Foreign Multinational Production in Canadian Manufacturing Sector

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Abstract: Foreign multinationals play an important role in Canadian economy. Their affiliates accounted for about 50% of manufacturing production and 30% of total business production in Canada. Understanding the linkage between foreign multinational production in Canada and Canada's characteristics (such as scale of economy, human capital endowment, business environment, and trade barriers) can provide useful insights for policy development. Based on the framework developed in Markusen and Maskus' work, this paper examines the determinants of foreign affiliates' production in Canadian manufacturing sector using a panel dataset of 12 parent countries and over 1988 to 2005 period. The paper finds that foreign affiliates' production fits well the knowledge-capital model with production being more of vertical integrated. The result suggests that mainly it is Canada's relative low skill abundance and low labour cost of unskilled workers that attract foreign MNEs.

Keywords: Foreign direct investment, multinationals, Foreign Affiliate

1. Introduction

The world economy has been integrating in an unprecedented way due to rapid development of transportation and information and communication technologies (ICTs), and the widespread adoption of free-market economic policies. Firms are able to implement supply-chain strategies and organize their production process in a more efficient way possible. As a result, more and more firms choose to become multinationals (MNEs) to take the advantage of the current wave of globalization. Currently there are over 70 thousand multinationals (MNEs,) with over 700 thousand foreign affiliates, operating all over the world, more than a four-fold increase since 1990. Global FDI inflows increased from US$ 59 billions in 1982 to over US $1.3 trillion in 2006.

Foreign multinational firms play an important role in Canadian economy. First, production of foreign affiliates represents a significant portion of Canadian business production. As shown in table 1, foreign affiliates in Canada accounted for about 30% of gross output in the total business sector and more than 50% gross output in the manufacturing sector[1]. Their gross operating surplus share is higher than their

[*] The paper is a result of my after-work research effort, continuing on my research at Industry Canada. Views expressed in this paper are my own and do not reflect in any way to those of either Statistics Canada or Industry Canada.

[1] The role of foreign affiliates and the role of FDI are related, but not the same. Foreign affiliates in Canada are firms operating domestically and foreign-controlled (with 50% or more voting power), hence there may be domestic ownership in foreign-controlled firms. On the other hand, there may also be foreign ownership in Canadian-controlled firms.

production share, suggesting that foreign affiliates are more profitable than domestic-controlled forms. Second, empirical studies suggest that foreign-controlled firms have higher productivity than domestic-controlled firms in Canada, mainly due to their higher capital-labour ratio, larger size, more outsourcing of inputs and the use of more advanced technologies[2].In addition, productivity spill over is found in Canada from foreign-controlled firms to domestic-controlled firms, mainly through technical connections, business model copying, enhanced competition, technology transfer and international R&D spillover[3].

Given the significant impact of foreign multinationals on Canadian business performance, it is important for Canadian policy researchers and policy makers to understand the role of Canada's characteristics, such as economic scale, skill endowment, and investment and trade barriers, in the production of foreign multinationals in Canada. This paper attempts to explore what Canada's characteristics encourage foreign multinational production in Canada. Following the framework developed in Carr, Markusen and Maskus (2001) and Markusen and Maskus (2002), this paper creates a panel dataset of foreign affiliates' production in the Canadian manufacturing sector from 12 parent countries over the period of 1988 to 2005 to investigate the impact of Canada's economic size, skilled workers, investment and trade barriers on foreign multinational production in Canada. The main finding of the paper is that foreign affiliates' production in Canada fits well the knowledge-capital model with production being more of vertical-integrated[4].This result indicates that relative scarce of skilled-labour is an important determinant of foreign multinational production in Canada, which is consistent to the fact that Canada's inward FDI from the U.S., the dominate source of FDI to Canada, is more of vertical type as related-party transactions made up 72% of exports of the U.S.-controlled firms based in Canada as shown in Olineck and McMechan (1996). While in the U.S. and major OECD countries, the vertical-model of MNEs is overwhelmingly rejected[5].

Modern theory of MNEs suggests that both firm-specific intangible assets (such as technologies and managerial skills) and country-specific characteristics (such as size and factor endowments) are important factors to firms' decision to be MNEs. The firm-specific assets motivate firms to become MNEs. When a firm is not able to fully appreciate economic rents globally from its specific assets through trade or a contract, it may be optimal for the firm to internalize its market transactions through FDI. On the other hand, country characteristics determine locations and magnitudes of multinational production.

The general equilibrium theory of MNE has distinguished two types of MNEs: vertical- and horizontal-integrated multinationals. A vertical-integrated MNE occurs when a firm locates its vertically-integrated production stages in different countries due to differences of relative factor proportions across countries, see Helpman (1984). For example, a firm can locate its skilled-labour-intensive activities in a country with relatively abundant skilled-labour supply and so forth. The vertical production of MNE usually increases host countries' imports of intermediate materials and exports of final products, implying that inward FDI and trade are complements in countries where vertical FDI dominates, for example see Johnson (2005) for East Asian countries. As a result, lower trade cost in host countries encourages vertical FDI. Also,

[2] See Globerman, Ries and Vertinsky (1994), Baldwin and Dhaliwal (2001), Rao and Tang (2005), and Baldwin and Gu (2005).

[3] See Gera, Gu and Lee (1999), Lileeva (2006) and Gu and Wang (2008).

[4] Theoretical models of MNEs will be discussed later in this section, and how to empirically distinguish the models of MNEs will be discussed in detail in Section 3.

[5] See Markusen and Maskus (2002) for the U.S. and Gao (2003) for OECD countries.

significant differences in relative factor endowments motivate vertical FDI such that the saving from lower cost of production net of extra trade cost is substantial.

The emergence of horizontal-integrated MNEs is based on proximity-concentration hypothesis, see Krugman (1983), Markusen (1984)), Brainard (1993), and Horstmann and Markusen (1992). When the benefits of proximity to markets are significant, a firm will split up its production into small units across countries to serve local markets and hence becomes a horizontal-integrated MNE. The horizontal model of MNEs is motivated by large local markets, high trade costs, similar ratio of factor endowments across countries, low set-up cost and plant-level economies of scale, such that trade cost savings are significant to offset higher cost of foreign production. There are empirical evidences to support the horizontal model of MNEs, for example, see Brainard (1997).

The vertical- and horizontal-models of MNEs have been integrated in the so-called knowledge-capital model by assuming geographical mobility of knowledge[6]. More specifically, knowledge-generating activity and production are substantially different and can be separated geographically from each other. Knowledge-generating activity is highly skill-biased and hence located generally in countries with abundant skills. Knowledge generated can be supplied to production at low cost. Production can be located in one country or multiple countries, depending on the relative benefits of proximity and concentration. Generally speaking, any MNE could involve vertical and horizontal FDI simultaneously. In a general equilibrium framework with two-country, two-factor and two-sector, Markusen et al (1996) and Markusen (1997) show that the vertical and horizontal MNEs can arise endogenously and their numerical simulation results confirm the theoretical predictions that there are more horizontal type of MNE activities among countries with similar size and skill endowments and more vertical type of MNE activities among countries with larger difference in skill endowments. In addition, it is predicted that a smaller and more skill-abundant country outwards more activities, which is the novel feature of the knowledge-capital model. Empirical attempts in Carr, Markusen and Maskus (2001) and Markusen and Maskus (2002) for the U.S. inbound and outbound affiliates' sales and in Gao (2003) for inbound and outbound affiliates' production of OECD countries provide supports to the knowledge-capital model.

The rest of the paper is organized as follows. Section 2 describes briefly foreign affiliates' activities in Canada. Section 3 specifies the regression model, drawing upon Carr, Markusen and Maskus (2001) and Markusen and Maskus (2002). Variables and data sources are described in section 5, and empirical results are presented in section 6. Section 7 concludes the paper.

2. Foreign Affiliates' activities in Canada: a description

Activities of foreign multinational firms play an important role in Canadian economy. The production of foreign affiliates in Canada accounted for a significant part of the total non-agriculture business production in Canada, as shown in table 1. In 2005, the gross output of foreign affiliates in Canada was CA$ 851.3 billion, or about 30% of the gross output of the Canadian total non-agriculture business sector. In the Canadian manufacturing sector, the gross output of foreign affiliates was CA$ 375.5 billion in 2005, accounting for about 44% of total production of foreign affiliates in Canada and more than 51% of

[6] See Markusen et al (1996), Markusen (1997) and Markusen (2002).

Canadian manufacturing production. The importance of the production of foreign affiliates varies considerably across industry in Canada. Its production shares were as high as more than 85% in motor vehicle manufacturing and 76% in Pharmaceuticals, and as low as 15.6% in utilities and construction (table 2).

Over the period of 1988 to 2005, the nominal production of foreign affiliates in Canada grew at an annual rate of 6.5% per year and its share in the Canadian total non-agriculture business production remained more or less constant around 30%. In the meantime, the average annual growth rate of nominal production of foreign affiliates in manufacturing sector was about 4.7%, lower than that for the total non-agriculture business sector. However, the share of the production of foreign affiliates in Canadian manufacturing sector increased from 45.8% in 1988 to 51.2% in 2005.

Foreign affiliates in Canada experienced strong growth in gross operating surplus. Their gross operating surplus increased from CA$ 9.3 billion in the manufacturing sector and CA$ 22.8 billion in the non-agriculture business sector in 1990 to CA$ 25.3 billion and CA$ 76.2 billion in 2005 for the two sectors respectively (table 2). The corresponding average annual growth rates over the period of 1990 to 2005 were 6.9% for the manufacturing sector and 8.4% for the total non-agriculture business sector. In 2005, the share of the gross operating surplus of foreign affiliates in national total was 30.5% in the total non-agriculture business sector, slightly higher than their share of production. However, during the same year, the share of the gross operating surplus of foreign affiliates was 55.2% in the manufacturing sector, 4-percentage-point higher than their share of production, indicating that foreign affiliates were more profitable than domestic-controlled firms in the Canadian manufacturing sector.

R&D spending and production of foreign affiliates in Canada grew at similar pace over the period 1990 to 2004. Their R&D spending increased from CA$1.9 billion in 1990 to CA$ 4.4billion in 2004 in the total non-agriculture business sector, and from CA$1.6billion in 1990 to CA$2.9billion in 2004 in the manufacturing sector. The corresponding average annual growth rates were 6.1% and 4.3%, respectively, slightly lower than the average annual growth rates of the corresponding production. The share of R&D spending of foreign affiliates in Canada was 34.9% in 2004 in the total non-agriculture business sector, significantly higher than their production share; while in the manufacturing sector, the foreign affiliates' share of R&D spending was only 38.3% in 2004, much lower than their share of production. In addition, the foreign affiliates' share of R&D spending declined by 2.2 percentage points in the total non-agriculture business sector and 7.0 percentage points in the manufacturing sector over 1990-2004 period.

3. Econometric specification

Carr, Markusen and Maskus (2001) made the first attempt of empirical examination of the knowledge-capital model of MNEs. Before specifying the econometric model for the purpose of this paper, this section will discuss the econometric specification Carr, Markusen and Maskus (2001) and the modified specification in Markusen and Maskus (2002).

Based on the results of numerical simulation in Markusen (1997), Carr, Markusen and Maskus (2001) assume that affiliate sales (or production) in a host country is a function of GDP and trade costs of both

parent and host countries, investment costs of the host country, and differences in GDP and skill endowments between parent and host countries. Specifically, their specification is

$$\begin{aligned}\text{Real Sales} = {} & \beta_0 + \beta_1(\sum \text{GDP}) + \beta_2(\Delta\text{GDP})^2 + \beta_3(\Delta\text{Skill}) + \beta_4(\Delta\text{GDP})(\Delta\text{Skill}) \\ & + \beta_5(\text{Trade Cost Host}) + \beta_6(\text{Trade Cost Host})(\Delta\text{Skill})^2 \\ & + \beta_7(\text{Investment Cost Host}) + \beta_8(\text{Trade Cost Parent}) + \beta_9(\text{Distance})\end{aligned} \tag{1}$$

Theoretical predictions suggest that the vertical-type (V-type thereafter) outward activities are increasing in the skill difference between parent and host countries and decreasing in host country trade costs, the horizontal-type (H-type thereafter) outward activities are increasing in market size, size and skill similarities, and host country trade costs, and the knowledge-capital-type (K-type thereafter) outward activities is increasing when the parent country is smaller and more skill-abundant. Host country investment costs discourage inbound FDI, and parent country trade costs encourage outbound FDI. Distance is usually an indicator of transportation costs and monitoring and managing costs and hence has negative impact on FDI. The interaction between host country trade costs and the squared skill difference actually weaken the impact of host country trade costs as the two variables have opposite impact on both V-type and H-type activities.

The major problem of the specification (1) is related to the skill difference variable. The skill difference is defined as the skill endowment in the parent country minus the skill endowment in the host country; hence it is positive when parent countries are more skill abundant and negative when host countries are more skill abundant. The positive coefficient of this variable implies that inbound activities are increasing in the skill difference when parent countries are more skill abundant, and decreasing in the skill difference when parent countries are less skill abundant; the former supports V-type activities while the latter supports H-type activities. As a result, the coefficient cannot be used to test whether V-type or H-type activities prevail. Even using the absolute value of skill difference, the problem can only be fixed partially. The negative coefficient of this redefined variable supports H-type model of FDI, but the positive coefficient is meaningless when parent countries are less skill abundant. Another problem of the specification is related to the interaction between the size difference and the skill difference. The positive coefficient of this interaction term indicates smaller and more skill-abundant countries outward more activities that supports K-type model of FDI, but as well implies that larger and less skill-abundant countries outward more activities that contradicts to any type of motivations.

These problems seem to be solved in Markusen and Maskus (2002) in which authors introduced two carefully-designed dummy variables. The first dummy variable takes the value of 1 when the parent country is more skill abundant than the host country and 0 otherwise, and the second dummy variable takes the value of -1 when the parent country is less skill abundant than the host country and 0 otherwise. So the use of first dummy variable is to eliminate those countries with relative fewer skills than a host country, and the use of second dummy variable is to eliminate those countries with relative more skills than a host country. The modified specification in Markusen and Maskus (2002) is

$$\begin{aligned}\text{Real Sales} = {} & \beta_0 + \beta_1(\sum \text{GDP}) + \beta_2(\Delta\text{GDP})^2 + \beta_3(\text{DUMMY1})(\Delta\text{Skill})(\Delta\text{GDP}) \\ & + \beta_4(\text{DUMMY1})(\Delta\text{Skill})(\sum \text{GDP}) + \beta_5(\text{DUMMY2})(\Delta\text{Skill})(\sum \text{GDP}) \\ & + \beta_6(\text{Trade Cost Host}) + \beta_7(\text{Trade Cost Parent}) \\ & + \beta_8(\text{Investment Cost Host}) + \beta_9(\text{Distance})\end{aligned} \tag{2}$$

The authors use the modified model for the U.S. inbound and outbound affiliates' sales and Gao (2003) uses the same model for bilateral affiliates' production of OECD countries. One possible problem in both specifications (1) and (2) is that the total GDP is used to control for the scale effect. As we know, larger countries outward more activities with H-type activities going to larger countries and V-type activities going to skill scarce countries. Therefore, the host country GDP instead of total GDP should be used to test V-type model against H-type model. The use of total GDP, as what has been done in Markusen and Maskus (2002) and Gao (2003), would over-reject V-type model[7]. For this reason, parent and host country GDPs are included separately in the econometric model used in this paper. In addition, the variable of common language, which is a standard variable in Gravity-type of models, is also included. The econometric specification is as the follow.

$$\begin{aligned}Y_{it}^{CA} = {} & \beta_0 + \beta_1\left(GDP_{it}\right) + \beta_2 GDP_t^{CA} + \beta_3\left(\Delta GDP_{it}^{CA}\right)^2 + \beta_4 DUM_1\left(\Delta SK_{it}^{CA}\right)\left(\Delta GDP_{it}^{CA}\right) \\ & + \beta_5 DUM_1\left(\Delta SK_{it}^{CA}\right)\left(\sum GDP_{it}^{CA}\right) + \beta_6 DUM_2\left(\Delta SK_{it}^{CA}\right)\left(\sum GDP_{it}^{CA}\right) \\ & + \beta_7 DIS_i^{CA} + \beta_8 LAN_i^{CA} + \beta_9 INVC_t^{CA} + \beta_{10} TC_{it} + \beta_{11} TC_t^{CA} + \beta_{12} TC_t^{CA}\left(\Delta SK_{it}^{CA}\right)^2 + \varepsilon_{ijt}\end{aligned} \tag{3}$$

With $\sum GDP_{it}^{CA} = GDP_{it} + GDP_t^{CA}$, $\Delta GDP_{it}^{CA} = GDP_{it} - GDP_t^{CA}$, $\Delta SK_{it}^{CA} = SKILL_{it} - SKILL_t^{CA}$

$$DUM_1 = \begin{cases} 1 \text{ if } \Delta SK_{it}^{CA} > 0 \\ 0 \text{ otherwise} \end{cases}, \quad DUM_2 = \begin{cases} -1 \text{ if } \Delta SK_{it}^{CA} < 0 \\ 0 \text{ otherwise} \end{cases}$$

The superscript CA refers to Canada, the only host country. The dependent variable represents real production of affiliates of country i in Canada, and independent variables include total GDP of Canada and source countries, the differences in GDP and relative skill abundance between source countries and Canada, investment costs in Canada, trade costs in Canada and source countries, geographical distance between Canada and source countries, and common official language shared between Canada and source countries.

Now let us discuss the expected signs of all parameters in equation (3) in corresponding to different types of multinational activities. First, the home country GDP is used to control for the scale effect. Countries with higher GDP are expected to outward more activities so β_1 is expected to be positive for all types of activities.

[7] Markusen and Maskus (2002) and Gao (2003) jointly test the coefficients of total GDP and squared GDP difference and both reject V-type model. When using host country GDP instead of total GDP, the test result in Markusen and Maskus (2002) won't change as the coefficient of squared GDP difference is significantly different from zero in the paper.

Second, Canada's GDP and size (GDP) similarity between parent countries and Canada raise H-type activities but have no impact on V-type activities, so β_2 is expected to be positive and β_3 is expected to be negative for H-type activities, and both β_2 and β_3 are expected to be zero for V-type activities. The simulation results in Markusen (1997) show that K-type activities are increasing in size and have the invert U-shape relation with size difference, so β_2 and β_3 have the same signs in K-type model as in H-type model.

Third, because H-type activities reach the maximum when there are no size and skill differences between a home country and Canada, β_4 is expected to be zero in H-type model. On the other hand, the simulation results in Markusen (1997) suggests that smaller and more skill-abundant countries are predicted to have more outward activities, implying that β_4 is negative for both K-type and V-type activities.

Fourth, β_5 corresponds to the source countries with more skills than Canada and β_6 correspond to the source countries with fewer skills than Canada. Given that the skill difference between two countries discourages the H-type FDI from one country to another, both β_5 and β_6 are expected to be negative for H-type activities. On the other hand, more skill abundant countries tend to outsource more V-type and K-type activities, β_5 is expected to be positive and β_6 is expected to be negative for both V-type and K-type activities. Note that the sign of β_5 for K-type activities is predicted to be negative in Markusen and Maskus (2002) but positive in their earlier version of the paper[8]. Gao (2003) argues that the sign of β_5 for K-type activities is ambiguous.

Last, It is straightforward that β_7 and β_9 are negative, and β_8 and β_{10} are positive for all types of activities. The sign of β_{11} is negative for V-type activities due to its induced increase in host country trade and positive for H-type activities due to the substitution between FDI and trade. The sign of β_{12} is opposite to that of β_{11} as discussed earlier in the paper. The predictions of signs of all coefficients are summarized in table 3.

4. Data sources

Data on foreign affiliates' production in Canadian manufacturing sector by investing countries over the period of 1988 to 2005 are obtained from OECD globalisation database. Twelve source countries (Australia, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, the United Kingdom, and the United States) are included in this paper as the data for these countries are available for most of years in the sample period, and these countries accounted for about 96% of total affiliates' manufacturing production in Canada. There are 192 non-missing bilateral observations. The data is in current price of Canadian dollar. It is converted to constant 2000 price using the deflator for

[8] See table 1 in Markusen, J. R. and Maskus, K. E., 1999, "Discriminating Among Alternative Theories of the Multinational Enterprise", NBER Working Paper No. 7164.

Canadian manufacturing gross output obtained from Statistics Canada, and then converted to the U.S. dollar using the Canada-U.S. bilateral exchange rate obtain from OECD national account database.

Country size is measured by GDP and constant U.S. dollar GDP data in 2000 price are obtained from OECD national accounts database. The relative skill abundance is calculated as the ratio of the share of hours worked by high skilled workers to the share of hours worked by low skilled workers, and the hours worked shares by skills are from EU and Canada KLEMS database. There are no data for Norway and Switzerland as they are not EU members. So for the two countries occupation statistics are used. From International Labour Organization (ILO) database occupation statistics can be found, either based on 1988 International Standard Classification of Occupations (ISCO) or ISCO-1968. The relative skill abundance is measured as the share of Group 1 (legislators, senior officials and managers), Group 2 (professionals) and Group 3 (technicians and associate professionals) occupations for ISCO-1988 based data, or the share of Group 0/1 (professional, technical and related workers) and Group 2 (administrative and managerial workers) for ISCO-1968 based data. The skill measure for Norway is ISCO-1968 based over the period of 1988 to 1995 and ISCO-1988 based after 1995; and that for Switzerland is ISCO-1988 based over the period of 1991 to 2005 and extended back to 1988 using the annual average growth rate over the whole period. For the purpose of comparison, two sets of the skill measures are calculated for Canada: KLEMS based and ISCO-1988 based. The skill differences between either Norway or Switzerland and Canada are first calculated using the occupation-based data and then re-scaled using the KLEMS based measure for Canada. The EU-KLEMS based skill measure for Italy is unreasonable high and hence re-scaled using the ISCO-1988 based measure for 2005.

The distance between two countries is the geodesic distances calculated using latitudes and longitudes of the most important cities/agglomerations (in terms of population). Capital cities are used with some exceptions such as Sydney for Australia, Toronto for Canada, Essen for Germany, and New York City for the U.S. The common language dummy equals one when two countries share the same official language(s) and zero otherwise. Both the distance and the common language data are obtained from the webpage of CEPII.

Survey data are used to construct the variables of investment cost in Canada, trade cost in Canada, and trade cost in the investing countries. The World Competitiveness Yearbook 1989-1995 (published by the World Economic Forum and IMD) and 1996-2005 (published by IMD) provide survey indices related to business investment such as cost of capital encourages business development, the legal and regulatory framework encourages the competitiveness of enterprises, adaptability of government policy to changes in the economy is high, bureaucracy does not hinder business activity, bribing and corruption do not exist, protectionism does not impair the conduct of your business, foreign investors are free to acquire control in domestic companies, investment incentives are attractive to foreign investors, competition legislation is efficient in preventing unfair competition, price controls do not affect pricing of products in most industries, and labor regulations (hiring/firing practices, minimum wages, etc.) do not hinder business activities. Higher values of these indices imply lower business investment cost. The simple average of all these indices for Canada is used to indicate Canada's investment cost. The trade cost for Canada and the investing countries is indicated using the simple average of survey indices related to trade barriers such as tariffs and quotas do not hurt, hidden import barriers are not an important problem and prevalence of trade

barriers does not hurt, obtained from The Global Competitiveness Report 1996-2005 (published by the World Economic Forum).

5. Estimation results

Equation (3) is estimated using the feasible GLS with cross-section weights to correct for cross-section heteroskedasticity, as done in Markusen and Maskus (2002) and Gao (2003). The AR (1) term is added to the model due to the concern of autocorrelation over time, and this makes the sample size down to 174. The estimation results are reported in table 4. The specification (1) in the table is the unrestricted knowledge-capital model of MNEs. It can be seen that all parameters, except the coefficient of the squared size difference (β_3), have the same signs as predicted, and the overall fitness is more than 98%. So the unrestricted specification (K-type model) fits the data very well. The coefficients of both parent country GDP and Canada's GDP (β_1 and β_2) are positive but not significant, indicating that size does not play an important role in the foreign affiliates' production in Canadian manufacturing sector. The coefficient of the squared size difference (β_3) has the wrong sign but its magnitude is almost zero, which provides a support to V-type activities. The coefficient β_4 has the right sign (negative) but not statistically significant. The coefficient β_5 is positive and statistically significant, which suggests that more skill-abundant countries outward more V-type activities to Canada when the skill difference is larger. The coefficient β_6 is negative and statistically significant, which is consistent with the prediction for all types of activities. The impact of geographic distance (β_7) is negative and significant and that of common language (β_8)is positive and significant, which is consistent with findings in the literature of trade and FDI. The variable of Canada's investment cost (β_9) has negative and insignificant impact on inbound affiliates' production, and the home country trade cost (β_{10}) encourage outbound production. The trade cost in Canada (β_{11}) has negative and significant impact on inbound affiliates' production, which provides a strong support to V-type model. As predicted, the sign of β_{12} is positive.

The good fit of the unrestricted K-type model indicates that knowledge is mainly generated at home countries and transfers to their affiliates in Canadian manufacturing sector. However, it is still important to understand whether the affiliates' production in Canadian manufacturing sector is dominated by V-type or H-type activities. The coefficients β_2 and β_3 are not significantly different from zero (as shown in table 4), which provides supports to V-type model. The signs and significant levels of β_5, β_{11} and β_{12} are also consistent with the predictions for V-type activities. These evidences strongly suggest that V-type activities dominate in the affiliates' production in Canadian manufacturing sector. However, though the sign of β_4 is consistent with the prediction for V-type activities, the null hypothesis of $\beta_4 = 0$ cannot be rejected and hence weakly supports H-type model.

The specification (2) in table 4 is the restricted V-type model. The estimation results show that all coefficients in the restricted V-type model have the same signs as in the unrestricted K-type model, but the significance of some coefficients including β_5 has been changed. The insignificance of β_5 weakens the

support to the restricted V-type model. The specification test result in table 4 rejects the restricted V-type model against the unrestricted K-type model at 1% level of significant.

The specification (3) in table 4 is the restricted H-type model. Comparing with the unrestricted K-type model, the estimation results of the restricted H-type model are almost unchanged. And the specification test cannot reject the restricted H-type model. However, the signs of β_5, β_{11} and β_{12}, their levels of significance, and the insignificance of β_2 and β_3, provide evidences strongly against H-type model.

Overall speaking, the estimation results suggest that foreign affiliates' activities in Canadian manufacturing sector fit well the knowledge-capital model of MNEs and their production is more of vertical motivated.

6. Conclusion

This paper aims to explore what country characteristics drive the foreign multinational production in Canadian manufacturing sector. The empirical evidences show that the knowledge-capital model of MNEs explains well the Canadian data, implying that knowledge transfer from headquarters plays an important role in foreign affiliates' production in Canadian manufacturing sector. In addition, the evidences strongly support V-type model, meaning that foreign affiliates' production in Canadian manufacturing sector is mainly vertical integrated. The results are not surprising as Canada relatively has more (and hence cheaper) unskilled labour than major developed countries, and multinational enterprises are attracted to Canada to seek higher economic rent. Over the period of 1988 to 2003, the relative skill abundant in Canada on average is only higher than Norway, France and Italy, and lower than other 9 countries, as shown in Chart 1. The average labour compensation per hour of unskilled workers in Canada is the second lowest among 10 countries in Chart 2, only higher than Italy.

The estimation results in this paper provide useful and important background for policy development. The empirical results in this paper indicate that it may be mainly the Canada's low labour cost that attracts foreign MNEs to come and use Canada's unskilled labour force. Therefore, any factors that raise the labour cost of unskilled workers in Canada may weaken foreign MNEs' incentives to locate their production activities in Canada and hence may result in production and employment cutbacks. Canada's labour cost advantage is facing competition from countries that are more skill-scarce and have much lower labour cost such as Mexico, China and other emerging economies. Another big challenge is possible appreciation of Canadian dollar that can easily wipe out Canada's labour cost advantage. Comparing with emerging economies, Canada has institutional advantage such as low trade and investment barriers. Further improving the institutional advantage can put Canada in a better position to attract foreign MNEs as implied in this paper as well as in Golub et al (2003) and Ghosh, Syntetos and Wang (2007).

A possible issue related to bilateral country specifications of MNE models including the one used in this paper is the assumption that outward activities from one parent country to a host countries are not depend on characteristics of other host countries. But actually MNEs compare different locations and choose the best one. However, to what extent such interdependence still shows up in the MNE models at an aggregate level is an open question, as discussed in Blonigen (2005).

References

Baldwin, J. and W. Gu (2005). Multinationals, Foreign Ownerships and Productivity Growth in Canadian Manufacturing, *the Canadian Economy in Transition Series*, Statistics Canada, Catalogue no. 11-622-MIE2005009.

Baldwin, J. and N. Dhaliwal (2001). Heterogeneity in Labour Productivity Growth in Manufacturing: Differences between Domestic and Foreign-Controlled Establishments, In *Productivity Growth in Canada*, Statistics Canada Analytical Studies Branch, Catalogue no. 15-204-XPE.

Blonigen, B. A. (2005). A Review of the Empirical Literature on FDI Determinants, NBER Working Paper, #11299.

Brainard, S.(1993). A Simple Theory of Multinational Corporations and Trade with Trade-off between Proximity and Concentration, NBER Working Paper, #4269.

Brainard, S. (1997). An Empirical Assessment of the Proximity-Concentration Trade-off between Multinational Sales and Trade, *American Economic Review*, 87(4):520-44.

Carr, D., L., J. R. Markusen and K. E. Maskus (2001). Estimating the Knowledge-Capital Model of the Multinational enterprise, *American Economic Review*, 91(3): 693-708.

Gao, T.(2003). Multinational Activity and Country Characteristics in OECD Countries, *Applied Economics Letters*, vol. 10, pp. 255-258.

Gera, S., W. Gu and F. Lee (1999). Foreign Direct Investment and Productivity Growth: The Canadian Host-Country Experience, Working Paper #30, Industry Canada.

Ghosh, M., P. Syntetos and W. Wang (2007). Impact of FDI Restrictions on Inward FDI in OECD Countries, *mimeo*, Industry Canada.

Globerman, S., J. Ries and I. Vertinsky (1994). The Economic Performance of Foreign Affiliates in Canada, *Canadian Journal of Economics*, 27, 143-156.

Golub, S., N. Giuseppe, D. Hajkova, D. Mirza, and K. Yoo (2003). Policies and International Integration: Influences on Trade and Foreign Direct Investment, OECD Economics Department Working Papers, #359.

Gu, W. and Y. Wang (2008). FDI and Productivity Growth: The Role of Inter-Industry Linkages, *mimeo*.

Helpman, E. (1984). A Simple Theory of Trade with Multinational Corporations, *Journal of International Economics*, v. 92, pp. 451-71.

Helpman, E. (1984). A Simple Theory of Trade with Multinational Corporations, *Journal of International Economics*, v. 92, pp. 451-71.

Horstmann, I. J., and J. R. Markusen (1992). Endogenous Market Structure in International Trade, *Journal of International Economics*, Vol. 32, pp. 109-129.

Johnson, A. (2005). Host Country Effects of Foreign Direct Investment: The Case of Developing and Transition Economies, Dissertation Series *#031*, Jönköping International Business School.

Krugman, P. R. (1983). The 'New Theories' of International Trade and the Multinational Enterprise, in C. P. Kindelberger and D. B. Audretsch (eds), *The Multinational Corporation in the 1980s*, MIT Press: Cambridge.

Markusen, J. R. (1984). Multinationals, Multi-Plant Economies, and the Gains from Trade, *Journal of International Economics*, vol. 16, pp. 205-266.

Markusen, J. R., A. J. Venables, D. Eby-Konan and K. H. Zhang (1996). A Unified Treatment of Horizontal Direct Investment, Vertical Direct Investment and the Pattern of Trade in Goods and Services, NBER Working Paper No 5696.

Markusen, J. R. (1997). Trade versus investment liberalization, NBER Working Paper No. 6231.

Markusen, J. R. (2002). *Multinational Firms and the theory of International Trade*, Cambridge, MA: MIT Press.

Markusen, J. R. and K. E. Maskus (2002). Discriminating Among Alternative Theories of the Multinational Enterprise, *Review of International Economics*, 10(4):695-707.

Olineck, C. and J. McMechan (1996). The Globalization of Canadian Merchandise Trade, Insights on…. Spring 1996: 7–10, Statistics Canada Catalogue no. 61F0019XPE.

Rao, S. and J. Tang (2005). Foreign Ownership and Total Factor Productivity in *Governance, Multinationals and Growth* edited by L. Eden and W. Dobson, pp. 100-21, Edward Elgar, UK and USA.

Table 1. Foreign Affiliates' activities in Canada

	Manufacturing				Total business			
	1990	**1995**	**2000**	**2005***	**1990**	**1995**	**2000**	**2005***
Production								
Level (billion)	179.1	254.5	331.9	375.5	318.9	447.6	694.5	851.3
As % of national total	47.1	51.2	49.9	51.2	30.3	30.1	30.1	29.9
Gross operating surplus								
Level (billion)	9.3	19.2	29.3	25.3	22.8	31.2	58.0	76.2
As % of national total	52.6	50.2	54.7	55.2	30.0	26.7	30.2	30.5
R&D spending								
Level (billion)	1.6	1.8	2.6	2.9	1.9	2.4	3.6	4.4
As % of national total	45.3	37.2	31.0	38.3	37.1	29.7	29.3	34.9

*: The year of 2004 for R&D spending.
Source: OECD Globalisation database.

Table 2. Production of Foreign Affiliates in Canada by industry (ISIC REV. 3), as % of national total

Code	Industry	2000	2001	2002	2003	2004	2005
10/14	Mining and quarrying	48.5	46.5	47.4	54.8	51.6	46.2
15/37	Total manufacturing	49.9	51.9	51.5	51.2	51.0	51.2
15/16	Food, beverages and tobacco	41.9	42.2	41.7	42.3	41.9	44.0
17/19	Textiles, wearing apparel, leather, footwear	18.9	18.4	17.4	15.8	16.9	17.3
20/22	Wood and paper products, publishing, printing	27.6	26.7	26.9	27.2	26.7	27.8
23/25	All chemical products	63.7	64.0	61.3	62.2	62.4	62.3
26	Non-metallic mineral products	59.1	63.8	58.1	61.7	61.9	61.4
27/28	Basic and fabricated metal products	25.6	25.5	28.9	26.4	27.2	26.1
29/30	Non-electrical machinery and equipment	23.9	26.3	31.0	30.0	26.8	28.7
31/32	Electrical machinery and electronic equipment	41.7	70.5	69.0	70.0	68.6	67.0
33	Medical, precision, opt. instruments; watches	20.9	21.7	26.2	28.7	22.1	21.1
34	Motor vehicles	88.7	88.2	87.9	86.4	85.7	85.3

35	Other transport equipment	36.2	32.4	27.4	29.6	37.9	40.8
36/37	Furniture, manufacturing n.e.c.; recycling	11.2	14.3	19.1	17.5	19.5	19.5
40/45	Electricity, gas and water supply; construction	16.2	17.7	12.8	13.7	13.5	15.6
50/55	Trade, repair; hotels and restaurants	25.6	24.0	24.2	24.5	25.7	26.0
65/74	Finance, insurance, real estate, business act.	20.3	19.7	20.1	20.8	19.6	18.8
	Other activities	8.1	7.7	9.0	8.9	10.6	11.0
01/99	**Total business enterprise**	30.1	29.7	29.5	29.9	30.0	29.9

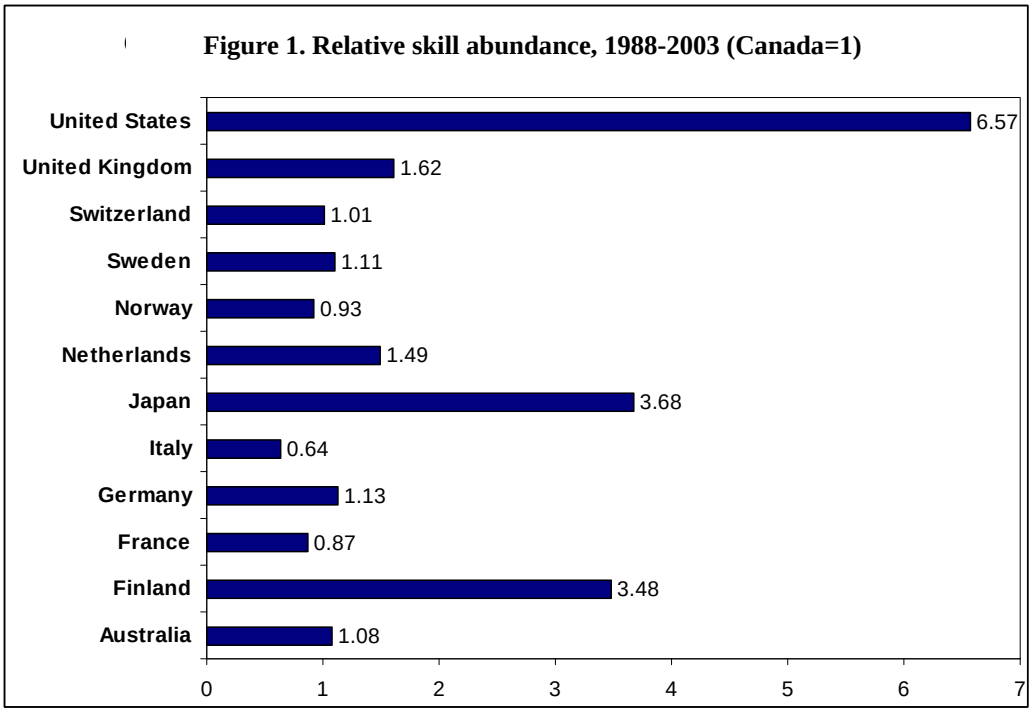
Source: OECD Globalisation database.

Table 3. Predictions of signs of all coefficients for the three types of activities

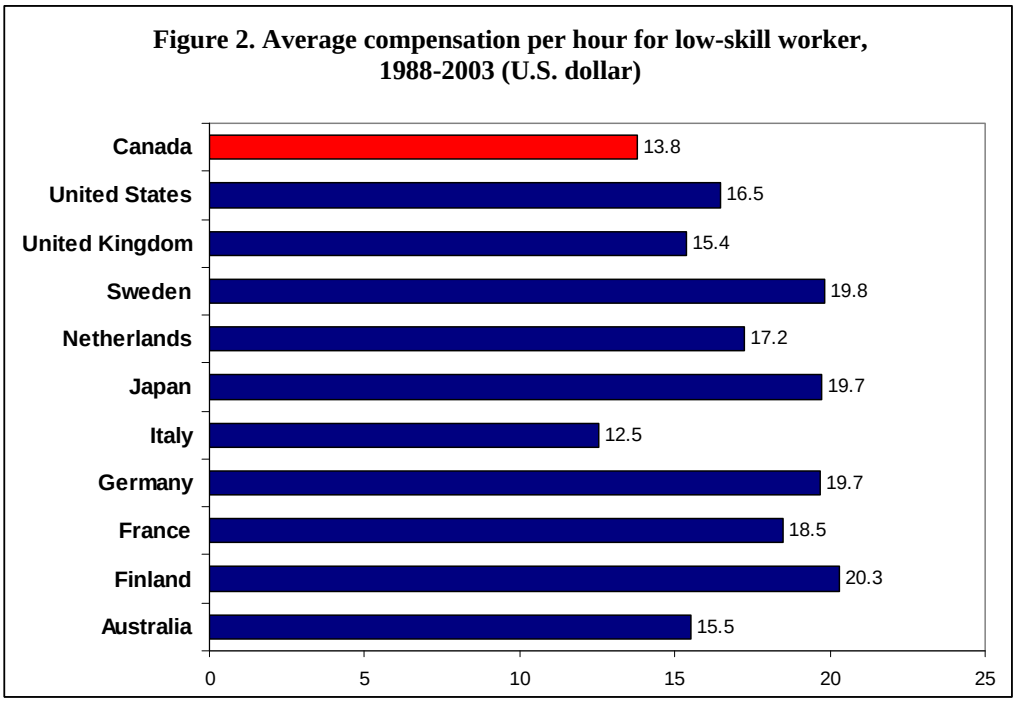
Variables and Coefficients		V-type	H-type	K-type
GDP parent country	β_1	+	+	+
GDP Canada	β_2	0	+	+
Squared GDP Diff	β_3	0	-	-
Dummy1* Skill Diff * GDP Diff	β_4	-	0	-
Dummy1* Skill Diff * GDP Sum	β_5	+	-	+
Dummy2* Skill Diff * GDP Sum	β_6	-	-	-
Distance	β_7	-	-	-
Common language	β_8	+	+	+
Investment cost in Canada	β_9	-	-	-
Parent country trade cost	β_{10}	+	+	+
Trade cost in Canada	β_{11}	-	+	?
Trade cost in Canada * Squared Skill Diff	β_{12}	+	-	?

Table 4. Feasible GLS estimation results

	(1)		(2)		(3)	
	Coefficient	**P-value**	**Coefficient**	**P-value**	**Coefficient**	**P-value**
Intercept	52408.4	0.0454**	66814.9	0.0888*	53583.8	0.0451**
β_1	0.0034	0.1124	0.0050	0.0063***	0.0033	0.1287
β_2	0.0011	0.5862			0.0006	0.7701
β_3	4.09E-10	0.2755			4.07E-10	0.2768
β_4	-3.16E-6	0.7614	-1.35E-6	0.9016		
β_5	1.82E-5	0.0696*	1.56E-5	0.1359	1.57E-5	0.0356**
β_6	-2.70E-5	0.0108**	-2.39E-5	0.0605*	-2.61E-5	0.0196**
β_7	-6298.0	0.0423**	-7818.4	0.0826*	-6332.5	0.0454**
β_8	6737.9	0.0292**	7458.9	0.1039	6671.1	0.0321*
β_9	-25.30	0.3314	-26.22	0.3064	-25.18	0.3295
β_{10}	94.18	0.0082***	94.47	0.0111**	94.83	0.0085***
β_{11}	-174.2	0.0009***	-156.4	0.0040***	-167.8	0.0011***
β_{12}	0.0265	0.0500**	0.0205	0.1373	0.0231	0.0285*
AR1	0.9640	0.0000***	0.9748	0.0000***	0.9648	0.0000***
Adjusted R^2	0.9842		0.9832		0.9841	
Observation	174		174		174	
DW test	2.01		2.03		2.02	
Specification Test	(2) against (1)		F-Statistics = 6.47		P-value = 0.0018***	
	(3) against (1)		F-Statistics = 0.00		P-value = 1.0000	



Source: The author's compilation based on data from EUKLEMS database, International Labour Organization and Statistics Canada.



Source: The author's compilation based on data from EUKLEMS database and Statistics Canada.

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