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Kozo Kiyota

Yokohama National University
and University of Michigan

Toshiyuki Matsuura

Research Institute of Economy, Trade and Industry

Shujiro Urata

Waseda University

and

Yuhong Wei

Hitotsubashi University

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Kozo Kiyota [†]
Faculty of Business Administration, Yokohama National University
and
Gerald R. Ford School of Public Policy, University of Michigan

Toshiyuki Matsuura[‡]
Research Institute of Economy, Trade and Industry

Shujiro Urata[¶]
Graduate School of Asia-Pacific Studies, Waseda University

Yuhong Wei[*]
Graduate School of Economics, Hitotsubashi University

[†] (Until August 2008) Gerald R. Ford School of Public Policy, University of Michigan; 735 S. State St., #3303, Ann Arbor, MI 48109-3091 USA; Tel: 734-615-6846; Fax: 734-763-9181; E-mail: kiyota [at] umich.edu
[‡] Research Institute of Economy, Trade and Industry; 1-3-1, Kasumigaseki, Chiyoda-ku, Tokyo, 100-8901 Japan; TEL: +81-3-3501-8233; FAX: +81-3-3501-8415; E-mail: matsuura-toshiyuki [at] rieti.go.jp
[¶] **Corresponding author:** Graduate School of Asia-Pacific Studies, Waseda University; Nishi-Waseda Bldg. 7F, 1-21-1 Nishi-Waseda, Shinjuku-ku, Tokyo 169-0051 Japan; Tel: +81-3-5286-1414; Fax: +81-3-3208-1032; E-mail: surata [at] waseda.jp
[*] Graduate School of Economics, Hitotsubashi University; 2-1 Naka, Kunitachi, Tokyo 186-8601, Japan. Tel: +81-42-580-8000; E-mail: ed032004 [at] srv.cc.hit-u.ac.jp

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Abstract

This paper examines the determinants of the backward vertical linkages of Japanese foreign affiliates in manufacturing for the period 1994-2000, focusing on the *local* backward linkages, or local procurements in the host country. Our major findings are twofold. First, the unobserved affiliate-specific characteristics explain the large part of the variation of the backward linkages among foreign affiliates. Second, the experience of the affiliate has positive and sometimes non-linear impacts on local procurements for the affiliates, especially in Southeast Asia and China. (81 Words)

Key Words: Vertical Backward Linkages, Foreign Direct Investment, Local Procurements, Southeast Asia, China

JEL Classification Code: F10 (International Trade, General), F23 (Multinational Firms; International Business), D21 (Firm Behavior)

1. INTRODUCTION

Backward vertical linkages of multinationals are becoming one of the most important issues in the fields of international trade and development economics for two reasons. One is the growing *international* backward linkages. We have witnessed the rapid expansion of foreign trade in intermediate goods, but the rate of increase in such trade does not seem attributable only to the reduction in trade barriers.[1] Instead, growing international backward linkage by multinationals, or growing intermediate input trade between headquarters and foreign affiliates, has contributed significantly to the rapid expansion of intermediate goods trade (Kleinert, 2001).[2] Indeed, Japanese multinationals in the 1990s are no exceptions. Table 1 shows the share of intra-firm exports in total exports of Japanese firms. The share of intra-firm exports increased from 33.3 percent in 1994 to 42.7 percent in 2000 for manufacturing as a whole.[3]

=== Table 1 here ===

The second reason is increased interest in *local* backward linkages, or local procurements for host countries. It is particularly important for developing countries to identify the determinants of local procurements of multinationals.[4] This is because the host country could enhance the potential benefits of hosting foreign direct investment (FDI) with the increase in local procurements.[5] For instance, supporting industries in the host countries are expected to grow, as local procurements increase. Moreover, vertical backward linkages could contribute to the technology transfer from multinationals to

domestic firms (Javorcik, 2004).

In light of the growing importance of vertical backward linkages, it appears for Japanese multinationals that local backward linkages grew faster than the international backward linkages. Table 2 presents the local and imported inputs of Japanese foreign affiliates for the period 1990-2000. Imports of affiliates in every region expanded from 1991-1995 to 1996-2000. Table 2 clearly shows that the growth of local procurements has been faster than the growth of imports. Accordingly, the ratio of local inputs to total intermediate inputs in the foreign affiliates of Japanese multinationals increased throughout the period.

=== Table 2 here ===

Despite its importance, to the best of our knowledge, only Belderbos, Capannelli, and Fukao (2001) have examined the determinants of local backward linkages of multinationals at the affiliate level, focusing on Japanese electronics manufacturing affiliates. Using foreign affiliate-level cross-section data for 1992, they conducted cross-section regression analysis. The results indicated that the local procurements of Japanese foreign affiliates depended on the quality of infrastructure, the size of the local supporting industry or components suppliers, and local content regulations.

Another related study is Hanson, Mataloni, and Slaughter (2005) that focused on international vertical backward linkages. They investigated affiliates' demand for imported inputs as a function of trade costs, factor prices, and other control variables. Based on U.S. manufacturing firm-level cross-section data in 1994, they found that U.S. affiliates' demand for imported inputs was high if the

trade costs were low, if the relative wages of less-skilled labor were low, and if corporate income tax rates were low.

Our study builds upon this previous research. Our contribution is twofold. First, we employ a more rigorous theoretical framework than Belderbos et al. (2001). We apply the analytical framework of Hanson et al. (2005) to examine the local backward linkages, estimating Japanese foreign affiliates' demand for local inputs based on a Translog cost function. Second, we take into account unobserved affiliate-specific characteristics.[6] Both Belderbos et al. (2001) and Hanson et al. (2005) used affiliate-level data, but their studies used cross-section analysis. The recent literature on international trade has revealed that the trade patterns of plants (or firms) are different even in a given industry.[7] Indeed, local procurement patterns do not seem to be fully explained by the industry-level factor.

Figure 1 presents the distribution of the local procurement ratio for Japanese foreign affiliates in four selected industries (textiles, general machinery, electric machinery, and transportation equipment) in 2000. The local procurement ratio is defined as the share of local intermediate inputs in total costs.[8] The figures show wide variations in the local procurement ratios among the affiliates in the four industries under study. In textiles, although the average local procurement ratio is 38 percent, approximately 30 percent of the affiliates indicate less than 10 percent of local procurement. This is also observed in the other three industries, implying that heterogeneity of local procurements exists and therefore local procurement patterns do not seem to be explained very well by the industry-level factor. Some of this heterogeneity can be explained by observable affiliate characteristics. But we should note that affiliate

heterogeneity is not necessarily observed. Given these considerations, without controlling for affiliate-level heterogeneity, it is difficult to identify the determinants of backward linkages accurately.

=== Figure 1 here ===

To control for affiliate-level heterogeneity, we have developed affiliate-level longitudinal (panel) data, using the confidential survey conducted by the Japanese Ministry of Economy, Trade and Industry (METI). The coverage of the data is broader than previous studies. Our data cover more than 1,800 manufacturing affiliates for 1994-2000, enabling us to examine the differences of the determinants among industries.

The organization of the paper is as follows. The next section explains the estimation model and data, and the following section discusses the estimation results. A summary of findings and policy implications are presented in the final section.

2. RESEARCH DESIGN

(a) The model

Denote the cost function of a foreign affiliate i in industry j located in country c by $C_{ijc}(\mathbf{p}_{ijc}, y_{ijc})$, where y_{ijc} represents gross output of the affiliate and $\mathbf{p}_{ijc}$ is a vector of factor prices. The output is produced by a set of inputs n $(n \in N)$. The second-order Taylor's series approximation in logarithms to the cost function is:

$$\ln C_{ijc} = \ln \alpha_0 + \sum_{n \in N} \alpha_n \ln p_{ijc}^n + \frac{1}{2} \sum_{n \in N} \sum_{m \in N} \beta_{nm} \ln p_{ijc}^n \ln p_{ijc}^m + \alpha_y \ln y_{ijc} + \frac{1}{2} \alpha_{yy} (\ln y_{ijc})^2 + \sum_{n \in N} \beta_{ny} \ln p_{ijc}^n \ln y_{ijc}, \quad (1)$$

where $\beta_{mn} = \beta_{nm}$. Differentiating this function with respect to input prices and then employing Shephard's Lemma, we obtain a cost-share equation of the form:

$$\frac{\partial \ln C_{ijc}}{\partial \ln p_{ijc}^n} = \frac{p_{ijc}^n}{C_{ijc}} \cdot \frac{\partial C_{ijc}}{\partial p_{ijc}^n} = \frac{p_{ijc}^n x_{ijc}^n}{C_{ijc}} = \alpha_n + \sum_{n \in N} \beta_{nm} \ln p_{ijc}^n + \beta_{ny} \ln y_{ijc}, \quad (2)$$

where $\sum_{n \in N} p_{ijc}^n x_{ijc}^n = C_{ijc}$.

Suppose that affiliate i produces y_{ijc}, using four inputs: K (capital stock), L (labor), D (intermediate inputs from host country c), and M (intermediate inputs from imports). Denote the cost shares by $s_{ijc}^n = p_{ijc}^n x_{ijc}^n / C_{ijc}$ ($\sum_{n \in N} s_{ijc}^n = 1$). Then the cost share of local inputs becomes:

$$s_{ijc}^D = \ln \alpha_D + \beta_{DL} \ln p_{ijc}^L + \beta_{DK} \ln p_{ijc}^K + \beta_{DD} \ln p_{ijc}^D + \beta_{DM} \ln p_{ijc}^M + \beta_{Dy} \ln y_{ijc}, \quad (3)$$

where $p_{ijc}^n, n \in \{K, L, D, M\}$ represents the price of input n. The higher the value of s_{ijc}^D, the more the affiliate uses the host country's intermediate inputs, implying that local procurements are high. Introducing time dimension t and adding other control variables Z_{ijct}, unobserved affiliate-specific characteristics θ_i, and an error term μ_{ijct}^D, the regression equation is as follows:

$$s_{ijct}^D = \beta_0 + \beta_{DL} \ln p_{ijct}^L + \beta_{DK} \ln p_{ijct}^K + \beta_{DD} \ln p_{ijct}^D + \beta_{DM} \ln p_{ijct}^M + \beta_{Dy} \ln y_{ijct} + \gamma Z_{ijct} + \theta_i + \mu_{ijct}^D, \quad (4)$$

where $\beta_0 = \ln \alpha_D$. Unobserved affiliate-specific characteristics capture the affiliate-specific factors that affect the local procurements of foreign affiliates. But these characteristics are not observed because of

data unavailability. An example is an affiliate-specific local supply-chain network. For instance, affiliates with their specific local supply-chain networks in the host country can purchase local products more cheaply than other firms. Such local networks, which may not be observed, can be different among affiliates even though they belong to the same parent-firm group.[9]

(b) Data

(i) Source

We use the micro database of *Kaigai Jigyou Katsudou Kihon (Doukou) Chousa* (*The Survey on Overseas Business Activities*, hereafter the METI survey) prepared by the Research and Statistics Department, METI (1996-2002a). The METI survey is conducted annually by a questionnaire based on self-declaration survey forms (one for parent firm and one for each foreign affiliate) given to the parent firm. From this annual cross-section survey, we developed panel data for foreign affiliates in manufacturing from 1994 to 2000. The detailed description of the data is provided in an Appendix below. The number of foreign affiliates exceeds 1,800 for each year. The lists of countries and industries are presented in Tables A1 and A2, respectively.

(ii) Cost share of local inputs: s_{ijct}^{D}

The cost share of local inputs for our analysis is defined as local intermediate inputs divided by total costs.[10] Total costs are defined as the sum of intermediate input purchases, wage payments, interest payment, rental expenses, and depreciation.

(iii) Input prices: $p^L_{ijct}, p^K_{ijct}, p^D_{ijct}, p^M_{ijct}$

The input price of labor p^L_{ijct} is defined as annual average wages. Since it is difficult to obtain average wages at the firm level, we use the industry average wage of foreign affiliates by country. This in turn implies that p^L_{ijct} is collapsed into p^L_{jct}. The data are obtained from the METI survey.

The prices of capital and domestic intermediate inputs at the industry level are not available for most of the countries listed in Table A1. We assume that the prices of capital and domestic intermediate inputs are affiliate-specific, unobserved, and fixed across time.[11] This implies that these prices, together with unobserved affiliate-specific characteristics θ_i, are represented as an unobserved affiliate-specific fixed effect ω_i. That is,

$$\beta_{DK} \ln p^K_{ijct} + \beta_{DD} \ln p^D_{ijct} + \theta_i = \omega_i . \quad (5)$$

A large part of intermediate inputs is traded within the same firm located in different countries (intra-firm trade). We thus assume that the imported inputs of each affiliate come from the same industry in Japan. This assumption can be justified because the share of imported inputs from Japan in total imported inputs is quite high.[12] Following Hanson et al. (2005), we assume that p^M_{ijct} is decomposed into local input price and trade cost:[13]

$$\ln p^M_{jct} = \ln p^M_{jt} + \ln(1 + \tau_{ct} + g_{ct}), \quad (6)$$

where p^M_{jt} is the input price index of intermediates in industry j, τ_{ct} is the *ad valorem* tariff rate that country c levies on imports, and g_{ct} is the *ad valorem* freight rate on imports from Japan to country c.

For p_{jt}^{M}, we use the sectoral-input-price index of manufacturing industry in Japan, which comes from the Bank of Japan (2004). To control for the effects of exchange rate movements, we multiply the sectoral-input-price index by the nominal-exchange-rate index (1989 = 1) obtained from IMF (2004). The tariff rate is defined as tariff revenues divided by imports. Both tariff revenues and imports are obtained from World Bank (2004). The freight rate is defined as the C.I.F. value of imports divided by the F.O.B. value of imports obtained from IMF (2004).

(iv) Output: y_{ijct}

Output is defined as sales of a foreign affiliate. To obtain real output, sales are deflated by each country's GDP deflator. The data are taken from the METI survey.

(v) Other control variables: Z_{ijct}

Six additional variables are used as control variables and tested for their impacts on the use of local inputs. The six variables can be grouped into two sets. One set concerns the characteristics of foreign affiliates and parent firms in Japan, and the other the conditions of the host country or host market. For the variables in the first group, we used the length of operation ($EXPER_{ijct}$), the share of equity of the foreign affiliates held by the parent firms in Japan ($SHARE_{ijct}$), the share of local sales in total sales ($LOCSALES_{ijct}$), and the capital-labor ratio of the parent firm ($KLRATIO_{ijct}$). For the variables in the second group, we used the value-added of the manufacturing sector ($SUPPLIERS_{ct}$) and the presence of foreign affiliates of Japanese multinationals ($JSUPPLIERS_{jct}$). The data for the capital-labor ratio of parent firm are taken from *The Results of the Basic Survey of Japanese Business Structure and Activities*

by the METI (1996-2002b), and other variables are from the METI survey.

The length of operation, $EXPER_{ijct}$, is included to examine its impact on the local procurement ratio. We also include the squared value of $EXPER_{ijct}$ to take into account the possible non-linear effect of experience. Foreign affiliates of multinationals without knowledge about local firms have to rely on their parent firm or affiliates for the supply of intermediate inputs in the early stages of their operation. As foreign affiliates increase their knowledge about the local supply of inputs, they are likely to increase local inputs. At least two factors may contribute here. One is the expectation or request from the host country to increase local inputs. A host country government may realize the importance of increasing local linkages with affiliates in order to promote technology transfer and to develop supporting industries, or local input suppliers. Accordingly, the government that is keen on gaining maximum benefits from hosting foreign affiliates of multinationals requests foreign affiliates to increase local inputs.

The other factor that would lead to increased local inputs is the behavior of foreign affiliates in reducing various risks resulting from international transactions. Reliance on imported inputs would place the foreign affiliates in a vulnerable position as international transactions are subject to uncertainties associated with exchange-rate changes, transportation, communication, and other factors. We would therefore expect $EXPER_{ijct}$ to have a positive impact on the share of local inputs in total inputs. If the effects of experience are particularly important for the first several years and then diminish afterwards, the coefficient of squared values will be negative.

The share of equity of the foreign affiliates held by the parent firm, $SHARE_{ijct}$, is expected to have a negative impact on local procurement. Foreign affiliates under tight control of the parent firm tend to rely heavily on the parent firm for procurement of inputs, output sales, personnel, and other factors. Indeed, the parent firm has an incentive to increase supply or sales of inputs to its subsidiaries in order to maintain its business at home.

The share of local sales in total sales of foreign affiliates, $LOCSALES_{ijct}$, is included to capture the importance of local-market orientation for the determination of input sources. We hypothesize that greater local-sales orientation leads to higher reliance on local inputs. Two factors may be considered here. First, foreign affiliates of Japanese multinationals with high local sales orientation are likely to have strong linkage with local firms not only in terms of sales but also in terms of procurement of inputs. Second, foreign affiliates engaged in the production of products for the local market rely on local inputs because such production tends to require local inputs.

The capital-labor ratio of the parent firm $KLRATIO_{ijct}$ is used to control for the effects of the parent firm in Japan. Capital-intensive firms are more likely to possess more firm-specific intangible assets than the less capital-intensive firms. This implies that the transaction between a foreign affiliate and local firms tends to be low compared with the transaction between a foreign affiliate and its parent firm because of transaction costs, imperfect information, and incomplete contracts.[14] We thus expect that an affiliate of capital-intensive firms is more likely to import intermediate inputs from Japan while less capital-intensive firms are more likely to use local inputs.

Turning to host-country factors, we include the value-added of manufacturing ($SUPPLIERS_{ct}$) to capture the availability of inputs from the host country. We expect $SUPPLIERS_{ct}$ to have a positive impact on local inputs, since a large manufacturing sector indicates the presence of potential input suppliers. The data are taken from World Bank (2004).

A limitation of our data is that local procurements may include the procurements from foreign affiliates of other Japanese firms in the same country. Japanese firms are argued to have established exclusive networks with other Japanese firms in procurement of inputs as well as sales of outputs. In order to control for such "Japanese network" effects in the procurement of inputs, we include the presence of foreign affiliates of Japanese firms ($JSUPPLIERS_{jct}$), which is measured by the number of foreign affiliates of Japanese multinationals in the same country under study. Significantly positive coefficients are expected if "Japanese network" has strong effects on the local procurements. The data are obtained from Matsuura (2005).

Another important set of control variables is related to policy effects such as local content requirements and restriction on equity participation. However, in our data, these variables are available only for 1995 and 1998, implying that the inclusion of the policy effects makes it difficult to conduct panel data analysis. We thus exclude the policy effects in this paper but these are addressed in Kiyota, Matsuura, Urata, and Wei (2006).

In sum, our baseline model is specified as follows:

$$s_{ijct}^{D} = \omega_i + \beta_{DL} \ln p_{jct}^{L} + \beta_{DM} \ln p_{jct}^{M} + \beta_{Dy} \ln y_{ijct} + \gamma_1 EXPER_{ijct} + \gamma_2 EXPER_{ijct}^{2} + \gamma_3 SHARE_{ijct} + \gamma_4 LOCSALES_{ijct} + \gamma_5 KLRATIO_{ijct} + \gamma_6 SUPPLIERS_{ct} + \gamma_7 JSUPPLIERS_{jct} + \mu_{ijct}^{D}. \quad (7)$$

The definitions of the variables and expected signs of coefficients are summarized in Table A3, while summary statistics and the correlation matrix for these variables are presented in Tables A4-A6.

3. RESULTS

(a) Results of baseline model

Table 3 shows the regression results of equation (7) generated by a pooled OLS and a fixed-effect model for all manufacturing (columns [1]-[5]) and for selected industries (columns [6]-[9]).[15] Columns [1]-[2] and [6]-[9] are the results for all countries. Columns [3], [4], and [5] present the results for United States, East and South East Asia, and China, respectively. Four findings stand out from this table. First, the affiliate-specific fixed-effect is likely to be far more important than standard economic variables in explaining the local backward linkages. Controlling for the affiliate fixed effect reduces the statistical significance of many of the explanatory variables when compared to the OLS estimates, and raises R-squares substantially. This implies that the unobserved affiliate-specific characteristics such as local supply-chain networks in the host country may play an important role in expanding the backward linkages. This differs from previous studies.[16] This also implies that the determinants of the local procurement patterns can be misinterpreted without controlling for unobserved affiliate-specific characteristics.

Second, in manufacturing, the coefficients of $\ln y_{ijc}$, $LOCSALES_{ijct}$, $JSUPPLIERS_{jct}$ are positive and statistically significant. The results thus suggest that local procurements will be high for affiliates with a high local-sales orientation or for countries where the presence of Japanese foreign affiliates is high.

=== Table 3 here ===

Third, the coefficients of $EXPER_{ijct}$ are positive and significant. This implies that experience has a significant impact on local procurements. Note that the effect of experience might be different across regions in which foreign affiliates are located. Indeed, when we estimate the baseline model separately for the United States, East and Southeast Asia, and China, the positive effect of experience is confirmed for the affiliates in the United States, and East and Southeast Asia, although the coefficients from the different regression results cannot be directly compared each other. Note that, among the control variables, a large regional difference is confirmed in experience (Table A5), implying that the effects of experience are different across regions. In order to investigate the regional differences in the effects of experience in a comparable way, we extend the baseline model to include cross terms between $EXPER_{ijct}$ and regional dummies, which will be examined in more detail in the next subsection.

The coefficients of $EXPER_{ijct}^2$ are positive for manufacturing as a whole. However, the results for different sectors reveal that the coefficient is significant only for textiles. This result may suggest that local textile firms in host countries are well developed and, therefore, the effects of experience diminish rapidly relative to other industries.

Note also that some of the variables such as the share of equity of the foreign affiliates held by the parent firm ($SHARE_{ijct}$) and the share of local sales in total sales ($LOCSALES_{ijct}$) are different across technologies, or industries. For instance, the form of corporate governance is likely to affect the share of equity. Similarly, in the food manufacturing industry there might be a closer relationship between local sales and local inputs than in the machinery industries. To take into account these differences, we estimated the cost function by industry.

The fourth finding is that the significance level of the estimated coefficients is slightly different among industries. For instance, the coefficients of $JSUPPLIERS_{jct}$ are significantly positive in textiles, electric machinery, and transportation equipment, while the coefficients of $LOCSALES_{ijct}$ indicate positive and significant signs in manufacturing, textiles, general machinery, electric machinery, and transportation equipment. This suggests that there are some differences in the determinants of local procurements among industries, but local-sales orientation is an important factor regardless of the industry.

(b) Regional difference of the impacts of experience

Table 4 presents the regression results with the cross-term involving experience and regional dummies. We include five regional dummies: ASEAN4, China, NIES, Europe, and Other Countries.[17] "Other Countries" include all other countries except the United States. Therefore, the coefficients reflect the difference between the United States and each region. As we confirmed in Table 3, Table 4 indicates high adjusted R-squares for aggregated level (all manufacturing) and sectoral level (all four selected

industries). Local-sales orientation is also an important determinant at both aggregated and sectoral level.

=== Table 4 here ===

Contrary to Table 3, Table 4 shows the positive and statistically significant experience effects. At the aggregated level, the positive and significant effects are observed in all regions. Significantly positive effects are also confirmed at the sectoral level, except for transportation machinery equipment. Experience has positive effects on local procurements in general machinery and electric machinery for ASEAN4 and China. Strong non-linear effects are also observed in general machinery for ASEAN, China, and other countries and in electrical machinery for other countries. These results imply that the effects of experience may take different forms among industries and regions. Note also that ASEAN and China present significantly positive and relatively large coefficients not only in manufacturing as a whole but also in both general machinery and electric machinery. This result suggests that the experience is an important determinant of local procurement, especially in Southeast Asian countries and China.

It is worth noting that the vertical linkage patterns are different across industries. FDI in textiles, general machinery, and electric machinery is likely to be horizontal: the same horizontal stage of a production process of a product is duplicated in home and host countries. On the other hand, FDI in the transportation equipment industry tends to be vertical: a part of the production process of a product is separated and relocated into a different country. Although we could not confirm positive effects of experience in transportation machinery equipment even after we controlled for the regional difference in Table 4, this weak linkage of the transportation equipment industry with local firms may not be

surprising. This is because the transportation equipment industry is more vertically integrated between production in Japan and foreign production in FDI-hosting countries.

4. CONCLUDING REMARKS

This paper has examined the determinants of the backward vertical linkages of Japanese foreign affiliates in manufacturing for the period 1994-2000. In analyzing these linkages, we have focused on local procurements. A unique feature of our analysis is the use of affiliate-level panel data, which enables us to control for unobserved affiliate-specific characteristics.

Our major findings are twofold. First, the unobserved affiliate-specific characteristics explain the large part of the variation of the backward linkages among foreign affiliates, a finding not known in previous studies. This suggests that unobserved affiliate-specific characteristics such as local supply-chain network may play an important role in the formation of the backward linkage of foreign affiliates. This also implies that the determinants of local procurement patterns can be misinterpreted without controlling for unobserved affiliate-specific characteristics.

Second, experience, which is measured by the length of operation, has positive and sometimes non-linear effects on local procurements of affiliates, especially in the Southeast Asian countries and China. This indicates that foreign affiliates of Japanese multinationals in Southeast Asia and China develop local backward linkages over time, as they accumulate experience in local operation. We interpret these results to reflect the existence of “vintage” effects in Southeast Asia and China. Earlier established affiliates show significantly higher procurement levels in these countries.

The fact that this phenomenon is observed mainly in developing countries may be attributable to several factors. One is the difference in the speed of formation of supporting industries, or local input suppliers, in these two types of countries. Rapidly expanding supporting industries in Southeast Asia and China enable the foreign affiliates of Japanese firms in these countries to increase local procurements. By contrast, in developed countries supporting industries are already well established by the time Japanese firms set up their affiliates. Thus, there is only limited opportunity for affiliates to increase local procurements over time. Another reason may be the closed nature of the procurement network in Southeast Asia and China compared with the situation in developed countries. Similar to the case in Japan, business practices are rather closed in Asian countries, as firms in these counties pursue a long-term relationship based on trust. As such, it takes time for Japanese foreign affiliates to establish business relationships with local firms in these countries.

The second finding has important policy implications. Host governments wishing to increase local procurements should develop an attractive and stable FDI environment. Unless foreign firms stay long enough, a host country cannot expect foreign firms to develop local linkages. It is well known that countries with a stable macroeconomic environment, well-developed infrastructure, including not only hard infrastructure such as transportation and communication facilities but also soft infrastructure such as law and order, education system, bureaucracy, and open trade and FDI regimes, can attract foreign firms and host them for a long time. By the same token, policy makers should recognize that enhancing the absorptive capacity of local firms also takes time.

In conclusion, there are several research issues for the future that are worth mentioning. First, further investigation of backward linkage is an important extension. For instance, we have assumed that imported inputs come from the same industry in Japan. However, such an assumption might be inappropriate in some industries because the vertical linkage cuts across industries. In order to conduct more detailed analysis, input-output table information can be of help to capture the inter-sectoral linkages.[18]

Second, it is also important to distinguish more clearly the difference between the experience of Japanese affiliates and local firms. We have implicitly assumed that both local and incumbent suppliers produce the same quality of inputs since beginning production operation in the host country. However, the local firms can improve the quality of their supplies through the interaction with Japanese affiliates (or technology spillovers from Japanese affiliates to local firms), thereby enhancing absorptive capacity. Although a part of the growth of local supplies is controlled for in the regression analysis, we do not clearly distinguish the difference of experience between local firms and Japanese firms.

Third, a study utilizing data on the different countries or periods will add another national perspective to the growing body of empirical literature on backward vertical linkages. We found that the intermediate inputs trade between headquarters and foreign affiliates was related to the industry composition of exports (Table 1). Therefore, the impacts of experience on backward vertical linkages may not be the same for different countries and different periods.

Finally, the linkage of information between a parent firm and its affiliates constitutes an important

question for future research. Not only intangible assets but also other parent firm characteristics may affect the behavior of foreign affiliates. In this connection, it is also important to identify the source of unobserved affiliate-specific characteristics in more detail. Although we found that unobserved affiliate-specific characteristics explained the large part of the variation of the backward linkages among foreign affiliates, the unavailability of the necessary information precludes us from conducting further empirical investigation of the importance of affiliate-specific characteristics in the determination of procurement behavior of Japanese foreign affiliates. To conduct such analysis, it is imperative that the quality and coverage of the firm- and affiliate-level data must be improved and expanded.

APPENDIX: DATA DESCRIPTION

This paper uses the micro database of the METI survey. The main purpose of the METI survey is to obtain basic information on the activities of foreign affiliates of Japanese firms. The METI survey covers all Japanese firms that had affiliates abroad (hereinafter referred to as parent firm) as of the end of the fiscal year (March 31).[19] A foreign affiliate of a Japanese firm is defined as a firm that is located in a foreign country in which a Japanese firm had more than or equal to a 10 percent equity share. Industrial classification is available at the 2-digit level. From this annual cross-section survey, we developed a longitudinal (panel) data for foreign affiliates in manufacturing from 1994 to 2000. Each affiliate is traced throughout the period using the name of the firm as a key.[20] The number of observations is 41,792 affiliate-years (cumulative total from 1994 to 2000).

Further, to control for parent-firm characteristics, we merged the METI survey with the *Kigyou Katsudou Kihon Chousa Houkokusho* (*The Results of the Basic Survey of Japanese Business Structure and Activities*) by the METI (1996-2002b). This survey was first conducted in 1991, then in 1994, and annually afterwards. The survey covers all firms with more than 50 employees and with more than capital of 30 million yen, for both manufacturing and non-manufacturing firms. The limitation of this survey is the lack of some financial information and such firm-group information as *keiretsu*.[21] The number of affiliates whose parent characteristics are available from *The Results of the Basic Survey of Japanese Business Structure and Activities* is 37,708 observations (out of 41,792 observations).

We dropped the affiliates from our sample set for which affiliate-age (the year of the survey

minus the year of establishment), the number of employees, total sales, local sales, total intermediate input, and local intermediate inputs are zeros or missing. Due to missing values for these variables, 16,570 out of 37,708 observations are dropped, among which 999 observations are dropped due to missing values of the local intermediate inputs. After the clean-up of the data, the total number of observation is 21,138 affiliate-years.

=== Tables A1-A6 here ===

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[1] For instance, using confidential U.S. affiliate-level data over the period 1983-92, Feinberg and Keane (2001) found that the imports of U.S. affiliates in Canada did not have a statistically significant relationship with the reduction of tariffs in Canada.

[2] Hummels, Ishii, and Yi (2001) measured the degree of vertical linkages, using input-output tables from ten OECD and four emerging market countries between 1970 and 1990. They found that the use of imported inputs to produce exported goods grew about 30 percent during 1970-90. Similarly, Yeats (2001) found that the growth of trade in inputs, which now account for 30 percent of world trade in manufactures, was faster than the growth of trade in final goods.

[3] A detailed description of the data will be provided in Section 2(b) and the Appendix. Note that there are some differences across sectors. Section 3 discusses sectoral difference of backward linkages in more detail.

[4] See, for instance, Lowe and Kenney (1999) for discussion of the consumer electronics industry in Mexico and Kelegama and Foley (1999) for discussion of the garment industry in Sri Lanka. UNCTAD (2001) reviews several policies to promote linkages between foreign affiliates and domestic firms, including local content requirements.

[5] "Several less-developed and newly industrializing countries in Asia and Latin America have instituted formal local content requirements for foreign investors, while others have made preferential investment status conditional on local content, or have put informal pressure on foreign investors to extend their vertical linkages." (Belderbos et al. 2001, p.189) Local content requirements have become illegal under the terms of the trade-related investment measures (TRIMs) agreement in the World Trade Organization (WTO) in 1995. The elimination of regulations is allowed to take place within five years for developing countries and seven years for leased developed countries. Some developing countries requested (and are still requesting) to postpone the elimination.

[6] Some concrete examples are provided in Section 3(a).

[7] See, for instance, Bernard, Eaton, Jensen, and Kortum (2003).

[8] Total costs are defined as the sum of intermediate input purchases, wage payments, interest payment, rental expenses, and depreciation.

[9] This argument may be valid only in the short- and medium-term because local supply-chain networks evolve in the long run (i.e., θ_i becomes θ_{it} in the long run).

[10] Because of limited data the availability, we cannot decompose the local intermediate inputs into locally-sourced inputs and purchase from other foreign affiliates.

[11] A concern of note is the change of prices through the period. This can be captured by year dummies. However, the fixed-effect model does not allow us to include year dummies and "experience" simultaneously. Because of data limitations on these factor prices, it is not possible to estimate the system of equations and impose cross-equation parameter restrictions (i.e., the symmetry of cross-price derivatives).

[12] For the period of our study the average share for all foreign affiliates was as high as 65.8 percent.

[13] As Hanson et al. (2005) argued, the investigation of the effects of trade costs can provide useful insight into the international vertical linkage of multinationals. We addressed this issue in another paper (Kiyota, Matsuura, Urata, and Wei, 2007), where we found that high trade costs increased local procurements.

[14] Another possible proxy to capture firm-specific intangible assets is R&D intensity. However, most R&D might be a product-specific rather than a firm-specific variable. We thus use capital intensity instead of R&D intensity to capture the effect of a firm-specific intangible asset. In our estimation, we confirmed that the

results were generally the same even when we use R&D intensity rather than capital intensity.

[15] Although the dependent variable takes the value between zero and one, we employ a linear model rather than a Tobit model. This is because of the incidental-parameter problem. That is, the maximum-likelihood estimator of a non-linear model (including a Tobit model) with a fixed-effect and short time periods is inconsistent (For more detail, see Hsiao, 2003, p.194). One might think that another possible remedy is to apply logit transformation to the dependent variable: $\ln(s/1-s) = x'\beta$. But such a specification is not consistent with equation (1), since logit transformation implies that the cost share should be specified as: $s = 1/\{1+\exp(-x'\beta)\}$. Further, the logit transformation means that firms without local procurements (i.e., $s = 0$) are excluded from the analysis. Therefore, we do not apply logit transformation.

[16] The F-test indicates that the null hypothesis that all the affiliate-specific effects are zero is rejected at the 1 percent significance level.

[17] ASEAN includes Indonesia, Malaysia, the Philippines, and Thailand. NIES includes Hong Kong, Korea, Singapore, and Taiwan. Europe includes Belgium, France, Germany, Italy, Netherlands, Spain, and the United Kingdom. Other Countries include all other countries except the United States. A list of countries is presented in Table A2.

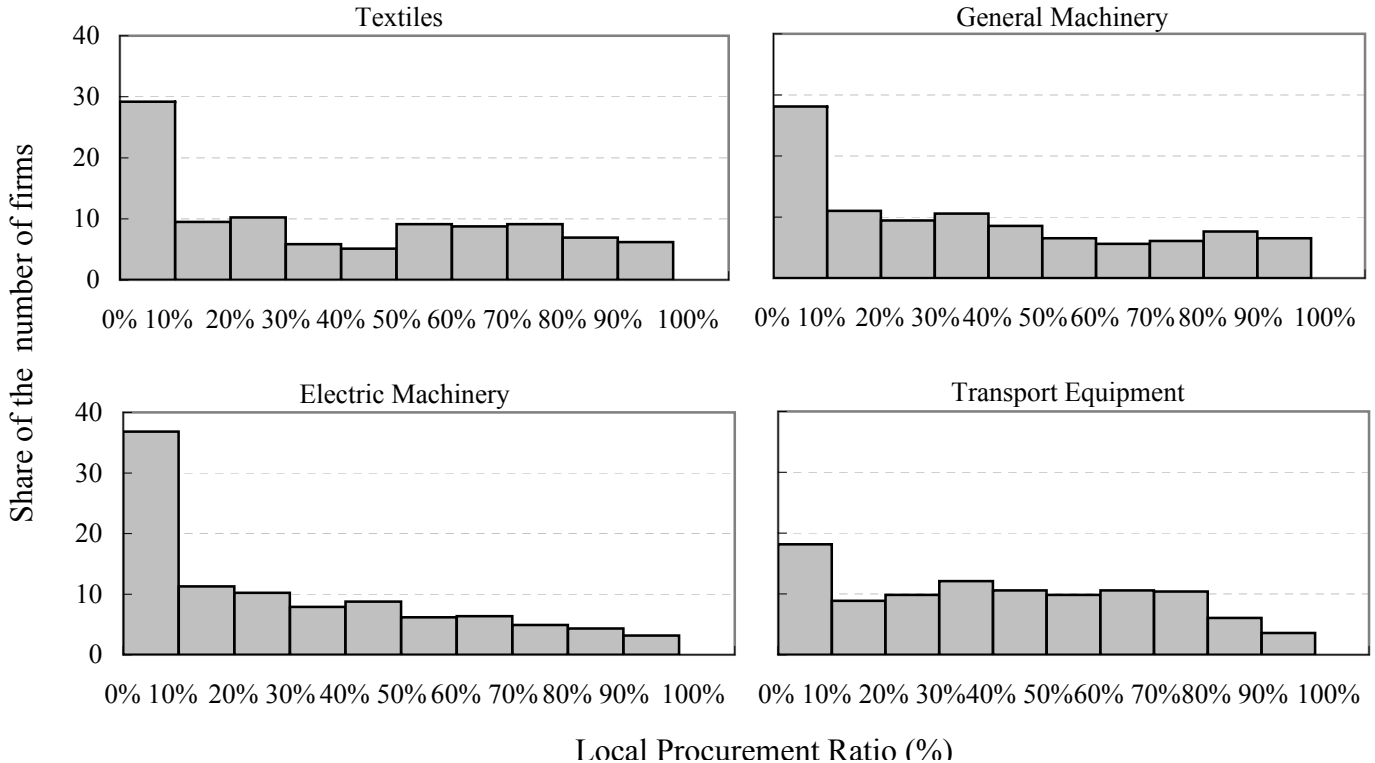
[18] For the use of input-output tables to capture inter-sectoral linkages (or supply-chain networks), see Javorcik (2004).

[19] Some industries such as financial and insurance and real estate are not covered in the survey.

[20] There are some affiliates that changed their name during our sample period. In this case, we also use industry, location, scale, and the information on parent firm to trace the affiliates. For detailed information on the construction of the panel data, see Matsuura (2005).

[21] Belderbos et al. (2001) used *Nihon no Kigyou Guruupu* (*Japanese Corporate Groups*) by Toyo Keizai Inc. to obtain the information on *keiretsu*. However, we found that the data were not updated after 1999. We thus decided to link the METI survey with *The Results of the Basic Survey of Japanese Structure and Activities* rather than *Japanese corporate groups* to control for the parent characteristics. For more detailed information on *The Results of the Basic Survey of Japanese Business Structure and Activities*, see for instance Kiyota and Urata (2007).

Figure 1. Local Procurement Ratio, 2000



Note: Average local procurement ratio is 38%, 36%, 30%, and 42% for textiles, general machinery, electric machinery, and transportation equipment, respectively.

Source: The METI Survey

Table 1. The Ratio of Intra-firm Exports to Total Exports

Industry	All manufacturing	Textiles	General machinery	Electric machinery	Transportation equipment
1994	33.3%	9.2%	30.5%	33.5%	36.9%
2000	42.7%	35.4%	28.9%	35.4%	57.4%

Source: METI (1996b, 2002b) *The Results of the Basic Survey of Japanese Business Structure and Activities*.

Table 2. Backward Linkages of Japanese Firms

		Millions of Dollars		Index: 1991-1995 = 100.0		Index: Total = 100.0	
		1991-1995 average	1996-2000 average	1991-1995	1996-2000	1991-1995	1996-2000
World	Total intermediate inputs	75,873	98,428	100.0	129.7	100.0	100.0
	Imported inputs	45,161	57,164	100.0	126.6	59.5	58.1
	Local inputs	30,712	41,264	100.0	134.4	40.5	41.9
United States	Total intermediate inputs	29,841	40,046	100.0	134.2	100.0	100.0
	Imported inputs	14,569	16,991	100.0	116.6	48.8	42.4
	Local inputs	15,272	23,055	100.0	151.0	51.2	57.6
Europe	Total intermediate inputs	3,042	4,389	100.0	144.3	100.0	100.0
	Imported inputs	2,598	3,319	100.0	127.8	85.4	75.6
	Local inputs	444	1,070	100.0	240.9	14.6	24.4
NIES	Total intermediate inputs	11,220	17,733	100.0	158.0	100.0	100.0
	Imported inputs	7,918	11,177	100.0	141.2	70.6	63.0
	Local inputs	3,302	6,556	100.0	198.5	29.4	37.0
ASEAN4	Total intermediate inputs	4,731	7,879	100.0	166.5	100.0	100.0
	Imported inputs	2,540	3,903	100.0	153.7	53.7	49.5
	Local inputs	2,191	3,975	100.0	181.4	46.3	50.5
China	Total intermediate inputs	379	2,069	100.0	545.9	100.0	100.0
	Imported inputs	250	1,159	100.0	464.2	65.9	56.0
	Local inputs	129	910	100.0	703.8	34.1	44.0

Source: The METI Survey.

Table 3. Estimation Results of Cost Function

	Dependent variable: local procurements (local inputs / total costs)								
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Region/country	All countries	All countries	United States	East and Southeast Asia	China	All countries	All countries	All countries	All countries
Industry	All manufacturing	All manufacturing	All manufacturing	All manufacturing	All manufacturing	Textiles	General machinery	Electric machinery	Transportation equipment
$\ln P_L$	-0.007	-0.003	0.006	0.009	0.028	-0.013	-0.017	-0.004	-0.016
	[-3.40]***	[-0.68]	[0.46]	[1.39]	[1.46]	[-0.56]	[-1.12]	[-0.50]	[-1.14]
lnY	0.011	0.027	0.041	0.022	0.017	0.006	0.037	0.015	0.028
	[8.23]***	[10.63]***	[6.56]***	[6.83]***	[2.92]***	[0.62]	[4.68]***	[3.33]***	[5.09]***
$\ln P_M$	-0.039	-0.005	0.120	-0.044	-0.094	-0.031	0.039	0.022	-0.077
	[-4.52]***	[-0.42]	[1.52]	[-2.86]***	[-1.48]	[-0.73]	[0.88]	[0.79]	[-2.42]***
SUPPLIERS	0.008	0.006	-1.149	0.042	0.235	0.033	-0.023	0.028	0.088
	[6.34]***	[0.29]	[-1.98]***	[1.69]*	[1.76]*	[0.43]	[-0.40]	[0.79]	[1.48]
JSUPPLIERS	0.032	0.147	0.461	0.087	-0.025	0.054	0.132	0.228	0.117
	[12.70]***	[5.05]***	[2.62]***	[2.53]**	[-0.27]	[0.47]	[1.30]	[4.33]***	[1.60]
LOCSALES	0.051	0.126	0.040	0.159	0.236	0.165	0.092	0.145	0.106
	[8.85]***	[14.44]***	[1.91]*	[13.39]***	[9.35]***	[3.78]***	[3.93]***	[9.98]***	[4.59]***
SHARE	-0.209	-0.019	0.001	-0.023	-0.059	-0.024	-0.027	0.017	-0.052
	[-24.39]***	[-1.40]	[0.03]	[-1.14]	[-1.50]	[-0.42]	[-0.87]	[0.60]	[-1.45]
KLRATIO	0.011	-0.002	0.009	-0.002	0.049	0.056	0.047	-0.049	-0.015
	[3.83]***	[-0.21]	[0.54]	[-0.21]	[2.26]**	[2.26]**	[1.86]*	[-3.36]***	[-0.48]
EXPER	0.004	0.004	0.037	0.005	-0.002	0.018	0.003	0.007	0.007
	[4.69]***	[2.05]**	[1.65]*	[1.86]*	[-0.15]	[2.58]***	[0.51]	[2.04]**	[1.32]
$EXPER^2$	-0.0001	-0.0001	0.0001	-0.0001	-0.001	-0.001	0.000	0.000	0.000
	[-4.08]***	[-2.03]***	[1.24]	[-1.33]	[-1.40]	[-3.78]***	[-0.43]	[-1.13]	[-1.40]
Constant	-0.035	-1.091	27.886	-1.610	-6.319	-1.185	-0.423	-2.235	-3.071
	[-0.96]	[-2.36]***	[1.82]*	[-2.68]***	[-1.93]*	[-0.68]	[-0.32]	[-2.62]***	[-2.21]***
Estimation method	Pooled OLS	Fixed-effect	Fixed-effect	Fixed-effect	Fixed-effect	Fixed-effect	Fixed-effect	Fixed-effect	Fixed-effect
N	21138	21138	4044	13039	3288	1554	2400	5546	3070
Number of affiliates	6372	6372	1213	3937	1055	465	669	1606	926
R-squared	0.056	0.775	0.782	0.762	0.775	0.757	0.755	0.734	0.786
Adj. R-squared	0.056	0.677	0.687	0.659	0.668	0.650	0.659	0.625	0.692

Notes: 1) ***, **, * indicates the level of significance at 1%, 5%, and 10%, respectively
2) Figures in brackets indicate t-statistics.
3) East and Southeast Asia includes China, Hong Kong, Korea, Indonesia, Malaysia, Philippines, Taiwan, Thailand, and Vietnam.
4) For the definition of variables, see main text and Table A3.

Source: The METI Survey

Table 4. Estimation Results of Cost Function with Regional Dummies

	Dependent variable: local procurements (local inputs / total costs)				
	[1]	[2]	[3]	[4]	[5]
Region/country	All countries	All countries	All countries	All countries	All countries
Industry	All manufacturing	Textiles	General machinery	Electric machinery	Transportation equipment
$\ln P_L$	-0.003	-0.003	-0.013	0.000	-0.015
	[-0.56]	[-0.13]	[-0.86]	[-0.05]	[-1.08]
lnY	0.026	0.005	0.032	0.011	0.028
	[10.12]***	[0.45]	[3.92]***	[2.27]**	[5.03]***
$\ln P_M$	-0.016	0.031	0.054	0.046	-0.085
	[-1.20]	[0.68]	[1.05]	[1.56]	[-2.50]***
SUPPLIERS	-0.012	-0.012	-0.020	-0.007	0.073
	[-0.55]	[-0.16]	[-0.33]	[-0.19]	[1.19]
JSUPPLIERS	0.093	-0.007	0.157	0.130	0.088
	[2.97]***	[-0.06]	[1.38]	[2.26]**	[1.11]
LOCSALES	0.126	0.137	0.095	0.141	0.106
	[14.35]***	[3.15]***	[4.03]***	[9.71]***	[4.58]***
SHARE	-0.017	-0.033	-0.028	0.025	-0.057
	[-1.29]	[-0.58]	[-0.89]	[0.89]	[-1.60]
KLRATIO	-0.002	0.058	0.047	-0.050	-0.015
	[-0.19]	[2.32]**	[1.82]*	[-3.43]***	[-0.49]
EXPER	-0.008	0.034	-0.013	-0.009	-0.004
	[-2.18]***	[1.08]	[-1.35]	[-1.30]	[-0.48]
$EXPER^2$	0.000	-0.001	0.000	0.000	0.000
	[0.82]	[-1.34]	[1.29]	[1.13]	[0.93]
EXPER	0.013	-0.055	0.024	0.018	0.015
× ASEAN4 dummy	[2.90]***	[-1.59]	[1.69]*	[1.91]*	[1.40]
$EXPER^2$	0.000	0.001	-0.001	0.000	0.000
× ASEAN4 dummy	[-0.10]	[1.35]	[-1.83]*	[-0.73]	[-1.14]
EXPER	0.022	0.000	0.048	0.045	0.018
× China dummy	[3.64]***	[-0.01]	[2.47]**	[4.01]***	[0.90]
$EXPER^2$	0.000	0.001	-0.004	-0.001	0.000
× China dummy	[-0.81]	[0.54]	[-2.50]***	[-1.01]	[0.02]
EXPER	0.011	-0.073	0.017	0.009	0.017
× NIES dummy	[2.30]**	[-1.96]*	[1.44]	[0.98]	[1.39]
$EXPER^2$	0.000	0.001	0.000	0.000	-0.001
× NIES dummy	[-0.83]	[1.63]	[-0.60]	[-0.51]	[-1.88]*
EXPER	0.013	-0.033	0.020	0.014	0.004
× Europe dummy	[2.44]**	[-0.86]	[1.54]	[1.27]	[0.29]
$EXPER^2$	0.000	0.001	-0.001	0.000	0.000
× Europe dummy	[-1.40]	[0.73]	[-1.56]	[-0.53]	[-0.36]
EXPER	0.021	-0.027	0.037	0.022	0.014
× Other Countries dummy	[3.35]***	[-0.72]	[2.21]**	[1.52]	[1.07]
$EXPER^2$	-0.001	0.001	-0.001	-0.001	-0.001
× Other Countries dummy	[-3.04]***	[0.63]	[-2.12]***	[-1.78]*	[-1.59]
Constant	-0.221	0.593	-0.678	-0.559	-2.451
	[-0.42]	[0.32]	[-0.44]	[-0.54]	[-1.64]
N	21138	1554	2400	5546	3070
Number of affiliates	6372	465	669	1606	926
R-squared	0.775	0.764	0.758	0.737	0.787
Adj. R-squared	0.678	0.657	0.660	0.628	0.692

For notes and sources, see Table 3.

Table A1. Number of Foreign Affiliates, by Industry

	1994	1995	1996	1997	1998	1999	2000
Textiles	132	170	186	234	275	284	274
Chemical	174	231	307	307	397	460	459
Basic metal	90	153	159	153	205	236	246
Fabricated metal products	69	58	81	90	118	124	113
General machinery	217	271	315	327	383	439	445
Electric machinery	517	652	733	748	869	991	1,037
Transportation equipment	236	358	428	481	531	505	529
Precision instruments and machinery	53	99	79	95	110	130	131
Other manufacturing	334	462	479	493	607	613	635
All manufacturing	1,822	2,454	2,767	2,928	3,495	3,782	3,869

Table A2. Number of Foreign Affiliates, by Country

	1994	1995	1996	1997	1998	1999	2000
China	116	281	415	512	604	664	696
United States	419	558	554	555	651	660	647
Thailand	155	209	232	248	308	350	362
Malaysia	141	161	185	182	233	254	269
Indonesia	83	113	136	166	235	237	265
Taiwan	170	197	206	202	234	250	257
Singapore	120	145	162	144	180	192	186
Hong Kong	70	106	122	129	141	165	161
Korea	93	115	118	120	127	149	157
United Kingdom	94	118	117	117	132	134	141
Philippine	34	46	77	95	106	124	126
Germany	74	80	95	84	92	108	111
France	36	36	46	47	58	66	62
Vietnam	1	5	14	29	42	53	60
Canada	36	33	48	48	51	64	57
Brazil	40	54	47	46	55	52	55
India	12	19	22	34	43	51	50
Australia	28	41	34	31	42	39	43
Mexico	19	38	31	25	37	40	38
Netherlands	24	29	26	32	32	36	37
Spain	15	24	28	26	27	25	28
Italy	18	18	23	23	27	30	28
Belgium	16	17	20	24	23	27	24
New Zealand	4	8	6	6	10	8	7
Argentina	4	3	3	3	5	4	2
Total	1,822	2,454	2,767	2,928	3,495	3,782	3,869

Table A3. The List of Variables

Variable	Definition	Expected signs	Sources
Local procurements	The ratio of local purchase to total cost		The METI survey
Local inputs share	The ratio of local purchase to total purchase		The METI survey
$\ln P_L$	Log of average wage of Japanese overseas affiliates, by country and industry	?	The METI survey
$\ln Y$	Log of sales deflated by GDP deflator	?	IMF (2004) and the METI survey
$\ln L$	Log of the number of employment	?	The METI survey
$\ln P_M = \ln P'_M + \ln(1+\tau+g)$	Price of the imported intermediate goods	+	
$\ln P'_M$	Price of the imported intermediate goods from Japan		BOJ (2004) and IMF (2004)
$\ln(1+\tau+g)$	Log of trade cost		IMF (2004) and World Bank (2004)
EXPER	Experience	+	The METI survey
$EXPER^2$	Square of experience	-	The METI survey
LOCSALES	The ratio of local sales to total sales	+	The METI survey
SUPPLIERS	The value of manufacturing GDP	+	World Bank (2004)
JSUPPLIERS	Log of the number of Japanese affiliates, by country	+	The METI survey
SHARE	Equity share of Japanese parent firm	-	The METI survey
KLRATIO	Log of capital-labor ratio	-	The Results of the Basic Survey of Japanese Business Structure and Activities

Table A4. Basic Statistics

Variable	*N*	Mean	S.D.	10 percentile	90 percentile
Local procurements	21138	0.37	0.32	0.00	0.85
$\ln P_L$	21138	0.46	1.35	-0.87	1.92
lnY	21138	7.58	1.97	5.27	9.95
$\ln P_M$	21138	1.05	0.35	0.64	1.34
SUPPLIERS	21138	27.72	2.25	24.98	32.04
JSUPPLIERS	21138	6.95	0.89	5.93	8.24
LOCSALES	21138	0.64	0.39	0.00	1.00
SHARE	21138	0.79	0.26	0.40	1.00
KLRATIO	21138	2.51	0.74	1.68	3.47
EXPER	21138	10.54	8.57	2.00	24.00
EXPER × ASEAN4 dummy	21138	2.40	5.90	0.00	9.00
EXPER × China dummy	21138	0.68	1.91	0.00	3.00
EXPER × NIES dummy	21138	2.90	7.06	0.00	12.00
EXPER × Europe dummy	21138	1.37	4.64	0.00	4.00
EXPER × Other Countries dummy	21138	1.04	4.60	0.00	0.00
$EXPER^2$	21138	184.54	285.10	4.00	576.00
$EXPER^2$ × ASEAN4 dummy	21138	40.61	151.27	0.00	81.00
$EXPER^2$ × China dummy	21138	4.12	16.50	0.00	9.00
$EXPER^2$ × NIES dummy	21138	58.20	182.74	0.00	144.00
$EXPER^2$ × Europe dummy	21138	23.45	125.23	0.00	16.00
$EXPER^2$ × Other Countries dummy	21138	22.23	128.84	0.00	0.00

Table A5. Regional Difference of Control Variables

	SUPPLIERS	JSUPPLIERS	LOCSALES	SHARE	KLRATIO	EXPER	$EXPER^2$
World	27.72	6.95	0.64	0.79	2.51	10.54	184.54
United States	28.03	8.23	0.86	0.91	2.55	11.25	187.85
ASEAN4	28.27	6.63	0.54	0.72	2.54	9.88	167.30
Indonesia	32.95	6.46	0.52	0.71	2.57	9.74	173.51
Malaysia	25.10	6.62	0.47	0.78	2.50	10.11	152.41
Philippines	27.09	5.92	0.44	0.83	2.54	7.86	119.70
Thailand	27.98	6.99	0.62	0.64	2.56	10.45	190.10
China	28.59	7.55	0.51	0.70	2.48	4.37	26.47
NIES	27.50	6.71	0.63	0.79	2.42	13.89	278.57
Hong Kong	25.12	6.96	0.56	0.89	2.35	11.25	207.81
Korea	32.50	6.13	0.72	0.64	2.40	12.96	242.40
Singapore	24.20	6.92	0.53	0.93	2.48	13.96	262.27
Taiwan	28.45	6.74	0.69	0.71	2.44	15.95	353.41
Europe	25.95	6.14	0.65	0.90	2.52	11.34	193.99

Note: Mean values are reported.

Table A6. Correlation Matrix

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]
Local procurements	[1]	1.00																				
$\ln P_L$	[2]	0.01	1.00																			
lnY	[3]	0.06	0.50	1.00																		
$\ln P_M$	[4]	0.01	-0.01	0.04	1.00																	
SUPPLIERS	[5]	0.08	-0.04	0.00	0.67	1.00																
JSUPPLIERS	[6]	0.09	0.22	0.13	-0.09	0.08	1.00															
LOCSALES	[7]	0.10	0.19	0.00	-0.10	0.03	0.13	1.00														
SHARE	[8]	-0.18	0.18	0.07	-0.20	-0.23	0.09	-0.13	1.00													
KLRATIO	[9]	0.04	0.04	0.09	0.05	0.01	-0.01	0.06	-0.06	1.00												
EXPER	[10]	0.03	0.13	0.26	-0.19	-0.10	-0.09	0.10	0.04	0.02	1.00											
EXPER × ASEAN4 dummy	[11]	0.04	-0.17	0.08	0.24	0.10	-0.13	-0.05	-0.19	0.06	0.30	1.00										
EXPER × China dummy	[12]	0.01	-0.29	-0.11	0.26	0.14	0.24	-0.15	-0.13	0.00	-0.19	-0.14	1.00									
EXPER × NIES dummy	[13]	0.00	0.10	0.10	-0.27	-0.03	-0.11	-0.04	-0.02	-0.06	0.46	-0.17	-0.15	1.00								
EXPER × Europe dummy	[14]	-0.11	0.28	0.15	-0.07	-0.23	-0.28	0.01	0.14	0.01	0.23	-0.12	-0.11	-0.12	1.00							
EXPER × Other Countries dummy	[15]	0.04	-0.28	-0.17	-0.15	-0.15	-0.32	0.09	0.02	0.03	0.29	-0.09	-0.08	-0.09	-0.07	1.00						
$EXPER^2$	[16]	0.02	0.08	0.19	-0.15	-0.06	-0.09	0.09	0.01	0.02	0.94	0.29	-0.17	0.43	0.21	0.30	1.00					
$EXPER^2$ × ASEAN4 dummy	[17]	0.04	-0.11	0.09	0.17	0.09	-0.08	0.01	-0.17	0.07	0.38	0.93	-0.10	-0.11	-0.08	-0.06	0.40	1.00				
$EXPER^2$ × China dummy	[18]	0.01	-0.20	-0.06	0.18	0.10	0.17	-0.12	-0.10	0.01	-0.08	-0.10	0.91	-0.10	-0.07	-0.06	-0.10	-0.07	1.00			
$EXPER^2$ × NIES dummy	[19]	0.00	0.08	0.11	-0.20	-0.01	-0.09	-0.03	-0.03	-0.04	0.50	-0.13	-0.11	0.95	-0.09	-0.07	0.50	-0.09	-0.08	1.00		
$EXPER^2$ × Europe dummy	[20]	-0.08	0.18	0.11	-0.05	-0.15	-0.18	0.01	0.10	0.00	0.27	-0.08	-0.07	-0.08	0.87	-0.04	0.33	-0.05	-0.05	-0.06	1.00	
$EXPER^2$ × Other Countries dummy	[21]	0.04	-0.22	-0.13	-0.14	-0.13	-0.22	0.08	0.03	0.02	0.32	-0.07	-0.06	-0.07	-0.05	0.94	0.35	-0.05	-0.04	-0.05	-0.03	1.00