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MATSUURA Toshiyuki
Keio Economic Observatory, Keio University

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Keio Economic Observatory, Keio University†

Abstract

This study investigates the impact of foreign direct investment (FDI) on domestic corporate performance using firm-level data on Japanese automobile parts suppliers. While previous studies used the propensity score matching method and focused mainly on the impact of the extensive margin of FDI, this study uses data on the automobile makers' FDI as an instrumental variable for suppliers' FDI and estimates the impact of both extensive and intensive margins of FDI on domestic corporate performance. Our empirical results reveal that while the impact of intensive margins of FDI has no significant impact on corporate performance, FDI in both developed and developing countries has a positive impact on sales and total factor productivity (TFP) in the case of extensive margins. Furthermore, the impact of the first flow of FDI is more profound than that of subsequent flows.

Keywords: Multinational enterprises, Extensive and Intensive margins, Keiretsu network
JEL classification: F21, F23, L62

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† 2-15-45, Mita, Minato-ku, Tokyo, 108-8345, Japan. E-mail: matsuura@sanken.keio.ac.jp

1. Introduction

In recent years, the impact of foreign direct investment (FDI) on domestic corporate performance has been a central concern among business circles and policy makers. Since many firms from developed countries engaging in FDI have relocated their production sites to low-cost countries, concerns are repeatedly expressed regarding "hollowing out" a phenomenon referring to the potential negative employment impact of such FDI on these developed economies. On the other hand, firms relocating labor-intensive production to low-cost countries tend to specialize in skill- or knowledge-intensive production in the home country. Thus, FDI may indirectly improve domestic productivity and promote the home country's exports of skill- or knowledge-intensive goods to its foreign subsidiaries.

Several studies have empirically examined the impact of FDI on domestic output, employment, and productivity. Debaera et al. (2010) examined this impact on Korean Multinational Enterprises (MNEs), Navaretti et al. (2010) on Italian and French MNEs, and Hayakawa et al. (2013) on Japan. It is most difficult to empirically identify the causal factors for the impact of FDI on the above-mentioned factors because, as Helpman et al. (2004) suggested, FDI has a selection effect: high-productivity firms are more likely to become multinationals. Thus, to identify the causal effect of FDI, a simple comparison between MNEs and non-MNEs suffers from selection bias. As an alternative, the above-mentioned studies used the propensity score matching method that has an advantage when appropriate instrumental variables are not available. However, this method has some drawbacks. First, while matching can eliminate the selection-induced bias associated with observable firm characteristics, it cannot do so with unobservable characteristics. Second, the previous studies compare the impact of newly investing firms with their counterfactual impact in combination with a difference-in-difference (DID) estimator. In other words, the previous studies focus on the impact of the extensive margin of FDI, namely, the change in firms' domestic performance before and after their first foreign investment.

Investigating the extensive margin of FDI restricts our attention to relatively small or young firms since large, established firms have relatively more experience in FDI. Furthermore, the sales and procurement patterns of foreign subsidiaries change over time. For example, Kiyota et al. (2008) demonstrateds that local procumbent ratio of MNE subsidiaries increases as they accumulate experience in local operation. It means MNE subsidiaries' import from home country will be decreasing as the year of operation increase. And thus, the effect of FDI on production activities at home country may changes as their production size increases, suggesting that the impact of the

extensive margin of FDI may differ from that of the intensive margin of FDI, namely in terms of an increase in production in the foreign subsidiaries.

Against this backdrop, the present study investigates the impact of not only the extensive margin of FDI but also the intensive margin using the transaction network data for the Japanese automobile parts industry. Many automobile parts suppliers in Japan are members of an automobile manufactures' vertical Keiretsu. The automobile Keiretsu has fostered long-term relationships between assemblers and suppliers[2]. Thus, once automobile manufacturers relocate their production site abroad, some auto parts suppliers follow these manufacturers and also invest abroad. We use the transaction relationship of auto parts suppliers with automobile manufacturers as an instrument for auto parts suppliers' FDI[3]. An FDI decision by automobile manufacturers mainly depends on the market size or the trade costs, but it is unlikely that suppliers' performance affects the FDI decisions of automobile manufacturers.

In this study, we focus on the Keiretsu relationship between suppliers and assemblers in the 1990s. This is because Nissan Motor, which ranks second in Japan, after Toyota, began to redefine their Keiretsu relationship following the merger of Renault and Nissan Motor in 1999. However, until the 1990s, the long-term supplier–assembler Keiretsu relationship was relatively stable; therefore, it is also less likely that automobile makers chose good suppliers and added them as Keiretsu members during our sample periods. Moreover, the timing and size of FDI in automobile production has varied among Japanese auto manufactures. Thus, we believe that automobile makers' FDI is a good candidate for use as an instrumental variable.

Furthermore, there are two reasons to focus on Japanese automotive industries. First, automobile manufacturing industries have actively investing abroad in these 30 years and it has the most developed international production networks. Thus, our research might be the good case study for accessing the impact of the

[2] Keirestsu is a business group composed of companies with supply chain partners or an association of companies formed around bank. The automobile manufacturers' vertical Keiretsu is different from the horizontal Keiretsu, which consists of the groups within the sphere of a main bank, such as Mitsubishi or Mitsui. The automobile Keiretsu members collaborate to carry out R&D projects to ensure stable supply. In the case of the horizontal Keiretsu, cross-shareholding among firms within the same Keiretsu is prevalent. But this is not the case for automobiles in the vertical Keiretsu. For example, according to Miwa and Ramseyer (2006), from among 180 Toyota Keiretsu suppliers (members of the suppliers' association for Toyota), there are only 11 suppliers whose shareholding ratio by Toyota was greater than 50% in 1991.

[3] Previous studies, such as Head et al. (1995), Yamashita et al. (2014), and Nakajima and Ito (2014) demonstrate that the FDI made by a transaction partner is one of the determinates of the decision to invest abroad. For example, while Head et al. (1995) investigate the location choice of Japanese FDI in the US, focusing on the KEIRETSU, Yamashita et al. (2014) and Nakajima and Ito (2014) use comprehensive sales-procurement transaction network data.

internationalization of the production network. Second, firms in automobile industry have a broad transaction network both within industry and across industries. It means the restructuring of production network associated with FDI will affect other firms through intra- and inter-industry transaction networks. Accordingly, exploring the impact of FDI focusing on Japanese automotive parts suppliers is an interesting case study.

The rest of this paper is organized as follows: Section 2 explains the pathway for the impact of FDI on corporate performance by introducing the conceptual framework and summarizing the previous studies. Section 3 provides the empirical methodologies and the treatment of the data used. The empirical results are presented in Section 4, and Section 5 concludes.

2. Pathway for the Impact of FDI on Corporate Performance

2.1 Conceptual framework

Before proceeding to the empirical investigation, we introduce theoretical considerations regarding the impact of FDI on domestic corporate performance. Since the impact of FDI substantially differs depending on its type, we begin by explaining the nature of two types of FDI: horizontal FDI (HFDI) and vertical FDI (VFDI). HFDI is motivated by an attempt to avoid broadly defined trade costs by establishing production facilities in the foreign market rather than by exporting from the home country. In contrast, VFDI seeks to exploit the factor price gap between the home and the foreign country. Therefore, VFDI firms relocate production activities in which the host country has a comparative advantage and specialize in activities in which the home country has a comparative advantage.

The impact of FDI on output and employment on the home country may be either negative or positive, depending on whether activities at home and in the foreign country are complements or substitutes. In the case of HFDI, foreign investment substitutes exports from the home country. Therefore, output and employment will decrease. Also, an increase in the number of foreign production sites raises the demand for services in company headquarters at home. In the case of VFDI, a certain portion of the production activities shifts from one country to another; this reduces domestic production and employment. However, these negative effects may be offset if the MNEs gain market share due to the cost savings induced by VFDI. In addition, VFDI firms often relocate labor-intensive production to a low-wage country. This stimulates intra-firm trade of intermediate goods from the home country to the foreign country. As a result, domestic production of intermediate goods and the associated labor demand will increase.

The impact on productivity also differs according to the types of FDI. Since HFDI reduces domestic production, productivity may decline due to the loss of economies of scale. However, if firms invest in locations with a high density of high-tech activities, foreign affiliates can be effective channels for transferring technological knowledge to the home country. Such knowledge transfer from the foreign country, if any, will have a positive impact on productivity in the home country. In the case of VFDI, investing firms may improve productivity due to the benefit of cross-border production sharing.

2.2 Previous studies

In this subsection, we briefly summarize the results of previous studies. Most recent studies classify FDI in developed countries and developing countries as HFDI and VFDI,[4] and their results are summarized in Table 1. In regard to the effect of productivity, while Navaretti et al. (2010) in their study on Italy and France and Hijzen et al. (2011) in their study on France demonstrated that HFDI improves domestic productivity, Hayakawa et al. (2013) in their study on Japan found positive significant effects on productivity in the case of VFDI. As for the impact on sales and employment, Navaretti and Castellani (2011) found positive impacts on sales and employment through both HFDI and VFDI. Hijzen et al. (2011) and Hayakawa et al. (2013) use French and Japanese firm-level data respectively, and also found that both HFDI and VFDI by French and Japanese firms increase domestic employment. In contrast, Debaera et al. (2010) in their study on Korea reported not finding any positive impact on employment through either FDI type.

== Table 1 ==

The above-mentioned previous studies use propensity score matching in combination with a DID estimator; therefore, these studies focus only on the extensive margin of FDI. However, there are some studies that investigate the impact of the intensive margin of FDI by estimating the labor demand function. For example, Harrison and McMillan (2011) in their study on US, Yamashita and Fukao (2009) and Kambayashi and Kiyota (2015) in their study on Japan, and Muendler and Becker (2010) in their study on Germany estimated the labor demand function for MNEs' domestic employment and examined whether or not FDI substitutes domestic

[4] Some early researches do not distinguish between FDI types. For example, Navaretti and Castellani (2007) for Italy, Masso et al. (2008) for Estonia, Imbriani et al. (2011) for Italy, and Ito (2014) for Japan investigate the impact of FDI on sales, employment, and productivity.

employment. While Yamashita and Fukao (2009) used output or employment of the foreign affiliate as the independent variable in the Arrellano–Bond GMM method to estimate the impact on labor demand, Harrison and McMillan (2011), Muendler and Becker (2010) and Kambayashi and Kiyota (2015) estimated the unconditional labor demand function derived from the translog cost function for MNEs and used the factor price in the foreign country as an independent variable. As a result, the latter studies focus only on the labor substitution caused by the factor price gap between the home and foreign country. Moreover, these studies restrict their attention to labor demand only for MNEs. They do not compare the impact of the first flow and the subsequent of FDI on corporate performance variables[5].

3. Empirical Investigation

3.1. Methodology

We estimate the impact of FDI on firm-level outcome variables, such as sales, employment, and productivity by using the following regression equation:

$$Y_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 X_{it} + \varepsilon_{it}, \qquad (1)$$

where Y_{it} is the outcome for firm i in year t, FDI_{it} is the dummy variable for FDI or the indicator for the scale of foreign production, X_{it} represents other firm characteristics, and ε_{it} is an error term. In this study, we focus on FDI in U.S., Canada, the UK, Australia, Thailand, Malaysia, the Philippines, China, and Taiwan, since these are the major destination countries for Japanese auto assemblers. Following Kambayashi and Kiyota (2015), in our estimation, we use the pairs of each firm's FDI to each destination country and corporate performance variables and estimate equation (1) by pooling nine FDI destination countries. Therefore, our sample has three dimensions: parent firm (i), FDI destination countries (j), and time (t)[6]. The equation to be estimated is represented as follow;

[5] Muendler and Becker (2010) investigate the impact of both extensive and intensive margin of FDI on their employment for German MNEs. However, their sample firms are restricted to non-MNEs that are to become MNEs during the sample periods, implying that it may suffer from the selection bias.

[6] One may think why FDI variable in the different country are not placed as independent variables in one equation. There are two reasons. First, if we place several FDI variables as independent variables in one equation, we'll face multi-colinearity problems. Second, aggregating country-level FDI indicators at regional-level might be one solution. However, the relationship between automobile manufactures FDI and suppliers FDI should be identified at country-level, not at regional-level. Furthermore, it is hard to find an appropriate weight when aggregating FDI indicators at regional-level.

$$Y_{it} = \beta_0 + \beta_1 FDI_{it}^{j} + \beta_2 X_{it-1} + \varepsilon_{it}^{j}. \quad (2)$$

When estimating equation (2) via ordinary least squares, the coefficient for FDI need not represent the causal effect of FDI on the outcome variables because of the endogenous bias. To isolate a source of variation in a firm's FDI, we use the Keiretsu automobile manufacturers' FDI (*AUTO_FDI*) as instrumental variables. In addition, as other instrumental variables, we use the logged GDP for each destination country. In other words, we estimate the following first-stage regression equation;

$$FDI_{it}^{j} = \alpha_1 + \alpha_2 AUTO\_FDI_{it}^{j} + \alpha_3 logGDP_t^{j} + \gamma X_{it-1} + \nu_{it}^{j} \ . \quad (3)$$

To distinguish the impact of the extensive margin and intensive margin of FDI, we use two different measures of FDI: a dummy variable for FDI and the level of employment in the foreign affiliates (affiliate size). The former is the dummy variable, which takes the value one if firms have a foreign affiliate and zero otherwise, and is used to capture the extensive margin of FDI. Because our sample includes the decisions to invest in nine countries, represented by the pairs of variables of domestic corporate performance and FDI in each destination country, the extensive margin of FDI in this study includes both the decision to engage in FDI for the first time and the increases in FDI in the number of destination countries. The affiliate size is the logged number of employees of the foreign affiliates and used to capture the impact of the intensive margin of FDI.

When estimating the impact of the extensive margin of FDI, the endogenous variable in equation (2) is binary, we use endogenous treatment-effects model. More formally, the endogenous treatment-effect model is composed of two equations; the one is the outcome variable *y* and the other is the endogenous variable *D*,

$$\mathrm{y} = \mathbf{x}\beta + \gamma \boldsymbol{D} + \varepsilon \quad (4)$$

$$\boldsymbol{D} = \begin{cases} 1, \text{if } \boldsymbol{w}\eta + v > 0 \\ 0, \text{otherwise} \end{cases}, \quad (5)$$

where *x* are the covariates that affect the outcome *y* and *w* are the variable used to model treatment *D*, and the error term and *u* are bivariate normal with mean zero and have the following covariance matrix;

$$\begin{bmatrix} \sigma^2 & \rho\sigma \\ \rho\sigma & 1 \end{bmatrix}$$

x and *w* are assumed to have no correlation with the error terms. Since this model

cannot be taken into account the nature of panel data, we convert outcome variables into the log-difference from year *t*-1 to year *t* (ΔY_{it}). We estimate the model focusing on those samples that have no investment in year *t*-1. As for the intensive margin, since endogenous variable is continuous variable, we estimate the equation (2) by fixed-effect instrumental variable model.

3.2. Data Source

In this study, we combine four types of firm-level data. One type is the firm-level data acquired from the Basic Survey of Japanese Business Structure and Activities (BSJBSA) compiled by the Ministry of Economy, Trade and Industry (METI), Japan. This survey began in 1991 and was conducted annually after 1994.[7] The BSJBSA statistically captures an overview of Japanese corporate firms, which includes the diversification and globalization of corporate activities and strategies for R&D. As previously discussed, we use this firm-level data for the automobile parts industry for 1991 and for the 1994–2000 periods. We exclude suppliers whose shareholding ratio of automobile assemblers is greater than 50% since these suppliers might jointly decide with the automobile assemblers to invest abroad[8].

The other firm-level data are the Basic Survey of Overseas Business Activities (BSOBA) also compiled by METI. These data are used to link the information on outward FDI to the above mentioned automobile suppliers' firm-level dataset. The BSOBA contain data on Japanese overseas affiliates, including the location, year of establishment, number of employees, and industry classification. Since the micro data for the foreign affiliates are available only after 1995, we complement it with the information we have on the foreign affiliate for the years 1991 and 1994 from the Directory of Japan's Automobile Parts Industry, which is compiled by the Japan Automobile Parts Industry Association (JAPIA). In this study, we exclude those affiliates that do not engage in manufacturing activities.

The third firm-level dataset comprises the list of members of the Keiretsu suppliers association[9]. The first-tier suppliers of each Japanese automobile manufacturer

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[7] All firms with more than 50 employees and capital of more than 30 million yen are covered in the survey.

[8] In our empirical assessment, we conduct two robustness checks. First, we exclude those suppliers whose shareholding ratio of automobile manufactures is greater than 20%. Second, we also exclude those suppliers that belong to only one Keiretsu group. These keiretsu suppliers may have a strong relationship with Keiretsu auto manufactures and may make a joint decision of their FDI.

[9] An alternative data source for the transaction network is the firm-level transaction network data collected by the credit survey companies, Teikoku Data Bank and Tokyo Shoko Research. Recent

are members of the supplier association[10]. The list is provided by the Directory of Japan's Automobile Parts Industry, compiled by JAPIA. The fourth dataset comprises the level of automobile oversea production by Japanese assemblers by country and year, which is used as an instrumental variable. This dataset is obtained from the World Motor Vehicle Statistics compiled by the Japan Automobile Manufacture Association. We match these three firm-level datasets, referring to the name and location of each firm. Some of automotive parts suppliers belong to more than two automobile manufactures' Keiretsu groups. For example, in our sample, there are 120 automotive parts suppliers that belong to more than two Keiretsu group in 1991. In such a case, we sum up all the number of oversea productions by Keiretsu automobile manufactures that an automotive parts supplier belongs to.

As for firm characteristics, we use sales deflated by industry-level output deflator, number of employees, and total factor productivity (TFP) as outcome variables. In this study, we obtain TFP by estimating the production function with the Wooldridge (2009) modification of the Levinshon and Petrin (WLP) methodology, following Petrin and Levinsohn (2012). This method takes into account the potential collinearity in the first stage of the Levinsohn and Petrin (2003) estimator, as suggested by Ackerberg et al. (2006)[11]. For other firm characteristics, we include the logged age of firms (Firm age), the lagged capital–labor ratio (K-L ratio), R&D intensity (R&D sales ratio), and firm size dummy variables. We also control the logged number of oversea employees that belong to the same firms and are located in other countries in year t-1 (FDI_other). Since the number of oversea employees sometimes become zero, we plus one and then take log when constructing "FDI_other"[12].

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studies, such as Yamahsita et al. (2014), Nakajima and Ito (2013), and Ito and Tanaka (2014) used this dataset to investigate Japanese FDI. While these datasets are more comprehensive, they are unable to identify which transaction tie is more important. Therefore, we use the member lists of the Keiretsu supplier associations in this study.

[10] Member firms of associations have meetings from time to time, and they exchange business information. As of 1991, Toyota had 180 suppliers in its network and Nissan Motor had 193.

[11] Variables for output and input are constructed as follows: real gross output is measured as sales deflated by the output deflator, while intermediate input is the cost of materials deflated by the input deflator. Labor input is measured by the total number of employees. We constructed the net capital stock by deflating the nominal book values of tangible assets with the capital stock deflator. The capital stock deflator is defined as the ratio of the net stock by industry to the book value of the industry-level tangible assets. The net capital stock by industry values are obtained from the Japan Industrial Productivity (JIP) Database 2013, while the book values of capital by industry are obtained by aggregating the individual data obtained from the BSJBSA. All output and input deflators are obtained from the JIP Database 2013.

[12] Basic statistics are presented in Table A1.

3.3. Data Overview

Figure 1 indicates the volume of foreign production by Japanese automobile assemblers. This chart suggests a large heterogeneity of foreign production among Japanese automobile assemblers. While Toyota, Nissan Motor, and Honda own large foreign production sites in North America and Europe, foreign production for the remaining assemblers is relatively small. We use this variation as an instrumental variable for our identification.

=== Figure 1: Size of Foreign Production ===

Table 2 reports the characteristics of foreign affiliates owned by Japanese automobile assemblers and auto parts suppliers. The ratio of imports from Japan to total procurement for automobile assemblers is approximately 40%, regardless of the location of the affiliates. In contrast, the ratio for auto parts suppliers is higher for Asia. It amount to 49%. One may argue that the FDIs by the parts suppliers are more horizontal than vertical because the suppliers are relatively small and they invest abroad to maintain their transactions with the Keiretsu assemblers rather than continuing to export. This table suggests that since the import ratio from Japan is nearly 50% in the case of affiliates in Asia, auto suppliers' FDI in developing countries, such as in Asia, has a vertical nature.

=== Table 2: Affiliate characteristics: Ratio of import from Japan ===

Table 3 presents basic statistics for firm characteristic for our sample. The data show that MNEs have higher sales, a higher number of employees, and higher TFP. These MNEs premier may reflect the fact that only firms with higher productivity are able to invest abroad and become MNEs as suggested by theoretical and empirical previous studies, such as Helpman et al. (2004), Mayer and Ottaviano (2008) and Kiyota and Kimura (2006). As for the difference in firm characteristics according to Keiretsu affiliation, similar patterns have been found: Keiretsu firms are larger in terms of both sales and employment and have higher K-L ratio and TFP.

=== Table 3: Firm characteristics ===

Table 4 provides the number of MNEs and Keiretsu suppliers. Among

approximately 900 sample firms, about 300 firms belong to the Keiretsu supplier associations. Two things are noteworthy. First, while one third of the Keiretsu suppliers are MNEs, the proportion of MNEs for non-Keiretsu suppliers is less than 10 percent. This is probably because Keiretsu suppliers are larger and have higher TFP than non-Keiretsu suppliers as indicated in Table 3. Second, both Keiretsu and non-Keiretsu suppliers have actively invested abroad from 1991 to 2000. Especially, the number of MNEs among non-Keiretsu suppliers has increased more than double.

=== Table 4: Number of MNEs and Keiretsu suppliers ===

As a preliminary analysis, we estimate the conditional logit model for the location choice for FDI by Japanese automotive parts suppliers. Our sample consists of nine countries, and we use automobile production by Keiretsu assemblers, non-Keiretsu Japanese assemblers, and non-Japanese assemblers as independent variables. We also include the number of foreign affiliates of Japanese auto parts suppliers and the distance from Japan. Table 5 provides the estimation results for the conditional logit model. The results suggest that the volume of foreign production by the Keiretsu assemblers always has significant coefficients. This suggests that the Keiretsu assembler–supplier tie is one of the important determinants of the location choice of suppliers' FDI.

=== Table 5: Location choice ===

4. Estimation Results

First, to explore the determinants of FDI, we estimate the equation (3) and (5). Estimation results are presented in table 6. While column (1)-(3) use FDI dummy variables as dependent variables and estimate probit model, the number of workers in foreign affiliates (affiliate size) is used as a dependent variable and estimate fixed effect model in column (4)-(6). These results correspond to the determinants of the FDI extensive margin and intensive margin, respectively. The estimation results suggest that Kiretsu automobile manufactures' FDI (*AUTO_FDI*) have significant positive impact on FDI decision by auto parts suppliers both in terms of the extensive margin and intensive margin of FDI. And we confirm the LR test and F-test statistics reject the null hypothesis for the joint insignificance of all the covariates. We use the specifications in column (4) and (6) for the impact of the extensive and intensive margin of FDI.

=== Table 6: First-Stage Estimation ===

Next, we estimate the equation (4) and (5) simultaneously to examine the impact of the extensive margin of FDI. The baseline results are presented from column (1) to (3) in Table 7. For all outcome variables, namely, sales, employment and TFP, the coefficient of FDI is positive and significant, suggesting that starting to invest abroad or launching production operation in new location have positive impact on corporate performance at home.

One may consider that the impact of FDI may differ according to region. As we discuss in Table 2, while foreign affiliates in developed countries are more horizontal, FDI in Asian countries has a vertical nature. We separate our samples into developed and developing (namely Asian) countries, and investigate whether or not the impact of FDI differs. The results are presented from column (4) to (9) in Table 7. The coefficients for FDI are all positive and significant, implying that impacts of the extensive margin of FDI do not differ according to destination countries.

=== Table 7 ===

Next, we compare the impact of the first FDI and the subsequent FDIs. Since we estimate equation (4) by using the pair of parent performance variables and the FDI by country and pool the nine-country FDI pairs, the effect of the extensive margin of FDI includes not only the impact of the first FDI but also the impact of the increase in the number of foreign affiliates. As we mentioned, most previous studies using the propensity score matching methodology focus on the performance changes when firms start foreign production. To highlight the effect of the first FDI, we estimate the equation (4) focusing on those firms that have at least one foreign affiliate in year $t-1$ and results are presented from column (1) to (3) in table 8. The coefficients for FDI are significant only in case of column (2), namely, the impact on the employment at home. Furthermore, the size of coefficient for employment is smaller than that of baseline result presented in column (2) in table 7. These results imply that results suggest that the impact of FDI on corporate performance is mainly driven by the first investment.

In table 8, we conduct two robustness checks. First, from column (4) to (6), we exclude those firms that belong to only one automobile Keiretsu group. Since these suppliers may have strong relationship with automobile manufactures, they might decide to invest abroad together with them. The results are presented from column (4) to (6) and major results do not change. Second, we exclude those auto parts suppliers whose capital share of keiretsu auto manufactures is greater than 20% and results are

presented in the column (7) to (9). Again, major results are same with the baseline results[13].

=== Table 8 ===

Table 9 presents the results of the impact of the intensive margin of FDI. In baseline results presented in column (1)-(3), the coefficients for affiliate size are all positive but significant at 10% only in case of the impact on sales. From column (4)-(9), we split our sample into FDI to Asia and FDI to advanced countries. Affiliate size has positive and significant impact on sales and employment only in case of FDI to advanced countries. Table 10 presents the same robustness check as in table 8. Positive and significant coefficients are found only in case of the impact on sales when excluding the first FDI. In sum, the impact of the intensive margin of FDI has been found only in some cases of the impact on sales but these results are statistically significant only at 10% and found it is not so robust.

=== Table 9 & Table 10 ===

5. Concluding remarks

This study investigates the impact of FDI on corporate performance at home country, focusing on the Japanese automobile parts industry. This study differs from other previous studies in that it uses instrumental variable technique to deal with the issue on the reverse causality and use supplier-customer transaction relationship as an instrument for automotive suppliers' FDI, while the most of previous studies use the propensity score matching method and focus only on the impact of the extensive margin of FDI on corporate performance at home. Our approach enables us to investigate the impact of both the extensive margin and intensive margin of FDI.

Using Japanese automobile Keiretsu relationship, our empirical analysis reveals that the extensive margin of FDI has a positive impact on sales, employment and TFP. These results do not differ if we split our sample according to region. In addition,

[13] As another robustness check, we exclude FDI to China and estimate the same regression model. While Japanese automobile manufactures start to invest in most of region in our sample before 1990, FDI to China was exception. Since Japanese automobile manufactures has started to invest in China since the middle of 1990, some of auto parts manufactures may start to invest in China in consultation with keiretsu auto manufactures in our sample periods. However, major results are the same as in the baseline results.

comparing the impact of FDI between the first FDI and the subsequent FDI's, we find that the impact of the first FDI on corporate performance is more profound than that of the subsequent FDIs. In contrast, the impact of the intensive margin of FDI has been found only in case of the impact on sales but these results are statistically significant only at 10% and found it is not so robust. We conclude that the impacts of FDI on corporate performance are mainly driven by the extensive margin of FDI, especially when firms start to invest abroad.

Although our study presents interesting findings, it also suggests various avenues for future researches. First, although we found the evidence that the extensive margin of FDI has positive and significant impact on the corporate performance, its mechanics and the numerical magnitude have not yet been explored and remain black box. Identifying the source of productivity gain requires more detailed data and more sophisticated identification strategies, but it is important agenda. Second issue is the applicability of our results to other industry. As we discussed, the automobile industry is the one that has the most developed international production and distribution network. Thus, we believe our evidence from automotive parts suppliers has important implications. However, the nature of international production network may differ from one industry to the other and thus the impact of FDI may vary by industries. Therefore, it is also important to compare the impact of FDI by industries.

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Table 1: Summary of previous studies that use the propensity score matching method

		Type of FDI	Sales	TFP	Emp
Debere et al. 2010	South Korea	HFDI	n.a.	n.a.	+
		VFDI	n.a.	n.a.	
Hijzen et al, 2011	France	HFDI		+	+
		VFDI			
Naveretti and Castellani, 2010	France	HFDI	+		+
		VFDI	+		+
	Italy	HFDI	+	+	+
		VFDI			+
Hayakawa et al. 2013	Japan	HFDI			+
		VFDI		+	+

Table 2: Ratio of Imports from Japan to total intermediate goods purchase in 1995

	Automobile assembler	Auto Parts manufacturer
North America	40.2%	36.5%
Asia	41.2%	48.6%
Europe	41.4%	35.1%

Source: Author's calculation based on Basic Survey of Oversea Business and Activities.

Table 3: Firm Characteristics: MNEs and Keiretsu suppliers

	Sales	# of Employees	K-L ratio	TFP
non-MNEs	8,611	278	1.374	1.754
	(18187.0)	(471.6)	(0.139)	(0.430)
MNEs	64,758	1,715	1.333	2.078
	(133341.3)	(3560.0)	(0.076)	(0.378)

	Sales	# of Employees	K-L ratio	TFP
non-KEIRETSU	7,022	236	1.372	1.705
	(17124.3)	(405.8)	(0.149)	(0.439)
KEIRETSU	34,655	948	1.360	1.967
	(91060.1)	(2431.8)	(0.098)	(0.386)

Note: Figures in parentheses are standard deviation. Unit for sales is millions of Yen.

Source: Author’s calculation based on linked firm-level database.

Table 4: Number of Keiretsu suppliers and MNEs

		non-KEIRETSU suppliers			KEIRETSU suppliers		
	Total	Sub-total	non-MNEs	MNEs	Sub-total	non-MNEs	MNEs
1991	866	540	523	17	326	239	87
1994	878	541	519	22	337	243	94
1995	941	587	564	23	354	248	106
1996	929	580	553	27	349	236	113
1997	932	586	556	30	346	227	119
1998	927	586	548	38	341	215	126
1999	930	585	546	39	345	212	133
2000	879	546	509	37	333	206	127

Source: Author's calculation based on linked firm-level database.

Table 5: Conditional logit model for FDI location choice

	(1)	(2)	(3)
Automobile production	0.0858***	0.101***	0.0704***
by KEIRETSU assembler	(0.0216)	(0.0214)	(0.0223)
Automobile production	0.000217	0.0229	-0.00959
by non-KEIRETSU assembler	(0.0187)	(0.0192)	(0.0201)
Automobile production		0.284***	0.185***
by non-Japanese assemblers		(0.0507)	(0.0549)
# of Japanese auto parts			0.561***
suppliers			(0.101)
Distance from Japan	-1.409***	-1.514***	-0.953***
	(0.112)	(0.108)	(0.151)
Observations	3,630	3,630	3,630

Note:

1) Standard errors in parentheses

2) ***, **, and * indicates statistical significance at 1%, 5% and 10% level, respectively.

Table 6: FDI decision by auto parts suppliers

VARIABLES	(1) Probit FDI dummy	(2) Probit FDI dummy	(3) Probit FDI dummy	(4) Fixed Effect Affiliate size	(5) Fixed Effect Affiliate size	(6) Fixed Effect Affiliate size
Auto_FDI	0.00016***	0.00001**	0.00001**	0.0160***	0.0147**	0.0137**
	(0.00003)	(0.00001)	(0.00001)	(0.0059)	(0.0059)	(0.0059)
GDPgrowth			-0.00077			
			(0.00059)			
GDP						0.1058
						(0.0926)
FDI_other$_{t-1}$		0.00007***	0.00007***		0.0480***	0.0464***
		(0.00002)	(0.00002)		(0.0130)	(0.0131)
Firm age		0.00013*	0.00013*		3.9489***	4.0086***
		(0.00008)	(0.00007)		(1.3134)	(1.3143)
KL-ratio$_{t-1}$		-0.00012	-0.00012		-1.1201*	-1.1385*
		(0.00024)	(0.00024)		(0.6543)	(0.6544)
R&D sales ratio$_{t-1}$		0.00202*	0.00197*		-0.2396	-0.2224
		(0.00116)	(0.00114)		(0.8818)	(0.8818)
Constant				4.9066***	-8.8237*	-11.7446**
				(0.0691)	(5.1303)	(5.7318)
Year FF	Yes	Yes	Yes	Yes	Yes	Yes
Country FF	Yes	Yes	Yes	No	No	No
Firm-country FF	No	No	No	Yes	Yes	Yes
Observations	51,906	51,906	51,906	1,690	1,690	1,690
Number of id				352	352	352
R-squared	0.152	0.286	0.287	0.1209	0.1402	0.1411
LR Chi2	316.7	596.9	599.0			
F test				26.16	15.43	14.49

1) Standard errors in parentheses

2) ***, **, and * indicate statistically significance at 1%, 5%, and 10%, respectively.

3) Coefficients for Probit model are marginal effect.

Table 7: The impact of the extensive margin of FDI: baseline results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	baseline	baseline	baseline	Asia	Asia	Asia	Advanced	Advanced	Advanced
VARIABLES	Δ lnSales	Δ lnEmp	Δ TFP	Δ lnSales	Δ lnEmp	Δ TFP	Δ lnSales	Δ lnEmp	Δ TFP
FDI dummy	0.1087***	0.0912***	0.2088***	0.1044***	0.0914***	0.2033***	0.1364***	0.0935***	0.2366***
	(0.0159)	(0.0112)	(0.0318)	(0.0187)	(0.0130)	(0.0368)	(0.0303)	(0.0214)	(0.0618)
FDI_other_{t-1}	-0.0003	-0.0020***	0.0015*	-0.0004	-0.0021***	0.0014	-0.0002	-0.0017***	0.0015
	(0.0004)	(0.0003)	(0.0009)	(0.0005)	(0.0004)	(0.0011)	(0.0007)	(0.0005)	(0.0014)
Firm age	-0.0221***	-0.0156***	-0.0213***	-0.0221***	-0.0156***	-0.0213***	-0.0222***	-0.0156***	-0.0215***
	(0.0014)	(0.0010)	(0.0027)	(0.0018)	(0.0013)	(0.0035)	(0.0021)	(0.0016)	(0.0043)
$KL\text{-}ratio_{t-1}$	0.0426***	0.1064***	-0.0202*	0.0427***	0.1065***	-0.0198	0.0425***	0.1062***	-0.0208
	(0.0052)	(0.0038)	(0.0104)	(0.0067)	(0.0049)	(0.0134)	(0.0082)	(0.0060)	(0.0164)
$R\&D\ sales\ ratio_{t-1}$	0.2743***	-0.2005***	-0.0835	0.2782***	-0.2012***	-0.0772	0.2692***	-0.2000***	-0.0919
	(0.0478)	(0.0346)	(0.0954)	(0.0617)	(0.0447)	(0.1232)	(0.0756)	(0.0547)	(0.1506)
Constant	-0.0315***	-0.1209***	0.0697***	-0.0319***	-0.1210***	0.0701***	-0.0310**	-0.1208***	0.0713**
	(0.0089)	(0.0065)	(0.0178)	(0.0114)	(0.0083)	(0.0227)	(0.0139)	(0.0101)	(0.0277)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm size dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	51,920	51,920	51,652	31,219	31,219	31,058	20,701	20,701	20,594

1) Standard errors in parentheses

2) ***, **, and * indicate statistically significance at 1%, 5%, and 10%, respectively.

Table 8: The impact of the extensive margin of FDI: robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Excl. first FDI	Excl. first FDI	Excl. first FDI	Excl. supliers that belong to only one keirets	Excl. supliers that belong to only one keirets	Excl. supliers that belong to only one keirets	Excl. keiretsu parent share>20%	Excl. keiretsu parent share>20%	Excl. keiretsu parent share>20%
VARIABLES	Δ lnSales	Δ lnEmp	Δ TFP	Δ lnSales	Δ lnEmp	Δ TFP	Δ lnSales	Δ lnEmp	Δ TFP
FDI dummy	-0.0184	0.0783***	-0.0603	0.1140***	0.0822***	0.2076***	0.1076***	0.1231***	0.2448***
	(0.0258)	(0.0148)	(0.0454)	(0.0192)	(0.0138)	(0.0388)	(0.0207)	(0.0143)	(0.0404)
FDI_other_{t-1}	0.0001	-0.0008	0.0091***	-0.0003	-0.0020***	0.0020**	-0.0025***	-0.0037***	0.0012
	(0.0011)	(0.0007)	(0.0022)	(0.0005)	(0.0003)	(0.0009)	(0.0005)	(0.0004)	(0.0011)
Firm age	-0.0274***	-0.0352***	0.0056	-0.0228***	-0.0157***	-0.0211***	-0.0215***	-0.0148***	-0.0211***
	(0.0063)	(0.0044)	(0.0131)	(0.0014)	(0.0010)	(0.0028)	(0.0015)	(0.0011)	(0.0030)
$KL\text{-}ratio_{t-1}$	-0.0311	0.1709***	-0.2441***	0.0434***	0.1069***	-0.0201*	0.0376***	0.1051***	-0.0225*
	(0.0227)	(0.0156)	(0.0469)	(0.0053)	(0.0038)	(0.0106)	(0.0058)	(0.0043)	(0.0117)
$R\&D\ sales\ ratio_{t-1}$	0.3705***	0.3479***	-0.5588***	0.2414***	-0.2377***	-0.0891	0.2322***	-0.3138***	-0.1949*
	(0.0838)	(0.0575)	(0.1732)	(0.0511)	(0.0372)	(0.1027)	(0.0564)	(0.0422)	(0.1136)
Constant	0.1312***	-0.1632***	0.2799***	-0.0299***	-0.1213***	0.0708***	-0.0267***	-0.1238***	0.0743***
	(0.0410)	(0.0282)	(0.0852)	(0.0091)	(0.0066)	(0.0183)	(0.0100)	(0.0075)	(0.0201)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm size dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,440	6,440	6,422	49,462	49,462	49,203	38,649	38,649	38,431

1) Standard errors in parentheses

2) ***, **, and * indicate statistically significance at 1%, 5%, and 10%, respectively.

Table 9: The impact of the intensive margin of FDI: baseline results

	(1)	(3)	(2)	(4)	(6)	(5)	(7)	(9)	(8)
	baseline	baseline	baseline	Asia	Asia	Asia	Advanced	Advanced	Advanced
VARIABLES	lnSales	lnEMP	TFP	lnSales	lnEMP	TFP	lnSales	lnEMP	TFP
Affiliate size	0.1803*	0.0659	0.1177	0.0973	0.0205	0.1261	0.5109*	0.3505*	0.2969
	(0.1059)	(0.0670)	(0.1542)	(0.1243)	(0.0784)	(0.2086)	(0.2878)	(0.2027)	(0.2415)
FDI_other_{t-1}	-0.0034	0.0038	-0.0168*	0.0043	0.0102**	-0.0167	-0.0251	-0.0146	-0.0247
	(0.0063)	(0.0040)	(0.0092)	(0.0064)	(0.0040)	(0.0107)	(0.0179)	(0.0126)	(0.0150)
Firm age	0.3815	0.3239	-0.4993	0.3249	0.3520	-0.4415	0.1585	-0.3819	-1.4878
	(0.5778)	(0.3657)	(0.8414)	(0.6259)	(0.3952)	(1.0506)	(2.0209)		(1.6953)
$KL\text{-}ratio_{t-1}$	-0.3423	-1.1995***	0.1675	-0.3374	-1.0356***	-0.1451	0.2784	-0.7906	0.7756
	(0.2251)	(0.1425)	(0.3279)	(0.2458)	(0.1552)	(0.4126)	(0.7829)	(0.5513)	(0.6568)
$R\&D\ sales\ ratio_{t-1}$	0.4105	0.2978*	0.2461	0.2602	0.1915	0.3282	0.2493	0.1675	0.0505
	(0.2575)	(0.1630)	(0.3750)	(0.3137)	(0.1980)	(0.5265)	(0.8560)	(0.6028)	(0.7181)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm size dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,669	1,669	1,669	934	934	934	735	735	735
Number of id	331	331	331	198	198	198	133	133	133
Hansen J test	0.186	0.345	0.824	0.226	0.517	0.810	0.586	0.336	0.575

1) Standard errors in parentheses

2) ***, **, and * indicate statistically significance at 1%, 5%, and 10%, respectively.

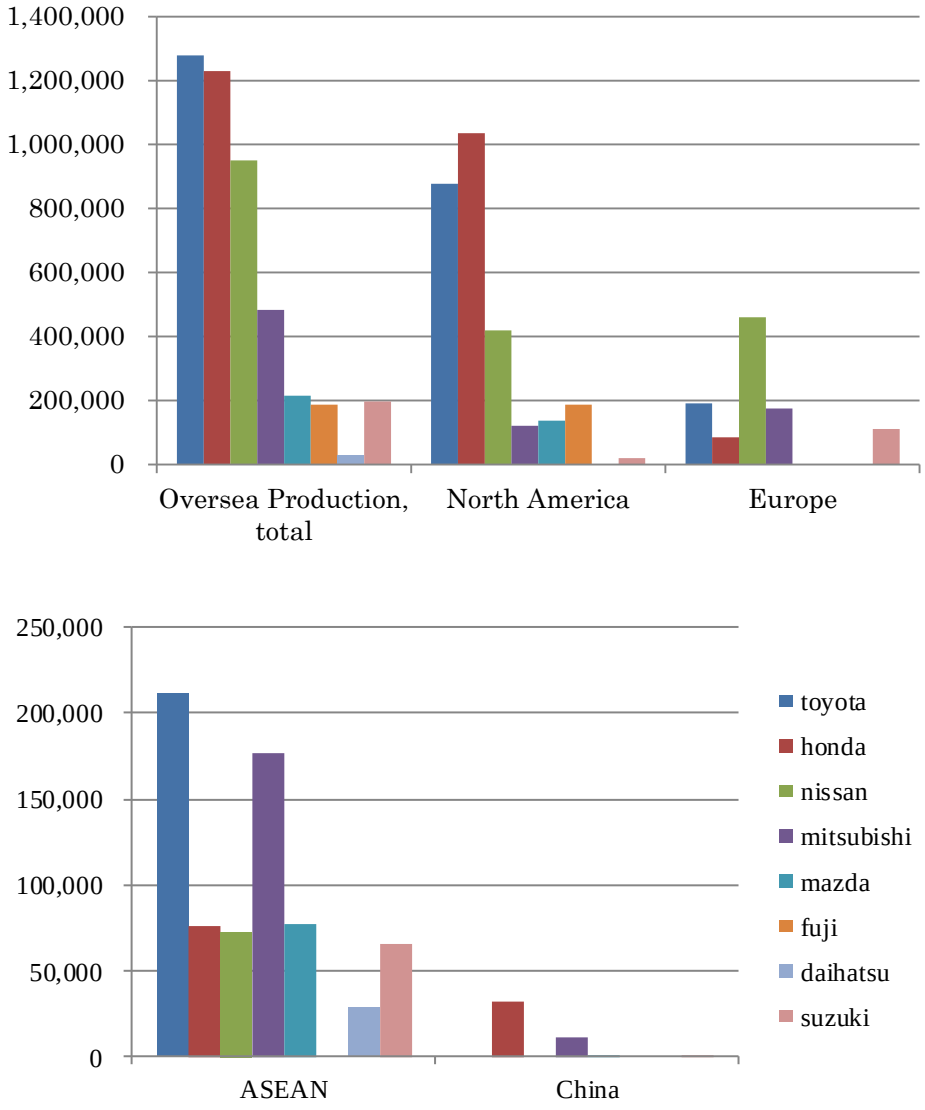
Table 10: The impact of the intensive margin of FDI: Robustness checks

	(1)	(3)	(2)	(4)	(6)	(5)	(7)	(9)	(8)
	Excl. first FDI	Excl. first FDI	Excl. first FDI	Excl. supliers that belong to only one keirets	Excl. supliers that belong to only one keirets	Excl. supliers that belong to only one keirets	Excl. keiretsu parent share>20%	Excl. keiretsu parent share>20%	Excl. keiretsu parent share>20%
VARIABLES	lnSales	lnEMP	TFP	lnSales	lnEMP	TFP	lnSales	lnEMP	TFP
Affiliate size	0.1803*	0.0659	0.1177	0.1128	0.0590	0.1191	0.1128	0.0590	0.1191
	(0.1059)	(0.0670)	(0.1542)	(0.1227)	(0.0795)	(0.2029)	(0.1227)	(0.0795)	(0.2029)
FDI_other_{t-1}	-0.0034	0.0038	-0.0168*	0.0020	0.0073	-0.0193*	0.0020	0.0073	-0.0193*
	(0.0063)	(0.0040)	(0.0092)	(0.0070)	(0.0045)	(0.0116)	(0.0070)	(0.0045)	(0.0116)
Firm age	0.3815	0.3239	-0.4993	0.7283	0.2779	-0.2959	0.7283	0.2779	-0.2959
	(0.5778)	(0.3657)	(0.8414)	(0.6971)	(0.4516)	(1.1526)	(0.6971)	(0.4516)	(1.1526)
$KL\text{-}ratio_{t-1}$	-0.3423	-1.1995***	0.1675	-0.4124*	-1.1943***	0.1195	-0.4124*	-1.1943***	0.1195
	(0.2251)	(0.1425)	(0.3279)	(0.2499)	(0.1619)	(0.4132)	(0.2499)	(0.1619)	(0.4132)
$R\&D\ sales\ ratio_{t-1}$	0.4105	0.2978*	0.2461	-0.1122	0.0172	0.2745	-0.1122	0.0172	0.2745
	(0.2575)	(0.1630)	(0.3750)	(0.3484)	(0.2257)	(0.5760)	(0.3484)	(0.2257)	(0.5760)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm size dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,669	1,669	1,669	1,224	1,224	1,224	1,224	1,224	1,224
Number of id	331	331	331	247	247	247	247	247	247
Hansen J test	0.186	0.345	0.824	0.118	0.875	0.364	0.118	0.364	0.875

1) Standard errors in parentheses

2) ***, **, and * indicate statistically significance at 1%, 5%, and 10%, respectively.

Figure 1: Volume of Japanese automobile production by region and automobile assemblers in 2000



Source: World Motor Vehicle Statistics (Japan Automobile Manufacturer Association)

Appendix

Table A1: Basic Statistics

variable	# of obs	mean	sd	p25	p75
Extensive margin					
Δ lnSales	51920	-0.006	0.181	-0.091	0.083
Δ lnEmp	51920	-0.015	0.121	-0.059	0.027
Δ TFP	51920	0.040	0.358	-0.128	0.200
FDI dummy	51920	0.003	0.057	0.000	0.000
Auto_prod	51920	2.881	4.795	0.000	8.007
FDI_other	51920	0.723	1.941	0.000	0.000
KL-ratio	51920	1.370	0.128	1.288	1.447
R&D sales ratio	51920	0.007	0.015	0.000	0.006
variable	# of obs	mean	sd	p25	p75
Intensive margin					
lnSales	1690	10.714	1.267	9.927	11.344
lnEmp	1690	7.230	1.166	6.604	7.845
TFP	1690	2.149	0.356	1.955	2.384
Affiliate size	1690	5.331	1.309	4.554	6.193
Auto_prod	1690	9.650	5.031	9.473	13.120
FDI_other	1690	5.139	2.931	4.111	7.118
KL-ratio	1690	1.317	0.068	1.271	1.354
R&D sales ratio	1690	0.027	0.025	0.006	0.041