Intra-firm trade and contract completeness: Evidence from Japanese affiliate firms

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Abstract

The issue on growth and its variation of intra-firm trade of intermediate inputs is of great interest in international economics. This paper examines the determinants of intra-firm trade by shedding light, not only on factor price and trade cost, but also on the organizational form in terms of the ownership of overseas plants and control over intermediate input for further processing, using micro data at the affiliate firm level. In the empirical analysis, since organizational form and intra-firm trade are jointly determined, we adopted instrumental variable regression treating the choice of a purchasing manager as an endogenous variable. The results suggest that control over input decisions critically affects intra-firm trade of intermediate inputs.

Keywords: Intra-firm trade, incomplete contract, ownership and control
JEL codes: F14, F23, L14

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1. Introduction

In recent decades, the nature of international trade has changed dramatically. Growth of world trade has been driven largely by rapid growth of trade in intermediate inputs, such as components and equipment. For example, Yeats (2001) found that 30% of world trade in manufacturing is intermediate inputs. Hurmels, Ishii and Yi (2001) and Yi (2003) demonstrate that a large part of the growth of international trade is explained by vertical fragmentation of production, which involves a sequential, vertical trading chain stretching across countries, with each country specializing in particular stages of a good's production sequence.

A large part of trade of intermediate inputs is accounted for by intra-firm trade by multinational enterprises (MNEs). According to Slaughter (2000), more than 50% of U.S. exports are undertaken by U.S. MNEs. And Hanson et al. (2005) reports 93% of exports by U.S. MNEs to their overseas affiliates were intermediate inputs. The extent of intra-firm trade varies across both industries and countries. As explained by Hanson et al. (2005), intra-firm trade for further processing by U.S. affiliates is common among machinery, transport equipment, and electronics. U.S. affiliates located in countries with low trade costs and low wages, such as Mexico or Canada, are engaged in input processing through intra-firm trade.

Recently, many economists have stepped forward to explain the growth and its variation of intra-firm trade of intermediate inputs. However, traditional trade theory cannot explain the choice between intra-firm trade with vertical integration and international outsourcing. Thus, researchers are motivated to incorporate the concepts from industrial organization and contract theory that explain the organizational form of the firm.

The objective of this paper is to identify the determining factors affecting intra-firm trade by Japanese manufacturing MNEs' affiliates data. We examine the determinants of intra-firm by shedding light, not only on factor price and trade cost, but also on the organizational form in

terms of the ownership of overseas plant and control over intermediate input for further processing.

The paper is organized as follows: the next section introduces previous studies related to the determinants of intra-firm trade; section 3 explains the estimation model and data; section 4 discusses the estimation results; and a summary of the findings and policy implications are presented in the final section.

2. Related Literature

Our work is built from several related research projects on intra-firm trade. The first one is research on trade costs and factor price. For example, Hanson et al. (2005) investigated affiliates' demand for imported inputs based on firm-level cross section data for U.S. MNEs in 1994. They found that trade costs between the U.S. and host countries, relative wages of less-skilled workers and corporate tax rates in host countries have a significant effect on intra-firm trade.

The study on the determinants of intra-firm trade is closely related to the study on local procurement. For example, Belderbos et al. (2001) examined the determinants of local procurement for Japanese electronics manufacturing affiliates. Using affiliate-level cross section data for 1999, they found the quality of infrastructure, the size of local supporting industry and local content regulations have a significant effect on local procurement. Kiyota et al. (2008) used Japanese foreign affiliate-level panel data set and estimated translog factor demand function. They concluded the experience of the affiliates, as measured by the length of operation, had a positive impact on local procurement in Asian countries.

The second body of literature is theoretical or empirical research, which combines traditional trade theory with the choice of organizational form. For example, Grossman and

Helpman (2004) and Feenstra and Hanson (2005) take into account property right theory and an incentive systems approach to explore trade-off between vertical integration through FDI and foreign outsourcing. According to the property rights theory, since an enforceable agreement takes place only after investment, relationship-specific investment is distorted. When the economic rent of investment is distributed through ex post Nash bargaining, each party's incentive to invest depends on the ownership of the asset, which determines the residual rights of control. Generally, to minimize the loss of surplus due to investment distortion, the ownership should be given to the agent that is most important in raising surplus. Therefore, if the agent's effort to overall surplus is important, the property rights approach suggests foreign outsourcing is better than vertical integration. On the other hand, under the incentive systems approach, a principal's optimal incentive contract is designed to induce effort by managers. When perfect monitoring of managers' effort is not possible, first-level effort cannot be achieved. If vertical integration through FDI reduces monitoring cost, it is preferred rather than arms-length transaction, namely, foreign outsourcing.

In case of Grossman and Helpman (2004), they develop a model in which the firms choose their modes of organization and the location of their subsidiaries or suppliers. And they also provide the sorting of the firms with different productivity levels into different organizational forms. Feenstra and Hanson (2005) investigate the ownership and control structure of firms engaged in export-processing in China. They considered two trade modes; pure assembly and import and assembly. In the former regime, foreign buyers both own and supply a plant in China with inputs. In the latter regime, a plant in China imports inputs of its own accord, processes and sells the processed goods to a foreign buyer. According to property the rights approach, the control rights over inputs should be given to the local managers when local managers' effort is important. In this case, the ownership of a plant in China and control over inputs are split. By

contrast, when managers' effort is not important, the incentive systems approach implies that both ownership and control should be allocated to the foreign firm. They used Chinese Custom data which includes processing imports and exports by year, 8-digit HS product, origin or destination city-district in China, destination country and customs regime (pure-assembly or import-and-assembly) and ownership type (foreign and Chinese-owned). They show that the combination of foreign ownership of plants and Chinese managers' control over input are most common and consistent with the property rights approach.

The third group of studies is research on institutional quality and international trade. Concerned with relationship-specific investment and international trade, the importance of country-specific institutional differences has received a great deal of attention in recent literature. For example, Levchenko (2007) developed a simple model within the framework of incomplete contracts and presents institutional differences as one of sources of comparative advantage. He also provides empirical evidence of the institutional differences as an important determinant of trade flows. Similarly, Nunn (2007) examined institutional comparative advantage using a new measure of institutional intensity. He paid much attention to relationship-specific investment and constructed the measure of the proportion of intermediate inputs that are relationship-specific by products. Global trade pattern was found to be well explained by contract enforcement rather than by countries' endowments of physical capital and skilled labor.

Our contribution is two fold. First, we used affiliates-level micro data, which enabled us to control various characteristics of overseas affiliates, including organizational form. Previous research such as Hanson et al. (2005) and Kiyota et al. (2008) also used micro data but they did not incorporate the organization form. Since organizational form and intra-firm trade are jointly determined, we used instrumental variable estimation. Second, we also take into account

differences in country specific institutional qualities, which lead to policy implications.

3. Research Design

As an indicator of intra-firm trade at the affiliates-level, we used the ratio of import from headquarter to total purchase for Japanese foreign affiliates. Affiliates-level data have advantages in the information on technology level for affiliates, organization form and business environment in host countries. Our data source is *Kaigai jigyo katsudo kihon (doko) chosa* (*The Survey on Overseas Business and Activities*), which is the confidential survey by Ministry of Economy, Trade and Industry of Japanese government. We computed intra-firm trade ratio and the results are shown in table 1 and 2.

From table 1, some regional differences can be identified. In 1995, while the intra-firm trade ratio for affiliates in North America, South America and Europe was approximately 35%, the ratio for China and ASEAN exceeded 50%. Both China and ASEAN have attracted many Japanese MNEs due to low labor costs and low trade costs in terms of distance. However, the intra-firm trade ratio for China and ASEAN has gradually declined in 1998 and 2001, implying improvement of local business environment enables MNEs affiliates to increase local procurement and reduce intra-firm trade.

== Table 1 ==

Table 2 presents wide variations among industries. While the intra-firm trade ratio for light manufacturing (i.e. textiles) is around 15% to 30% of general machinery, electronics, transport equipment, and precision machinery exceeds 35%. Processing these products involves various production stages which are separable. And since each stage has different factor intensity, firms

may have an incentive to locate labor intensive activities in low wage countries. Among those industries, general machinery and transport equipment show a remarkable decrease in the intra-firm trade ratio (from 0.43% to 0.35-37%) while the ratio of electronics and precision machinery is stable for the period.

== Table 2 ==

Various factors might be responsible for the determination of intra-firm trade ratio. However, we will focus on the contractibility and nationalities of persons in charge of input control. Statistical descriptions suggest that both factors possibly affect the intra-firm trade ratio. Figure 1 illustrates the relation between the mean value of intra-firm input purchase ratio of foreign affiliates from their parent firms and the contractibility in host countries. As a proxy for the contractibility, we used the rule of law index, compiled from global governance indicators which increase the quality of the legal environment, and categorized host countries into five 20 percentile increments of rule of law index. The bar charts in the figure show that intra-firm trade ratio is negatively related with the contractibility in host countries, suggesting low transaction costs in arm's-length transactions in the country where the rule of law index is high.

== Figure 1 ==

The simple bar chart in Figure 2 shows the mean value of intra-firm input purchase ratio of foreign affiliates from their parent firms by the nationality of purchasing manager. Although the mean ratio is almost the same between the two in 1995, the significant difference is found in 1998 and 2001. This statistical difference suggests that an affiliate with a local purchasing

manager is likely to procure intermediate input from local suppliers. We will further explore the relationship between differences in organizational form and intra-firm trade, as well as other determining factors in the following section.

== Figure 2 ==

3.1 The determinant of Intra-firm trade: the Hypotheses

In this subsection, we discern the determining factor for intra-firm trade ratio. In the analysis, we divide the possible explanatory factors into three groups, namely (1) trade cost and factor price, (2) institutional quality, and (3) organizational form, measured by the nationality of managers who are in charge of input control.

First, we note market specific factors including the trade cost and factor price in the host country. Hanson et al. (2005) found that vertical production networks of U.S. MNEs are sensitive to less-skilled labor costs and trade costs between the U.S. and host countries using imported input data at the firm-level. As shown in table 1 and 2, Japanese MNEs also appear to engage in processing imported intermediate inputs in the countries where labor and trade costs are lower such as China and ASEAN, and the processing products using imported inputs concentrate on industries with various production processes including labor intensive activity. Following the earlier empirical evidence, we test the following hypothesis on the effect of unskilled wages and trade costs on intra-firm trade.

Hypothesis I: Lower trade costs and unskilled wages encourage intra-firm trade.

Secondly, we note the contract completeness as an institutional factor in the host country. If the legal system in the host country is weak, the transaction cost is high when dealing with arm's-length local suppliers. In such a case, MNEs will choose vertical integration in the market, where the cost of a lawsuit is high, in order to avoid holdup costs and intermediate inputs are supplied by intra-firm trade. Hence, the hypothesis to identify the factors affecting intra-firm trade is presented as follows:

Hypothesis II: The improvement of contractibility in the host country induces lower costs for its affiliate to transact with local suppliers and in turn decreases the ratio of intra-firm trade of inputs.

Thirdly, as we saw in the previous section, the nationalities of managers who are in charge of input control have an impact on intra-firm trade. A similar pattern was found and examined by Feenstra and Hanson (2005) using Chinese custom's distinct trade data. In their setting, input search and processing in China requires specific investment by foreign firms and the appointment of a local Chinese manager. Effort level for local managers cannot be controlled by foreign firms. As we mentioned in section 2, allocation of control rights over input depends on how important the local Chinese manager's effort is. On the one hand, if effort by a local manager is essential, control rights over input should be given to the local manager. On the other hand, foreign firms or dispatched managers from a headquarter are in charge of input control if relationship-specific investment, such as human capital investment, by foreign firms is indispensable for processing. In addition, contractibility might affect organizational form. In a poor business environment, since the cost of negotiation with a local manager would be extremely high, MNEs hesitate to give control rights over input to local managers. In sum, when

local manger's effort is important and the degree of legal enforcement is high enough, control rights over input are given to local managers. Meanwhile, when the degree of contractual completeness is low or managers' effort is not crucial, foreign firms maintain both ownership and control over input, dispatching a manager from headquarters and increasing intra-firm trade. Following from Feenstra and Hanson (2005), the importance of local managers' effort is measured by the value added ratio of each affiliate in our empirical analysis. Therefore, the third hypothesis is summarized as follows;

> Hypothesis III: Affiliate firms with a high value added ratio are inclined to be given input control and purchase input from local firms in arm's-length transactions.

Note that allocation of control rights over input and intra-firm trade are jointly determined. We treat a variable for the delegation of control rights over input as an endogenous variable and used Instrumental Variable (henceforth IV) regression technique.

3.2 The Determinants of Intra-firm trade: Empirical Specification

Based on the theoretical conjecture foregone, we test empirically how the firm- specific and market- specific factors affect the intra-firm procurement ratio of affiliate firms. The equation for estimation is specified as follows:

$$\begin{aligned} m_{aijt} = {} & \alpha_0 + \beta_1 pm_{aijt} + \beta_2 asize_{aijt} + \beta_3 local_{aijt} + \beta_4 share_{aijt} \\ & + \beta_5 psize_{ijt} + \beta_6 KL_{ijt} + \beta_7 pRD_{ijt} + \beta_8 agg1_{jt} + \beta_9 agg2_{jt} \\ & + \beta_{10} unsw_{jt} + \beta_{11} sw_{jt} + \beta_{12} dist_{jt} + \beta_{13} rule_{jt} + \alpha_t + \varepsilon_{aijt} \end{aligned} \qquad (1)$$

where *a* denotes the foreign affiliates of Japanese firms *i*, *i* is the index for the affiliate's parent firm, *j* denotes the host country, and *t* is the year. α_0 is a constant, α_t represents the time trend and ε_{aijt} is the error term.

The dependent variable *m* is the ratio of intra-firm input purchases of foreign affiliates *a* from the parent firm. In order to examine how the modes of organization affect it, we use the ownership share *share* and a dummy variable *pm*, (which takes on the value of 1 if the nationality of the purchasing manager in charge of input control is local, and 0 if the assigned manager is dispatched from the parent firm) as qualitative information on control rights over input purchases.

As other affiliate's characteristics, *asize*, and *local* indicate the number of employees as a size of the affiliate and local sales ratio, respectively. We also control parent firm characteristics including the number of employees as firm size *psize*, capital-labor ratio *KL* and R&D intensity *pRD*.

Affiliate firms may procure input from other Japanese affiliate firms in the host country instead of purchasing from their parent firms. Thus the model includes two agglomeration variables presenting the existence of Japanese affiliate firms in the host country, taking into account transactions with other affiliates invested by Japan. One is the number of affiliates invested by the same parent firm in the host country *agg*1 and the other one is the number of Japanese affiliates in the host country *agg*2.

unsw and *sw* denote the average wage per employee of unskilled and skilled workers, respectively, in the host country. These variables are based on wage payment data recorded in the affiliate firm-level data. Due to the limited availability of wage data, we defined the average wage in textile, wood pulp, leather, printing, and food industries as wages of unskilled workers, and that in electrical machinery, transportation machinery, and precision machinery industries as

wages of skilled workers.

For trade costs, we use the distance between capital city in the host country and Tokyo, *dist* compiled from CEPII. As a proxy measurement of the contractibility, the rule of law index, *rule* in the global governance indicators provided by the World Bank Institute, have been adopted.[1] We also take into account year, industry and region specific factors for intra-firm input purchases. Hence, the estimated equation includes year dummy 2-digit industry dummy and region dummy variables.

Organizational form and intra-firm procurement are simultaneously determined. Hence we treat the purchasing manager dummy as an endogenous variable. Since the instrumental-variables regression assumes that the endogenous variables are continuous and are not appropriate for use with discrete variables, we apply a two-step procedure described by Wooldridge (2002, pp.623-624). First, we estimate the probit model using the set of regressors in the equation for the intra-firm procurement ratio and additional instruments and obtain predicted probabilities. In the second step, we estimate the two-stage least squares (2SLS) model using the fitted probabilities as instruments.[2] The two-stage tobit model also used for a robustness check to solve the problem that the ratio of intra-firm trade procurement includes left-censored observations and right-censored observations.

As mentioned in Hypothesis III, theoretical conjecture implies that investment level and investment specificity affect allocating control rights over input purchases. For additional instruments used in the first step estimation, we adopt the value-added ratio and R&D intensity at an affiliate-level as a proxy for investment level and specificity, respectively. The affiliate

[1] The index is based on hundreds of variables and reflects the views of thousands of citizens, survey respondents, and experts worldwide (Kaufmann et al. 2006). This original index ranges from −2.5 to 2.5 and is indicating that a higher score represents a country with a higher level of the contractibility.
[2] Although the estimator holds a consistency whether or not the equation in first stage is linear, the two-step procedure yields more efficient estimates than applying the 2SLS model (Wooldridge, 2002).

firm's age is also included in the instruments to control a possible vintage effect on control rights decisions. We estimate following the probit model using additional instruments in the first step.

$$y^* = \mathbf{X\beta} + \boldsymbol{\gamma}\mathbf{Z} + e \qquad y = \begin{cases} 1 : local & if \quad y^* > 0 \\ 0 : Japan & if \quad y^* \le 0 \end{cases} \qquad (2)$$

where X is a set of regressors in equation (1) and Z is a set of additional instruments including three variables, value-added over total sales of an affiliate firm, *va*, R&D intensity, *aRD* and affiliate firm's age, *age*. Table 3 shows the data descriptions and the summary of the statistics for each variable. The ratio variables are converted to percentage so that the estimation results can be interpreted easily.

== Table 3 ==

3.3. Data Issues

We used the micro database of *Kaigai jigyo katsudo kihon (doko)chosa* (*The Survey on Overseas Business and Activities*, hereafter we call SOBA) constructed by Ministry of Economy, Trade and Industry (METI). The aim of this survey is to obtain basic information on the activities of foreign affiliates of Japanese firms. The survey covers all Japanese firms that had affiliates abroad. The survey consists of two parts: one is the Basic Survey, which is more detailed and carried out every three years; the other is the Trend Survey which is comparatively rough and carried out between the Basic Surveys. Major items in the SOBA are establishment

year, breakdown of sales and purchases, employment, costs, and research and development and so forth. Micro-data of the SOBA is available after 1995. However, the volume of intra-firm trade is not included the Trend Survey. Thus our samples are restricted to 1995, 1998, and 2001. A more detailed description of the data is provided in the Appendix A.

4. Estimation results

4.1 Result of Choice Model on Purchasing Manager

We first estimate the binary response model on the purchasing manager dummy using regressors in the second step and additional instruments, such as the value added ratio of the affiliate firm, and gain the fitted probabilities for an instrument in the IV regression. The results of the estimation of the probit model are presented in table 4. Columns (1), (2) and (3) presents the results using full observations on affiliates with accurate information on the variables of interest, and columns (4), (5) and (6) present the results using a subsample covering only majority-owned affiliate firms (>50% ownership share). The statistical significance of explanatory variables is almost the same among the estimations except for distance. Thus, we regard the result in column (1) as a baseline result. The coefficients of the value added ratio are positive and significant as predicted. This result is consistent with the theoretical prediction that granting input control to a local manager is optimal when the role of the affiliate side is important to the value of the relationship. The marginal effect of the value added ratio on the predicted probabilities is 0.0026. This result means that the probability of choosing a local manager increases 2.6% when the percentage of value added ratio increases by 10 points. Although it was predicted that investment specificity is negatively related to granting control over input purchases to local, contrary to expectations, the estimated coefficient for the R&D intensity of the affiliate firm, which is used as a proxy for investment specificity, is positive and significant. The calculated marginal effect is 0.02 and the probability of choosing a local

manager increases 2% when the percentage of R&D intensity increases by 1 point. At the same time, the affiliate's experience in the host country is also positively correlated with choosing a local manager.

The coefficients of both affiliate's size and parent firm's size variables are negatively significant. An increase in the capital-labor ratio of a parent firm also leads to the probability of choosing a local manager. However the marginal effects of these firm characteristics are quite marginal, considering the magnitude of unit. The two variables indicating agglomeration of Japanese firms in the host county are not significantly different from zero The effects of both skilled and unskilled wages are positive. The correlations in terms of the rule of law and distance are not clear. When all dummy variables are introduced, the rule of law index is not correlated with control over input purchasing, while the distance to the host country is negatively related with control as expected.

== Table 4 ==

4.2 Result of Estimation on Intra-firm trade

In the second step, we estimate the 2SLS and two-stage tobit model with IV regression using the fitted probabilities obtained from probit estimation as an instrument variable. The results are displayed in table 5. To clarify the difference with the case where the purchasing manager dummy is treated as exogenous, the results of the OLS and tobit model without IV regression are also displayed.

== Table 5 ==

The purchasing manager dummy is not correlated with the ratio of intra-firm procurement at all in the OLS and tobit model without industry dummies, while negative sign with significance at the 5% level is found in the models including industry dummies. Interestingly, the estimator is changed drastically by IV regression. As shown in column (2) and (4), the coefficient of the purchasing manager dummy becomes strongly significant and negative.[3] The results are not changed even if industry and region dummy variables are added into the estimated equation as displayed in column (6), (8), (10) and (12). The Durbin-Wu-Hausman tests of exogeneity of the purchasing manager dummy variable in the 2SLS model reject the null hypothesis of no endogeneity. The results of Wald test of exogeneity in the tobit with IV regression also supports that there is endogeneity. The coefficient estimated by 2SLS is -24 while the marginal effects for the expected value of the dependent variable conditional on being uncensored is -13. This result suggests that the delegation of decision right to local manager for purchasing input lower the ratio of intra-firm procurement of the affiliate firm from its parent firm by at the least 13 percentage points. This effect is quite large compared to the effects of other factors.

As proxy for factor price in the host country, two variables, unskilled wages and skilled wages, are included in the model. It was predicted that the vertical fragmentation of production is common among the countries with low unskilled wages, and the coefficient of *unsw* shows the negative sign and *sw* shows the positive sign, respectively. Although the former variable is not significant, the latter variable is strongly and positively significant in the models without region dummy variables. After controlling for region specific factors, the significance disappears. The coefficient of distance variable is strongly significant and negative as expected, indicating that the greater the transportation cost, the lower the intra-firm trade.

[3] The estimation is carried out by maximum likelihood estimation. We also gained Newey's minimum chi-squared estimator, but the result does not change.

Another issue is how the rule of law index as a proxy for contractibility in a host country influences the intra-firm transaction. Since a high score of the index reflects that the costs of a lawsuit are law, it is expected that the rule of law index are negatively related to intra-firm procurement ratio. The coefficient of *rule* is negative and significant as predicted. If we rely on the results of the tobit model with IV regression, the marginal effect of *rule* is computed as -3.0 ~ -3.7, which means a 1 score increase in the rule of law index is associated with the ratio of intra-firm procurement decreasing by 3 ~ 3.7 percentage points.

Table 5 also shows the results of other firm- and country-specific factors. With regard to the firm size, the parent firm size and the intra-firm procurement seem to be almost unrelated, while the size of the affiliate firm is negatively related to the procurement ratio from the parent firm. The estimation equation also includes the ownership share in order to control the commitment level of the parent firm. Although one might expect that the estimation result may be affected by the threshold of ownership share, it was not changeful even if the estimated sample is restricted to majority-owned firms (see Appendix B). The ownership share is positively correlated with the intra-firm procurement as expected. The local sales ratio and parent firm's capital-labor ratio show a positive and negative sign, respectively while the significance disappeared after controlling industry-specific factors. The coefficient of the parent firm's R&D intensity is found to be significantly positive for the procurement ratio even after controlling for industry and region dummies. The marginal effect is computed as 0.4 after controlling industry dummies, which means a 1 percentage point increase in R&D intensity to total sales of the parent firm, raises the ratio of intra-firm input purchasing by 0.4 percentage point. This result suggests that a vertical fragmentation is more common among R&D intensive firms in the home country. The result of the number of affiliate firms invested by the same parent firm in the host country was found to decrease the procurement from a parent firm. On

the other hand, the total number of Japanese affiliate firms seem to be positively correlated with the procurement from a parent firm, while the statistical significance is not observed in the model including industry dummies. One possible explanation for these results is that the input procurement from parent firms is likely to be replaced by that from other affiliates in the host country, if it exists while a vertical fragmentation of production processes are concentrated in the country where the is an amassing of Japanese MNEs.

5. Concluding Remarks

The issue on the growth and its variation of intra-firm trade of intermediate inputs is of great interest in international economics. This paper examines the determinants of intra-firm trade by shedding light, not only on factor price and trade cost, but also on the organizational form in terms of the ownership of overseas plants and control over intermediate input for further processing, using micro data at the affiliate-firm level. In the empirical analysis, since organizational form and intra-firm trade are jointly determined, we adopted instrumental variable regression, treating a choice of purchasing manager as an endogenous variable. Our empirical examination is the first attempt to control organizational form for explaining intra-firm trade.

We implement a two-step procedure in the empirical analysis proposed by Wooldridge (2002). First, we estimate the binary response model on the choice of purchasing manager using the set of regressors in the equation for explaining the intra-firm procurement ratio and additional instruments. In the second step, we estimate the equation for intra-firm trade by IV regression using the fitted probabilities gained from the first step as an instrument variable. In the results of the probit model, control over input decisions is positively correlated with the value-added ratio of an affiliate firm. This finding is consistent with Feenstra and Hanson

(2005) who demonstrate that disintegrated ownership and control over input makes sense when it is optimal to hold investment incentives to both and find that foreign factory ownership and local input control is more common in high value added industry using Chinese data. The results of IV regression on intra-firm trade clearly show that the choice of whether granting control rights over input purchases to a local manager has a large impact on the procurement of intermediate input from Japan after controlling its endogeneity. The contribution of this paper is to suggest that control over input decisions critically affects intra-firm trade of intermediate inputs.We also take into account differences in country specific institutional qualities. The introduction of the variable of rule of law index is yet another unique feature of our estimation.

This discussion is also closely related to the policy issue in developing countries. As discussed Javorcik (2004), local procurement by MNE's is pointed out as one of the channel of technology spillover from MNEs. Therefore, host governments in developing countries wish to increases local procurement rather than intra-firm trade. From this point of view, several important policy implications can be obtained from our analysis for the countries that seek to efficiently increase procurement from local firms. First, the countries have to improve institutional quality. Since intra-firm procurement is increasing in countries with low performance of institutional factors. Therefore, in order to boost the localization of MNEs' input purchases, improvement of legal institutions is a crucial factor. Second, policy maker should provide an FDI friendly environment, under which MNEs' affiliates can operate for long period of time. This is because the delegation of decision right to local staff, which contributes the increases local procurement, takes time.

Reference

Belderbos, R., Capannelli, G., and Fukao, K., 2001, "Backward vertical linkages of foreign manufacturing affiliates: Evidence from Japanese multinationals," World Development, 29(1): 189-208.

Feenstra, R C., and G. Hanson, 2005, "Ownership and control in outsourcing to China: estimating the property rights theory of the firm," Quarterly Journal of Economics, 120(2), pp.729-761.

Hanson, G. H., Mataloni, R. J., Jr., and Slaughter, M. J., 2005, "Vertical production networks in multinational firms," Review of Economics and Statistics, 87(4): 664-678.

Grossman, G., and E. Helpman (2004), "Managerial Incentives and International Organization of Production," Journal of International Economics, 63(2), pp.237-262.

Javorcik, B S., 2004, "Dose Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillover Through Backward Linkage," American Economic Review, 94(3): 605-627.

Kiyota, K., Matsuura, T., Urata, S., and Wei, Y., 2008, "Reconsidering the Backward Vertical Linkage of Foreign Affiliates: Evidence from Japanese Multinationals", World Development, 36(8): 1398-1414.

Levchenko, A., 2007, "Institutional Quality and International Trade," Review of Economic Studies, 74(3), pp.791-819

Nunn, N., 2007, "Relationship-Specificity, Incomplete Construct, and the Pattern of Trade," Quarterly Journal of Economics, 122(2), pp.569-600.

Slaughter, M., 2000, "Production Transfer within Multinational Enterprises and American Wages," Journal of International Economics, 50(2), pp.449-472.

Wooldridge, J. M., 2002, Econometric Analysis of Cross Section and Panel Data, Cambridge, MA: The MIT press.

Appendix A. Data Description

This paper used the micro database of SOBA which is a firm-level survey by the Research and Statistics Department, Ministry of Economy, Trade and Industry, Government of Japan. The aim of this survey is to obtain basic information on the activities of overseas affiliates of Japanese firms. The parent companies are Japanese corporations which, as of the end of March, own or have owned overseas affiliates in the past, excluding those in the financial and insurance industry or real estate industry. The survey includes various items on affiliates' characteristics such as the establishment year of affiliates, the breakdown of sales and purchases, employment, costs, and research and development, and so forth are available.

Further, to control for parent-firm characteristics, we linked affiliate survey, SOBA with firm-level survey, *Kigyo Katsudo Kihon Chosa* (*Basic Survey of Japanese Business Activities and Structures*, hereafter we call BSJBSA) by Ministry of Economy, Trade and Industry. This survey was first conducted in 1991, then in 1994 annually afterwards. The coverage of this survey is all firms with more than 50 employees and capitalization of at least 30 million yen for mining, manufacturing, wholesale and retail and some service sectors.

We dropped from our sample set those manufacturing affiliates whose primary activities are not "production." Since SOBA dose not request respondents to report a breakdown list of their shipment, industry classifications are not always reliable. In fact, there are many affiliates who belong to the manufacturing sector, but have an extremely low value added ratio. Probably, these affiliates might mainly engage in wholesale activates but report their industry classification as the manufacturing sector. Fortunately, the survey has qualitative inquire on current and future of their primary activities; "production", "research and development", "wholesale", "retailing" and so forth. We restrict our sample to those affiliates who belong to manufacturing sector and report its current primary activates as "production."

Appendix B. Estimation Results on Majority-owned firms

Dependent variable: Intra-firm imports from Japan / total purchase (%)	(1) OLS	(2) 2SLS	(3) Tobit	(4) IVTobit		(5) OLS	(6) 2SLS	(7) Tobit	(8) IVTobit		(9) OLS	(10) 2SLS	(11) Tobit	(12) IVTobit	
	Coef.	Coef.	Coef.	Coef.	ME	Coef.	Coef.	Coef.	Coef.	ME	Coef.	Coef.	Coef.	Coef.	ME
Purchasing manager dummy (local=1)	-0.930	-19.021	-0.998	-20.792	-9.463	-0.704	-23.912	-0.713	-26.539	-12.709	-1.159	-20.925	-1.164	-24.544	-11.999
	[1.417]	[8.944]*	[1.596]	[10.316]*		[1.363]	[9.719]*	[1.526]	[11.170]*		[1.362]	[9.622]*	[1.525]	[11.118]*	
N of affiliate's employee (100 persons)	-0.310	-0.385	-0.293	-0.375	-0.170	-0.358	-0.456	-0.353	-0.462	-0.221	-0.36	-0.44	-0.354	-0.45	-0.219
	[0.078]**	[0.089]**	[0.089]**	[0.101]**		[0.080]**	[0.090]**	[0.086]**	[0.102]**		[0.078]**	[0.088]**	[0.085]**	[0.100]**	
Affiliate's Local sales ratio (%)	0.005	0.022	0.026	0.046	0.021	-0.02	0.008	-0.006	0.026	0.012	-0.035	-0.014	-0.023	0.002	0.001
	[0.020]	[0.022]	[0.022]	[0.025]		[0.020]	[0.024]	[0.022]	[0.027]		[0.021]	[0.023]	[0.023]	[0.027]	
Ownership share (%)	0.242	0.194	0.306	0.253	0.115	0.198	0.137	0.252	0.185	0.088	0.19	0.137	0.243	0.181	0.088
	[0.045]**	[0.053]**	[0.054]**	[0.062]**		[0.043]**	[0.053]*	[0.051]**	[0.062]**		[0.043]**	[0.053]**	[0.051]**	[0.061]**	
N of parent firm's employee (100 persons)	0.012	0.007	0.013	0.008	0.004	0.015	0.009	0.016	0.009	0.004	0.017	0.012	0.019	0.013	0.006
	[0.007]	[0.007]	[0.008]	[0.008]		[0.007]*	[0.008]	[0.008]*	[0.009]		[0.007]**	[0.008]	[0.008]*	[0.009]	
Parent firm's Capital-Labor ratio	0.004	-0.029	-0.023	-0.059	-0.027	0.033	-0.001	0.017	-0.021	-0.010	0.033	0.005	0.018	-0.016	-0.008
	[0.025]	[0.028]	[0.027]	[0.033]		[0.025]	[0.029]	[0.028]	[0.034]		[0.025]	[0.028]	[0.028]	[0.033]	
Parent firm's R&D intensity (%)	0.794	0.915	1.069	1.202	0.545	0.379	0.442	0.538	0.611	0.292	0.326	0.361	0.486	0.531	0.258
	[0.212]**	[0.230]**	[0.249]**	[0.266]**		[0.250]	[0.240]	[0.258]*	[0.275]*		[0.251]	[0.235]	[0.258]	[0.271]	
N of affiliates invested by same parent firm in the host country	-0.347	-0.349	-0.452	-0.453	-0.205	-0.422	-0.362	-0.547	-0.478	-0.228	-0.52	-0.482	-0.657	-0.61	-0.297
	[0.181]	[0.181]	[0.205]*	[0.212]*		[0.176]*	[0.191]	[0.208]**	[0.222]*		[0.178]**	[0.188]*	[0.209]**	[0.220]**	
N of Japanese affiliates in the host country	0.039	0.03	0.047	0.037	0.017	0.033	0.013	0.039	0.017	0.008	0.014	-0.002	0.014	-0.004	-0.002
	[0.013]**	[0.015]*	[0.016]**	[0.017]*		[0.017]	[0.020]	[0.020]*	[0.023]		[0.020]	[0.022]	[0.023]	[0.025]	
Unskilled wage in the host country	-0.067	0.641	-0.11	0.67	0.304	0.54	1.429	0.53	1.52	0.726	-0.664	-0.006	-0.856	-0.071	-0.035
	[1.064]	[1.134]	[1.209]	[1.310]		[0.988]	[1.118]	[1.148]	[1.287]		[1.187]	[1.260]	[1.351]	[1.464]	
Skilled wage in the host country	4.122	5.169	4.048	5.191	2.355	4.996	6.274	5.191	6.613	3.157	2.045	2.973	1.865	2.962	1.443
	[1.469]**	[1.603]**	[1.698]*	[1.847]**		[1.421]**	[1.596]**	[1.633]**	[1.832]**		[1.626]	[1.816]	[1.935]	[2.094]	
Distance (100km)	-0.131	-0.12	-0.157	-0.144	-0.065	-0.107	-0.091	-0.13	-0.111	-0.053	-0.285	-0.316	-0.318	-0.354	-0.173
	[0.025]**	[0.027]**	[0.030]**	[0.032]**		[0.024]**	[0.028]**	[0.029]**	[0.032]**		[0.047]**	[0.051]**	[0.053]**	[0.059]**	
Rule of Law index (0~5)	-6.459	-6.65	-6.944	-7.145	-3.241	-7.838	-8.098	-8.6	-8.868	-4.233	-7.211	-7.222	-7.553	-7.566	-3.685
	[1.393]**	[1.455]**	[1.621]**	[1.675]**		[1.350]**	[1.437]**	[1.556]**	[1.651]**		[1.436]**	[1.473]**	[1.617]**	[1.696]**	
Year dummy 1998	0.187	0.65	-0.705	-0.196	-0.089	-1.65	-1.032	-2.914	-2.23	-1.064	-0.69	-0.163	-1.632	-1.021	-0.497
	[2.503]	[2.690]	[2.977]	[3.083]		[2.395]	[2.644]	[2.838]	[3.022]		[2.435]	[2.635]	[2.873]	[3.029]	
Year dummy 2001	-3.738	-2.298	-5.33	-3.754	-1.702	-4.734	-2.874	-6.622	-4.522	-2.158	-3.832	-2.212	-5.36	-3.425	-1.667
	[2.512]	[2.759]	[2.964]	[3.164]		[2.415]	[2.743]	[2.840]*	[3.139]		[2.458]	[2.729]	[2.865]	[3.140]	
Industry dummy	No	No	No	No		Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	
Region dummy	No	No	No	No		No	No	No	No		Yes	Yes	Yes	Yes	
Constant	38.19	51.211	33.785	48.019		48.185	65.099	46.241	64.988		55.922	71.424	53.886	72.222	
	[6.058]**	[9.032]**	[7.170]**	[10.407]**		[6.344]**	[9.774]**	[7.382]**	[11.197]**		[6.660]**	[10.228]**	[7.680]**	[11.797]**	
Observations	2388	2388	2388	2388		2388	2388	2388	2388		2388	2388	2388	2388	
R2	0.05					0.15					0.16				
P-value of Durbin-Wu-Hausman Test / Wald of exogeneity		0.03		0.0518			0.01		0.0193			0.03		0.033	
Log likelihood			-10597.785	-12150.669				-10435.18	-11939.787				-10425.182	-11922.185	

Notes: Standard errors in parenthesis; *, ** indicate significance at the 5, and 1 percent levels, respectively. Observations include 387 left-censored observations, 2490 uncensored observations and 129 right-censored observations.

Table 1. Distribution of intra-firm trade ratio over industries

By Region	1995	1998	2001
North America	0.371	0.344	0.328
South America	0.324	0.341	0.314
Europe	0.349	0.319	0.346
Oceania	0.418	0.250	0.215
ASEAN	0.406	0.360	0.337
NIES	0.385	0.374	0.331
China	0.562	0.487	0.406
Other Asia	0.465	0.434	0.366

Table 2. Distribution of intra-firm trade ratio over industries

By Industry	1995	1998	2001
Textile	0.241	0.155	0.293
Chemical	0.279	0.302	0.274
Primary Metal	0.407	0.474	0.346
Metal Products	0.399	0.419	0.379
General Machinery	0.435	0.368	0.372
Electronics	0.438	0.418	0.416
Transport	0.424	0.387	0.349
Precision	0.483	0.457	0.475

Table 3. Data descriptions and summary statistics

Variable	Data discription	Mean	Std. Dev	Min	Max
m	Intra-firm imports from Japan / total purchase (%)	34.90	32.39	0	100
pm	The nationality dummy of person in charge of input control (Japan =0: Local = 1)	0.63	0.48	0	1
va	Affiliate's Value added / Sales (%)	38.36	19.76	0	99.97
aRD	Affiliate's R&D intensity (%)	0.38	1.82	0	49.88
age	Affiliate's Age (year)	11.71	8.91	0	48
asize	N of affiliate's employee (100 persons)	4.44	8.56	0	159.29
local	Affiliate's Local sales ratio (%)	63.58	37.46	0	100
share	Ownership share (%)	79.48	25.09	0	100
psize	N of parent firm's employee (100 persons)	71.75	122.02	0.55	711.70
pRD	Parent firm's R&D intensity (%)	30.86	30.93	0	510.76
KL	Parent firm's Capital-Labor ratio	3.52	3.28	0	40.52
agg1	N of affiliates invested by same parent firm in the host country	3.01	4.44	1	33
agg2	N of Japanese affiliates in the host country	43.09	49.34	1	227
unsw	Average wage of unskilled worker in the host country	0.79	0.95	0	5.27
sw	Average wage of skilled worker in the host country	0.93	0.98	0	4.88
dist	Distance (100km)	58.14	37.20	11.58	183.74
rule	Rule of Law index (0~5)	3.09	0.87	1.59	4.58

Table 4. Results of choice model on purchasing manager

Dependent variable: *pm* Purchasing manager dummy (local=1)	Probit[1]		Probit[2]		Probit[3]		Probit[4] majority-owned sample		Probit[5] majority-owned sample		Probit[6] majority-owned sample	
Additional instruments	Coef.	ME	Coef.	ME	Coef.	ME	Coef.	ME	Coef.	ME	Coef.	ME
Affiliate's Value added / Sales (%)	0.007	0.00266	0.007	0.00243	0.007	0.00247	0.007	0.00253	0.006	0.00228	0.006	0.00237
	[0.001]**		[0.001]**		[0.001]**		[0.001]**		[0.001]**		[0.001]**	
Affiliate firm's R&D intensity (%)	0.053	0.01956	0.051	0.01872	0.050	0.01854	0.053	0.02055	0.053	0.02017	0.052	0.02012
	[0.020]**		[0.020]*		[0.020]*		[0.020]**		[0.021]*		[0.021]*	
Affiliate's Age (year)	0.014	0.00526	0.015	0.00570	0.016	0.00588	0.015	0.00580	0.016	0.00621	0.017	0.00637
	[0.003]**		[0.003]**		[0.003]**		[0.003]**		[0.004]**		[0.004]**	
N of affiliate's employee (100 persons)	-0.015	-0.00553	-0.015	-0.00564	-0.015	-0.00553	-0.014	-0.00553	-0.015	-0.00570	-0.015	-0.00568
	[0.003]**		[0.003]**		[0.003]**		[0.004]**		[0.004]**		[0.004]**	
Affiliate's Local sales ratio (%)	0.002	0.00064	0.003	0.00094	0.002	0.00083	0.002	0.00093	0.003	0.00122	0.003	0.00109
	[0.001]*		[0.001]**		[0.001]**		[0.001]**		[0.001]**		[0.001]**	
Ownership share (%)	-0.010	-0.00368	-0.010	-0.00371	-0.010	-0.00382	-0.006	-0.00246	-0.007	-0.00251	-0.007	-0.00255
	[0.001]**		[0.001]**		[0.001]**		[0.002]**		[0.002]**		[0.002]**	
N of parent firm's employee (100 persons)	-0.001	-0.00023	-0.001	-0.00027	-0.001	-0.00026	-0.001	-0.00026	-0.001	-0.00032	-0.001	-0.00030
	[0.000]*		[0.000]**		[0.000]*		[0.000]*		[0.000]**		[0.000]**	
Parent firm's Capital-Labor ratio	-0.003	-0.00115	-0.003	-0.00104	-0.003	-0.00099	-0.004	-0.00161	-0.004	-0.00141	-0.004	-0.00136
	[0.001]**		[0.001]**		[0.001]**		[0.001]**		[0.001]**		[0.001]**	
Parent firm's R&D intensity (%)	0.019	0.00715	0.005	0.00193	0.002	0.00085	0.016	0.00613	0.004	0.00141	0.001	0.00040
	[0.008]*		[0.009]		[0.009]		[0.009]		[0.010]		[0.010]	
N of affiliates invested by same parent firm in the host country	-0.001	-0.00027	0.007	0.00253	0.005	0.00170	0.004	0.00142	0.012	0.00442	0.009	0.00361
	[0.007]		[0.007]		[0.007]		[0.007]		[0.008]		[0.008]	
N of Japanese affiliates in the host country	-0.001	-0.00023	-0.001	-0.00055	-0.002	-0.00058	-0.001	-0.00036	-0.002	-0.00073	-0.002	-0.00067
	[0.001]		[0.001]*		[0.001]		[0.001]		[0.001]*		[0.001]*	
Unskilled wage in the host country	0.108	0.04022	0.109	0.04031	0.063	0.02341	0.121	0.04637	0.127	0.04882	0.084	0.03231
	[0.043]*		[0.044]*		[0.052]		[0.046]**		[0.047]**		[0.056]	
Skilled wage in the host country	0.229	0.08501	0.228	0.08441	0.157	0.05806	0.168	0.06457	0.17	0.06525	0.114	0.04374
	[0.057]**		[0.059]**		[0.071]*		[0.062]**		[0.065]**		[0.078]	
Distance (100km)	0.000	0.00009	0.001	0.00026	-0.006	-0.00219	0.001	0.00038	0.001	0.00045	-0.005	-0.00192
	[0.001]		[0.001]		[0.002]**		[0.001]		[0.001]		[0.002]*	
Rule of Law index (0~5)	-0.114	-0.04254	-0.129	-0.04761	-0.103	-0.03808	-0.086	-0.03317	-0.103	-0.03946	-0.079	-0.03023
	[0.054]*		[0.056]*		[0.058]		[0.059]		[0.061]		[0.064]	
Year dummy 1998	-0.032	-0.01181	-0.038	-0.01418	-0.018	-0.00648	0.014	0.00522	0.009	0.00349	0.024	0.00939
	[0.090]		[0.093]		[0.095]		[0.107]		[0.111]		[0.114]	
Year dummy 2001	0.084	0.03120	0.080	0.02942	0.100	0.03682	0.14	0.05369	0.132	0.05044	0.148	0.05670
	[0.091]		[0.095]		[0.097]		[0.107]		[0.112]		[0.114]	
Industry dummy	No		Yes		Yes		No		Yes		Yes	
Region dummy	No		No		Yes		No		No		Yes	
Constant	0.775		0.840		1.051		0.332		0.449		0.600	
	[0.207]**		[0.230]**		[0.241]**		[0.263]		[0.291]		[0.301]*	
Observations	3006		3006		3006		2388		2388		2388	
Pseudo R2	0.0858		0.1083		0.1142		0.0779		0.1021		0.1073	

Notes: Standard errors in parenthesis; *, ** indicate significance at the 5, and 1 percent levels, respectively.

Table 5. Results of intra-firm trade ratio

Dependent variable: Intra-firm imports from Japan / total purchase (%)	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)		(9)	(10)	(11)	(12)	
	OLS	2SLS	Tobit	IVTobit[1]		OLS	2SLS	Tobit	IVTobit		OLS	2SLS	Tobit	IVTobit	
	Coef.	Coef.	Coef.	Coef.	ME	Coef.	Coef.	Coef.	Coef.	ME	Coef.	Coef.	Coef.	Coef.	ME
Purchasing manager dummy (local=1)	-2.419	-24.02	-2.831	-25.668	-11.329	-2.469	-26.725	-2.909	-28.645	-13.336	-2.856	-24.009	-3.308	-27.356	-12.905
	[1.285]	[7.853]**	[1.470]	[9.213]**		[1.237]*	[8.594]**	[1.419]*	[9.978]**		[1.238]*	[8.478]**	[1.421]*	[9.914]**	
N of affiliate's employee (100 persons)	-0.311	-0.405	-0.284	-0.385	-0.168	-0.365	-0.47	-0.354	-0.467	-0.215	-0.365	-0.453	-0.354	-0.454	-0.212
	[0.070]**	[0.081]**	[0.082]**	[0.094]**		[0.071]**	[0.082]**	[0.080]**	[0.094]**		[0.070]**	[0.080]**	[0.080]**	[0.093]**	
Affiliate's Local sales ratio (%)	0.006	0.022	0.027	0.043	0.019	-0.011	0.012	0.003	0.028	0.013	-0.021	-0.003	-0.008	0.012	0.005
	[0.017]	[0.019]	[0.020]	[0.022]*		[0.018]	[0.020]	[0.020]	[0.024]		[0.018]	[0.020]	[0.021]	[0.023]	
Ownership share (%)	0.219	0.14	0.306	0.222	0.097	0.197	0.11	0.277	0.185	0.085	0.19	0.113	0.271	0.183	0.085
	[0.025]**	[0.039]**	[0.031]**	[0.046]**		[0.025]**	[0.041]**	[0.030]**	[0.047]**		[0.025]**	[0.041]**	[0.030]**	[0.048]**	
N of parent firm's employee (100 persons)	0.011	0.006	0.013	0.008	0.004	0.012	0.006	0.013	0.007	0.003	0.013	0.009	0.016	0.011	0.005
	[0.006]	[0.007]	[0.007]	[0.008]		[0.006]	[0.007]	[0.007]	[0.008]		[0.006]*	[0.007]	[0.007]*	[0.008]	
Parent firm's Capital-Labor ratio	-0.025	-0.054	-0.06	-0.091	-0.040	0.009	-0.018	-0.013	-0.042	-0.020	0.01	-0.013	-0.012	-0.039	-0.018
	[0.019]	[0.022]*	[0.023]**	[0.027]**		[0.020]	[0.023]	[0.024]	[0.028]		[0.020]	[0.023]	[0.024]	[0.027]	
Parent firm's R&D intensity (%)	0.977	1.139	1.356	1.527	0.668	0.55	0.629	0.768	0.855	0.394	0.507	0.553	0.723	0.779	0.364
	[0.186]**	[0.210]**	[0.227]**	[0.246]**		[0.216]*	[0.220]**	[0.239]**	[0.254]**		[0.217]*	[0.216]*	[0.239]**	[0.251]**	
N of affiliates invested by same parent firm in the host country	-0.402	-0.438	-0.588	-0.622	-0.272	-0.392	-0.367	-0.58	-0.549	-0.253	-0.474	-0.466	-0.672	-0.659	-0.308
	[0.157]*	[0.165]**	[0.188]**	[0.196]**		[0.154]*	[0.172]*	[0.192]**	[0.202]**		[0.156]**	[0.170]**	[0.193]**	[0.202]**	
N of Japanese affiliates in the host country	0.053	0.045	0.066	0.058	0.025	0.039	0.023	0.049	0.032	0.015	0.019	0.005	0.026	0.009	0.004
	[0.012]**	[0.013]**	[0.015]**	[0.016]**		[0.015]*	[0.017]	[0.018]**	[0.020]		[0.018]	[0.019]	[0.021]	[0.023]	
Unskilled wage in the host country	0.097	0.872	0.077	0.908	0.397	0.441	1.258	0.433	1.295	0.597	-0.697	-0.126	-0.832	-0.18	-0.084
	[0.970]	[1.048]	[1.142]	[1.232]		[0.903]	[1.034]	[1.094]	[1.201]		[1.080]	[1.164]	[1.281]	[1.369]	
Skilled wage in the host country	3.208	4.854	3.141	4.879	2.135	4.071	5.79	4.22	6.038	2.783	1.396	2.586	1.35	2.689	1.255
	[1.334]*	[1.494]**	[1.547]*	[1.750]**		[1.284]**	[1.484]**	[1.491]**	[1.719]**		[1.486]	[1.657]	[1.768]	[1.932]	
Distance (100km)	-0.112	-0.106	-0.141	-0.135	-0.059	-0.101	-0.09	-0.129	-0.116	-0.053	-0.238	-0.277	-0.28	-0.324	-0.151
	[0.022]**	[0.023]**	[0.026]**	[0.027]**		[0.021]**	[0.024]**	[0.026]**	[0.027]**		[0.040]**	[0.046]**	[0.048]**	[0.053]**	
Rule of Law index (0~5)	-5.972	-6.411	-6.487	-6.946	-3.040	-6.889	-7.373	-7.568	-8.083	-3.726	-6.469	-6.672	-6.758	-7.01	-3.272
	[1.233]**	[1.310]**	[1.466]**	[1.534]**		[1.195]**	[1.296]**	[1.416]**	[1.503]**		[1.267]**	[1.325]**	[1.472]**	[1.544]**	
Year dummy 1998	-3.494	-3.254	-4.773	-4.517	-2.881	-4.921	-4.665	-6.542	-6.271	-1.973	-3.897	-3.584	-5.313	-4.963	-2.311
	[2.131]	[2.217]	[2.488]	[2.588]		[2.062]*	[2.182]*	[2.388]**	[2.520]*		[2.093]	[2.185]	[2.422]*	[2.542]	
Year dummy 2001	-7.11	-5.878	-9.175	-7.87	-3.956	-7.747	-6.377	-10.059	-8.605	-3.438	-6.813	-5.523	-8.875	-7.412	-3.453
	[2.148]**	[2.270]**	[2.503]**	[2.653]**		[2.077]**	[2.255]**	[2.413]**	[2.608]**		[2.112]**	[2.258]*	[2.442]**	[2.630]**	
Industry dummy	No	No	No	No		Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	
Region dummy	No	No	No	No		No	No	No	No		Yes	Yes	Yes	Yes	
Constant	42.194	60.865	36.344	56.091		50.826	71.528	47.192	69.163		57.476	76.974	53.706	75.943	
	[4.841]**	[8.346]**	[5.620]**	[9.785]**		[5.098]**	[8.983]**	[5.847]**	[10.411]**		[5.407]**	[9.502]**	[6.177]**	[11.110]**	
Observations	3006	3006	3006	3006		3006	3006	3006	3006		3006	3001	3006	3006	
R2	0.07		0.0093			0.15	0.04	0.0221			0.16	0.07			
P-value of Durbin-Wu-Hausman Test / Wald of exogeneity		0.003		0.0119			0.002		0.009			0.008		0.014	
Log likelihood			-13028.839	-14914.676				-12860.428	-14688.519				-12852.452	-14668.586	

Notes: Standard errors in parenthesis; *, ** indicate significance at the 5, and 1 percent levels, respectively. Observations include 387 left-censored observations, 2490 uncensored observations and 129 right-censored observations.

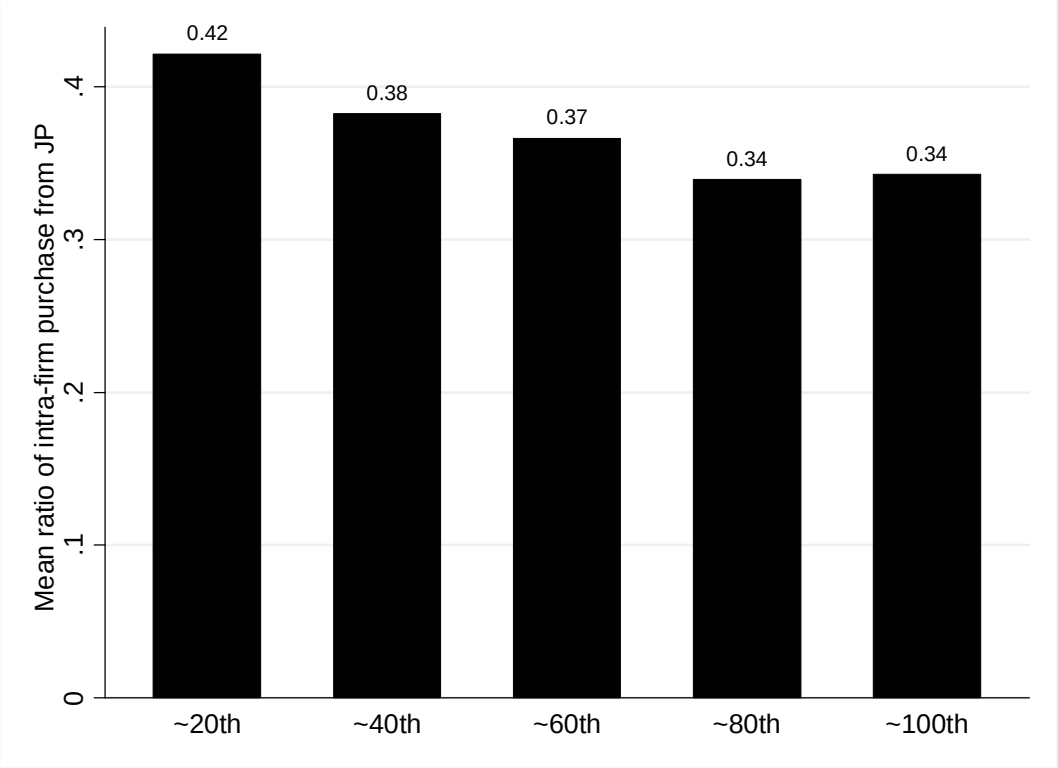

Figure 1. Intra-firm trade ratio and contractibility in host countries

Note: The horizontal axis denotes categorized host countries by percentiles of rule of law index.

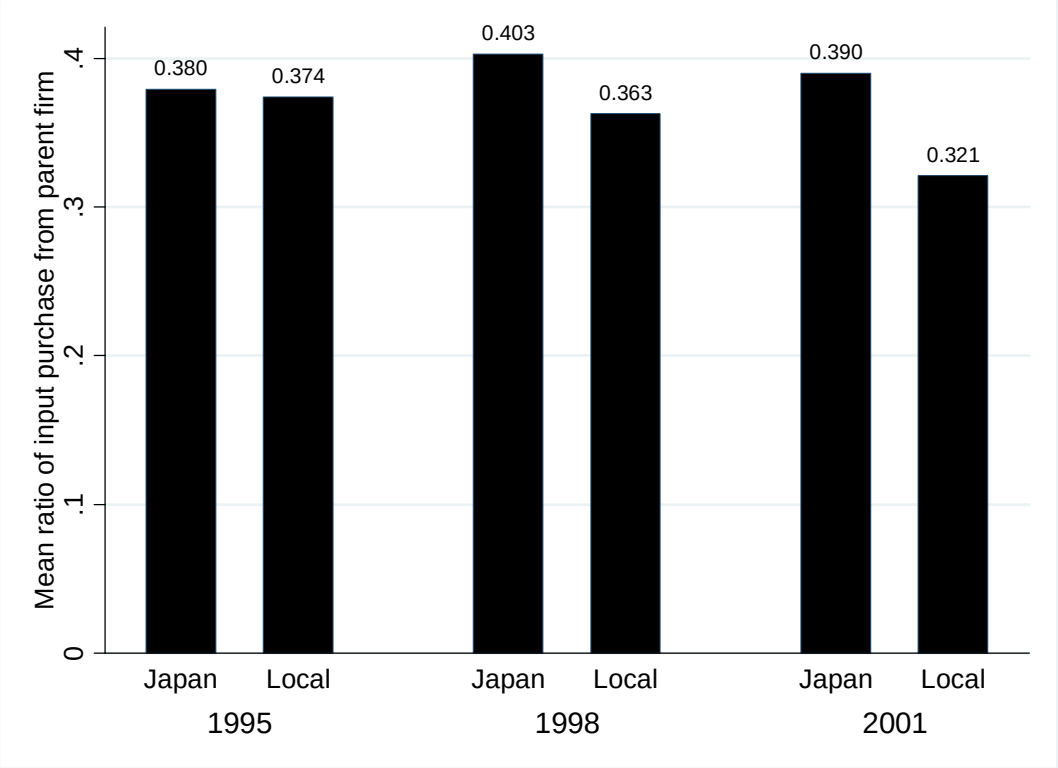

Figure 2. Intra-firm trade ratio by the nationality of purchasing manager and year

Note: "Local" means that the nationality of purchasing manager is local while "Japan" means that the purchasing manager is dispatched from Japan.