The determinants of offshore production by Multinational Corporations (MNCs) : a comparison of Japanese and US MNCs

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Toshiyuki Matsuura, Kiyoyasu Tanaka*
Shujiro Urata

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Keywords: Multinational firm, FDI, Japan, U.S., skill endowment
JEL classification: F21, F23

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* Corresponding author: Kiyoyasu Tanaka. Address: Economic Integration Studies Group, Inter-Disciplinary Studies Center, Institute of Developing Economies, 3-2-2 Wakaba, Mihama-ku, Chiba-shi, Chiba 261-8545 Japan. Phone: 81-43-299-9755; Fax: 81-43-299-9763. E-mail: kiyoyasu_tanaka@ide.go.jp

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INSTITUTE OF DEVELOPING ECONOMIES (IDE), JETRO
3-2-2, WAKABA, MIHAMA-KU, CHIBA-SHI
CHIBA 261-8545, JAPAN

The Determinants of Offshore Production by Multinational Corporations (MNCs): A Comparison of Japanese and U.S. MNCs[*]

Toshiyuki Matsuura
Institute for Economic and Industrial Studies, Keio University
Kiyoyasu Tanaka[†]
Inter-Disciplinary Studies Center, Institute of Developing Economies
Shujiro Urata
Graduate School of Asia-Pacific Studies, Waseda University

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Abstract

This study employs confidential *affiliate-level* panel data to improve measures of foreign affiliate activities of Japanese firms in manufacturing sectors. Combining existing data on U.S. MNCs with the Japanese data, we illustrate the pattern and determinant of their foreign affiliate sales by destination market across countries and industries for the period 1989-2005. Among our results, Japanese and U.S. MNCs are similar in the substantial growth of their foreign affiliate sales and the importance of sales to local markets. However, Japanese MNCs are distinctive from U.S. MNCs in that Japanese affiliate sales in Asia were prominently higher in host markets with lower educational attainment.

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[†] Kiyoyasu Tanaka. Address: Economic Integration Studies Group, Inter-Disciplinary Studies Center, Institute of Developing Economies, 3-2-2 Wakaba, Mihama-ku, Chiba-shi, Chiba 261-8545 Japan. Phone: 81-43-299-9755; Fax: 81-43-299-9763.
E-mail: kiyoyasu_tanaka@ide.go.jp

I. Introduction

Economic integration across borders has been rapidly developing as policy and technical barriers to foreign direct investment (FDI) and international trade have declined in recent decades. According to UNCTAD (2008), the volume of global GDP and exports of goods and non-factor services in current prices increased 4.5 and 7.1 times from 1982 to 2007, respectively. World FDI inflows, however, increased even more rapidly, 31.6 times for the period. In 2007, the presence of multinational corporations (MNCs) in the world economy, measured by the value-added of all foreign affiliates, accounted for an estimated 11% of global GDP. Furthermore, global trading chains by MNCs represent a substantial portion of world trade flows. Indeed, U.S. MNCs accounted for close to 80% of U.S. exports and imports in 2000 (Bernard et al., 2005). MNCs have been a driving force in the process of economic globalization.

In order to understand the role of MNCs in the conduct of international commerce and production, it is crucial to understand the nature of offshore production by MNCs. It has long been documented that manufacturing firms are widely engaged in global production networks by geographically fragmenting particular stages of the production process (Feenstra, 1998). For instance, MNCs maintain headquarter services and production of intermediate goods at home, and their foreign subsidiaries assemble intermediates that are imported from the home country so as to produce final goods. The fragmentation of production by MNCs is motivated by the desire to shift production activities to countries in which factor costs are relatively low (Helpman, 1984; Markusen, 2002). As many markets are geographically segmented by borders, MNCs face a rich array of production organization to serve final consumers around the globe. An optimal

form of global supply chains that stretches over various countries concerns the degree of vertical specialization within multinational production networks in order to save international transportation costs (Yeaple, 2003a; Grossman et al., 2006).

A large number of empirical studies have investigated a fundamental force in MNC decisions as to the location of offshore production. From a policy perspective, this issue is at the center of the debate over the extent to which the recent waves of trade and investment liberalization induce MNCs to relocate domestic production abroad. As briefly described, MNCs may systematically shift production facilities to countries with lower wages and factor costs. As such, multinational behavior raises great concern that a reduction of trade barriers for freer trade could accelerate the pace of hollowing-out of domestic manufacturing sectors if MNCs organize offshore production primarily for factor-cost considerations.

Although the concern is critically dependent on the question of what factors determine FDI activity, the prevalence of evidence indicates that MNCs primarily pursue horizontal FDI that is motivated by access to foreign markets in the face of trade barriers (Brainard, 1997; Carr et al., 2001). On the other hand, there is mixed evidence of vertical FDI that is motivated by international differences in factor costs, as predicted by the factor-proportions theory of trade (Blonigen, 2005). These findings suggest that the factor-cost motivation may not be prevalent in accounting for the general location of multinational production. Instead, only a few particular manufacturing industries such as machinery and electronics are conducive to offshoring of production in the host countries that have comparative advantage (Yeaple, 2003b). From a theoretical point of view, the existing evidence does not appear to bear out the significance of production fragmentation by MNCs. Thus, the empirical literature remains largely inconclusive as to

whether a hollowing-out scenario afflicts the global economy in a quantitatively important way.

However, one of the key issues in prior research concerns the prevalence of evidence based on offshore production by U.S. MNCs. There is considerable evidence that U.S. MNCs have extensively engaged in vertical production networks in Canada and Mexico – the members of the North American Free Trade Agreement (NAFTA) − by exporting intermediate inputs to their affiliates for further processing (Feinberg and Keane, 2001; Hanson et al., 2001, 2005). Apparently, these countries enjoy low trade costs for shipments, and wage-cost advantages in the case of Mexico. Their geographic location could present a strong incentive for U.S. firms to consolidate vertical production chains in the NAFTA. As such, FTAs may generate a strong force against the shift of production to non-FTA member countries with lower factor costs, which would make it difficult to take the prediction of factor-proportions theory to U.S. MNCs data. An open question is whether U.S. MNCs-based results can be generalized to apply to the nature of offshore production by MNCs originating from other parent countries. Furthermore, the issue is aggravated by the limitation of existing data on multinational activity. A number of data problems on the measurement of multinational production, including the definition of foreign affiliates, sectoral classification, and survey methods, undermine comparability of the measures of multinational production. Thus, currently available data pose a challenge for an empirical analysis of multinational activities of MNCs of different nationality on a uniform basis as well as exploring the peculiarity of the structure of U.S. multinational production.

To fill these gaps in the current literature, we exploit confidential *affiliate-level* panel data from the Ministry of Economy, Trade, and Industry, Japan, in order to

construct improved measures of foreign affiliate sales by Japanese MNCs (Matsuura, 2004). In particular, we assemble the official surveys to estimate missing sales of a large number of foreign affiliates during 1989-2005. The estimated data on affiliate sales that vary by destination market are aggregated over industry and country solely for majority-owned foreign subsidiaries to match the Japanese data with U.S. data.[1] This new dataset enables us to make a rigorous comparison on the nature of offshore production between Japanese and U.S. MNCs. Then, we combine the Japanese and U.S. data to explore the following questions. What are the characteristics of offshore production by Japanese and U.S. firms? What are the determinants of their foreign production? To what extent is the pattern of Japanese and U.S. multinational production consistent with factor-cost and market-access motives of FDI? These questions should shed new light on the distinctiveness of U.S. multinational production as compared to Japanese MNCs. Further, a comparative analysis helps us to evaluate the influence of the U.S. data on the empirical evidence that factor-seeking motivation is not prevalent in the general pattern of FDI activity.

The descriptive analysis illustrates several features of Japanese and U.S. multinational activities. In the past decades, foreign affiliate sales by Japanese and U.S. MNCs substantially increased alike. But the employment growth of Japanese affiliates was much more rapid than that of U.S. affiliates. For both Japanese and U.S. MNCs, local sales explain the majority of affiliate total sales across country and industry categories, indicating the importance of local markets for attracting offshore production by multinationals. Second, the similarity between Japanese and U.S. affiliates figures prominently in the composition of affiliate sales across three regions: Asia, Europe, and

[1] More details of the dataset are presented in section IV.

South America. Regional-market characteristics, rather than sectoral characteristics, are influential in explaining the target market for offshore production by Japanese and U.S. MNCs. In contrast, there also exist some differences between Japanese and U.S. MNCs. In particular, Japanese affiliates are distinctive in that the composition of affiliate exports for a home country becomes progressively larger across sectors as the income level of host country declines; it also becomes progressively greater across country-income levels as the sectoral skill intensity decreases.

In the regression analysis, we use a comprehensive panel data on foreign affiliate sales disaggregated by country, industry, and destination market to explore what factors motivate multinational sales. Our interest lies in examining comparative advantage (vertical) and market access (horizontal) motives of offshore production by Japanese and U.S. MNCs. In this respect, we find several interesting patterns. First, foreign affiliate sales by Japanese MNCs tend to be larger in unskilled-labor-abundant countries, with the more pronounced impact of unskilled labor on Japanese affiliates in Asia. Since this pattern is consistent with the model of vertical FDI, Japanese MNCs appear to engage substantially in vertical production chains across borders to take advantage of international differentials in factor costs. In contrast, the evidence suggests that foreign affiliate sales by U.S. MNCs are only marginally sensitive to variation in host country's unskilled-labor-abundance. This is not to say that U.S. MNCs do not pursue vertical FDI strategies. Rather, we find that the comparative advantage motive of offshore production by U.S. manufacturing affiliates seems to be, *on average*, weaker than that by Japanese affiliates. The results for the determinants of export versus local sales also bear out these assertions.

The rest of this chapter is organized as follows. Section II briefly reviews the

literature on the determinants of FDI. Section III explains the econometric framework for the analysis of offshore production by multinationals. Section IV describes our primary data sources of Japanese and U.S. MNCs and other data sources. In section V, we illustrate the overall picture of Japanese and U.S. affiliate activities by focusing on the composition of affiliate sales by destination markets across sectoral skill intensity and host-country characteristics. Section VI presents the regression results of the determinants of affiliate sales. Section VII concludes.

II. Literature Review

We begin by describing theoretical studies of FDI in order to motivate the empirical work on the determinants of multinational production. Then, we discuss the recent empirical works that attempt to identify the role of comparative advantages in FDI activity. Lastly, we review prior research using U.S. and/or Japanese MNCs data to clarify the contribution of our study.[2]

The literature has previously made a clear distinction between factor-seeking (vertical) and market-seeking (horizontal) motives of FDI activity. First, Helpman (1984) and Helpman and Krugman (1985) have examined the role of factor-proportions differences in accounting for multinational production. Some firms fragment the production process into various stages that differ by factor proportions; for instance, skilled labor is used more intensively in headquarters services than final assembly. Differences in relative skilled-labor endowments across countries generate international differentials in skilled-labor costs, which may not be equalized by international trade. In this case, these firms locate headquarters activity in the country where skilled labor is

[2] For a more comprehensive review, see Blonigen (2005) and Helpman (2006).

relatively cheap, but move production activity to the country where unskilled labor is relatively cheap. Comparative advantage creates an incentive for vertical MNCs that are headquartered in one country but produce in another country. Then, the model predicts that offshore production by vertical MNCs should occur primarily between countries that are sufficiently different in relative skill abundance. From the standpoint of firms in skilled-labor-abundant countries, the supply of unskilled labor in a foreign country is a crucial factor in undertaking vertical investment.

Second, Markusen (1984) and Brainard (1997) have analyzed a firm's decision between exporting and local production. In contrast to the vertical models, firms have identical factor intensities across stages of the production process, which rule out vertical fragmentation of production. Instead, these firms are motivated by trade barriers between countries to shift production facilities offshore. If gains from the savings of trade costs exceed additional fixed costs of building a foreign plant, these firms become horizontal MNCs that are headquartered in one country but produce in multiple countries. In the absence of comparative advantage motives, the horizontal model predicts that horizontal FDI should occur between countries of similar factor proportions.

The recent literature maintains factor-cost and market-access motives as a primary explanation of multinational production, but goes beyond the traditional distinction between vertical and horizontal FDI by extending the analysis at least in two ways. First, Yeaple (2003a) and Ekholm et al. (2007) analyze a three-country (region) framework in which multinational firms with production facilities in a low-cost market can serve their home market and/or a third market by exports from their offshore production. These studies highlight cross-country dependence as an important determinant of FDI; MNCs take into account regional market characteristics in determining a host country for their

offshore production . Second, Helpman et al. (2004) introduce firm-level heterogeneity in the firm's decision between exporting and horizontal direct investment. As only the most productive firms are shown to engage in FDI, they shed light on the role of within-sector firm-productivity differences in accounting for the cross-sectoral pattern of multinational sales.

The early empirical analysis including Brainard (1997), Carr et al. (2001), and Blonigen et al. (2003) is motivated to estimate the prediction of the general equilibrium models of horizontal and vertical FDI. These studies find that affiliate/FDI activities are prevalent between similar countries and respond positively to trade barriers as measured by tariffs and transportation costs. These results are taken as evidence of market-seeking FDI. In contrast, the data do not strongly support the hypothesis of vertical FDI models that larger differences in relative factor abundance should increase MNCs activity from skilled-labor-abundant to unskilled-labor-abundant countries. In addition, Markusen and Maskus (2001) find that skilled-labor-abundance in a host country increases export sales by foreign affiliates of U.S. MNCs that are aggregated over manufacturing industry at the country-level for the period 1986-1994. This suggests that US. multinationals, *on average*, tend to consolidate offshore production for export in more skilled-labor-abundant countries.

To resolve the mixed evidence of vertical FDI, recent studies have taken a closer look at U.S. MNCs activity. Hanson et al. (2001) document a detailed pattern of outward U.S. FDI across industries and countries in the 1980s and 1990s. Their analysis points to the concentration of U.S. multinational activities in high-income countries in the 1980s, but a subsequent shift towards low-income countries in the 1990s. Hanson et al. (2005) use U.S. firm-level data to study trade in intermediate inputs between foreign affiliates

and parent firms. Their results indicate that lower trade costs and wages for unskilled labor encourage affiliate demand for imported inputs. In addition, Yeaple (2003b) finds that host-country relative skill endowments tend to increase (decrease) affiliate activity by U.S. MNCs in less (more) skilled-labor-intensive sectors, thereby supporting a chain of comparative advantage across industries and countries. All of these studies provide evidence that U.S. MNCs engage in vertical activity for certain sectors and countries. However, the evidence does not support the claim that vertical motivations of offshore production are prevalent in the general pattern of U.S. FDI. The vertical model of FDI does not receive strong support from the data on U.S. MNCs in which skilled-labor-abundant countries account for the dominant share of their offshore production. These issues provide a motivation for comparing the role of comparative advantage in the structure of Japanese and U.S. multinational activities.

There is limited empirical work that analyzes factor-cost motivations of offshore production for multinationals of different nationality. Braconier et al. (2005a) define vertical FDI as FDI driven by factor-cost differentials across countries. They find that wage costs for low skilled workers decrease foreign affiliate sales of U.S. and Swedish MNCs from the late 1980s through 1990s, suggesting that these MNCs invest more in a low-wage country for less-skilled labor. However, their results show that affiliate sales increase in high-skilled-labor costs. It is not clear why both U.S. and Swedish MNCs tend to seek *higher* wages for skilled labor. These results are inconsistent with vertical FDI as defined above. Furthermore, Braconier et al. (2005b) estimate the knowledge-capital model of multinational enterprises, as described in Markusen (2002), to study whether FDI activity is driven by differences in relative skill endowments. Using a dataset on affiliate sales collected from a wide range of country sources, they find support for a

vertical component of the model. But the study does not address comparability in affiliate data sources.

Prior research on a comparative analysis of Japanese and U.S. MNCs includes Eaton and Tamura (1994) who study bilateral FDI stocks in Japan and the U.S. during the period 1985-1990. They find that host-country educational level was likely to significantly increase U.S. FDI activities, but have little influence on Japanese FDI. Lipsey (2000) also examines Japanese and U.S. affiliate production for export in East Asia since the mid 1970s. His findings indicate that the pattern of affiliate export by Japanese firms was more consistent with host-country comparative advantages than U.S. firms, but the pattern of Japanese and U.S. affiliates became alike over time.

All of these studies suggest that comparative advantage motives play a certain role in explaining a cross-country pattern of overall offshore production by MNCs. However, no attempt was made to harmonize the measurement of foreign affiliate activities across data sources. Measurement discrepancies are likely to arise for a variety of reasons including the definition of foreign affiliate, the survey quality, and industry classification. Pooling MNC data may invalidate the consistency of estimated effects of factor-cost differentials as measured by wage levels or relative skill endowments. In general, prior work has paid little attention to the issue of whether data inconsistency may distort the estimate of determinants of multinational activity.

To construct a dataset on affiliate activity that is comparable across data sources, we exploit confidential *affiliate-level* panel data for foreign affiliates owned by Japanese firms. Estimating missing sales by foreign affiliates in the original survey, the dataset improves publicly available data on Japanese affiliate sales. We aggregate estimated affiliate sales by country and industry to construct panel data on the majority-owned

foreign affiliates by Japanese firms, which improve comparability with U.S. MNCs data. Combining the improved Japanese data with existing U.S. data, we explore the patterns and determinants of offshore production by Japanese and U.S. MNCs in a consistent fashion. This approach is close to the study of Tanaka (2009), which showed that offshore production by Japanese MNCs was attracted to unskilled-labor-abundant countries more strongly than U.S. MNCs in the 1990s. Our study is distinctive in that our dataset is constructed solely from majority-owned foreign affiliates in which their sales are disaggregated by both country and industry.

III. Empirical Model

This section presents our empirical framework that is designed to examine underlying motivations of offshore production by multinationals. In order to make our results comparable to prior research on FDI, we adopt a reduced-form estimation that links country and industry characteristics with a measure of multinational activity. In general, FDI theory does not offer a theoretically-derived standard specification for determinants of FDI, but a commonly used specification is based on the knowledge-capital model as specified in Carr et al. (2001). Roughly speaking, their estimating equation captures the simulated distribution of affiliate production that varies by cross-country differences in country size, relative skill endowments, and transportation costs. We modify the estimating equation to meet the nature of our dataset by introducing a sectoral variation in the affiliate data. In particular, we exploit mainly a variation in host-country skilled-labor abundance to examine comparative advantage motives of FDI, which are allowed to differ by Japanese and U.S. MNCs.

We estimate the following empirical model:

$$ASALE_{ijkt} = \beta_0 + \beta_1 SKILL_{jt} + \beta_2\, SKINT_{ikt} + \beta_3\, GDP_{jt} + \beta_4\, DIST_{ijt} + \beta_5 SPATIAL_{ijt} + \eta X'_{jt}$$

$$+ (\beta_6 SKILL_{jt} + \beta_7\, SKINT_{ikt} + \beta_8\, GDP_{jt} + \beta_9\, DIST_{ijt} + \beta_{10} SPATIAL_{ijt} + \eta X'_{jt}) \times US + \varepsilon_{ijkt} \quad (1)$$

where the subscript indicates home country i, host country j, industry k, and time t. *ASALE* is a various type of foreign affiliate sales as a proxy for affiliate production for local and export markets. *SKILL* is a measure of supply of skilled labor in a host country. *SKINT* is a sectoral intensity of skilled labor in a parent country. *GDP* is a measure of host-market size. *DIST* represents the geographic distance between parent and host countries. *SPATIAL* measures a spatial dispersion of third-countries' affiliate activity originating from the same parent nation. *X* includes region and year dummies. *US* indicates a dummy variable which takes on unity if a home country is the U.S., and zero if the home country is Japan.

We estimate the model (1) to explore the main hypothesis that comparative advantage motives play a driving force in explaining the pattern of offshore production by multinationals. The factor-proportions theory suggests that a cross-country difference in skilled-labor abundance generates an incentive for firms to locate unskilled-labor-intensive production in the country where the unskilled-labor wage is relatively low. In the specification, the strength of comparative advantage motives is captured primarily by the *SKILL* variable; from a standpoint of firms headquartered in skilled-labor-abundant countries such as Japan and the U.S., factor-seeking offshore production should be located in less skilled-labor-abundant countries. Vertical MNCs are encouraged not only to invest more in unskilled-labor-abundant countries but to expand the scale of production operation in such countries. If the data are consistent with the prediction of factor-seeking FDI, then we expect $\beta_1 < 0$. Note that there is only a host-country variation in *SKILL* so that we estimate the *average* response of MNCs to

host-country skill abundance at the industry level.

The interaction term between *SKILL* and *US* in the model allows us to test the second main hypothesis that the strength of comparative advantage motives may systematically differ by Japanese and U.S. MNCs. Under the null hypothesis, there is no difference in the intensity of comparative advantage motives, suggesting that the coefficient of the interaction is not statistically different from zero. However, we argue that a regional concentration of vertical production networks could systematically differentiate the cross-country distribution of offshore production by Japanese MNCs from that by U.S. MNCs. Vertical production chains within multinational firms are driven not only by low wages for unskilled labor, but by low trading costs for moving intermediate inputs and/or final products across borders. So, vertical FDI activity takes into account factor-cost considerations and the savings of transportation costs in an inherently intricate manner. As a host country is more distant from a home market, a reduction in production cost of taking advantage of low wages could be offset by greater transport costs that increase for shipping goods multiple times. Mutually reinforcing influences of factor and trade costs could generate an agglomeration force to the pattern of vertical FDI in the proximate region.

The preponderance of evidence points to the important role of East Asia and North America for vertical production networks by Japanese and U.S. firms, respectively. Japanese firms are widely engaged in vertical trading chains across East Asia, which serves as a hub for offshore production networks (Kimura and Ando, 2005). U.S. MNCs extensively create vertical production networks by locating input processing in their foreign affiliates in Canada and Mexico (Feinberg and Keane, 2001; Hanson et al., 2001, 2005). The distinctive feature of Japanese vertical production networks relative to the U.S.

is the diversity of the region; East Asia consists of many countries of different factor proportions whereas North America is comprised only of Canada and Mexico. A possible hypothesis is that the geographic proximity of East Asia to Japan may disproportionately highlight the comparative advantage motives, as measured by cross-country variations in skill endowments, in explaining the pattern of Japanese multinational sales. If this is the case, host country's skilled-labor abundance is likely to have a greater negative impact on Japanese MNCs relative to U.S. MNCs. Thus, we predict $\beta_6 > 0$.

The comparative advantage explanation may have different implications for different types of multinational sales because some component of affiliate activity is encouraged by other investment motivations such as market access, fiscal incentives, and tax evasion. The strength of the comparative advantage motives should be weaker in affiliate sales to local markets as MNCs build offshore production for local sales in order to gain access to foreign markets. The impact of skill endowments in a host country can be different across affiliate sales for local and export markets. Hence, we estimate the model separately for each type of affiliate sales to allow for different coefficients of *SKILL* across sales destinations.

We include industry- and country-specific variables that are important determinants of FDI. *SKINT* enters the model to control for sectoral intensity of knowledge capital as a source of multinational expansion. Firms in relatively high skilled-labor-intensive industries may invest more in a foreign market whereas firms in relatively low skilled-labor-intensive industries may invest less abroad. The host-market size as measured by *GDP* increases the entry of multinational firms as well as the scale of affiliate production. As horizontal MNCs are encouraged by trade frictions between countries, *DIST* as a proxy for international transport costs is expected to encourage

foreign affiliate sales. Further, recent theory of FDI suggests that multinationals take into account the spatial location of FDI activity originating from the same parent country (Coughlin and Segev, 2000; Baltagi et al., 2007; Blonigen et al., 2007). As export-platform FDI may cluster in a specific region to exploit gains from agglomeration, *SPATIAL* can have a positive impact on foreign affiliate sales. Thus, we expect $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$, $\beta_5 > 0$. Additionally, we allow these independent variables to have different coefficients between Japanese and U.S. MNCs by interacting them with the US dummy.

Finally, *X* is a vector of other control variables. We introduce a dummy variable for time to control for aggregate time effects that influence multinational sales around the globe. The model includes a dummy variable for three regions (Asia, Europe, and South America) to address the effects of regional characteristics on affiliate sales. By including an interaction term with these dummy variables, the year and regional effects are also allowed to vary by Japanese and U.S. MNCs.

IV. Data Description

Data on Foreign Affiliates of Japanese and U.S. Firms

In this section, we first describe data sources on foreign affiliates of Japanese and U.S. MNCs. Japanese data come from *the basic survey of overseas business activities* (BSOBA) by Japanese firms. The survey is annually conducted 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 MNCs 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. Using affiliate samples in the survey, METI reports aggregate information on foreign affiliate activity of Japanese firms. However, the

officially available data on foreign affiliates are likely to suffer seriously from the varying quality of surveys across years. Variation in foreign affiliate sales in the survey may not be sufficiently correlated with variation in real economic activity of foreign affiliates even at the aggregate level such as industry and country. As these data problems are not well understood, it is even unknown to what extent the survey quality affects the aggregate information on foreign affiliate activity. Thus, the existing government data on Japanese MNCs are not appropriate for rigorous empirical analysis on multinational activity

Many unresolved data problems motivate us to devote much effort on improving the Japanese survey data. One key issue lies in the fact that there are many foreign affiliates that enter and exit a host market in an apparently inconsistent way, possibly reflecting serious reporting errors. As a complete list of foreign affiliates in operation is crucial for the consistent measurement of multinational sales at the aggregate level, we construct *affiliate-level* panel data by linking parent firms and foreign affiliates from the *confidential* data of BSOBA questionnaire. The affiliate-level panel data are used to pin down affiliate samples with missing information on their activity, which are likely to arise from reporting errors. Then, missing sales of foreign affiliates are estimated by linear interpolation at the affiliate level during the years 1989-2005. To permit public access to the dataset, the improved dataset aggregates affiliate sales, purchases, and employment over country, industry, and year.[3]

The previous dataset on Japanese FDI activity, however, remains to have several issues for a comparative analysis of multinational activity. One issue of comparability

[3] Available at http://www.rieti.go.jp/jp/database/FDI2009/index.html. See Matsuura (2004) for details.

between Japanese and U.S. MNCs data is that the concept of foreign affiliate ownership differs between Japanese and U.S. data. Building on our previous work, this paper addresses the deviation of the ownership concept to improve comparability with existing data on U.S. MNCs. Specifically, we compile the improved data on foreign affiliates for which more than 50% of their equity stakes are owned by Japanese parent firms. For the following analysis, we employ the resulting dataset on foreign affiliates by Japanese firms.

The data on foreign affiliate activities of U.S. parent firms in nonbank manufacturing come from the survey of *U.S. direct investment abroad* published by the U.S. Bureau of Economic Analysis (BEA). To match with the definition of affiliate ownership in the RIETI data, we use the data on the majority-owned foreign affiliates in the BEA source. There are 5 items that are commonly available variables in the data sources and used for the analysis: affiliate total sales, local sales, exports to the home market, exports to the third market, and the number of employees. The BEA switched from the Standard Industry Classification (SIC) system to the North American Industry Classification System (NAICS) for the industry category of foreign affiliates since 1999. Because the industry-by-country analysis using all samples is likely to suffer from a discontinuity in the industry classification, we separately examine the pre- and post-1999 samples in the regression analysis.

Both the improved dataset on Japanese MNCs and existing U.S. MNCs data are used in Tanaka (2009), which reports that the measurement of the volume of affiliate sales across the RIETI and BEA datasets is fairly consistent. However, when comparing aggregate sales by Japanese manufacturing affiliates in the U.S. from the RIETI source with those from the *Foreign Direct Investment in the United States* published by the BEA,

the former data exceeds the latter to large extent. While the discrepancy may not necessarily be extended to affiliate activities in other countries, we suspect that the industry classification method is a primary reason for an observed deviation between data sources. Specifically, an industry to which certain foreign affiliates belong is determined by sectoral sales of the affiliates at the 4 digit-level in the BEA survey, but by the subjective judgment of a person who files a report in the METI survey. Some foreign affiliates of Japanese firms that are assigned to manufacturing could be classified as wholesale affiliates. The comparability issue on industry classification between Japanese and U.S. sources is not addressed in our study.

There are at least two other issues for a comparison on the real volume of foreign affiliate sales. First, affiliate sales in the RIETI are reported in millions of Yen, but those in the BEA in millions of U.S. dollars. While it is possible to measure the RIETI's affiliate sales in the U.S. dollars using Yen-dollar exchange rates, the dollar-denominated affiliate sales are highly sensitive to an exchange-rate movement across years. Second, affiliate sales in both datasets are measured in nominal terms so that price deflators by country and industry are necessary for measuring a real volume of sales. While the price deflators such as wholesale and consumer price index are readily available at the country-by-year level, a deflated volume of affiliate sales can be extremely large in countries that experienced high inflation in the 1980s and 1990s.

All of these problems suggest that the nature of affiliate data does not allow for a straightforward comparison of the volume of offshore affiliate sales by Japanese and U.S. MNCs. To proceed in a meaningful way, we assume that foreign affiliates in the METI and BEA surveys report the composition of their sales by destination in a consistent way over time. Instead of the volume of sales, we focus on the share and growth of affiliate

sales by destination in the descriptive analysis. In the regression analysis for a pooled sample, we attempt to control for some component of systematic deviations between these data sources by including dummy variables for U.S. MNCs, year, and an interaction term between U.S. MNCs and year. This approach helps us to mitigate an influence of systematic measurement errors on the investigation of comparative advantage motives of FDI.

Other Data Sources

We use other data sources on country and industry characteristics. Data on skilled-labor abundance are taken from Barro and Lee (2001). Educational attainment is measured by the average years of schooling of the population over age 25, which serves as a proxy for supply of skilled labor in a country. Data on real GDP measured in billions of year 2000 U.S. dollars come from the *World Development Indicators*.[4] For geographic distance, we employ the dataset on geographic variables compiled by the CEPII, the research center in international economics in France.[5] To construct a measure of spatial dispersions of FDI activity, we define a spatial-lag variable as:

$$SPATIAL_{\mathrm{ijt}} = \sum_{\mathrm{s}} \frac{\sum_{\mathrm{k}} ASALES_{\mathrm{iskt}}}{Distance_{\mathrm{js}}} \qquad (2)$$

where the subscript, s, indicates a third country. Data on *ASALES* come from the RIETI and BEA survey used for our dependent variable, respectively. The CEPII's distance data are used to measure a geographic distance between host and third countries.

Data on industry characteristics used in the analysis include the composition of skilled labor in employment. For the Japanese sample, we use the ancillary dataset on

[4] Taiwan GDP data are obtained from the Department of Commerce, Taiwan.
[5] Available at http://www.cepii.fr/anglaisgraph/bdd/distances.htm.

sectoral employees by occupation in the Japan Industrial Productivity Database 2009.[6] Data on skilled-labor intensity in the U.S. manufacturing sector come from the NBER manufacturing productivity database constructed by Bartelsman and Gray (1996). In these datasets, skilled labor is measured by the share of nonproduction workers in total employment. Thus, unskilled labor is approximated by the composition of production labor in the labor force in an industrial sector. These datasets on industry skill intensity are aggregated over industries to match the industry classification of foreign affiliates by Japanese and U.S. firms, respectively.

V. The Pattern of Foreign Affiliate Activity by Japanese and U.S. MNCs

Before proceeding with the formal econometric analysis, this section provides descriptive analysis of offshore production of Japanese and U.S. MNCs. The main purpose section is to present the stylized facts on the pattern and trend of foreign affiliate activities in a consistent way in order to make a comparison of Japanese and U.S. MNCs. As briefly explained in the data description, we illustrate the composition of affiliate sales by destination and affiliate employment to characterize the nature of foreign production.

Worldwide Pattern of Foreign Affiliate Activity

We start by describing the overall growth of Japanese and U.S. and multinational activity. Figure 1 illustrates the worldwide pattern of their affiliate activities for the years 1985-2005. The left-hand panel shows the rapid growth of foreign affiliate sales for both Japanese and U.S. MNCs. During the period, U.S. affiliate sales increased more than fivefold from 250 to over 1,100 billion U.S. dollars in nominal terms. More impressively, Japanese affiliate sales increased from less than 10 billion to over 750 billion dollars

[6] See the data at http://www.rieti.go.jp/en/database/JIP2009/index.html.

during the period 1985-2005. These figures represent the massive expansion of offshore production by Japanese and U.S. companies for the past decades. Furthermore, the right-hand panel illustrates that Japanese and U.S. multinationals employed around 3 million workers around the globe in 2005, respectively. While foreign employment by U.S. MNCs remained virtually constant in the past decades, Japanese affiliate employment increased at a remarkably rapid pace. In sum, U.S. affiliate sales increased rapidly without much expansion of foreign employment. But the rapid growth of Japanese affiliate sales occurred together with increased employment.

[Figure 1 around here]

Foreign Affiliate Sales by Country Income and Sectoral Skill Intensity

To organize the descriptive analysis, we place the comparative-advantage motive of FDI at the center of the analysis as discussed in Yeaple (2003b). Specifically, we sort Japanese and U.S. affiliate industries by the intensity of skilled labor according to the industry information. Using the median value of skilled-labor intensity in year 1985 as a cutoff point, we classify the above- and below-median industries as high and low skill-intensive sectors, respectively.[7] As to the characteristics of the host countries, we use World Bank's country classification, i.e., high, upper middle, lower middle, and lower income countries, according to gross national income per capita. To avoid the change of income category for the countries, we adopt the classification in the year 1987. Additionally, we introduce the regional dimension to explore the characteristics of

[7] High skill sectors in the U.S. sample include chemicals and allied products, industrial machinery and equipment, and electronic and other electric equipment. The other sectors are defined to be low skill intensive. In the case of Japan, transportation equipment is also classified as high skill intensive according to the cutoff point of skill intensity. The conclusions are not affected in a significant way by classifying the transportation equipment as low skill sector.

Japanese and U.S. MNCs in Asia, Europe, and South America.

Figure 2 illustrates the composition of foreign affiliate sales by destination across country income and industry-skill intensity. Because of data availability, we take the average shares for the period 1989-2005 of the U.S. and Japanese samples. First, local sales of U.S. affiliates account for the majority of total sales across country and industry groups. The same feature is also observed for Japanese affiliates. These findings imply that offshore production by multinationals serves primarily local markets. However, the importance of local markets varies more significantly across countries than industries. The portion of local sales is relatively larger in upper middle and low income countries for both the Japanese and U.S. samples. Second, U.S. affiliate exports to a third market are relatively higher in high income countries, but a cross-industry difference appears to be small. In contrast, Japanese affiliate exports to a third country are relatively larger in high and lower-middle income countries. Roughly speaking, a distinctive pattern of third-market exports is not clearly observed.

[Figure 2 around here]

Lastly, U.S. and Japanese affiliate sales to the home country account for a small share of total sales across countries and sectors. In contrast with the U.S. sample, the Japanese sample is distinctive in that the share of affiliate exports for the home market becomes progressively larger in both low- and high-skill-intensive sectors as the level of host-country income declines. Also, the home-export share appears to be larger in low skill-intensive industries as the country income declines progressively. These patterns seem to be consistent with a comparative advantage motive of FDI in which the degree of offshore production motivated by factor price differentials varies with country and

industry characteristics.

Foreign Affiliate Sales by Region and Sectoral Skill Intensity

In Figure 3, we disaggregate the sectoral composition of various affiliate sales by region: Asia, Europe, and South America. Consistent with the previous figures, affiliate sales to a local market explain the dominant share of total sales across the regions for both the U.S. and Japanese samples. The fraction of local sales is relatively larger in South America, possibly suggesting that multinational production in the region is driven strongly by market access.

[Figure 3 around here]

In Europe, U.S. affiliate sales to a third market account for the prominent portion of total sales. A similar pattern can be also observed for the Japanese sample. These findings imply that Europe plays a large role in explaining the somewhat higher share of affiliate exports to a third country that were previously observed in high-income countries. Lastly, affiliate sales to a home market represent the small part of total sales in Europe and South America. In contrast, home-market exports appear to be a relatively important portion of affiliate sales in Asia. These patterns can be seen in both U.S. and Japanese samples. When illustrating the composition of offshore production by Japanese and U.S. MNCs across the regions, we can observe similar patterns on the relative importance of affiliate sales by destination. This suggests that both U.S. and Japanese MNCs respond to the regional characteristics in a similar fashion by choosing the main market for local production.

Growth of Foreign Affiliate Sales by Country Income in High and Low Skill Industry

Figure 4 shows the 3-year average growth rate of Japanese and U.S. affiliate sales by destination market in high skill-intensive sector for the period 1990-2004. The left- and right-hand panels show the Japanese and U.S. samples, respectively. Over the early and middle 1990s, every type of Japanese affiliate sales across country groups had recorded high growth. In particular, affiliate exports in low income countries exhibited a remarkably high increase. Each type of U.S. affiliate sales had on average moderate growth rates in the 1990s. From the late 1990s to the early 2000s, we observe a decline in the growth rates of affiliate sales by destination. Thereafter, affiliate sales started to grow at a positive rate. As observed in the U.S. sample, the Japanese affiliate activities declined at the end of the 1990s. Subsequently, the growth rates of affiliate production by Japanese MNCs remained moderate during the early 2000s.

[Figure 4 around here]

In Figure 5, we display the average growth rates of Japanese and U.S. affiliate sales in low skill-intensive industry. The left-hand panel displays the growth rate of Japanese affiliate sales. The affiliate activities exhibit a high growth rate over the 1990s. Foreign affiliate sales by Japanese firms in low-income countries appear to grow at a relatively fast pace. However, each type of affiliate sales declined to a low growth rate in the early 2000s.

[Figure 5 around here]

In the right-hand panel, U.S. affiliate sales appear to exhibit a moderate growth

rate in the 1990s.[8] In contrast to the high skill industry, we can observe a surge in the growth rate of affiliate sales to third and home markets in middle income countries for the end of the 1990s. As expected, the growth rate of affiliate sales in high-income countries remained low over time. Overall, we do not observe a clear trend in the growth of U.S. affiliate sales by destination.

In sum, these figures demonstrate the substantially high growth rates for Japanese affiliate sales in both high and low skill industries over the periods. Particularly, low-income countries played an important role in the expansion of Japanese affiliate activities. In contrast, no clear pattern on the growth of U.S. affiliate sales in the 1990s and early 2000s can be observed.

Growth of Foreign Affiliate Employment

Finally, we describe the growth of foreign affiliate employment by Japanese and U.S. multinationals during the period 1990-2004 in Figure 6. The growth of employment by U.S. MNCs in low-income countries was relatively high over time across high and low skill industries. The employment in high and middle income countries exhibited no prominent growth during the period. In contrast, the employment growth in Japanese affiliates was remarkably high across countries of different income levels in the 1990s. At the beginning of the 2000s, however, the increase in affiliate employment slowed down. From a comparative point of view, affiliate employment seems to grow more rapidly in the 1990s for Japanese MNCs than U.S. MNCs. During the 2000s, however, both Japanese and U.S. affiliates appear to exhibit a slowdown or decline in the employment

[8] A 96-98 dip in U.S. third-market export for low income country was caused by primary and fabricated metal industry in India. A 99-01 jump in U.S. home-market export for middle income country resulted primarily from computers in Malaysia and the Philippines. These observations imply that the suppression of some observations for confidentiality in the U.S. survey could lead to less imprecise estimates of the growth rate at the country and industry level.

expansion.

[Figure 6 around here]

Summary

The descriptive analysis produces several characterizations of the pattern of foreign affiliate activities in the case of Japanese and U.S. MNCs. The growth of Japanese and U.S. affiliate sales was remarkably rapid in the past decades. The rise of affiliate sales coincided with the massive expansion of employment for Japanese MNCs. The composition of Japanese affiliate sales to a home country varies by country income and industry skill intensity in a consistent way with comparative advantage motives. The composition of U.S. and Japanese affiliate sales shows significantly similar patterns across regions. Finally, Japanese affiliate activities exhibited a remarkably high growth in the 1990s as compared to the U.S. affiliates.

VI. Estimation Results on Determinants of Affiliate Sales by Japanese and U.S. MNCs

In this section, we investigate the factors that motivate Japanese and U.S. MNCs to engage in offshore production. To organize the regression analysis, we first explore the determinants of the level of foreign affiliate sales for the whole sample. Then, we divide the sample by the location of their affiliates - Asia and Europe - to study whether Japanese and U.S. firms respond differently to regional characteristics. Next, we examine the determinants of the composition of affiliate sales by destination markets to identify the determinants of the destination market of foreign affiliate sales.

Throughout this section, we are interested in estimating the coefficient of *SKILL*

as measured by the average years of schooling of the population in a host country. As we intend to exploit a new dataset on Japanese multinational activity to conduct a comparative analysis on Japanese and U.S. MNCs, we will not address causal effects of country/industry characteristics on affiliate activity. Thus, we mainly contrast the difference in estimated coefficients between Japanese and U.S. samples, which are less subject to omitted variables bias.

Benchmark Results

Table 1 presents the results of equation (1) estimated by ordinary least squares (OLS) with standard errors clustered at the industry level. To address a discontinuity in the U.S. industry classification, the sample covers the period 1989-1998 in columns (1)-(4) and the years 1999-2005 in columns (5)-(8). The dependent variable is a natural logarithm of foreign affiliate sales that vary by target market across specifications.

[Table 1 around here]

Column (1) shows the result for total affiliate sales. The coefficient of *SKILL* is significantly negative, suggesting that a 1% increase in the average years of schooling in a host country is expected to reduce Japanese affiliate sales by 3.6%. The interaction term between host-country skilled-labor abundance and the U.S. dummy has a significantly positive coefficient. Taking into account the coefficient of skill endowments, a change in host-country skill endowment has little influence on U.S. affiliate sales. In columns (2)-(4), the results show that skilled-labor abundance in a host country is also negatively correlated with Japanese affiliate sales to local, home, and third markets. A negative impact of SKILL appears to be pronounced for local sales and third-country export sales.

On the other hand, the negative link between skill endowment and affiliate sales becomes weak in the case of U.S. MNCs, after accounting for the coefficient of the interaction.

A plausible interpretation of these findings is that Japanese MNCs tend to locate offshore production in less skilled-labor-abundant countries whereas U.S. MNCs place little emphasis on host-country skill endowment for the location of offshore production. As the coefficient of *SKILL* represents an average effect of foreign skilled-labor across sectors, this pattern holds, on average, for multinational sales at the manufacturing industry level. From a theoretical point of view, the comparative advantage story appears to be an important force in driving affiliate production more strongly for Japanese MNCs than U.S. MNCs. Using the country-level data, similar evidence has been provided in Eaton and Tamura (1994) and Tanaka (2009). Furthermore, we find little correlation between industry skill intensity and affiliate sales across the specifications. In the work of Hanson et al. (2001), a sectoral intensity of skilled labor is positively correlated with U.S. affiliate sales in 12 manufacturing and non-manufacturing industries. As our regression covers only manufacturing in the sample, the smaller variation across industries is likely to produce an estimate with large standard errors.

The economic size of a host market as measured by real GDP has a significantly positive coefficient across various affiliate sales. The significant negative coefficient of the interaction between GDP and the U.S. dummy implies that the positive effect of host-country GDP is weaker for U.S. affiliates than Japanese affiliates. Japanese MNCs are more sensitive to the size of the host market for their affiliate activity. On the other hand, the coefficient of the distance variable is significantly negative. The coefficient of the distance interaction with the U.S. dummy is significant but smaller in size than the distance coefficient. This suggests that proximity to a home country encourages offshore

production by both Japanese and U.S. firms, with the negative impact more pronounced for Japanese MNCs. With respect to the estimated effects of host-country characteristics for U.S. affiliates, these findings are in line with the evidence in prior research such as Brainard (1997), Carr et al. (2001), and Hanson et al. (2001).

Lastly, the spatial lag variable denoted by *SPATIAL* is positively associated with various types of affiliate sales, with the magnitude of the effect being smaller for U.S. affiliates. Blonigen et al. (2007) and Baltagi et al. (2007) find a positive influence of the spatial lag for U.S. outward FDI. We add further evidence that Japanese MNCs tend to locate offshore production in the market with greater spatial distribution of FDI from Japan. Further, Japanese MNCs exhibit a stronger responsiveness to the spatially distributed FDI from the same parent country than do U.S. MNCs. A possible interpretation is that Japanese MNCs are widely engaged in production chains around the globe, with a strong network with other Japanese firms through transactions in intermediate and final goods. As a result, direct investment by Japanese firms in a third country could improve an environment for Japanese firms to promote offshore production in a host country. A sequential improvement of investment climate specific to Japanese firms through production networks could reflect the larger positive coefficient of *SPATIAL* for Japanese MNCs.

Columns (5)-(8) of Table 1 display the results for the period 1999-2005. Roughly speaking, the pattern of coefficient signs and statistical significance across variables and specifications is similar to the results before the year 1999. However, there are some differences in the magnitude of the coefficients. Host-country skilled-labor abundance has a smaller negative impact on various affiliate sales in the recent period, with the unsystematic difference between Japanese and U.S. MNCs. The implication is that

foreign investment motivated by factor-cost differentials in the 1990s could have declined in the early 2000s. Perhaps, a rapid development of offshore production in unskilled-labor-abundant countries in the past decades might lead to an increase in labor costs, which weaken the comparative advantage motive of offshore production. This interpretation is in line with a decline in the growth rate of affiliate sales in low income countries since the late 1990s. Furthermore, the results indicate that the *SPATIAL* variable has smaller coefficients in the post-1999 sample. This suggests that Japanese affiliate sales became less sensitive to the spatially distributed FDI of the same parent country in the 2000s. Consistent with the estimated coefficients of *SKILL*, we interpret that offshore production of Japanese MNCs for a factor-cost motivation was extensively established in the 1990s, so that cross-country dependency of FDI activity originating from Japan might have declined over time.

Determinants of Foreign Affiliate Sales in Asia versus Europe Samples

In the descriptive analysis, we illustrate that the composition of affiliate sales by destination varies by the host-country region for both Japanese and U.S. MNCs. However, the benchmark results have assumed that the determinants of foreign affiliate sales are identical across the regions. As Blonigen and Wang (2005) empirically demonstrate a systematic difference between developed and developing countries in the empirical model of FDI, we relax this assumption by estimating equation (1) separately for the Asia and Europe samples.

Table 2 displays the regression results for Japanese and U.S. affiliate sales in Asia. In columns (1)-(4), we find that *SKILL* has a significantly negative coefficient for various affiliate sales by Japanese firms during the period 1989-1998. In particular,

affiliate export to a home market exhibits the largest coefficient in absolute value; a 1% increase in the average years of schooling in Asian countries was associated with a 9% decline in Japanese affiliate exports to a home country. Hence, it is suggested that Japanese MNCs significantly increased their offshore production in relatively unskilled-labor-abundant countries of Asia in order to export products back to the Japanese market. In contrast, *SKILL* has a positive impact on U.S. affiliate sales after accounting for the interaction term; U.S. MNCs tend to have larger affiliate sales in more skilled-labor-abundant countries of Asia. While the prior analysis of Tanaka (2009) shows that host-country educational attainment significantly reduces Japanese affiliate sales at the country level, our findings further imply that a comparative advantage motive appears to be pronounced for foreign subsidiaries by Japanese companies in Asia. In sum, we could interpret our results as suggesting that Japanese MNCs were seeking unskilled labor in Asia, but U.S. MNCs were attracted to skilled labor.

[Table 2 around here]

Industry skill intensity is mostly insignificant across specifications for the Japanese sample, but the coefficient of the interaction term of *US* and *SKINT* points to a positive impact of skill intensity on U.S. affiliate sales. Taken together with the results of *SKILL*, U.S. multinational activity in Asia is larger for the relatively skill-intensive sector and skilled-labor-abundant countries. The results can be interpreted as suggesting that U.S. firms in skill-intensive sectors were seeking skilled labor for their offshore production in Asia. Next, the impact of host-market size on affiliate sales significantly differs for Japanese and U.S. MNCs in Asia. Host country's GDP in Asia is negatively associated with Japanese affiliate sales. As the negative effect of GDP is largest for

affiliate exports to a home country, Japanese firms tend to undertake local production for export in a smaller market. In contrast, U.S. affiliate sales of any type are positively correlated with the economic size of the host nation. As many prior studies find a positive effect of host-market size, this finding is taken as evidence of a market-access motive of FDI (Brainard, 1997; Braconier et al., 2005a). In contrast, our results are consistent with the hypothesis that Japanese MNCs motivated by factor-cost differences in Asia consolidate offshore production in the small market.

Geographic distance is significantly and negatively associated with Japanese affiliate sales in Asia, suggesting that the distance effect would capture in part transport costs for intermediate input trade in vertical offshore production. On the other hand, U.S. affiliate sales in Asia are positively correlated with distance, consistent with a market-access story. The spatial lag variable has a positive impact on both Japanese and U.S. affiliate sales, but there is little difference. In addition, columns (5)-(8) present the results for the period 1999-2005. The overall pattern of coefficient signs and statistical significance is generally consistent with the previous discussion. Nevertheless, the distinction between Japanese and U.S. MNCs becomes statistically weak as to the determinants of host-country characteristics. Possibly, these results imply that the nature of offshore production by Japanese and U.S. MNCs became alike in the 2000s.

Table 3 presents the results for Japanese and U.S. affiliates in Europe. Because many European countries are classified as high-income countries, our hypothesis is that market access rather than comparative advantage would play a large role in explaining the variation of affiliate sales in the region. Using the sample for 1989-1998, columns (1)-(4) show that various Japanese affiliate sales in European countries are negatively correlated with skilled labor abundance, with weak statistical significance. As the

interaction variable with the U.S. dummy has insignificant coefficients, host country's skill endowment has little influence on U.S. affiliate sales in Europe. Furthermore, the regression results for 1999-2005 in columns (5)-(8) indicate little association between affiliate sales and skill abundance. As there is no clear pattern between sectoral skill intensity and affiliate sales, it is reasonable to conclude that skilled labor abundance in European countries exerts little systematic influence on foreign affiliate activities by Japanese and U.S. MNCs.

[Table 3 around here]

Market size has significantly positive coefficients across various affiliate sales in the sample period. Taking into account the *US* interaction term, both Japanese and U.S. affiliate sales in Europe increased with respect to the economic size of the host market. These results imply that Japanese and U.S. firms in Europe concentrate offshore production plants in the larger market. However, the distance variable as a proxy for international transportation costs is insignificant. While the saving of shipping cost can be important for market-seeking FDI by Japanese and U.S. firms, distance may pick up the negative effect of monitoring cost of foreign affiliates.

Lastly, the spatial lag variable has a significantly positive coefficient across the type of affiliate sales. The interaction term with the U.S. dummy shows a significantly negative coefficient, but the size of the coefficient is small. These results imply that Japanese and U.S. MNCs tend to clustered with other investors from the same country in European markets during the 1990s. The tendency of clustering in Europe is stronger for Japanese affiliates than U.S. affiliates. However, it appears possible to interpret that the importance of clustering declined for the location of Japanese and U.S. MNCs in Europe

over time since the late 1990s.

Determinants of Affiliate Sales for Export versus Local Market

The previous regressions have focused on the level of various affiliate sales, but paid little attention to the factors that determine the target market of affiliate sales. To examine this issue, we specify the dependent variable as a share of affiliate export sales in affiliate total sales. Then, we estimate model (1) with the share variable to study the determinants of the relative importance of the destination market of affiliate sales, conditional on the total size of affiliate total sales. This specification allows us to explore factors that motivate foreign affiliates to shift from production for local markets toward export markets.

Table 4 presents the results of the new specification estimated by OLS for the period 1989-1998 and 1999-2005. We also divide the sample by region to take into account regional attributes of the data; a dummy variable for region is excluded from these regressions. In column (1) using the world sample, the estimated coefficient of *SKILL* is insignificant. Columns (2) and (3) present the regressions for the Asia and Europe samples in order to check the influence of regional characteristics on the imprecisely estimated coefficient of *SKILL*. For the Asia sample, the *SKILL* variable has a significantly negative coefficient, with its *US* interaction having a significantly positive coefficient. The OLS estimate suggests that a 10% increase in the host country's average years of schooling is associated with a 4 point *decrease* in the ratio of export sales to total sales for Japanese affiliates in Asia. On the other hand, the corresponding change would lead to a 2 point *increase* for U.S. affiliates in Asia. Hence, Japanese MNCs increase the share of production for export in *less* skilled-labor-abundant countries, whereas U.S.

MNCs increase the ratio of export production in *more* skilled-labor-abundant countries.

These results for Japanese affiliates are carried over to the sample period for 1999-2005 although the statistical evidence for U.S. affiliates becomes weak. In addition, skilled-labor abundance has little effect on the relative importance of affiliate sales for export, as is consistent with the hypothesis that FDI activity in Europe is primarily driven by market-access motives. Taken together, we interpret the evidence as suggesting that comparative advantage motives of FDI played a larger role in offshore production by Japanese MNCs in Asia than that of U.S. MNCs.

[Table 4 around here]

Industry skill intensity has insignificant coefficients across specifications for different periods, suggesting that sectoral characteristics had little impact on the composition of affiliate sales by target market. The coefficients of the GDP variable are significantly negative across the models; Japanese and U.S. affiliates tend to increase the share of local sales in the larger host market. The distance variable indicates the significantly negative coefficients in columns (1) and (2), with the negative coefficient being larger in Asia. But the coefficients are insignificant for the Europe sample. Consistent with the prediction of factor-seeking FDI models, Japanese affiliates in Asia tend to engage in production for the local market when their host country is distant from Japan. On the other hand, Japanese affiliates are likely to concentrate on export sales when their host country is closer to Japan. These patterns lend support to the idea that multinationals have an incentive to reduce transportation costs of delivering final goods that are assembled at their offshore production site. Lastly, the spatial lag variables have only weakly significant coefficients across specifications. Thus, clustering plays little role

in the target market of their foreign production.

VII. Conclusion

The rise of multinational firms in the world economy is a distinguishing feature of the economic globalization. As multinationals play an increasingly important role in the conduct of international commerce and production, it is of great interest to understand the nature of offshore production by multinationals. Consequently, there is a growing number of empirical studies on multinational behavior. In particular, the location of multinational production has been a central question from a policy perspective because many countries attempt to attract foreign investment in order to internalize spillover effects of the presence of multinational firms. However, widely available data on multinational activity such as FDI stock and foreign subsidiary sales are subject to a variety of measurement issues including international comparability, country coverage, and quality of surveys. Thus, previously available measures of multinational activity pose a challenge for exploring the nature of multinational behavior using various data sources in a consistent way. In practice, researchers have chosen either to focus on multinational behavior from a single parent country such as the U.S., or analyze multinational data from various country sources that are not sufficiently harmonized.

In this chapter, we have attempted to fill these gaps by improving the measurement of various activities of foreign affiliates by Japanese parent firms in a comparable way with widely used data on U.S. multinationals. In particular, we employ confidential affiliate-level panel data from the Ministry of Economy, Trade, and Industry, Japan, to construct a consistent dataset on manufacturing foreign subsidiaries of Japanese and U.S. firms at the country- and industry-level during the period 1989-2005.

Furthermore, we improve comparability of affiliate sales by destination market across two data sources by including solely majority-owned foreign affiliates.

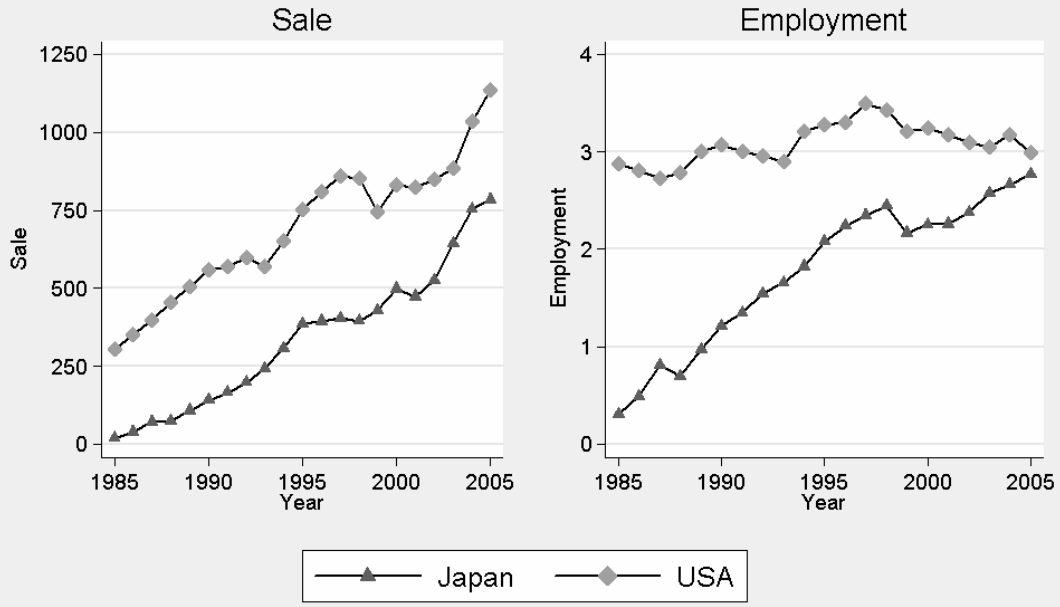
The descriptive analysis illustrates that Japanese and U.S. affiliate sales around the globe increased substantially in past decades, but Japanese multinationals increased their foreign employment much more rapidly than U.S. multinationals. As to the destination market, affiliate sales to a host market accounts for the majority of their total sales across various country and industry categories. On the other hand, the pattern of Japanese affiliate sales is distinctive from that of U.S. affiliates in that the proportion of affiliate exports to a home market increases progressively as host-country income levels and sectoral skill intensity decline. Moreover, the regression analysis shows that sales of Japanese affiliates are higher in host countries with lower educational attainment, but U.S. affiliate sales are larger in host nations with higher educational levels. These patterns figure prominently in Asian countries. Taken together, we interpret these results as evidence for comparative-advantage motives of offshore production in the case of Japanese multinationals. In contrast, our analysis is consistent with the previous findings that factor-cost motives play a limited role in offshore production of U.S. multinationals in specific industries and countries.

While we have illustrated the distinctive characteristics of foreign affiliate activities by Japanese and U.S. multinationals in a fairly comparable way, we have not explicitly addressed the question of what factors would lead to different patterns of foreign activities by multinationals from different nationalities. It is beyond the scope of this chapter to discuss a wide range of reasons behind these different patterns. Having noted this, we interpret the results on Japanese multinationals as indicating that they establish offshore production plants in unskilled-labor-abundant countries to conduct

unskilled-labor-intensive stages of production. Under these schemes, Japanese parent firms supply intermediate inputs to their foreign affiliates, which perform the final assembly, and subsequently export the final products back to the home market or to the third markets. As such, international fragmentation of the production process necessarily involves a multitude of transportation of intermediate inputs and final goods across borders. Multinationals are likely to face a trade-off between wage and trade costs in moving their plants abroad. In this respect, the geographic proximity of labor-abundant Asian countries to Japan can provide a distinctive advantage for Japanese companies to expand production networks internationally.

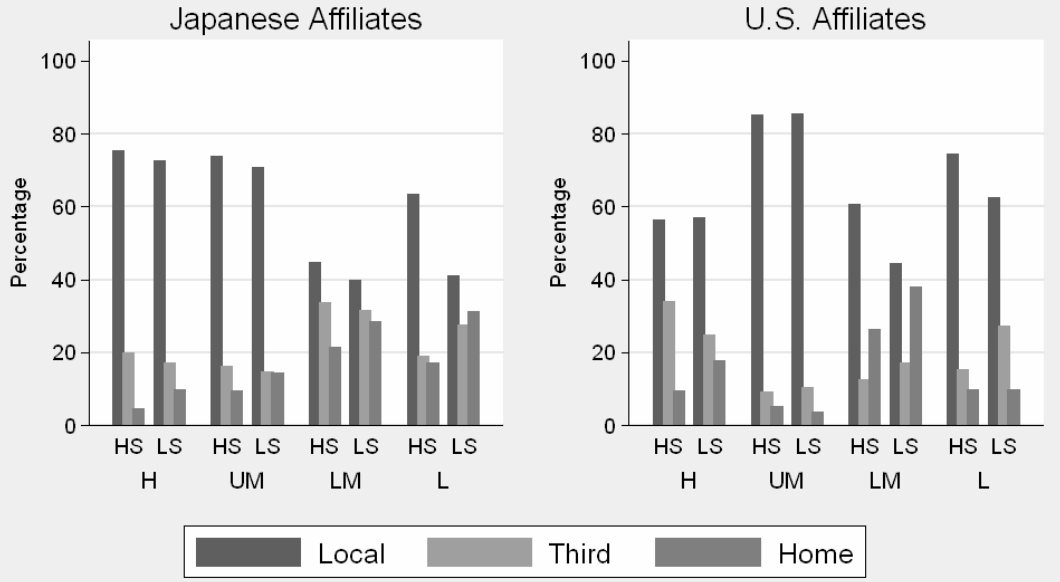
As a final note, we emphasize some of the issues that are not explored in this chapter but merit further research using the new dataset on Japanese affiliates. As argued by Yeaple (2003b), multinational firms in skilled-labor-intensive industries may prefer to locate their production plants in relatively skilled-labor-abundant countries. On the other hand, firms in unskilled-labor-intensive industries are likely to build their plants in relatively unskilled-labor-abundant countries. The factor intensity of production processes and factor abundance in foreign countries could interact in a systematic way to determine the pattern of multinational sales across countries and sectors. As such, it would be interesting to extend our study to the sectoral analysis of multinational activity, which may shed further light on the comparative features of multinationals. However, it is also likely to involve comparability issues in the measurement of industry characteristics across countries.

Figure 1. Worldwide Pattern of Japanese and U.S. Multinational Activities
Affiliate Sales and Employment for Year 1985-2005



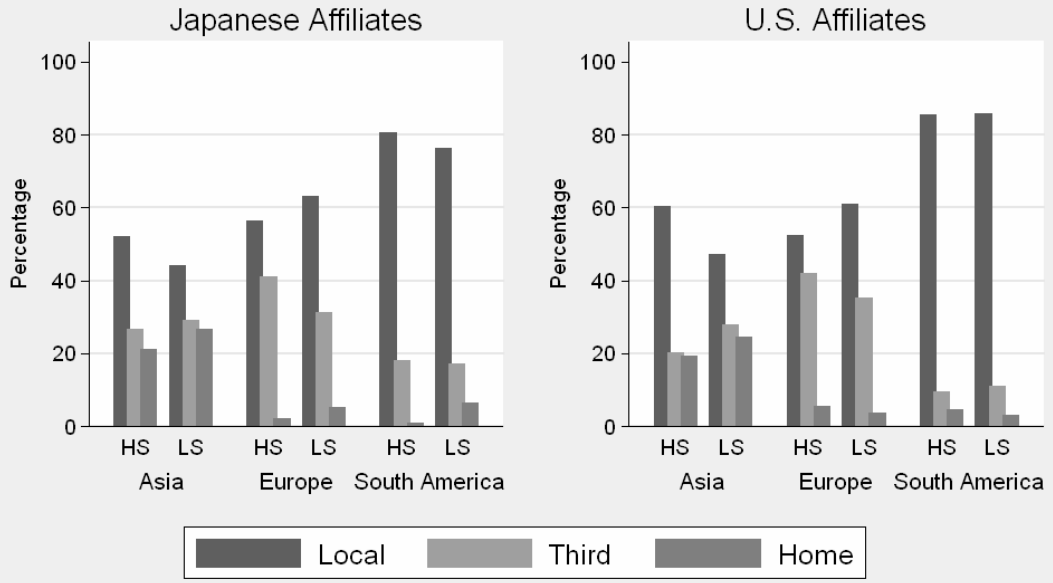
Note: Affiliate sales are in billions of U.S. dollars; employment is in millions of employees.
Source: RIETI and U.S. BEA

Figure 2. Japanese and U.S. Affiliate Sales by Destination Market
Average Share by Industry and Income Group for 1989-2005



Note: HS and LS indicate high and low skilled-labor intensive sectors; H, UM, LM, and L mean high,upper middle,lower middle, and low income countries; U.S. industry category changed in 1999 from SIC to NAICS.
Source: RIETI and U.S. BEA

Figure 3. Japanese and U.S. Affiliate Sales by Destination Market and Region
Average Share by Industry for 1989-2005

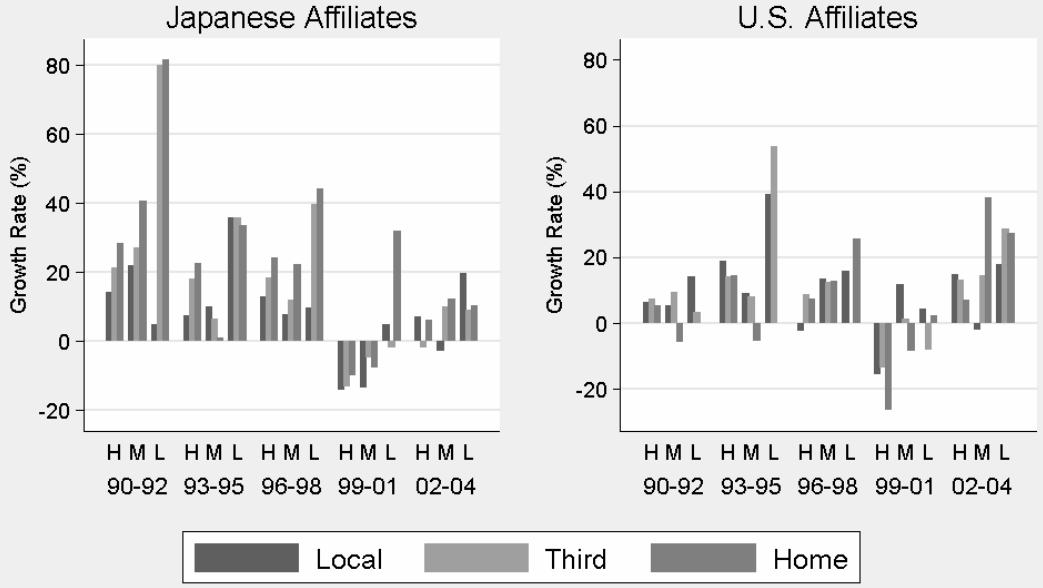


Note: HS and LS indicate high and low skilled-labor intensive sectors; the U.S. industry classification changed in 1999 from SIC to NAICS.

Source: RIETI and U.S. BEA

Figure 4. Growth of Japanese and U.S. Affiliate Sales in High Skill Industry

3-year Average Growth Rate by Destinationa Market and Country Income for 1989-2004

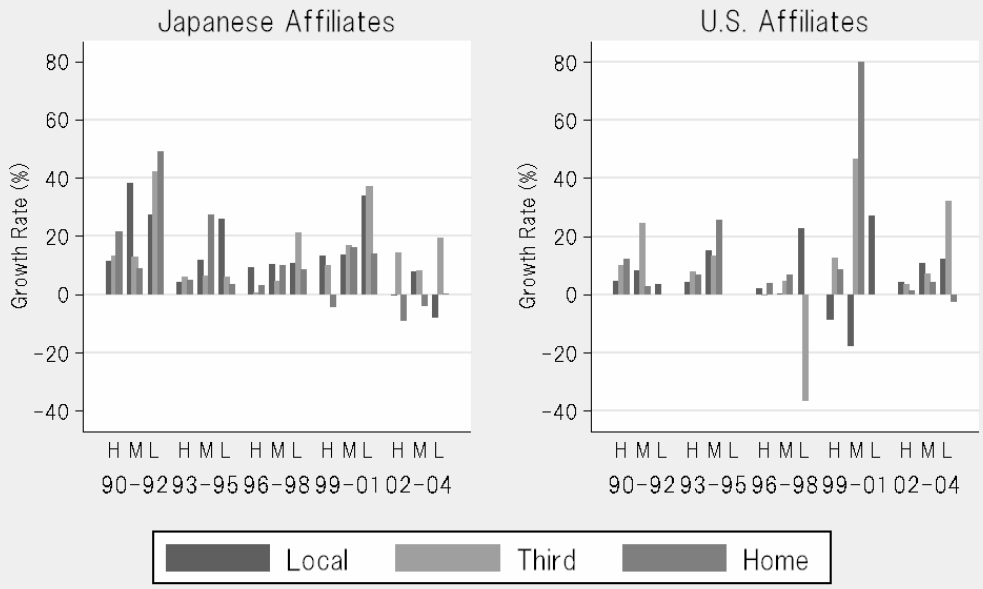


Note: H, M, and L mean high, middle, and low income countries; the U.S. industry classification changed in 1999 from SIC to NAICS.

Source: RIETI and U.S. BEA

Figure 5. Growth of Japanese and U.S. Affiliate Sales in Low Skill Industry

3-year Average Growth Rate by Destination Market and Country Income for 1989-2004

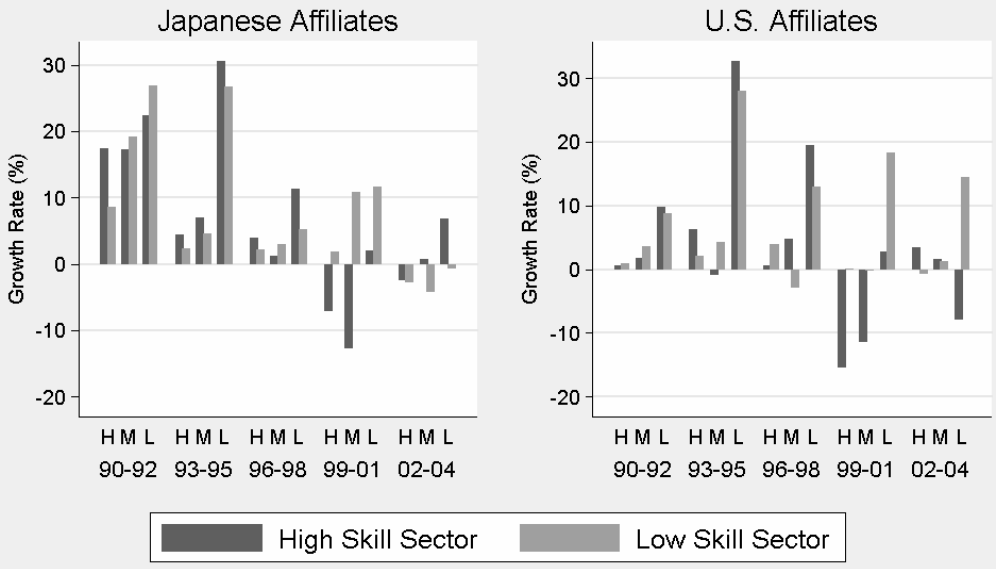


Note: H, M, and L mean high, middle, and low income countries; the U.S. industry classification changed in 1999 from SIC to NAICS

Source: RIETI and U.S. BEA

Figure 6. Growth of Japanese and U.S. Affiliate Employment

3-year Average Growth Rate by Country Income and Sectoral Skill Intensity for 1989-2004



Note: H, M, and L mean high, middle, and low income countries; the U.S. industry classification changed in 1999 from SIC to NAICS.

Source: RIETI and U.S. BEA

Table 1. Regression Results of Determinants of Japanese and U.S. Affiliate Sales

Dependent variable: log of foreign affiliate sales

Period	1989-1998				1999-2005			
Sale	Total	Local	Home	Third	Total	Local	Home	Third
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SKILL	-3.55[a]	-6.45[a]	-2.44[a]	-5.62[a]	-3.07[a]	-0.85[b]	1.32	-0.92
	[-7.76]	[-7.20]	[-3.47]	[-7.94]	[-5.54]	[-2.05]	[1.41]	[-1.03]
SKILL×US	3.25[a]	6.39[a]	1.89[a]	5.56[a]	2.36[a]	-0.15	-2.95[a]	-0.65
	[7.20]	[7.82]	[4.71]	[6.70]	[3.70]	[-0.23]	[-3.43]	[-0.55]
SKINT	0.88	1.66	0.36	1.43	0.48	0.46	1.07	1.31
	[0.64]	[0.94]	[0.26]	[0.76]	[0.34]	[0.33]	[0.99]	[0.61]
SKINT×US	0.88	0.83	2.17	1.48	1.33	1.37	2.98[a]	2.45
	[0.80]	[0.47]	[1.63]	[1.02]	[0.87]	[0.82]	[4.92]	[1.19]
GDP	0.69[a]	1.88[a]	1.21[a]	1.04[a]	0.42[b]	0.35[b]	0.48	-0.06
	[3.25]	[9.89]	[4.77]	[3.91]	[2.40]	[2.23]	[1.17]	[-0.22]
GDP×US	-0.11	-0.82[a]	-0.79[b]	-0.54	0.23	0.71[a]	0.27	0.85[a]
	[-0.51]	[-4.74]	[-2.31]	[-1.56]	[1.30]	[3.49]	[0.50]	[3.07]
DIST	-1.67[a]	-2.49[a]	-1.89[a]	-2.27[a]	-0.95[a]	-0.46[b]	0.27	0.19
	[-4.94]	[-4.77]	[-3.92]	[-2.66]	[-3.65]	[-2.11]	[0.29]	[0.50]
DIST×US	1.10[b]	2.12[a]	0.83[b]	1.77[c]	0.49	0.04	-1.40	-0.97
	[2.55]	[3.45]	[2.30]	[1.74]	[1.38]	[0.16]	[-1.25]	[-1.12]
SPATIAL	1.50[a]	2.61[a]	1.83[a]	2.63[a]	0.85[a]	0.37	0.33	0.57[b]
	[9.55]	[10.7]	[12.3]	[15.9]	[4.32]	[1.39]	[1.64]	[2.57]
SPATIAL×US	-0.83[a]	-1.91[a]	-0.37	-1.17[a]	-0.33[c]	0.24	0.92[a]	0.73[a]
	[-4.52]	[-5.52]	[-1.52]	[-4.59]	[-1.94]	[0.95]	[3.24]	[3.11]
R-squared	0.52	0.47	0.47	0.45	0.72	0.77	0.58	0.62
Observations	3167	3038	2799	2893	2138	1932	1833	1814

Note: Total, Local, Home, and Third indicate affiliate total sales, local sales, export to a home market, and export to a third market, respectively; constant and dummy variables for year, region, US, US×region, and US×year are included, but not reported; t statistics computed from standard errors clustered at the industry level are in parentheses.

a: significant at 1%

b: significant at 5%

c: significant at 10%

Table 2. Regression Results of Determinants of Japanese and U.S. Affiliate Sales in Asia

Dependent variable: log of foreign affiliate sales

Period	1989-1998				1999-2005			
Sale	Total	Local	Home	Third	Total	Local	Home	Third
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SKILL	-3.67 [a]	-4.83 [a]	-8.94 [a]	-4.95 [a]	-2.11 [a]	-1.31 [a]	-6.35 [a]	-3.47 [a]
	[-4.64]	[-3.61]	[-5.80]	[-3.82]	[-3.56]	[-3.45]	[-3.73]	[-2.79]
SKILL×US	5.11 [a]	7.10 [a]	10.84 [a]	7.06 [a]	2.01 [a]	0.66	4.69 [a]	1.69
	[5.50]	[4.94]	[8.30]	[5.10]	[3.28]	[1.32]	[2.73]	[1.11]
SKINT	0.08	0.10	0.06	0.15	1.17	0.63	2.36	2.38
	[0.13]	[0.11]	[0.04]	[0.13]	[0.92]	[0.63]	[0.90]	[1.04]
SKINT×US	2.42 [a]	4.33 [a]	2.73	3.66 [a]	2.12	2.84 [b]	3.54 [c]	4.13 [c]
	[3.81]	[3.11]	[1.25]	[4.38]	[1.50]	[2.00]	[1.84]	[1.90]
GDP	-1.29 [a]	-1.54 [a]	-3.31 [a]	-2.11 [a]	-0.18	0.24 [a]	-1.28 [b]	-0.65
	[-4.60]	[-3.73]	[-8.25]	[-4.55]	[-0.78]	[2.89]	[-2.24]	[-1.52]
GDP×US	1.75 [a]	2.63 [a]	3.41 [a]	2.45 [a]	0.45 [b]	0.39 [b]	1.21 [b]	0.66
	[5.87]	[7.29]	[8.12]	[3.93]	[1.97]	[2.01]	[2.01]	[1.20]
DIST	-3.21 [a]	-4.34 [a]	-7.99 [a]	-4.34 [a]	-1.10 [b]	-0.69 [b]	-3.70 [a]	-1.15
	[-4.91]	[-3.77]	[-10.7]	[-3.50]	[-2.34]	[-2.09]	[-2.81]	[-1.04]
DIST×US	6.28 [a]	9.74 [a]	10.11 [a]	7.98 [a]	-0.60	-2.48 [c]	-2.97	-6.06 [a]
	[4.41]	[5.24]	[6.41]	[2.83]	[-0.71]	[-1.74]	[-1.15]	[-2.75]
SPATIAL	0.74 [a]	1.08 [a]	1.13 [a]	1.35 [a]	0.37	0.36	0.83 [a]	0.76 [a]
	[3.24]	[2.81]	[12.0]	[6.88]	[1.47]	[1.27]	[3.85]	[2.93]
SPATIAL×US	-0.45	-0.81	-0.04	-0.29	-0.02	0.19	0.33	0.51
	[-1.49]	[-1.55]	[-0.12]	[-0.84]	[-0.07]	[0.67]	[1.00]	[1.87]
R-squared	0.75	0.62	0.62	0.61	0.85	0.84	0.72	0.72
Observations	1277	1221	1141	1187	956	880	843	818

Note: Total, Local, Home, and Third indicate affiliate total sales, local sales, export to a home market, and export to a third market, respectively; constant and dummy variables for year, US, and US × year are included, but not reported; t statistics computed from standard errors clustered at the industry level are in parentheses.

a: significant at 1%

b: significant at 5%

c: significant at 10%

Table 3. Regression Results of Determinants of Japanese and U.S. Affiliate Sales in Europe

Dependent variable: log of foreign affiliate sales

Period	1989-1998				1999-2005			
Sale	Total	Local	Home	Third	Total	Local	Home	Third
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SKILL	-3.58	-9.76 [b]	-1.42	-8.84 [c]	-7.30 [c]	4.13	8.19	5.90
	[-1.54]	[-1.99]	[-0.57]	[-1.95]	[-1.88]	[0.95]	[1.19]	[0.93]
SKILL×US	1.46	6.78	0.19	5.76	6.32 [c]	-5.45	-7.79	-7.27
	[0.57]	[1.27]	[0.09]	[1.30]	[1.75]	[-1.22]	[-1.06]	[-1.20]
SKINT	3.50	4.46	3.84 [b]	4.48	2.73	1.97	3.70 [b]	2.51
	[1.39]	[1.25]	[2.02]	[1.32]	[1.21]	[0.82]	[1.98]	[0.79]
SKINT×US	-1.88	-3.07	-0.49	-1.80	-1.66	-1.10	0.01	-0.90
	[-0.85]	[-0.91]	[-0.36]	[-0.58]	[-0.68]	[-0.42]	[0.01]	[-0.30]
GDP	1.58 [a]	3.06 [a]	2.34 [a]	2.33 [a]	1.15 [a]	0.17	1.55	-0.07
	[4.95]	[9.97]	[5.53]	[6.27]	[6.30]	[0.36]	[1.55]	[-0.09]
GDP×US	-0.50	-1.65 [a]	-1.19 [b]	-1.47 [a]	-0.13	1.02 [b]	-0.27	0.90
	[-1.50]	[-4.12]	[-2.34]	[-3.37]	[-1.04]	[2.11]	[-0.25]	[1.14]
DIST	17.8 [c]	33.5 [b]	23.7	29.7 [c]	6.32	-2.95	20.4	2.01
	[1.90]	[2.09]	[1.38]	[1.75]	[0.85]	[-0.32]	[1.23]	[0.17]
DIST×US	-21.5 [b]	-38.5 [b]	-27.4	-34.0 [c]	-9.27	-1.10	-21.0	-4.15
	[-2.12]	[-2.28]	[-1.53]	[-1.81]	[-1.06]	[-0.11]	[-1.23]	[-0.34]
SPATIAL	4.13 [a]	7.83 [a]	4.99 [a]	7.94 [c]	3.30 [a]	-0.26	2.18	-0.25
	[5.20]	[14.37]	[4.49]	[8.81]	[2.71]	[-0.17]	[0.88]	[-0.15]
SPATIAL×US	-3.15 [a]	-6.98 [a]	-3.86 [a]	-6.24 [a]	-2.80 [b]	0.64	-1.21	1.31
	[-3.20]	[-12.00]	[-3.04]	[-5.68]	[-2.11]	[0.40]	[-0.50]	[0.84]
R-squared	0.45	0.51	0.47	0.43	0.68	0.70	0.44	0.47
Observations	1094	1046	972	1003	694	642	612	627

Note: Total, Local, Home, and Third indicate affiliate total sales, local sales, export to a home market, and export to a third market, respectively; constant and dummy variables for year, US, and US×year are included, but not reported; t statistics computed from standard errors clustered at the industry level are in parentheses.

a: significant at 1%

b: significant at 5%

c: significant at 10%

Table 4. Determinants of Local versus Export Sales for Japanese and U.S. Affiliates

Dependent variable: Affiliate export sales to total sales

Period	1989-1998			1999-2005		
Sample	World	Asia	Europe	World	Asia	Europe
Variable	(1)	(2)	(3)	(5)	(6)	(7)
SKILL	-9.42	-39.2 [a]	12.3	-0.51	-42.2 [c]	37.7
	[-0.99]	[-3.32]	[0.48]	[-0.05]	[-1.94]	[0.37]
SKILL×US	15.2 [c]	55.5 [a]	-24.0	-1.61	39.9	-35.0
	[1.88]	[3.66]	[-0.97]	[-0.15]	[1.52]	[-0.39]
SKINT	-1.93	-1.67	22.2	2.99	25.9	-9.96
	[-0.15]	[-0.08]	[1.23]	[0.27]	[0.74]	[-0.71]
SKINT×US	11.42	-0.80	5.39	12.8 [b]	3.38	28.8
	[0.62]	[-0.07]	[0.19]	[2.24]	[0.13]	[1.64]
GDP	-10.3 [a]	-21.9 [a]	-4.48	-7.48 [a]	-16.9 [a]	-4.88
	[-3.12]	[-4.53]	[-0.67]	[-3.17]	[-3.22]	[-0.50]
GDP×US	3.36	13.6 [a]	-5.80	2.69	6.90	-1.40
	[0.83]	[3.46]	[-0.92]	[0.90]	[1.45]	[-0.15]
DIST	-15.2 [a]	-36.4 [a]	28.6	3.44	-18.4	44.8
	[-2.73]	[-6.08]	[0.25]	[0.67]	[-1.33]	[0.30]
DIST×US	15.4 [a]	33.4	6.53	-3.37	-26.1	-8.24
	[2.60]	[1.60]	[0.06]	[-0.51]	[-1.57]	[-0.05]
SPATIAL	3.95 [c]	3.12	13.0	0.71	4.28 [c]	-3.28
	[1.70]	[0.96]	[0.88]	[0.34]	[1.86]	[-0.13]
SPATIAL×US	10.7 [a]	10.6 [a]	7.37	9.70 [a]	6.55 [b]	12.6
	[3.31]	[2.70]	[0.38]	[7.75]	[2.29]	[0.57]
R-squared	0.23	0.29	0.21	0.22	0.31	0.13
Observations	2980	1172	1041	1910	865	638

Note: Constant and dummy variables for year, US, US×year are included in each specification; region and US×region dummies are included in the world sample; t statistics computed from standard errors clustered at the industry are in parentheses.

a: significant at 1%

b: significant at 5%

c: significant at 10%

Appendix

Table A1: Summary Statistics

Variable	Mean		S.D.		Min		Max	
	JP	US	JP	US	JP	US	JP	US
Total sale, ¥/$ million (JP/US)	11.4	7.23	2.43	1.91	-0.04	-0.17	16.5	11.3
Local sale, ¥/$ million (JP/US)	11.2	6.74	1.71	1.94	5.68	-0.17	16.4	10.4
Home export, ¥/$ million (JP/US)	8.13	4.28	3.30	2.59	-0.26	-0.17	13.7	10.8
Third export, ¥/$ million (JP/US)	9.81	5.63	2.45	2.68	-0.26	-0.17	14.4	10.3
Export share	38.1	36.4	25.1	25.4	0.00	0.00	97.0	99.3
Home export share	12.5	10.6	16.1	15.0	0.00	0.03	77.9	100
Third export share	25.7	27.6	21.5	21.7	0.00	0.27	92.3	100
SKILL, years of schooling	2.10	2.10	0.27	0.27	1.43	1.43	2.51	2.51
SKINT, nonprod. workers /total workers	-1.08	-1.13	0.20	0.28	-1.31	-1.46	-0.71	-0.61
GDP, $ billion	6.15	6.15	1.23	1.23	3.94	3.94	9.31	9.31
DIST, km.	8.81	9.04	0.67	0.66	7.05	6.60	9.82	9.70
SPATIAL	10.1	5.83	0.98	1.08	8.45	4.04	12.7	8.67

Note: All variables except for export ratios are defined in log.

Table A2: Correlation Coefficients

Japanese Sample		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
[1]	TSALE	1.00										
[2]	LSALE	0.95	1.00									
[3]	HEXPORT	0.64	0.53	1.00								
[4]	THEXPORT	0.78	0.63	0.56	1.00							
[5]	EXSHR	0.08	-0.22	0.34	0.47	1.00						
[6]	SKILL	0.12	0.14	0.07	0.07	-0.05	1.00					
[7]	SKILL×SKINT	0.05	0.04	0.02	0.11	0.03	-0.01	1.00				
[8]	SKINT	-0.08	-0.10	-0.03	0.02	0.10	-0.80	0.57	1.00			
[9]	GDP	0.20	0.31	-0.08	0.05	-0.35	0.29	0.02	-0.28	1.00		
[10]	DIST	-0.08	-0.05	-0.40	0.02	-0.11	-0.03	0.04	0.01	0.36	1.00	
[11]	SPATIAL	0.12	0.07	0.16	0.23	0.20	0.45	-0.01	-0.32	-0.22	-0.14	1.00
U.S. Sample		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
[1]	TSALE	1.00										
[2]	LSALE	0.95	1.00									
[3]	HEXPORT	0.82	0.70	1.00								
[4]	THEXPORT	0.90	0.78	0.78	1.00							
[5]	EXSHR	0.40	0.13	0.59	0.64	1.00						
[6]	SKILL	0.15	0.14	0.18	0.17	0.14	1.00					
[7]	SKILL×SKINT	0.32	0.25	0.40	0.35	0.25	0.01	1.00				
[8]	SKINT	0.15	0.09	0.18	0.18	0.13	-0.65	0.73	1.00			
[9]	GDP	0.56	0.65	0.37	0.43	-0.09	0.05	-0.04	-0.05	1.00		
[10]	DIST	-0.47	-0.49	-0.50	-0.32	-0.11	-0.32	0.08	0.29	-0.37	1.00	
[11]	SPATIAL	0.34	0.25	0.27	0.50	0.50	0.32	-0.02	-0.18	0.13	-0.12	1.00

Note: All variables except for export ratios are defined in log.

Table A3: List of Country and Industry

Country			
Argentina	Germany	Mexico	Switzerland
Australia	Hong Kong	Netherlands	Taiwan
Belgium	India	New Zealand	Thailand
Brazil	Indonesia	Philippines	United Kingdom
Canada	Italy	Singapore	
China	Japan	South Korea	
France	Malaysia	Spain	

Industry	
SIC for years 1989-1998	NAICS for years 1999-2005
Food and kindred products	Food
Primary and fabricated metals	Chemicals
Chemicals and allied products	Primary and fabricated metals
Electronic and other electric equipment	Machinery
Industrial machinery and equipment	Computers and electronic products
Transportation equipment	Electrical equipment, appliances, and components
Other manufacturing	Transportation equipment

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