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Kiyoyasu Tanaka

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Hi-Stat
Institute of Economic Research
Hitotsubashi University
2-1 Naka, Kunitatchi Tokyo, 186-8601 Japan
http://gcoe.ier.hit-u.ac.jp

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Kiyoyasu Tanaka*

Institute of Economic Research
Hitotsubashi University
Email: tanakak@ier.hit-u.ac.jp

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Abstract

This paper re-estimates the knowledge-capital model by James Markusen (2002) to study market access and factor endowment explanations of foreign direct investment (FDI). I add to the literature by combining consistent datasets on Japanese and U.S. multinational enterprises (MNE) in the period 1989-2002. To reduce potential bias, the prior specification of the knowledge-capital model is augmented with a number of additional control variables and estimated with a system GMM estimator. In the pooled sample, I find that both market access and relative skill endowments matter for the pattern of foreign affiliate sales. When separately estimating Japanese and US samples, the evidence shows that Japanese MNEs are encouraged by relative unskilled-labor abundance in a host country, consistent with a vertical motive of FDI. In contrast, U.S. MNEs concentrate on skill abundant countries, which is in favor of horizontal FDI. These findings imply that combining datasets on multinational activities with heterogeneous motives of FDI is critical for finding evidence of the knowledge-capital model.

Keywords: Multinational firm, foreign direct investment, market access, factor endowment

JEL classification: F21, F23

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1. Introduction

The rise of foreign direct investment (FDI) has been a prominent aspect of the globalization over the recent decades. The average growth rate of world FDI flows exceeded over 20 % per year in the period 1986-2000 and outpaced the growth rates of world income and international trade. The global production by multinational enterprises (MNE) accounted for 10 % of world output in 2005, as measured by the value added of all foreign affiliates as a share of world GDP (UNCTAD, 2006).

The theory of multinational firms focuses primarily on market access and factor-cost motives of FDI. Some MNEs are horizontally integrated by replicating the same production process in multiple countries to economize on transportation and trading costs of international trade (Markusen, 1984; Brainard, 1993; Markusen and Venables, 1998, 2000). Other MNEs are vertically integrated by geographically fragmenting stages of production to take advantage of international factor-price differences (Helpman, 1984; Helpman and Krugman, 1985). More recently, the knowledge-capital model (KC model) developed by Markusen (1997, 2002) encompasses both horizontal and vertical motives of FDI in a two-country general equilibrium. The model allows for the simultaneous existence of vertical and horizontal MNEs by assuming both trade costs and different factor intensities across production stages.

While the KC model integrates two separate motives of FDI in a coherent framework, a recent body of empirical work provides mixed evidence for the vertical part of the KC model. Consistent with a factor-cost motive, some studies find that MNE activity is positively influenced by international differences in relative skill endowments and larger in relatively unskilled-labor-rich countries (Carr, Markusen, and Maskus, 2001, hereafter CMM; Braconier, Norbäck, and Urban, 2005, hereafter BNU). Yet, others find that MNE operations are greater in more skill abundant countries (Brainard, 1997; Markusen and Maskus, 2001, 2002; Blonigen, Davies, and Head, 2003, hereafter BDH;). These mixed results raise the questions of whether MNEs pursue horizontal and/or vertical strategies in overseas production. What country

characteristics determine the pattern of affiliate activity? Does the KC model explain the rapid expansion of multinationals?

This paper reconsiders market access and factor endowment explanations of FDI by exploring three potential sources in the literature that may lead to the mixed support for the KC model: MNE data, policy influences, and endogeneity problems. First, most studies are based on US data of inward and outward affiliate sales (CMM, 2001; Markusen and Maskus, 2001, 2002; BDH, 2003). This may lead to skewed results because the US is by far larger than any other economy and among the most skill abundant countries. On the other hand, affiliate data collected from various national sources may have substantial variations in the survey qualities by source and year (BNU, 2005).[1] To construct a consistent dataset with a variety of country pairs, I combine new panel data on sales by foreign affiliates of Japanese MNEs with existing US MNE data over the period 1989-2002. Systematic differences across the data sources are controlled by parent-country fixed effects. I also construct another measure of MNE activity by excluding affiliate exports to the third country from total sales to mitigate a nuisance third-country effect in estimation.

Second, multinational activity has been influenced by recent policy changes characterized by a shift from protectionism toward FDI to liberalization and promotion of MNE, but previous studies focus on a limited number of explanatory variables.[2] An empirical specification is augmented with a number of extra conditioning variables that may affect multinationals: a common language, a land border, landlocked countries, island nations, regional trade agreements, bilateral investment treaties, bilateral tax treaties, tax sparing agreements, euro currency, and financial crises. Third, I employ the system generalized-method-of-moments (GMM) estimator developed by Blundell and Bond (1998) to address previously unexplored endogeneity issues.

[1] See Lipsey (2003) for a survey on the concept, measurement, and data of FDI.

[2] The number of international investment agreements such as bilateral investment and double taxation treaties reached almost 5500 at the end of 2005, which consisted of 2495 bilateral investment treaties, 2758 double taxation treaties, and 232 other agreements that contain investment provisions (UNCTAD, 2006).

The GMM estimation also extends previous findings on the KC model by investigating whether an exogenous component of key variables affects multinational activity.

Robust to a wide variety of alternative specifications, I find little evidence that affiliate sales are higher in relatively *unskilled-labor-rich* countries in a pooled Japanese and US sample. The vertical part of the KC model is not supported by the pooled data. However, I find in separate Japanese and US samples that Japanese affiliate sales are *larger* in relatively unskilled-labor-abundant countries but US affiliate sales are *smaller* in such countries. This finding helps in explaining weak support for vertical MNE in previous literature that uses almost exclusively the US data.

I confirm that market access plays a key role in determining a pattern of affiliate sales. The benchmark results suggest that (1) a 1 billion dollar increase in total GDP levels of home and host countries expands affiliate sales by 20 million dollars, (2) a 1 billion dollar increase in GDP differences between these countries reduces affiliate sales by 11 million dollars, and (3) a one-percentage-point increase in trade barriers as measured by a survey index of protectionism raises affiliate sales by 90 million dollars. These findings lend considerable support for the horizontal part of the KC model.

Section 2 overviews the theory and evidence on the KC model. Section 3 discusses three main improvements in empirical strategies: a largely augmented specification, new panel data on Japanese MNE with data sources on independent variables, and a brief description of a system GMM estimator. Section 4 contains the results. Section 5 concludes.

2. Theory and Evidence on the Knowledge Capital Model

The KC model developed by Markusen (1997, 2002) is a two-country general equilibrium model that allows for both horizontal and vertical MNEs. The model assumes two homogeneous goods (X and Y), two countries (home and foreign), and two homogeneous input factors, unskilled and skilled labor. Good Y is unskilled-labor-intensive and produced under

constant returns to scale in a competitive industry. Good X is skilled-labor-intensive and produced under increasing returns to scale, and producers are subject to Cournot competition with free entry and exit. Firms in this sector have headquarters services (blueprints, management, R&D, etc.) and production facilities. Trade costs exist for international trade and markets are segmented. In this structure, three types of firms may emerge; (1) horizontal MNE headquartered in the home country maintain production facilities in both countries, (2) vertical MNE headquartered in the parent nation have a single plant in the foreign country, which may export to home, and (3) national firms have headquarters services and a single plant in the home country, which may export to the foreign country.

Knowledge capital plays a key role in the existence of multinational firms. First, a parent firm can simultaneously supply headquarters services to both domestic and foreign plants at low cost due to a joint-input property of knowledge capital. The additional cost of building a second plant is small relative to the cost of establishing a new firm with a headquarters and plant abroad. Multi-plant economies of scale generate a cost advantage for horizontal MNE. Second, headquarters services are more skilled-labor intensive than production activities and can be geographically fragmented from production facilities. Different factor intensities and separability of knowledge capital generate a cost advantage for vertical MNE.

Based on numerical simulations, the KC model generates key predictions on the aggregate pattern of MNE activity as a function of characteristics of both parent and host countries. First, the theory predicts that affiliate production should be larger in the presence of greater factor-price differentials across countries, which are partly driven by differences in relative skill endowments. More specifically, when a host country is skill abundant relative to a parent nation, there is little incentive for firms to establish foreign plants because unskilled workers for production are too costly abroad. As the host country becomes moderately *unskilled-labor abundant*, a decline in the relative cost of skilled workers at home and unskilled workers in the foreign country encourages headquarters activity and foreign production of

horizontal MNE. A further decline in host-country skill abundance creates larger unequal factor prices across countries, which in turn promote vertical MNE to exploit much cheaper unskilled labor abroad. Thus, MNE activity should be larger in less skill abundant countries relative to parent nations and vice versa.

Second, a factor-price motive combines with the market size effects to further expand affiliate production because multinationals have an incentive to concentrate production in a large market for plant-level economies of scale. Particularly, larger market size allows vertical firms to sell the greater proportion of final output in a local market and reduce trade costs to import products back to home. MNE activity should be more pronounced in skilled-labor-scarce countries that have larger markets relative to parent nations.

Third, the total market size of home and host countries positively affects affiliate activity. When the total market size is larger, national firms with high marginal costs in serving foreign markets are replaced by horizontal MNEs with high fixed costs. Fourth, differences in the market size discourage production by multinationals. When market sizes are largely different, horizontal MNEs with high fixed costs are replaced by national firms that prefer the large country as a site of production to avoid costly production capacity in the small market.

Previous work focuses primarily on these implications of the KC model and evaluates the relative importance of a factor-cost motive by exploring the effects of relative skill endowments on MNE activity. The study by CMM (2001) estimates a specification that includes skill differences defined as the ratio of skilled labor to total labor force in a home country minus that in a host country and an interaction term between skill differences and market-size differences. Using panel data on US inbound and outbound affiliate sales in 1986-1994, they find that affiliate sales are positively correlated with the skill differences and its positive impact is more pronounced in relatively large host markets. An additional support for the vertical motive is provided by BNU (2005), who specify skill differences as the relative unskilled-labor abundance in a host country compared to a home nation and use data on affiliate sales with expanded country

coverage. However, data on affiliate sales developed from a diverse set of national sources may not be internationally comparable.

In contrast, when skill differences in the CMM's specification are defined as the absolute value to avoid a sign reversal in the difference term, larger skill differences reduce affiliate sales in the CMM's data (BDH, 2003).[3] The evidence in favor of the horizontal, rather than vertical, part of the KC model is further added by Markusen and Maskus (2001), who find that the levels of US outward affiliate sales disaggregated by destination markets are greater in more skill abundant countries. Markusen and Maskus (2002) show that the horizontal and KC model performs well in explaining a pattern of aggregate MNE activity, but the vertical model is a poor characterization of such activity.

However, these studies are almost exclusively based on US data of multinational activity in which the US involves either a parent country or a host country in every observation. In addition, most work does not fully address a variety of other important determinants of FDI and pay little attention to endogeneity of key regressors. These weaknesses may lead to biased estimates for key regressors. In sum, all of these concerns leave open the question of whether relative skill endowments affect multinational activity.

3. Empirical Strategy

3.1. Specification

Previous studies on the KC model have focused on a relatively small number of explanatory variables and omitted other important determinants of FDI. In order to reduce omitted variables bias, I largely augment a specification for a parent and host country i and j at time t:

[3] Carr et al. (2003) criticize the absolute value specification suggested by BDH because it imposes symmetry restrictions on affiliate sales between countries. They suggest that separating samples either for inbound and outbound US affiliate sales or for positive and negative skill differences is a more reasonable way to overcome the sign reversal issue.

$$RSALE_{ijt} = \beta_0 + \beta_1 SKILL_{ijt} + \beta_2 SKLGDPDF_{ijt} + \beta_3 GDPSUM_{ijt} + \beta_4 GDPDIFSQ_{ijt} + \beta_5 TC_{jt} + \beta_6 IC_{jt} + \beta_7 DIST_{ij} + \beta_8 CML_{ij} + \beta_9 BORD_{ij} + \beta_{10} LANDL_j + \beta_{11} ISLAND_j + \beta_{12} RTA_{jt} + \beta_{13} BIT_{ijt} + \beta_{14} BTT_{ijt} + \beta_{15} TSP_{ijt} + \beta_{16} EURO_{jt} + \beta_{17} CRIS_{jt} + \beta_{18} JPMNE + \Sigma_t \gamma_t T_t + \eta_{ij} + \varepsilon_{ijt} \quad (1)$$

- *RSALE* is the real volume of sales by affiliates of i in j at time t.
- *SKILL* is the relative skilled-labor abundance in i compared to j at t.
- *SKLGDPDF* is an interaction term between *SKILL* and the difference in real GDP levels between i and j at t.
- *GDPSUM* is the sum of real GDP levels of i and j at t.
- *GDPDIFSQ* is the square of differences in real GDP levels in i minus that in j at t.
- *TC* is trade costs for foreign products imported to j at t.
- *IC* is investment costs for multinational operations in j at t.
- *DIST* is the distance in kilometers between the capital cities in i and j.
- *CML* is a binary variable equal to one if i and j have a common language.
- *BORD* is a binary variable equal to one if i and j share a national border.
- *ISLAND* is a binary variable equal to one if j is an island nation.
- *LANDL* is a binary variable equal to one if j is a landlocked nation.
- *RTA* is a binary variable equal to one after j joins a regional trade agreement at t.
- *BIT* is a binary variable equal to one after a bilateral investment treaty between i and j enters into force at t.
- *BTT* is a binary variable equal to one after a bilateral tax treaty between i and j becomes effective at t.
- *TSP* is a binary variable equal to one after a tax sparing agreement between i and j enters into force at t.
- *EURO* is a binary variable equal to one after j introduces the euro at t.
- *CRIS* is a binary variable equal to one if j has a financial crisis in t-1.
- *JPMNE* is a binary variable equal to one if i is Japan.
- T_t is a set of time fixed effects, with γ_t a vector of the coefficients.
- η_{ij} is a country-pair fixed effect.
- ε_{ijt} is an error term, which is assumed to be $N(0, \sigma^2)$.

This paper addresses the main hypothesis that MNE activity motivated partly by factor price differentials should be larger in more unskilled-labor-rich host countries relative to home nations. This key prediction is captured by the *SKILL* variable. Following BNU (2005), the variable is defined as follows:

$$SKILL = \frac{SK\ Home}{SK\ Home + SK\ Host} \times \frac{USK\ Home + USK\ Host}{USK\ Home} \quad (2)$$

where SK Home and SK Host are skilled labor in home and host countries, and USK Home and USK Host are unskilled labor in home and host nations.[4] A rise in *SKILL* implies an increase in skilled-labor abundance of the home country relative to the host country or a rise in unskilled-labor abundance of the host country relative to the parent country. An expected sign of *SKILL* is positive.

An interaction term between *SKILL* and GDP differences captures the theoretical prediction that a positive influence of skill endowments on MNE activity should be more pronounced in larger countries. Since a rise in the relative size of host markets corresponds to a decline in GDP differences between home and host countries, an expected sign of *SKLGDPDF* is negative. These first two terms are key regressors to identify a vertical motive of Japanese and US MNEs.

Horizontal motives of MNE activity are captured primarily by *GDPSUM*, *GDPDIFSQ*, and *TC*. As explained in the previous section, the KC model predicts that *GDPSUM* and *GDPDIFSQ* should have positive and negative coefficients, respectively. Higher inward trade costs in the host country promote horizontal MNE that invest abroad for the savings of trade costs. An expected sign of *TC* is positive. Investment barriers deter MNE entry into host markets, and *IC* should have a negative coefficient. Distance between countries is a proxy not only for transport costs between countries but for information and monitoring costs on business operations in the foreign country. An expected sign of *DIST* is unclear.

As is common in the gravity model of international trade (Rose, 2004), I include time-constant country characteristics such as a common language (*CML*), a land border (*BORD*),

[4] It is controversial whether the effects of skill endowments should be captured by differences in relative skill endowments across countries or by the absolute value of skill differences (Carr et al., 2003; BDH, 2003). *SKILL* is used to avoid the problem that a rise in skill differences implies a *divergence* in relative skill endowments when a parent nation is *more* skill abundant but a *convergence* when a parent country is *less* skill abundant.

and island (*ISLAND*) and landlocked status (*LANDL*).[5] Since *CML* reduces business transaction costs in foreign countries for multinationals, it should have a positive coefficient. BORD facilitates production networks by linking parent and affiliate firms through land transportations, and an expected sign of *BORD* is positive. On the other hand, island nations lack the means of land transportation to nearby markets and incur higher transportation costs to regional markets. A predicted sign of *ISLAND* is negative. Lastly, landlocked nations are disadvantageous to marine transportation for a lack of ocean ports. An expected impact of *LANDL* is negative.

A rich body of empirical work investigates the effects of international investment agreements on multinationals. My study is distinctive in that MNE activity are measured more directly by affiliate sales than FDI flows and stocks used in most studies. Regional trade agreements (*RTA*) consist of trade liberalization within the region and investment liberalization toward foreign investors (Blomström and Kokko, 1997). Falling internal trade costs and the larger size of regional markets may expand affiliate exports to integrated countries. The investment liberalization contains the elimination of discriminatory policies against foreign firms as well as dispute resolution mechanisms, which may reduce investment barriers to FDI. An expected sign of *RTA* is positive.

The common objective of bilateral investment treaties (*BIT*) is to protect the property rights of foreign investors by improving the standard of legal protection, assuring compensation for the expropriation by host governments, and establishing dispute settlement mechanisms (Egger and Pfaffermayr, 2004; Hallward-Driemeier, 2003). *BIT* should have a positive effect on affiliate sales.[6] On the other hand, bilateral tax treaties (*BTT*) have ambiguous influences on MNE activity (Blonigen and Davies, 2004). *BTT* play a role in reducing double taxation on profits arising from business operations in a foreign country and eliminating tax avoidance of

[5] For US MNE, a common language includes English-speaking countries and a land border contains Canada and Mexico.

[6] Japan and the US have signed *BIT* with 10 and 45 host countries by the year 2002, respectively. The vast majority of these signatories represent the developing countries.

multinationals that are able to shift taxable profits from high to low tax countries. While a reduction of tax distortions may promote MNE activity in host signatories, tax treaties also weakens an incentive of MNE to invest abroad for tax minimization reasons.

Tax sparing agreements (*TSP*) are designed to resolve tax issues faced primarily by the developing countries that attempt to attract foreign investment through fiscal incentives such as tax exemptions (Hines, 2001; Azémar et al., 2006). A major issue is that the fiscal incentives do not necessarily reduce a tax burden of multinationals who claim a foreign tax credit in their home country. For instance, Japan has the worldwide tax system that provides a foreign tax credit to Japanese firms for the taxes already paid in foreign countries in order to avoid double taxation.[7] Under a tax credit rule, the tax savings from fiscal benefits by host governments merely decrease the amount of the foreign tax credit that multinational firms can claim, making their after-tax profits unchanged. To avoid this, *TSP* allow firms to claim a foreign tax credit for additional income that have been spared by fiscal grants in foreign countries. A predicted sign of *TSP* is positive.

Monetary economic events affect MNE activity. The common currency such as the euro (*EURO*) decreases transaction costs within the member countries and stimulates trade flows in the region (Rose, 2004). While falling internal trade costs expand affiliate exports to regional markets, they may stimulate multinationals to concentrate their production in lower cost countries within the monetary union.[8] An expected sign of *EURO* is ambiguous. On the other hand, the financial crises (*CRIS*) affect MNE operations through two channels as argued by Lipsey (2001); the stagnation in a host market might decrease local sales of foreign affiliates and the devaluation of a local currency could raise their export sales. The expected sign of *CRIS* is unclear. The predicted signs for the independent variables are summarized as follows:

[7] Japan signed the first tax sparing agreement with Pakistan in 1959 and maintained tax sparing provisions in force with 13 countries at the end of 2000, with most of these countries concentrated in Asia. In contrast, the US does not grant tax sparing provisions.

[8] Aristotelous (2005) examines the effects of euro currency on US FDI flows into the European Monetary Union members.

[Table 1 around here]

3.2. Data

Empirical work on multinationals has always faced a trade-off between data consistency and country coverage. The more data are collected from a variety of national sources, the less consistent the data are due to deviations in measurement of foreign affiliate activity and the varying qualities across and within sources. For example, a survey on overseas business activities of Japanese parent firms is annually collected by the Ministry of Economy, Trade, and Industry (METI). Since responding to the METI survey is not mandatory for parent firms, the official data on Japanese MNE are known to suffer from low response rates of around 60 %, varying samples of parent firms over time, and widely fluctuating sales at the affiliate level (Lipsey, 2003).

To improve the Japanese survey data, Matsuura (2004) constructs panel data at the affiliate level and estimates missing sales for certain affiliates in the years 1989-2002.[9] Affiliate sales in the improved data are aggregated over manufacturing sectors to the country level. To expand country coverage, I also exploit data on foreign affiliates of US parent firms in nonbank manufacturing from the U.S. Bureau of Economics Analysis (BEA). Affiliate sales of Japanese and US MNEs are measured in millions of year 2000 US dollars using the average of Yen-dollar annual exchange rates in the 1989-2002 period and a US wholesale price index from the *International Financial Statistics* of the International Monetary Fund.

To check for consistency between the RIETI and BEA datasets, aggregate sales by Japanese manufacturing affiliates in the US from the RIETI source are compared with those from the *Foreign Direct Investment in the United States* published by the BEA. I find that Japanese affiliate sales from the RIETI are overestimated by 71.9 % on average for 1989-2002, compared

[9] The RIETI data are available at http://www.rieti.go.jp/jp/database/d08.html. See Matsuura (2004) for details.

to the BEA source.[10] Since such a discrepancy between Japanese and US affiliate sales would be higher (lower) in the larger (smaller) country. I control for the systematic differences in the data by a dummy variable for Japanese MNE.

I construct an alternative measure of MNE activity that excludes affiliate exports to a third country from total sales because the KC model is formulated in a two-country setting. The RIETI reports local sales and exports to a home country as a share of Japanese affiliate total sales. The sum of these sales is aggregated across manufacturing industries to the country level. I exploit the BEA data on local sales and export to home by the US majority-owned foreign affiliates (MOFA).[11] The sum of sales to local and home markets is measured in millions of US dollar analogously as affiliate total sales. Summary statistics and a list of countries included in regressions are shown in the appendix.

Standard data sources are used for the independent variables. Data on skill endowments are taken from the *Yearbook of Labor Statistics* published by the International Labor Organization (ILO). Skilled labor in each country is defined as the sum of workers classified as occupational categories 0/1 (professional, technical, and related workers) and categories 2 (administrative workers). Unskilled labor is defined as the total labor minus the skilled labor.[12] Data on real GDP measured in billions of year 2000 US dollars are taken from the *World Development Indicators*.[13]

Trade costs are measured by an index of national protectionism on imports from the *World Competitiveness Report* jointly published by the International Institute of Management Development (IMD) and the World Economic Forum for 1989-1995 and the *World Competitiveness Yearbook* by the IMD for 1996-2002. The index is developed from an extensive business survey that measures the perceptions of multinational managers on the business

[10] The deviations across the data sources may be due to survey methods, the survey quality, and the definition of foreign subsidiaries.

[11] MOFA are the foreign business enterprise in which the combined ownership of all US parents exceeds 50 %.

[12] Data appendix for details in constructing the skill variable is available upon request.

[13] Taiwan GDP data are taken from the Department of Commerce, Taiwan.

environment across countries. Trade cost is defined to range from zero to 100, with a higher number indicating greater trade barriers. Investment cost is a simple average of several survey indices from the same source. Investment cost is defined to range from zero to 100, with a higher value indicating larger investment barriers. Investment impediments include foreign investment restrictions, limitations on negotiating joint ventures, restrictions on hiring and firing practices, a lack of the fair administration of justice, limited accessibility of local and foreign capital markets, inadequate protection of intellectual property rights.

Data on distance measured in kilometers between capital cities of home and host countries are from the International Trade Data website of Raymond Robertson (formerly maintained by Jon Haveman). Data on a common language are from the same website. I use the CIA's *World Factbook* for a land border, island and landlocked nations. I exploit data from the World Trade Organization to construct an indicator for 4 regional trade agreements: EU, NAFTA, ASEAN Free Trade Area (AFTA), and Mercosur.[14] Information on bilateral investment treaties is taken from the *Bilateral Investment Treaties 1959-1999* published by the United Nations.[15] Whether *BIT* enters into force after signature is checked by the official websites of Japan and the US.

Data on bilateral tax treaties for Japan and the US are taken from the International Bureau of Fiscal Documentation and Blonigen and Davies (2004), respectively. Data from Azémar et al. (2006) and OECD (1998) are used to create an indicator of tax sparing agreements for Japan.

[14] The European Union (EU) was formed when the Maastricht Treaty was signed in February 1992 and entered into force in November 1993. The North America Free Trade Area (NAFTA) is defined to encompass the Canada-US Free Trade Agreement (CUFSTA) that came into effect in January 1989. The ASEAN Free Trade Area (AFTA) was signed in January 1992 and came into force in January 1993. The Common Market of the South (Mercosur) began when the Treaty of Asunción was signed in March 1991.

[15] Available at http://www.unctad.org/en/docs/poiteiiad2.en.pdf. It presents bilateral country names, date of signature, and date of entry into force during the period 1959-1999.

Eleven members of the EU introduced the euro as a common currency in 1999 and Greece adopted the euro in 2001.[16] Financial crises include Mexico in 1994 and East Asia in 1997.

3.3. Estimation Issues

A concern in estimating a vertical motive of MNE is potential endogeneity of the dependent variable and host-country skill endowments.[17] Multinationals play a growing role in the global production, and affiliate activity may affect the skill composition of overseas employment. Such a concern is particularly relevant for skill-scarce countries in which vertical MNEs primarily arise to exploit factor cost differentials. Multinationals may hire highly skilled labor in the skill-scarce country possibly because such workers have high labor productivity per output. It is likely that MNE activity may shift host-country skill abundance upward and reduce the *SKILL* variable. Such an endogeneity problem would bias the coefficient of *SKILL* downward and make it difficult to identify the vertical motive of MNE in non-experimental data.

The GMM estimator developed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998) offer an alternative solution to correct for endogeneity problems in panel data. To illustrate, I start by taking the first difference of equation (1) to eliminate country-pair fixed effects. Under the assumption that the error term in equation (1) has no serial correlation (I test this assumption), I create an instrument matrix of two to four period lagged levels of endogenous variables (skill endowments, GDP levels, and trade and investment costs) and lagged levels of exogenous variables (all other regressors). The GMM estimator then exploits a set of moment conditions that consist of the instrument matrix and the matrix of differenced error terms.

[16] Among these countries, my sample includes Austria, Belgium, Finland, Germany, Ireland, Italy, Netherlands, Portugal, Spain, and Greece.

[17] I also take into account endogeneity of GDP levels, and perceived trade and investment costs in GMM estimation.

To improve efficiency, Blundell and Bond (1998) develop a system GMM estimator by further assuming that changes in any instrumenting variables are uncorrelated with the country-pair fixed effects. Using equation (1), the system GMM estimator creates an additional instrument matrix of lagged changes of endogenous variables and current changes of exogenous variables. The new instrument matrix and the matrix of the composite error terms of country-pair fixed effects and idiosyncratic errors then provide an addition set of moment conditions that can be exploited to obtain consistent and efficient estimates of the coefficients.

I report a two-step estimator that is asymptotically efficient and robust to heteroskedasticity and arbitrary patterns of autocorrelation within country pairs. Since the parameters' standard errors in the two-step estimator are known to be severely downward biased in a finite sample, a small-sample correction for the two-step standard errors developed by Windmeijer (2005) is employed. In addition, I conduct specification tests to check the validity of instruments used: the Hansen test of overidentifying restrictions (Hansen, 1982) and Arellano-Bond test for autocorrelation. These statistics test the joint validity of the moment conditions and second-order autocorrelation of differenced errors, respectively.

4. Estimation Results

4.1. Benchmark Results

The benchmark results for equation (1) are presented in Table 2. Column (1) excludes additional controls and column (2) adds in a large number of such controls, with affiliate total sales as a dependent variable. Column (3) replaces total sales with sales to local and home markets in order to mitigate third-country influences. Since the presence of heteroskedastic errors is detected in initial regressions by a Breusch-Pagan test, these specifications are estimated by a weighted-least-squares (WLS) estimator with the squared sum of GDP levels as the weight. Robust standard errors are reported. Column (4) employs a system GMM estimator for affiliate

total sales to resolve potential endogeneity of skill endowments, GDP levels, and trade and investment costs.

There are several notable results in Table 2. First, the coefficient of *SKILL* is not statistically different from zero across specifications.[18] Aggregate Japanese and US affiliate sales are not positively associated with relative unskilled-labor abundance in a host country compared to a parent nation. This contrasts sharply with previous work on the KC model; differences in relative skill endowments between countries have a significantly positive impact on sales by US outward and inward affiliates (CMM, 2001), the skill differences have a significantly negative effects on US outward affiliate sales (BDH, 2003), and the *SKILL* variable in BNU (2005) has a significantly positive coefficient in an enlarged dataset on affiliate sales.

[Table 2 around here]

A major difference in my paper from previous work is that new panel data on Japanese MNEs are combined with US data. As shown later, since US multinationals concentrate primarily on skill abundant countries, US affiliate sales tend to be *discouraged* by the relative unskilled-labor abundance in a host market compared to the US. On the other hand, since Japanese multinationals have relatively large sales in less skilled-labor abundant nations, Japanese affiliate sales tend to be *encouraged* by the relative unskilled-labor abundance in a host country compared to Japan. Pooling Japanese and US samples may cancel these opposite effects out, possibly leading to the insignificant coefficient estimates.

The interaction term of *SKILL* and GDP differences does not enter with significance across specifications except for column (3). Although the interaction is intended to capture the prediction that vertical MNE activity should be more pronounced in relatively large host markets, my sample does not cover relatively skilled-labor-scarce countries that are larger than Japan and

[18] I find mixed evidence for a vertical motive in the regressions that replace *SKILL* with the skill difference term that is created from the ILO data and from the Barro-Lee's data on educational attainment of people over age 25. These results are available upon request.

the US. It may be difficult to find an interactive effect of skill endowments and relative market sizes in my data.

Consistent with previous literature, the total market size has significantly positive coefficients. Column (2) imply that a 1 billion dollar increase in bilateral GDP levels raises affiliate total sales by 20 million dollars. Since much of variations in GDP sum are due to host-country GDP levels, I also calculate a marginal effect of the host market size on affiliate sales, evaluated at the mean of *SKILL* and GDP difference.[19] The implied marginal effect suggests that a 1 billion dollar increase in the host market size raises affiliate total sales by 30 million dollars. Thus, the results confirm the previous findings that multinational sales are strongly encouraged by the market size.

The square of GDP differences has a significantly negative impact on affiliate sales. Column (2) suggests that affiliate sales increase by 11 million dollars as GDP differences decrease by 1 billion dollars, when a marginal effect is evaluated at the mean of *SKILL* and GDP differences.[20] Consistent with the finding in CMM (2001), a convergence in the bilateral market size increases affiliate sales, holding the total market size constant. The KC model implies that horizontal MNEs with high fixed costs replace national firms with lower marginal costs in serving countries of similar size.

Host-country trade costs have significantly positive coefficients in columns (2) and (3). The Second column suggests that a one-percentage-point increase in the trade cost index raises total affiliate sales by 90 million dollars. The results support horizontal motives of FDI to economize on costs of international trade by local production. In sum, the benchmark results produce an expected sign pattern for the market-access variables with sensible magnitudes and lend considerable support for horizontal, rather than vertical, motives of multinational activity.

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[19] ∂Rsale / ∂GDP Host = 19.5 + 0.0008*2*GDP Difference + 1.25*Skill = 30.2 at the mean values of the independent variables.

[20] ∂Rsale / ∂GDP Difference = − 0.0008*2*GDP Difference − 1.25*Skill = − 10.7 at the mean values of the independent variables.

Several additional findings are evident. Many of extra control variables enter with significance in regressions and an F-test statistic rejects the null of zero slopes at the one percent significance level. Omitting these important variables may lead to insignificant coefficients of trade costs in column (1). The results in column (3) for affiliate sales excluding exports to a third country are reasonably similar to those in column (2) for total sales, even when the same host countries are used in unreported regressions. This suggests that country determinants of multinational activity approximated by a bilateral relationship are relatively robust to third-country influences.

In column (4), the validity of instruments for suspected endogenous regressors is supported by moderate p-values of a Hansen test and a serial correlation test. Although the coefficient of *SKILL* is insignificant in GMM estimation, the larger GMM estimate implies that endogeneity problems may bias the WLS estimates of *SKILL* downward. In contrast, I find that a significantly positive coefficient of the GDP-sum variable is robust to potential endogenous bias. This confirms a positive market effect on affiliate sales.

5.2. Log Specification

The benchmark results support the horizontal part of the KC model by showing a strongly positive effect of market size on affiliate sales. Since an estimating equation is fairly similar to early work, the results illustrate the importance of Japanese MNE data, extra control variables, and a system GMM estimator. However, the regression results may be driven by highly skewed data on affiliate sales in which some observations have extremely large values. I explore the robustness of the results by specifying equation (1) in a log-linear form to improve the skewed data. Note that an interaction term of *SKILL* and GDP differences must be dropped for perfect collinearity. For multicollinearity issues, I use host-country GDP levels in place of GDP sum and the square of GDP differences.

Columns (1)-(4) of Table 3 present the results in a log specification for the corresponding columns of Table 2. A notable finding is that the coefficients of *SKILL* are significantly *positive* in column (1) but a significantly *negative* in column (2) that includes extra control variables. This suggests that the positive coefficient of *SKILL* in column (1) may pick up positive influences subsumed in the error term and would suffer from omitted variables bias. Such a concern is more pronounced by the fact that many of time-varying dummy variables such as regional trade agreements enter with significance in column (2). Since *SKILL* has insignificant coefficients in columns (3) and (4), the results show little evidence for a vertical motive of MNE activity.

[Table 3 around here]

The pattern of sign and statistical significance for the other main and control variables is generally consistent with those in the benchmark results. Affiliate sales are larger in larger host markets with higher inward trade barriers while they are smaller in higher investment-cost countries that are more distant from a parent country. Adjusted R-squares in a log specification have declined compared to those in the corresponding specification in Table 2, suggesting that equation (1) is a preferred specification. Overall, my sensitivity analysis confirms the benchmark results that support market access, rather than factor-cost, motives of FDI.

5.3. Japanese versus US MNEs

All of my regressions to this point have assumed identical effects of country determinants across Japanese and US MNEs that may mask heterogeneity across these multinational behaviors. I examine this by estimating a log specification separately for Japanese and US samples with common host countries.[21] Regional trade agreements are decomposed into NAFTA, EU, AFTA, and Mercosur to relax the assumption that they have the same effect on

[21] The Japanese sample includes the US, and the US sample contains Japan. The exclusion of these countries from the data does not change the results in a noteworthy way.

MNE activity. Note that a land-border dummy is omitted in the US regressions for multicollinearity with the NAFTA dummy.

Columns (1) and (2) of Table 4 report the WLS estimation for Japanese and US samples by using a log of host-country GDP as the weight to alleviate scale effects of market size. Columns (3) and (4) show the fixed-effects (FE) estimation for the corresponding samples to distinguish the time-series contributions to the WLS results.[22] The WLS estimates for *SKILL* are significantly *positive* for Japanese MNEs but significantly *negative* for US MNEs, suggesting that Japanese affiliate sales are larger in *less* skill-abundant countries but US affiliate sales are larger in *more* skill-abundant countries.[23] That Japanese MNEs may have stronger vertical motives than do US MNEs is also supported by the FE results that *SKILL* has a significantly positive coefficient only for the Japanese sample. The elasticity of Japanese affiliate sales with respect to *SKILL* lies between 1.1 and 3.3 while it is between -1.2 and 1.1 for US affiliate sales.

[Table 4 around here]

The finding that US MNEs are attracted to skill abundant countries is consistent with previous work such as Markusen and Maskus (2001, 2002), and BDH (2003). My analysis shows that Japanese MNEs primarily seek *less*-skilled labor overseas and may have stronger vertical motives than do US MNEs. This confirms the finding in Eaton and Tamura (1994) that host-country education has stronger effects on US outward FDI stock than Japanese outward FDI. My study is distinctive in that Japanese MNE activity measured by affiliate sales is lower in skill abundant countries.

The coefficient of market size is larger for Japanese MNEs than it is for US MNEs in the WLS estimation, and vice versa in the FE estimation. This implies that Japanese MNEs are

[22] Since the number of country pairs relative to periods is small in separate Japanese and US data, a system GMM estimator is not employed for a concern about a small samples bias. Endogeneity is a less serious concern in comparing the coefficients of key regressors across Japanese and US MNEs *if* the coefficients are biased in the same manner.

[23] The results are robust to the specifications in which alternative measures of *SKILL* are considered, including a ratio of skilled labor to the total labor and Barro-Lee's educational attainment levels in a host country. These results are available upon request.

more likely to consolidate offshore production in a large country, and US MNEs tend to respond more strongly to the growth of local markets. The KC model predicts that country size should be more important for vertical MNEs than it is for horizontal MNEs because vertical firms incur larger transport costs in smaller markets by shipping back the greater proportion of final output to their home country. In the short run, the host market growth is more important for local sales associated with horizontal MNEs than export sales by vertical MNEs. Thus, the results bolster the idea that Japanese MNEs may have stronger vertical motives than do US MNEs.

Host-country trade and investment costs discourage Japanese affiliate sales more strongly than US affiliate sales. Trade barriers generally encourage horizontal MNEs but deter vertical MNEs that may transport intermediate goods to their foreign affiliates for further processing. Investment impediments are more deterrent to vertical than horizontal FDI, as Yeaple (2003) finds that business barriers are more detrimental to export sales than local sales for US outward affiliate sales. Thus, the results on trade and investment costs also imply that vertical motives may be stronger for Japanese than US MNEs.

Turning to time-constant country characteristics, affiliate sales are discouraged by the greater distance between countries but promoted by a common language and island nations.[24] Landlocked nations do not affect affiliate sales. Time-varying country characteristics display the varying impact on affiliate sales across specifications, and I focus on the FE estimates that are less biased in estimating dynamic effects. Japanese MNE activity grew within countries with regional trade agreements more rapidly than did US MNE activity. For example, Japanese affiliate sales increased in the ASEAN free trade area by (exp(0.48) – 1≈) 61.6 %, compared to (exp(0.19) – 1≈) 20.9 % for US affiliate sales.[25]

Bilateral investment agreements increased US affiliate sales but had no effect on Japanese affiliate sales. Bilateral tax treaties decreased Japanese affiliate sales but raised US

[24] Island nations in the regressions include Australia, New Zealand, Philippines, and Singapore, which may explain a larger coefficient for Japanese MNEs.

[25] AFTA in the regressions contains Malaysia, Philippines, Singapore, and Thailand.

affiliate sales. Tax sparing agreements with Japan entered into force for Turkey in 1994 and Mexico in 1996, and Japanese affiliate sales were 0.8 times larger in these countries after tax sparing provisions were in place.[26] This estimated effect is small relative to the elasticity found in Hines (2001) that lies between 1.4 and 2.4 for cross-sectional data on Japanese outward FDI stocks. Lastly, the euro currency is negatively correlated with US affiliate sales while financial crises show no significant effect on MNE activity.

5. Conclusion

This paper reconsiders market access and factor endowment explanations of MNE activity by estimating the knowledge capital model of Markusen (2002) for a new panel dataset on Japanese and US MNEs in the period 1989-2002. Similar to previous weak support for a vertical motive of FDI, my empirical results provide little evidence that relative skill endowments affect affiliate sales in a pooled Japanese and US sample. But the results confirm that market access plays a key role in MNE activity. This conclusion is robust to a variety of alternative specifications such as the inclusion of a number of control variables, the alternative dependent variable of affiliate total sales, and the use of a system GMM estimator. It is also robust to a log specification of an estimating equation.

However, econometric analysis for separate Japanese and US samples present strikingly contrasting results for the pattern of Japanese and US affiliate sales. My estimates suggest that a 1 % increase in host-country unskilled-labor abundance relative to a home country raises Japanese affiliate sales by 1.1-3.3 % but may *decrease* US affiliate sales by 1.2 %. Japanese MNEs that have relatively large sales in less skill abundant countries follow the pattern consistent with a vertical motive of FDI, whereas the pattern of US MNEs that concentrate in more skill abundant countries is consistent with a horizontal motive of FDI. This finding may help in

[26] The elasticity of Japanese affiliate sales with respect to tax sparing agreements is $\exp(0.60)-1 \approx 82.2$ %.

explaining why relative skill endowments have little effects on affiliate sales in a pooled sample and previous literature on the KC model using US MNE data provide mixed support for the relative importance of vertical motives.

This study also finds that multinational activity is influenced by a variety of policies such as regional trade agreements, bilateral investment and tax treaties, and tax sparing agreements, with varying impacts on Japanese and US affiliate sales. For instance, bilateral tax treaties had negative dynamic effects on Japanese MNEs but increase US affiliate sales. Tax sparing agreements raise Japanese affiliate sales by 0.8 % in signatory countries but have no effect on US MNEs since the US does not grant tax sparing provisions. All of these results indicate that Japanese and US MNEs may pursue different expansion strategies. Future research is to explore the particular reasons for this difference between Japanese and US MNE behaviors. An investigation of more disaggregated data on affiliate sales should also extend this paper's findings.

Table 1: Variables and Expected Impacts on Affiliate Sales			
Skill	+	Island nation	-
Skill × GDP difference	-	Landlocked nation	-
GDP sum	+	Regional trade agreement	+
GDP difference squared	-	Bilateral investment treaty	+
Trade cost	+	Bilateral tax treaty	+/-
Investment cost	-	Tax sparing agreement	+
Distance	+/-	Euro currency	+/-
Common language	+	Financial crisis	+/-
Land border	+		

Table 2: Benchmark Results for Pooled Sample on Japanese and US Affiliate Sales

	(1) WLS	(2) WLS	(3) WLS	(4) GMM [a]
	Total Sales	Total Sales	Sales to Host and Home	Total Sales
Skill	3968	5742	13439	9077
	(9516)	(7616)	(9424)	(31059)
Skill × GDP difference	-0.070	-1.247	-3.359**	-6.448
	(1.839)	(1.465)	(1.641)	(6.526)
GDP sum	19.66***	19.46***	14.14***	20.75***
	(1.129)	(1.013)	(1.071)	(2.691)
GDP difference squared	-0.0009***	-0.0008***	-0.0002	-0.0006
	(0.0002)	(0.0002)	(0.0001)	(0.0006)
Trade cost	-21.50	93.58**	235.6***	-175.1
	(44.79)	(42.48)	(63.40)	(174.7)
Investment cost	-178.6***	-353.2***	-459***	61.78
	(49.82)	(49.63)	(77.91)	(319.9)
Distance	-1.645***	-1.204***	-1.251***	-1.092**
	(0.151)	(0.091)	(0.117)	(0.514)
Common language		8194***	9214***	6729
		(2323)	(2321)	(13236)
Land border		67864***	62451***	83015**
		(7942)	(7583)	(35605)
Island nation		1318	-1903	1346
		(951.6)	(1404)	(6948)
Landlocked nation		-4287***	-12791***	605.9
		(1010)	(2477)	(4622)
Regional trade agreement		1833**	5182***	2237
		(875)	(1257)	(3743)
Bilateral investment treaty		-7203***	-4370*	-5878
		(1273)	(2471)	(3727)
Bilateral tax treaty		-6768***	-5710***	-3882
		(694.9)	(1057)	(3963)
Tax sparing agreement		6727***	6089***	12764*
		(1020)	(1417)	(6603)
Euro currency		-6743***	-9161***	-4940
		(1992)	(2362)	(5165)
Financial crisis		-2594	-2209	1941
		(4969)	(3880)	(2682)
Number of observations	827	827	567	827
R^2	0.61	0.76	0.72	
Root MSE	14630	11525	12139	
Hansen test (p-value) [b]				0.54
Serial correlation test (p-value) [c]				0.14

Notes: Robust standard errors shown in parentheses; two-step standard errors in GMM corrected for a small sample bias; the weight in WLS being the squared sum of GDP; intercepts and dummies for Japanese MNE and year unreported.

*** Significant at 1 %; ** significant at 5 %; * significant at 10%.

a: The number of instruments and country pairs are 50 and 84, respectively.

b: The null hypothesis is that the instruments are not correlated with the residuals.

c: The null hypothesis is that the errors in the differenced equation have no second order serial correlation

Table 3: Log Specification for Pooled Sample on Japanese and US Affiliate Sales

	(1) WLS	(2) WLS	(3) WLS	(4) GMM [a]
	Total Sales	Total Sales	Sales to Host and Home	Total Sales
Skill	1.291***	-0.752**	0.008	-1.442
	(0.392)	(0.316)	(0.270)	(2.723)
GDP Host	0.903***	1.098***	0.762***	0.829**
	(0.047)	(0.042)	(0.042)	(0.330)
Trade cost	-0.249	-0.172	0.363***	-0.105
	(0.163)	(0.160)	(0.119)	(0.461)
Investment cost	-0.401*	-0.423*	-0.916***	-0.185
	(0.213)	(0.219)	(0.177)	(0.679)
Distance	-0.843***	-0.682***	-0.468***	-0.734***
	(0.063)	(0.080)	(0.061)	(0.276)
Common language		0.319**	0.253**	0.036
		(0.149)	(0.108)	(0.419)
Land border		-0.077	0.985***	0.133
		(0.240)	(0.183)	(0.685)
Island nation		1.161***	0.687***	1.224***
		(0.111)	(0.093)	(0.309)
Landlocked nation		0.044	-0.729***	-0.242
		(0.246)	(0.182)	(0.706)
Regional trade agreement		0.343***	0.361***	0.323
		(0.107)	(0.083)	(0.267)
Bilateral investment treaty		-0.614***	-0.239*	-0.517
		(0.171)	(0.133)	(0.570)
Bilateral tax treaty		-1.001***	-0.896***	-0.577
		(0.110)	(0.091)	(0.441)
Tax sparing agreement		1.923***	0.685***	1.395**
		(0.164)	(0.139)	(0.630)
Euro currency		-0.601***	-0.201	-0.325
		(0.215)	(0.176)	(0.334)
Financial crisis		0.672*	0.127	0.069
		(0.370)	(0.308)	(0.153)
Number of observations	827	827	567	827
R^2	0.48	0.66	0.62	
Root MSE	1.48	1.20	0.78	
Hansen test (p-value) [b]				0.29
Serial correlation test (p-value) [c]				0.59

Notes: Robust standard errors shown in parentheses; two-step standard errors in GMM corrected for a small sample bias; the weight in WLS being a logarithm of host GDP; intercepts and dummies for Japanese MNE and year unreported; all regressors (except dummies) defined in logarithms.
*** Significant at 1 %; ** significant at 5 %; * significant at 10%.

a: The number of instruments and country pairs are 42 and 84, respectively.

b: The null hypothesis is that the instruments are not correlated with the residuals.

c: The null hypothesis is that the errors in the differenced equation have no second order serial correlation

Table 4: Log Specification for Separate Samples on Japanese and US Affiliate Sales

	(1) WLS Japan	(2) WLS US	(3) FE Japan	(4) FE US
Skill	1.057*	-1.198***	3.268***	1.140
	(0.542)	(0.424)	(1.044)	(1.298)
GDP host	1.537***	1.063***	0.585	1.952***
	(0.094)	(0.056)	(0.456)	(0.211)
Trade cost	-0.842***	-0.091	-0.148	-0.126**
	(0.295)	(0.165)	(0.126)	(0.059)
Investment cost	-0.596	-0.375*	-0.670*	-0.332***
	(0.362)	(0.221)	(0.355)	(0.128)
Distance	-0.370***	-0.407***		
	(0.118)	(0.091)		
Common language		0.491***		
		(0.151)		
Island nation	1.132***	0.265*		
	(0.211)	(0.153)		
Landlocked nation	0.467	-0.234		
	(0.415)	(0.209)		
NAFTA	0.483	0.655**	0.316*	0.194***
	(0.294)	(0.278)	(0.180)	(0.074)
EU	-0.724***	0.523***	0.229**	0.124**
	(0.245)	(0.165)	(0.115)	(0.061)
AFTA	1.809***	1.449***	0.479***	0.189**
	(0.255)	(0.145)	(0.168)	(0.091)
Mercosur	-0.259	0.287**	-0.108	-0.155**
	(0.335)	(0.137)	(0.126)	(0.077)
Bilateral investment treaty	-1.009***	-0.318**	0.198	0.540***
	(0.266)	(0.142)	(0.170)	(0.107)
Bilateral tax treaty	-1.539***	-0.465***	-0.298**	0.142**
	(0.205)	(0.114)	(0.143)	(0.066)
Tax sparing agreement	1.562***		0.598***	
	(0.184)		(0.188)	
Euro currency	-0.338	-0.202	-0.254	-0.170***
	(0.351)	(0.219)	(0.166)	(0.045)
Financial crisis	-0.388	0.030	-0.160	-0.088
	(0.523)	(0.234)	(0.095)	(0.115)
Number of observations	438	384	438	384
Number of country pairs			41	41
R^2	0.64	0.73	0.23	0.78
Root MSE	1.34	0.70	0.50	0.17

Notes: Robust standard errors shown in parentheses; the weight in WLS being a logarithm of host GDP; intercepts and year dummies unreported; all regressors (except dummies) defined in logarithms.

*** Significant at 1 %; ** significant at 5 %; * significant at 10%.

Data Appendix

Table A1: List of countries

Argentina	Egypt	Malaysia	Slovak Republic
Australia	Finland	Mexico	South Africa
Austria	Germany	Netherlands	Spain
Belgium	Greece	New Zealand	Sweden
Brazil	Hong Kong	Norway	Switzerland
Canada	Hungary	Pakistan	Taiwan
Chile	Ireland	Philippines	Thailand
China	Israel	Poland	Turkey
Colombia	Italy	Portugal	United Kingdom
Czech Republic	Japan	Russia	United States
Denmark	Korea	Singapore	Venezuela

Table A2: Data sources

Variable	Source
Affiliate total sales	Japanese affiliate data from the Research Institute of Economy, Trade and Industry (RIETI), Japan; U.S. affiliate data from U.S. Bureau of Economic Analysis
Affiliate sales to home and host countries	Same as above
Skill	Yearbook of Labor Statistics, International Labor Organization
GDP	World Development Indicator, World Bank
Trade cost	World Competitiveness Report and World Competitiveness Yearbook, World Economic Forum and IMD
Investment cost	Same as above
Distance	Raymond Robertson's website (http://www.macalester.edu/~robertson/)
Common language	Same as above
Land border	CIA's World Factbook
Island nation	Same as above
Landlocked nation	Same as above
Regional trade agreement	WTO website (http://www.wto.org/index.htm)
Bilateral Investment treaty	Bilateral Investment Treaties 1959-1999, UN (2002) (www.unctad.org/en/docs/poiteiiad2.en.pdf)
Bilateral tax treaty	International Bureau of Fiscal documentation; Blonigen and Davies (2004)
Tax sparing agreement	Azémar et al. (2006); OECD (1998)
Euro currency	EU website (http://europa.eu/index_en.htm)
Financial crisis	Lipsey (2001)

Table A3: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Level specification					
Affiliate total sales	827	21364	39071	1.936	242349
Sales to host and home	567	20782	36177	299.0	223707
Japanese affiliate sales	438	13611	34477	1.936	242349
US affiliate sales	384	30482	42168	676.7	195949
Skill	827	1.046	0.170	0.501	1.792
GDP sum	827	6896	2452	3945	14782
GDP difference	827	5856	2496	-5282	9982
GDP host country	827	519.7	1219	20.22	10032
Trade cost	827	29.38	13.09	3.70	81.41
Investment cost	827	31.51	11.38	12.29	62.97
Distance	827	8779	3860	733	18373
Log specification					
Affiliate total sales	827	8.557	2.038	0.661	12.398
Sales to host and home	567	9.090	1.272	5.700	12.318
Japanese affiliate sales	438	7.806	2.189	0.661	12.398
US affiliate sales	384	9.460	1.354	6.517	12.186
Skill	827	0.032	0.160	-0.692	0.584
GDP host country	827	5.375	1.127	3.007	9.214
Trade cost	827	3.272	0.486	1.308	4.399
Investment cost	827	3.381	0.379	2.508	4.143
Distance	827	8.943	0.605	6.597	9.819

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