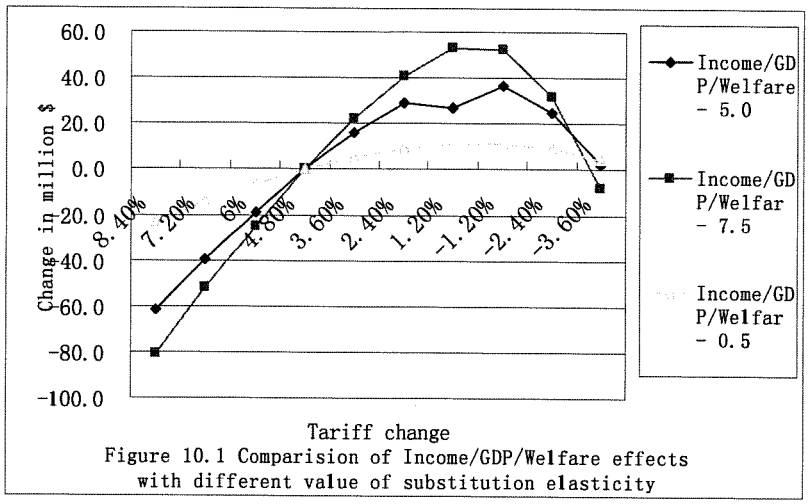


Figure 10.1 Comparision of Income/GDP/Welfare effects with different value of substitution elasticity

Source: Results from this simulation

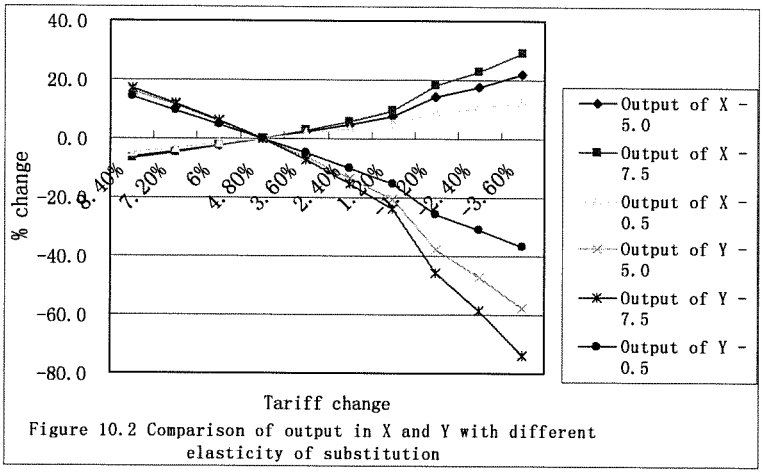


Figure 10.2 Comparison of output in X and Y with different elasticity of substitution

Source: Results from this simulation

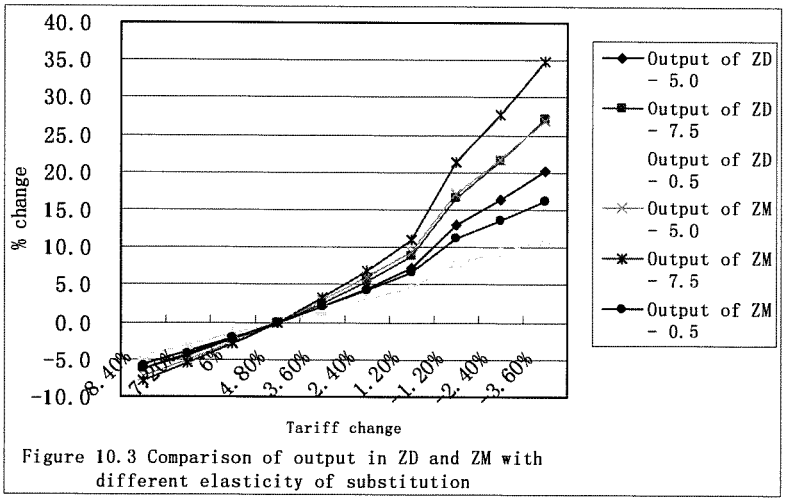


Figure 10.3 Comparison of output in ZD and ZM with different elasticity of substitution

Source: Results from this simulation

Trade pattern

Table 8 and 9 show the results of trade pattern for the second stage simulation. The comparison of the impact on trade pattern of both simulations is presented in Figure 11. For import V, the easier V can substitute domestic factors, the greater demand of V by firm to produce service. Thus import of V increases with the substitution value. For sector x, as analysed before that output effect is greater given higher substitution, the country can produce X at lower cost and export X in a larger volume. The situation for sector y is the opposite. With higher substitution, cost efficiency in x is magnified. In this case the country no longer has the comparative advantage in producing Y, so it turns to import Y in a larger volume. Then, following the reversed comparative advantage, trade pattern is also reversed by tariff removal. It is the same as the first simulation, but in different trade volume according to industry's substitution parameter. It proves that firm's production behaviour indeed changes the magnitude of FDI impacts on the trade pattern.

Table 8 Value of trade given changes in FDI restriction at elasticity of substitution ZM = 7.5

Tariff \ Comparing to Benchmark (million$)		Import of V	Net import of X	Net import of Y
Tariff increase	8.40%	-3425.7	-9576.9	13002.4
	7.20%	-3786.5	-7555.1	11341.7
	6%	-4195.7	-5304.0	9500.0
Benchmark	4.80%	-4660.9	-2789.5	7450.4
Tariff reduce	3.60%	-5192.2	29.3	5162.4
	2.40%	-5800.9	3201.8	2599.4
	1.20%	-6502.8	6787.7	-285.3
Subsidy	-1.20%	-8261.4	15511.6	-7249.9
	-2.40%	-9370.2	20855.8	-11485.5
	-3.60%	-10678.9	27039.3	-16360.2

Source: Results from this simulation

Table 9 Value of trade given changes in FDI restriction at elasticity of substitution ZM = 0.5

Change comparing to Benchmark (million $) / Tariff		Import of V	Net import of X	Net import of Y
Tariff increase	8.40%	-4307.6	-7769.9	12077.0
	7.20%	-4421.7	-6138.3	10560.1
	6%	-4539.7	-4478.6	9017.9
Benchmark	4.80%	-4660.9	-2789.5	7450.4
Tariff reduce	3.60%	-4785.8	-1070.3	5856.0
	2.40%	-4914.4	679.8	4234.0
	1.20%	-5046.8	2462.0	2584.5
Subsidy	-1.20%	-5323.6	6125.8	-802.4
	-2.40%	-5468.6	8009.8	-2541.3
	-3.60%	-5618.2	9929.5	-4311.5

Source: Results from this simulation

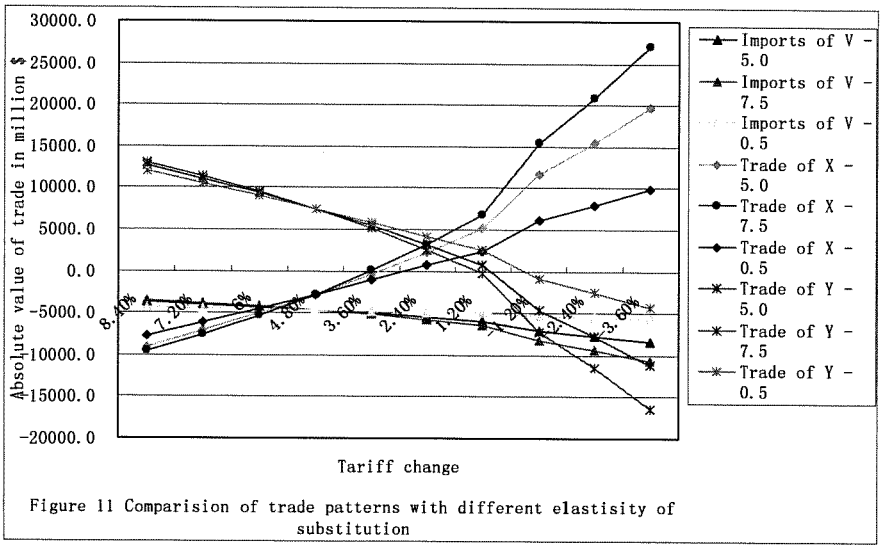


Figure 11 Comparision of trade patterns with different elastisity of substitution

Source: Results from this simulation

5. Conclusion

The impact of the liberalization of service FDI on the host economy, and especially on returns to factors, depends on firm production technology and on household utility function. In this paper, we have evaluated the impact of service FDI liberalization under certain specifications using a static CGE model that incorporates service FDI. We compared the impacts on welfare, trade pattern, real return to factors, and other sectoral features induced by the liberalization of service FDI in two scenarios. In the first scenario, we analyzed the impacts of tariffs on service FDI using base values for the substitution elasticity parameters. In the second one, we conducted the same experiments as in the first using different values of substitution elasticity between domestic factors and foreign input in the foreign-owned industry.

Our simulation results suggest that with a constant-returns-to-scale technology, the liberalization of service FDI would be in general beneficial to the host economy with regard to welfare. The magnitude of the benefits depends on the size of the substitution elasticity between domestic factors and imported inputs. This indicates that when foreign intermediate inputs can be easily substituted to domestic inputs in production, local firms would be able to benefit more from the cost efficient foreign input so that liberalization would increase output and generate greater social welfare.

Regarding trade pattern, we found similar results as with welfare; economic agent's behavior plays a role in magnifying or minifying the impact of service FDI on the output of each tradable sector. This could also be attributed to the ease of substitution between domestic production factors and the cost efficient foreign imported input. Output expansion would be greater if larger proportion of foreign input is accepted in production. On the contrary, output contraction in the non-FDI recipient industry would also be larger as the liberalization would not help in reducing their relative price.

The most important lesson derived from the simulations is that under the specification of a constant-returns-to-scale technology, service FDI liberalization does not increase the real return to all domestic factors as indicated by Markusen et al. (2006). It increases the return to some domestic factors at the expense of others. Further, the positive as well as the negative impacts increase with the elasticity of substitution between domestic factors and foreign inputs. On the one hand, the demand for the factor that is used intensively in

the FDI-recipient industry increases because the output effect on the factor demand dominates the substitution effect brought by service FDI. Real return to this factor, i.e., skilled labour, rises with all values of substitution elasticity without exception. The only difference is the magnitude of the increase: the lower the tariff rate, the higher the output effect and the larger the increases in factor return. On the other hand, the demand for the factor that is used intensively in the non FDI-recipient industry declines, i.e. all other factors L in this paper, as the cost efficient foreign input cannot expand enough output in the FDI-recipient industry so as to compensate the reduced factor demand in the non FDI-recipient industry. Smaller values of substitution possibility may improve the situation, as firms cannot substitute domestic factor easily and the output contraction in the non FDI-recipient industry is smaller.

To some extent, our simulation results could explain partially the conflicting economic effects of service FDI liberalization. As some case studies mentioned that the increase in service FDI reduces employment, the impact of service FDI on host country's employment is determined by some peculiar features of the production structure such as the degree of returns to scale in technology. The output effect and the substitution effect on domestic factor can be magnified or minified by these special characteristics.

References

Anuatti-Neto, F.; Barossi-Filho, M.; Gledson de Carvalho, A. and Macedo, R., "Costs and benefits of privatization: Evidence from Brazil", Research Network working paper NO. 455, IADB, June 2003

Arbenser, Lawrence, "A General Euilibrium analysis of the impact of inward FDI on Ghana: The role of complementary policies", Humboldt University of Berlin, 2004

Baldwin, J. R. and Sabouring, D., "Impact of adoption of advanced ICT on firm performance in the Canadian Manufacturing sector", Statistics Canada, 2001

Baldwin, Robert E., "The effect of trade and foreign direct investment on employment and relative wages", *OECD Economic Studies*, vol.23, pp. 7-54, 1994

Benjamin, Mancy and Diao, Xinshen, "Liberalizing Services Trade In APEC: A General Equilibrium Analysis with Imperfect Competition", *Pacific Economic Review*, vol. 5, iss. 1 pp 49, Feb. 2000

Blomstrom, Magnus, and Sjoholm, Fredrik, "Technology transfer and spillovers? Does local participation with multinationals matter?" NBER Working Paper No.6816, November 1998.

Blomstrom, Magnus, "Host country benefits of foreign investment", National Bureau of Economic Research Working paper no. 3815, March 1992

Bora, B. and Guisinger, S., "Impact of investment liberalisation in APEC", School of Economics, Flinders University, mimeo, 1997

Braconier, Henrik and Ekholm, Karolina, "Swedish multinationals and competition from high-and low-wage locations", *Review of International Economics*, vol.8, pp. 448-61, 2000

Brainard, S. Lael., "An empirical assessment of the proximity-concentration trade-off between multinational sales and trade", *American Economic Review*, vol.87, iss.4, pp.520-44, 1997

Caves, R.E., "Multinational Enterprise and Economic Analysis", Second Edition, Cambridge; Cambridge University Press, 1996

Chadha, Rajesh; Brown, Drusilla K.; Deardorff, Alan V. and Stern, Robert M., "Computational Analysis of the Impact on India of the Uruguay Round and the Forthcoming WTO Trade Negotiations", William Davidson Institute Working Papers Series 312, William Davidson Institute at the University of Michigan Stephen M. Ross Business School, 2000

Ciccone, A. and Hall, R. E., "Productivity and the Density of economic Activity", *American Economic Review*, vol.86, no.1, pp.54-70, 1996

Ciccone, Antonio and Hall, Robert E., "Productivity and the Density of Economic Activity", *The American Economic Review*, vol. 86, no. 1., pp. 54-70, Mar., 1996

Deardorff, A. V., "Terms of Trade: Glossary of International Economics", 2000, 2001, http://www-personal.umich.edu/~alandear/glossary/a.html.

Deardorff, A.V.; Brown, D.K. and Stern, R.M., "Some Economic Effects of the Free Trade Agreement Between Tunisia and the European Union", Michigan - Research Forum on International Economics, Papers 385, 1996

Dee, Philippa; Geisler, Chris and Watts, Greg, "The Impact of APEC's Free Trade Commitment", staff information paper, Industry Commission of Australia, 1996

Dixit, A. and Stiglitz, J., "Monopolistic Competition and Optimum Product Diversity", *American Economic Review*, vol.76, no.1, pp.297-308, 1977

Donovan, D. and Mai, Y. H., "APEC trade liberalization: the impact of increased capital mobility", Australian Commodities, ABARE, Canberra, vol.3, no.4, pp 520–526, December 1996

Driffield, Nigel and Girma, Sourafel, "Regional Foreign Direct Investment and Wage Spillovers: Plant Level Evidence from the UK Electronics Industry", Oxford Bulletin of Economics and Statistics, vol.65, iss. 4, pp 453, 2003

Duffield, Nigel and Munday, Max, Industrial Performance, "Agglomeration and Foreign Manufacturing Investment in the U.K.", *Journal of International Business Studies*, vol. 31, no. 1, pp.21-38, 2000

Dunning, J., "Multinational Enterprises and the Global Economy", New York: Addison-Wesley Publishing Company, 1993

Eckel, Carsten, "Fragmentation, efficiency-seeking FDI, and employment", *Review of International Economics*, vol. 11, Issue 2, pp. 317-331, 2003

Ernst, Christoph, "The FDI - employment link in a globalizing world: The case of Argentina, Brazil and Mexico", Employment strategy papers, 17, International Labour Office, 2005

Ethier, Wilfred J., "National and international returns to scale in the modern theory of international trade", *The American Economic Review*, vol.72, no. 3, pp.389-405, 1982

Eytan, Sheshinski and López-Calva, F. Luiz, "Privatization and its benefits: Theory, evidence, and challenges", in Kaushik, Basu, Ranjan Ray and Pulin Nayak (eds.), Markets and Governments, New Delhi: Oxford University Press, 2003.

Fischer, Ronald; Gutierrez, Rodrigo, and Serra, Pablo, "The effects of privatization on firms and on social welfare: the Chilean case", Research Network working paper, no. R-456, IADB, 2003

Francois, Joseph F., "Trade in Producer Services and Returns due to Specialization under Monopolistic Competition", *Canadian Journal of Economics*, vol. 23, pp. 109-124, 1990a

Francois, Joseph F., "Producer Services, Scale, and the Division of Labor", Oxford Economic Papers, vol. 42, pp. 715-729, 1990b

Froot, Kenneth A.; Scharfstein, David S., and Stein, J.C., "Risk Management: Coordinating Corporate Investment and Financing Policies", *Journal of Finance*, vol.48, iss.5, pp.1629-58, 1993

Fujita, M.; Krugman, P. and Venables, A., "The spatial economy: Cities, Regions, and International Trade", MIT Press, 1999

Galiani, Sebastian and Sanguinetti, Pablo, "The impact of trade liberalization on wage inequality: Evidence from Argentina", *Journal of Development Economics*, vol. 72, iss. 2, pp. 497-513, December 2003

Gera, Surendra; Gu; Wulong and Lee, Frank, "Foreign Direct Investment and Productivity Growth: The Canadian Host-Country Experience", Working Paper no. 30, Industry Canada, 1999

Glass, Amy J. and Saggi, Karnal, "FDI policies under shared factor markets", *Journal of International Economics*, vol.49, pp.309-32, 1999

Globerman, S. and Shapiro, D., "Assessing Recent Patterns of Foreign Direct Investment in Canada and the United States", in Richard Harris, ed., North American Linkages: Opportunities and Challenges, Calgary: University of Calgary Press, pp.279-308, 2003

Graham, E., "Outward direct investment and U.S. exports: Substitutes or Complements – with implications for U.S.-Japan policy", Institute for International Economics, Washington, D.C., 1993

Greenfield, H., "Manpower and the growth of producer services", New York: Columbia University, 1966

Grosse, R. and Trevino, L.J., "Foreign direct investment in the United States: An analysis by country of origin", *Journal of International Business Studies*, vol. 17, pp 139-155, 1996

Hanson, Gordon H. and Harrison, Ann, "Trade liberalization and wage inequality in Mexico", *Industrial and Labor Relations Review*, vol. 52, no. 3, pp.271-288, 1999

Hardin, Alexis and Holmes, Leanne, "Service Trade and Foreign Direct Investment", Industry Commission Staff Research Paper Australia, 27 Nov. 1997

Hejazi, W. and Pauly, P., "Motivations for FDI and domestic capital formation", *Journal of International Business Studies*, vol. 34, no. 3, pp. 282-289, 2003

Hejazi, W. and Safarian, A.E., "Explaining Canada's changing FDI patterns", University of Toronto, 2002

Hejazi, W. and Safarian, A.E., "Trade, foreign direct investment, and R&D spillovers", *Journal of International Business Studies*, vol.30, iss.3, pp.491-511, 1999

Helpman, E., "A Simple Theory of Trade with Multinational Corporations", *Journal of Political Economy*, vol.92, pp.451-471, 1984

Hoekman, B. and Braga, C., "Protection and trade in services", Policy Research Working Paper 1747, World Bank, Washington DC, 1997

Hoekman, B., "Assessing the General Agreement on Trade in Services", in Martin, W. and Winters, L. A. (eds), The Uruguay Round and the Developing Economies, World Bank Discussion Paper 307, Washington DC, pp. 327–364, 1995

Hymer, S., "The International Operations of National Firms: A Study of Direct Investment", unpublished PhD thesis, Massachusetts Institute of Technology, 1960

Jacobs, J., "The economy of cities", Random House: New York, 1969

Kálmán, Kalotay and Hunya, Gábor, "Privatization and FDI in central and eastern Europe", *Transnational Corporations*, vol. 9, no. 1, pp. 39-66, April 2000

Kindleberger, C.P., "American business abroad: Six lectures on direct investment", New Haven and London: Yale University Press, 1969

Kleinert, Jörn, "Trade and the Internationalization of Production", Kiel Working Papers 1104, Kiel Institute for the World Economy, 2002

Krugman, Paul, "Free trade and jobs", International Herald Tribune, vol.28-29, February 2004

Krugman, Paul, "Increasing Returns and Economic Geography", *Journal of Political Economy*, University of Chicago Press, vol.99, iss.3, pp. 483-99, June 1991

Krugman, Paul, "The move toward free trade zones", Economic Review, Federal Reserve Bank of Kansas City, pp 5-25, 1991

Lee, Hiro; Mensbrugghe, D., "A General Equilibrium Analysis of the Interplay between Foreign Direct Investment and Trade Adjustments", Kobe U. Research Institute for Economics & Business Admin, Discussion Paper no. 119, July 2001

Legault, Marc and Rao, P. Someshwar, "Economic Integration in North America: Trends in Foreign Direct Investment and the Top 1,000 Firms", Industry Canada, Micro-Economic Policy Analysis Staff including John Knubley, 1994

Lipsey, Robert E., and Weiss, Merle Yahr, "Foreign production and exports in manufacturing industries", *The Review of Economic Statistics*, pp. 488-494, 1981

Lipsey, Robert E., and Weiss, Merle Yahr, "Foreign production and exports of individual firms", NBER Reprints 0558, National Bureau of Economic Research, Inc., 1984

MacDougall, G.D.A., "The Benefits and Costs of Private Investment from abroad: A Theoretical Approach", *Economic Record*, vol. 36, pp. 13-35, 1960

Markusen, James, "Factor movements and commodity trade as complements", *Journal of International Economics*, vol. 14, iss 3-4, pp.341-356, 1983

Markusen, James, *Multinational firms and the theory of international trade*, MIT Press, 2004

Markusen, James; Rutherford, Thomas F. and Tarr, David, "Trade and Foreign Direct Investment in Producer Services and the Market for Foreign Expertise", *Canadian Journal of Economics,* Vol. 38, pp.758-777, 2006

Martin, Roger L. and Porter, Michael E., "Canadian Competitiveness: A Decade after the Crossroads", Mimeographed, 2001

Martin, W. and Yanagishima, K., "Concerted trade liberalisation and economic development in the Asia-Pacific region, background paper for East Asia's Trade and Investment", World Bank, International Economics Department, Washington, DC 1993

McKibbin, W. J., and Wilcoxen, P. J., "The role of services in modeling the global economy", *Asia Pacific Economic Review*, vol. 2, no. 2, pp 3–13, 1996

Noguer, Marta and Siscart, Marc, "Trade raises income: A precise and robust result", *Journal of International Economics*, vol. 65, iss. 2, pp.447-460, 2000

Paul, Catherine J. M. and Siegel, Donald, "Estimation of scale economies underlying growth and productivity: the empirical implications of data aggregation", *Southern economic journal*, vol. 65, iss. 4, pp.739-756, April 1999

Petri, Peter A., "Foreign direct investment in a computable general equilibrium framework", paper presented at the Brandes-Keio Conference on "Making APEC Work: Economic challenges and Policy alternatives," Keio University, Tokyo, Mar. 13-14, 1997

Rao,Someshwar and Tang, Jianmin, "The Contribution of ICTs to Productivity Growth in Canada and the United States in the 1990s", *International Productivity Monitor*, vol.3, pp.3-18, 2001

Stibora, Joachim and Aldert de Vaal, "Services and Services Trade: A Theoretical Inquiry", Amsterdam: Tinbergen Institute, 1995

Trefler, Daniel, "The long and short of the Canada-U.S. free trade agreement", *American Economic Review*, American Economic Association, vol. 94, iss. 4, pp. 870-895, 2004

UNCTAD 1999 (United Nations Conference on Trade and Development), World investment report 1999 – Foreign direct investment and the challenge of development, United Nations, New York and Geneva, 1999

UNCTAD 2000 (United Nations Conference on Trade and Development), World investment report 2000 – Cross-border mergers and acquisitions and development, United Nations, New York and Geneva, 2000

UNCTAD 2003 (United Nations Conference on Trade and Development), World investment report 2003 – FDI policies for development: National and International perspectives, United Nations, New York and Geneva, 2003

UNCTAD 2004 (United Nations Conference on Trade and Development), World investment report 2004 – The shift towards services, United Nations, New York and Geneva, 2004

UNCTAD 2005 (United Nations Conference on Trade and Development), World investment report 2005 – Transitional Corporations and the Internationalization of R&D, United Nations, New York and Geneva, 2005

Zhang, Kevin Honglin and Markusen, James R., "Vertical multinationals and host-country characteristics", *Journal of Development Economics*, Elsevier, vol.59, iss.2, pp. 233-252, 1999

Appendix

Household

1. $XC = (\frac{\alpha_U}{P_X})^{\sigma_C} \frac{CH}{\alpha_U^{\sigma_C} P_X^{1-\sigma_C} + (1-\alpha_U^{\sigma_C}) P_Y^{1-\sigma_C}}$

2. $YC = (\frac{1-\alpha_U}{P_Y})^{\sigma_C} \frac{CH}{\alpha^{\sigma_C} P_X^{1-\sigma_C} + (1-\alpha_U^{\sigma_C}) P_Y^{1-\sigma_C}}$

3. $CH = RL\overline{L} + RS\overline{S} + tvP_{WV}ERV$

Firms

4. $P_Y = (\frac{1}{A_Y})(\alpha_Y^{\sigma_Y} RS^{1-\sigma_Y} + (1-\alpha_Y)^{\sigma_Y} RL^{1-\sigma_Y})^{\frac{1}{1-\sigma_Y}}$

5. $S_Y = A_Y^{\sigma_Y - 1} YS(\frac{\alpha_Y P_Y}{RS})^{\sigma_Y}$

6. $L_Y = A_Y^{\sigma_Y - 1} YS(\frac{(1-\alpha_Y)P_Y}{RL})^{\sigma_Y}$

7. $P_X = (\frac{1}{A_X})(\alpha_X^{\sigma_X} RS^{1-\sigma_X} + \beta_X^{\sigma_X} RL^{1-\sigma_X} + (1-\alpha_X - \beta_X)^{\sigma_X} P_Z^{1-\sigma_X})^{\frac{1}{1-\sigma_X}}$

8. $S_X = A_X^{\sigma_X - 1} XS(\frac{\alpha_X P_X}{RS})^{\sigma_X}$

9. $L_X = A_X^{\sigma_X - 1} XS(\frac{\beta_X P_X}{RL})^{\sigma_X}$

10. $Z = A_X^{\sigma_X - 1} XS(\frac{(1-\alpha_X - \beta_X)P_X}{P_Z})^{\sigma_X}$

11. $P_Z = (\frac{1}{A_Z})(\alpha_Z^{\sigma_Z} P_{ZD}^{1-\sigma_Z} + (1-\alpha_Z)^{\sigma_Z} P_{ZM}^{1-\sigma_Z})^{\frac{1}{1-\sigma_Z}}$

12. $ZD = A_Z^{\sigma_Z - 1} Z(\frac{\alpha_Z P_Z}{P_{ZD}})^{\sigma_Z}$

13. $ZM = A_Z^{\sigma_Z - 1} Z(\frac{(1-\alpha_Z)P_Z}{P_{ZM}})^{\sigma_Z}$

14. $P_{ZD} = (\frac{1}{A_{ZD}})(\alpha_{ZD}^{\sigma_{ZD}} RS^{1-\sigma_{ZD}} + (1-\alpha_{ZD})^{\sigma_{ZD}} RL^{1-\sigma_{ZD}})^{\frac{1}{1-\sigma_{ZD}}}$

15. $S_{ZD} = A_{ZD}^{\sigma_{ZD} - 1} ZD(\frac{\alpha_{ZD} P_{ZD}}{RS})^{\sigma_{ZD}}$

16. $L_{ZD} = A_{ZD}^{\sigma_{ZD}-1} ZD(\frac{\alpha_{ZD} P_{ZD}}{RL})^{\sigma_{ZD}}$

17. $P_{ZM} = (\frac{1}{A_{ZM}})(\alpha_{ZM}^{\sigma_{ZM}} RS^{1-\sigma_{ZM}} + \beta_{ZM}^{\sigma_{ZM}} RL^{1-\sigma_{ZM}} + (1-\alpha_{ZM}-\beta_{ZM})^{\sigma_{ZM}} ((1+tv)P_V)^{1-\sigma_{ZM}})^{\frac{1}{1-\sigma_{ZM}}}$

18. $S_{ZM} = A_{ZM}^{\sigma_{ZM}-1} ZM(\frac{\alpha_{ZM} P_{ZM}}{RS})^{\sigma_{ZM}}$

19. $L_{ZM} = A_{ZM}^{\sigma_{ZM}-1} ZM(\frac{\beta_{ZM} P_{ZM}}{RL})^{\sigma_{ZM}}$

20. $V = A_{ZM}^{\sigma_{ZM}-1} ZM(\frac{(1-\alpha_{ZM}-\beta_{ZM})P_{ZM}}{(1+tv)P_V})^{\sigma_{ZM}}$

Market clear conditions

21. $XS = XC + TRX$

22. $YS = YC + TRY$

23. $\overline{L} = L_X + L_Y + L_{ZD} + L_{ZM}$

24. $\overline{S} = S_X + S_Y + S_{ZD} + S_{ZM}$

25. $P_{WX} TRX + P_{WY} TRY - P_{WV} V = 0$

26. $P_{WX} = \frac{P_X}{ER}$

27. $P_{WY} = \frac{P_Y}{ER}$

28. $P_{WV} = \frac{P_V}{ER}$