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Local Export Spillovers Within and Between Industries in Japan *

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Abstract

This study empirically tests the hypothesis that neighboring exporters increase the probability of export market entry (extensive margin) and export values (intensive margin). As mentioned in the international trade literature, export initiation requires additional fixed entry costs; therefore, a high productivity is required to earn a positive profit. If neighboring establishments are already exporting, the necessary information to initiate exports is available in those areas, thus lowering entry costs. Prior studies provide mixed evidence on learning from neighboring exporters and need further validation. This study employs a geocoding technique to identify establishment locations to test whether local export spillovers exhibit spatial decay. Using panel data on Japanese manufacturing establishments, this study provides evidence regarding intra-industry export spillover effects on the extensive and intensive margins of exports; however, evidence concerning inter-industry spillovers is limited.

JEL classification: F14, R12

Keywords: Export spillover, Learning from exporters, Agglomeration, Geocoding

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1. Introduction

Export expansion is one of the main concerns for policymakers worldwide. International trade literature mentions that export initiation requires additional fixed entry costs, which entail high productivity to earn a positive profit (Melitz, 2003; Melitz and Redding, 2014). Empirical studies also show that exporters are more productive than domestic firms (Bernard and Jensen, 1999; Bernard et al., 2007). Therefore, policies that reduce fixed entry costs will help firms initiate exports.

This study empirically examines whether neighboring exporters within or between industries increase the probability of export market entry (extensive margin) and export values (intensive margin). If neighboring establishments are already exporting, the information necessary to initiate exports is available in those areas, thus lowering entry costs. This conceptual idea is known as "export spillover" and "learning from exporters," attracting the attention of international trade researchers for decades.[1] For example, Aitken et al. (1997) examine the spillover effects of multi-national enterprises on exports using Mexican manufacturing plant data and find that the probability of domestic plants initiating exports is positively related to their proximity to multi-national enterprises. Using a panel data set of French manufacturers, Koenig (2009) shows that the agglomeration of local exporters has a positive spillover effect on the decision to initiate exports. Extending Koenig (2009), Koenig et al. (2010) examine the spillover effects of neighboring exporters on the decision to start exporting and the export volumes using the French export flow data. They observe that the export spillovers affect the extensive margin of exports but do not affect the intensive margin. However, Hu and Tan (2016) assert that neighboring exporters have a positive impact not only on the decision to initiate exports but also on the export volume of incumbent exporters.

Moreover, extant literature offers opposite or statistically non-significant results for spillovers from neighboring exporters. Bernard and Jensen (2004) estimate a dynamic linear probability model using a panel dataset of U.S. manufacturing plants. They reveal that most spillover variables have a negative or non-significant impact on export entry. Duan et al. (2020) conduct a meta-analysis of export spillovers based on 99 studies and report that half of the estimated spillover effects are statistically non-significant, concluding that the economic impact on exports is negligible even if the estimated effects are statistically significant. Although several studies have explored export spillover effects, mixed evidence exists concerning spillovers from neighboring exporters. Export spillover depends on the country- or firm-specific context; thus, this

[1] A similar concept in the international trade literature is the learning-by-exporting hypothesis (Clerides et al., 1998; Wagner, 2007; Mallick and Yang, 2013). Zhang and Malikov (2023) distinguish between learning-by-exporting and learning-from-exporters simultaneously and find that both effects of exporting enhance the productivity of domestic firms in Chile. Extending the idea of export spillover, Bisztray et al. (2018) examine the spillover for importing behavior. Kamal and Sundaram (2016) show that the transaction of the neighboring exporters is associated with future matching of importer–exporter using custom data between the U.S. importers and Bangladesh exporters.

study conducts further validation on this topic in Japan.

This study advances the literature by constructing intra- and inter-industry neighboring export variables. Most studies have considered geographical units based on administrative boundaries. However, spillovers from neighboring exporters are not necessarily limited by their boundaries. The choice of geographical units, such as state, city, and employment area, may be a source of bias when examining spillovers from neighboring exporters. To solve this issue, this study uses geocoding (address matching) technology to identify establishment locations.

The empirical challenge is how unobservable fixed factors are controlled for. Neighboring variables in an administrative unit are less likely to generate time variations within the establishment when considering locational fixed effects (FE) in the same administrative unit. By constructing neighboring export variables defined in a more disaggregated geographical space, this study's identification by the FE estimation relies on the time variation within the establishment.

Using microdata on manufacturing establishments in Japan, this study finds evidence regarding an intra-industry export spillover effect on extensive and intensive margins but not for inter-industry export spillover. The number of neighboring exporters, rather than neighboring export values, affects the decision to start exporting. Neighboring export values, rather than the number of neighboring exporters, increase the export values. The study's empirical results complement the findings of Koenig et al. (2010), who observe export spillovers on the extensive margin but no effect on the intensive margin in France. This study emphasizes that the intensive margin of exports is related to the neighboring export values. Furthermore, its findings complement a recent finding by the Ministry of Economy, Trade and Industry (2023), showing that an increase in global firms' overseas production ratio positively affects the export values of neighboring domestic establishments in Japan.

The study's results have important implications for export promotion. Although export clusters in a narrow geographical area help non-exporting firms in export initiation, they may be located far from export clusters. Therefore, governments should consider implementing effective policies that decrease fixed entry costs to initiate exports. Volpe Martincus and Carballo (2010), Hayakawa et al. (2014), Cadot et al. (2015), Lederman et al. (2016), Broocks and Biesebroeck (2017), and Makioka (2021) show that export promotion, which creates a temporal export cluster in a narrow space, positively affects exports by decreasing export entry costs. Mion et al. (2022) suggest that hiring managers with experience in exporting helps firms in export initiation; however, they do not have any impact on the intensive margin of exports. Masso et al. (2015) also mention that hiring managers with export experience matters in exports. Feenstra et al. (2014) indicate that extra fixed entry costs due to credit constraints reduce both the intensive and extensive margins of exports. Inui et al. (2014) find that the main banks in Japan help potential firms in initiating exports through

information spillovers. Export promotion policies range from those of the Human Resources Department to the banking sector.

The remainder of this study is organized as follows: Section 2 provides a brief literature review on export spillovers. Section 3 describes the empirical methods. Section 4 summarizes the panel dataset of Japanese manufacturing establishments and geocoding. Section 5 discusses the estimation results. Finally, the conclusions are presented in Section 6.

2. Literature Review

Extensive literature on export spillovers in both developed and developing countries exists. This section provides an additional literature review of related studies.

Clerides et al. (1998) consider the regional and industrial spillover effects of exporting firms on reducing average costs in Colombia, Mexico, and Morocco and find evidence that neighboring exporters may help domestic firms enter foreign markets. Using data from Columbia, Arguello et al. (2020) find that both agglomerations of exporters increase the survival rate of trade flows.

Greenaway and Kneller (2008) examine whether the agglomeration of exporters affects export market entry using firm-level data in the U.K. and find a positive spillover effect on the probability of export entry.

Along with Koenig (2009) and Koenig et al. (2010), Poncet and Mayneris (2013) find that exposure to other exporters increases the probability of starting exports in France. Following Koenig et al. (2010), Hu and Tan (2016) apply a similar approach to Chinese product-level trade data and find that, unlike Koenig et al. (2010), neighboring exporters positively affect the decision to initiate exports and export volume. In addition, the spillover effects show a spatial decay characteristic, meaning that the effect is stronger within the same city than in outside cities.

Ito et al. (2015) examines whether industrial agglomeration increases a firm's probability of exporting using a large dataset of Chinese manufacturing firms and found that the agglomeration of indigenous exporters in the industry or within the same region has a positive effect on the probability of export entry. However, they conclude that marginal effects of industrial agglomeration on export entry are small.

Fernandes and Tang (2014) investigate whether neighboring firms affect export entry and performance by constructing a theoretical model in which firms receive signals about foreign markets from their neighbors. Using the monthly export and import transactions of all Chinese firms, they state that increasing the number of neighboring exporting firms increases the probability of export entry.

Following Fernandes and Tang (2014), Hamilton (2023) develops a model for exports with demand uncertainty. Potential entrants use signals from neighboring exporters. Using export data from Chile, the exposure of signals to demand increases the probability of export market entry.

Using panel data from Chinese customs, Mayneris and Poncet (2015) investigate whether the proximity to multi-national exporters encourages domestic firms to initiate exports and observe a robust and positive impact.

Karpaty and Kneller (2011) consider two aspects of export spillovers. The first is the demonstration effect, which positively impacts exports, and the second is the congestion effect, which negatively impacts exports. Using a dataset from Sweden, Karpaty and Kneller (2011) report that foreign MNEs have positive effects on Swedish exports.

Choquette and Meinen (2015) examine information spillovers from exporting firms to non-exporting firms using data on manufacturing firm in Denmark. They disentangled the channels of export spillovers from three perspectives: intra-industry spillovers, inter-industry linkages, and labor mobility between firms. These significant export spillover effects suggest that a firm's export decisions are based on information from other firms.

Harasztosi (2016) examines the spillover effects on export entry in Hungary. The local peer variable includes the number of exporting firms in the same location, classified by export product and destination country. Harasztosi (2016) finds large heterogeneity in the spillover effect and reveals that the spillover benefits are mostly observed in the number of firms exporting the same products.

Amato et al. (2021) find that family-managed firms benefit more from export spillovers than non-family firms in Spain. Abegaz and Nene (2022) find heterogeneous export spillovers in terms of whether the same or other industries and domestic or foreign-owned exports exist in sub-Saharan African countries. Heterogeneity in export spillovers occurs across different firm organizations.

Kang (2016) finds an inverted U-shaped relationship between the agglomeration of exporters and probability of being an exporter in Chile, suggesting that the agglomeration of exporters also increases export entry costs, such as hiring highly skilled workers in the local labor market.

3. Method

Following Koenig et al. (2010), the empirical strategy consists of two frameworks. The first framework uncovers whether neighboring exporters help domestic establishments to initiate exports (extensive margin). The second framework evaluates whether neighboring exporters help incumbent exporters increase their exports (intensive margin of exports). Before examining this in detail, the following section defines neighboring exporters based on the geocoding technique.

3.1. Measuring Neighboring Exporters

This study constructed a new geographical dataset based on establishment-level microdata in terms of

intra- and inter-industry spillovers. Each establishment location was identified on a 500 m × 500 m grid square map using geocoding software (Address Matching Tool, MAPPLE). The geocoding process was conducted offline to protect the confidentiality of the establishment-level microdata. After obtaining the mesh code for each establishment, the number of exporters and export values for each mesh grid was aggregated. Based on the 500 m × 500 m grid squares, this study calculated neighboring exporters within and between industries in three ways.

First, it calculated the number of neighboring exporters within d km radius from the center of the mesh grid in year t as follows:

$$\mathrm{NE}_{iat}^{k} = \begin{cases} \sum_{b=1}^{R} \mathrm{Exporter}_{b}^{k} \cdot 1(D_{ab} < d\ \mathrm{km}) - 1, & \text{if Establishment } i \text{ is exporter}, \\ \sum_{b=1}^{R} \mathrm{Exporter}_{b}^{k} \cdot 1(D_{ab} < d\ \mathrm{km}), & \text{otherwise}. \end{cases} \tag{1}$$

In Equation (1), $\mathrm{Exporter}_{\boldsymbol{b}}^{\boldsymbol{k}}$ is the number of exporters for industry $\boldsymbol{k} \in \{\mathrm{Within}, \mathrm{Between}\}$ in the mesh grid $\boldsymbol{b}$, $\boldsymbol{R}$ is the number of mesh grids, and $\mathbf{1}(\cdot)$ is the indicator function that takes the value 1 if the bilateral distance between mesh grids $\boldsymbol{a}$ and $\boldsymbol{b}$, $\boldsymbol{D_{ab}}$, is the shorter than the threshold distance $\boldsymbol{d}$ km. Note that own establishment is subtracted if establishment $\boldsymbol{i}$ is an exporter.

Second, the share of neighboring exporters was calculated as follows:

$$\mathrm{SNE}_{iat}^{k} = \begin{cases} \dfrac{\sum_{b=1}^{R} \mathrm{Exporter}_{b}^{k} \cdot 1(D_{ab} < d\ \mathrm{km}) - 1}{\sum_{b=1}^{R} \mathrm{Estalishment}_{b} \cdot 1(D_{ab} < d\ \mathrm{km})}, & \text{if Establishment } i \text{ is exporter}, \\ \dfrac{\sum_{b=1}^{R} \mathrm{Exporter}_{b}^{k} \cdot 1(D_{ab} < d\ \mathrm{km})}{\sum_{b=1}^{R} \mathrm{Estalishment}_{b} \cdot 1(D_{ab} < d\ \mathrm{km})}, & \text{otherwise}. \end{cases} \tag{2}$$

In Equation (2), $\mathrm{Establishment}_{b}$ is the number of manufacturing establishments in mesh grid b. Instead of the number of neighboring exporters, this specification captures the intensity of exporting establishments.

Finally, the market potential specification of export values was considered as follows:

$$\log(\mathrm{EMP}_{iat}^{k};\ \delta) = \begin{cases} \log\left(1 + \sum_{b=1}^{R} \mathrm{Export}_{bt}^{k} \cdot D_{ab}^{-\delta} - \mathrm{Export}_{it}\right), & \text{if Establishment } i \text{ is exporter}, \\ \log\left(1 + \sum_{b=1}^{R} \mathrm{Export}_{bt}^{k} \cdot D_{ab}^{-\delta}\right), & \text{otherwise}, \end{cases} \tag{3}$$

In Equation (3), $\mathrm{Export}_{\boldsymbol{b}}^{\boldsymbol{k}}$ is the total export value for industry $\boldsymbol{k} \in \{\mathrm{Within}, \mathrm{Between}\}$ in mesh grid $\boldsymbol{b}$ in year $\boldsymbol{t}$, and $\boldsymbol{\delta}$ is the distance decay parameter. Note that export value of establishment $\boldsymbol{i}$ is subtracted from export value of the establishment area if establishment $\boldsymbol{i}$ is an exporter. To be comparable with the conventional approach based on the municipal variable, the value 1 is added.

The bilateral distance between the mesh grids was calculated as the great circle distance using the latitude and longitude of the centroid of each mesh grid. The spgen command developed by Kondo (2017) in Stata was used to construct variables for neighboring exporters.

3.2. Export Spillover Effect on Extensive Margin

The first framework identifies local spillover effects on the decision to initiate exports. Following De Loecker (2007), Greenaway and Kneller (2008), Koenig (2009), Koenig et al. (2010), Hu and Tan (2016), and Chang and Haoyu (2018), the export entry probability model is estimated as follows:[2]

$$\Pr\left(\text{Entry}_{iarst}=1|\boldsymbol{X}_{i,t-1},\eta_{rt},\psi_s\right) = \Phi\left(\alpha\text{Neighbor}_{a,t-1}^{\text{Within}}+\beta\text{Neighbor}_{a,t-1}^{\text{Between}}+\boldsymbol{X}_{i,t-1}\boldsymbol{\gamma}+\eta_{rt}+\psi_s\right), \quad (4)$$

where $\text{Entry}_{iarst}=1$ is the dummy variable if establishment i starts export in year t, $\Phi(\cdot)$ is the commutative distribution function of the standard normal distribution, $\text{Neighbor}_{a,t-1}$ is the neighboring exporter variables in Equation (1)–(3), $\boldsymbol{X}_{i,t-1}$ is the vector of control variables including markup, total factor productivity (TFP), the number of employees, wage, capital, and the dummy of multi-establishment, η_{rt} is the prefecture-year effect, and ψ_s is the industry fixed effect. The parameters of interest are α and β that capture the local export spillover on the decision to start exporting within and between industries, respectively. To avoid simultaneous bias, lagged explanatory variables are considered.

In the empirical analysis, entry into the export market must be defined. The simple definition of export entry is to compare the export status between years t and $t-1$. However, this definition suffers from the temporary suspension of exports. Therefore, this study imposes restrictions on the period during which exports were not observed. The first restriction imposed 2 years of non-export status during the pre-export period. Mathematically, the dummy variable of export entry (lag2) takes the value of 1 for $Y_{it}=1, Y_{i,-1}=0, \text{and } Y_{i,t-2}=0$ and 0 for $Y_{it}=0, Y_{i,-1}=0, \text{and } Y_{i,t-2}=0$, where Y_{it} is the export status (1/0) of establishment i in year t. Another restriction is imposing restrictions on the period of continuous export in the post-export period and period of non-export in the pre-export period. The second restriction imposes 1 year of export status after initiating exports in year t and 4 years of non-export status in the pre-export period. Mathematically, the dummy variable for export entry (lag 4) takes the value of 1 for $Y_{it}=1, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,t-3}=0, \text{and } Y_{i,t-4}=0$ and 0 for $Y_{it}=0, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,t-3}=0, \text{and } Y_{i,t-4}=0$, where Y_{it} is the export status (1/0) of establishment i in year t. This study does not use the full sample;

[2] Roberts and Tybout (1997) develop the theory of export entry with sunk costs, based on which they consider a dynamic probit model of export participation. Following Robert and Tybout (1997), Bernard and Jensen (2004) estimate the dynamic linear probability model of export decision including the spillover factors.

the sample is limited to those satisfying the export entry condition.

3.3. Export Spillover Effect on Intensive Margin

The second framework identifies local spillover effects on the export values of incumbent establishments. Following Koenig et al. (2010) and Hu and Tan (2016), the following regression is estimated:[3]

$$\log(\text{Export}_{iatrs}) = \alpha \text{Neighbor}_{at}^{\text{Within}} + \beta \text{Neighbor}_{at}^{\text{Between}} + \boldsymbol{X}_{it}\boldsymbol{\gamma} + \mu_i + \eta_{rt} + \psi_s + u_{iarst}, \qquad (5)$$

where Export_{iatrs} is the export value of establishment i in area a in year t, Neighbor_{at} is the neighboring exporter variables in Equation (1)–(3), $\boldsymbol{X}_{it}$ is the vector of control variables including markup, TFP, the number of employees, wage, capital, and the dummy of multi-establishment, μ_i is the establishment fixed effect, η_{rt} is the prefecture-year effect, ψ_s is the industry fixed effect, and u_{iarst} is the error term.

The parameters of interest are α and β that capture the local spillover on export values within and between industries, respectively. While previous studies, such as Koenig et al. (2010), consider the number and share of exporters, this study further introduces the size of export values because Kamal and Sundaram (2016) find that large exporters have statistically significant neighboring effects.

Although the baseline estimation is based on the ordinary least squares (OLS), the main identification strategy is based on a fixed effects estimation. Omitting unobservable factors leads to a bias. For example, positive global and local shocks lead to simultaneous increases in export value across exporters. Therefore, this study introduces a set of establishments, region-year FE, and industry FE.

4. Data

This study uses confidential establishment-level microdata from the Japanese manufacturing sector as surveyed by the Census of Manufacture (CM). The Ministry of Economy, Trade and Industry conducted CM annually until 2020 (survey year, 2019). This study covers a survey period from 2012 to 2019, after the Great East Japan Earthquake in March 2011.

The CM includes two questionnaires: Form A (Kou) for establishments with 30 or more employees and Form B (Otsu) for establishments with 29 or fewer employees. Although the export status is available in both forms, data on capital stock are only available for Form A, which is essential for establishment-level TFP estimation. Thus, this study only used Form A datasets for regression analysis. However, neighboring export

[3] Establishments with zero flows are excluded from the sample. Helpman et al. (2008) consider self-selection of firms into export markets and apply the Heckman two-stage estimation to the gravity model. This study also estimates the regression model by the Heckman two-stage estimation and confirms that the estimation results are almost similar to those by OLS.

variables were constructed from Forms A and B.

Figures 1–3 show the distribution of neighboring exporters calculated based on Equations (1)–(3) in addition to the municipal variables. Figure 1 shows the number of neighboring exporters with different distance thresholds in Equation (1). Figure 1(a) shows the number of neighboring exporters within the same municipality. Figures 1(b) and 1(c) show the number of neighboring exporters in a 500 m × 500 m grid square with different distance thresholds (2 km and 8 km). The number of neighboring exporters increases as the threshold distance increases.

Figure 2 shows the share of neighboring exporters with different distance thresholds in Equation (2). Figure 2(a) shows the share of neighboring exporters within the same municipality. Figures 1(b) and 1(c) consider the share of neighboring exporters in a 500 m × 500 m grid square with different distance thresholds (2 km and 8 km).

Figure 3 shows the neighboring export values with different distance decay parameters in Equation (3). Figure 3(a) shows the export values within the municipality. Figures 3(b) and 3(c) show the market potential form of neighboring export values with different distance decay parameters in Equation (3).

Figures 4–6 show the relationship between export values and neighboring exporters. Figures 4 and 5 use the number and share of neighboring exporters, whereas Figure 6 uses neighboring export values. There is a slightly positive relationship in Figures 5 and 6 when neighboring export values are used. This relationship is evaluated by analyzing the intensive margin of exports and controlling for other factors.

Following previous studies, this study includes control variables such as markup, TFP, establishment size (number of employees), wage per worker, capital, and a dummy for multi-establishment. Establishments' markup and TFP should be estimated because they are not directly measured.

The TFP estimation is proposed in several ways in the literature (Olley and Pakes, 1996; Levinsohn and Petrin, 2003; Ackerberg et al., 2015). This study employs the approaches proposed by Ackerberg et al. (2015) and De Loecker and Warzynski (2012). It assumes a value-added translog productivity function. The estimation procedure follows the same approach as Kondo (2016, 2018) using the same dataset as the CM in Japan. Additional explanations are provided in the Online Appendix (Appendix A).

Regarding the output variable, value added is used, which is calculated as total production minus total materials, fuel, and energy consumed, as well as the subcontracting expenses for production outsourcing. Regarding the inputs, two factors are considered: labor and capital stock. Labor is defined as the total number of hours worked per year. Using the average hours worked in a year in the manufacturing sector, which are obtained from the Monthly Labour Survey (Ministry of Health, Labour and Welfare), the total annual hours worked are calculated by multiplying the annual number of workers by the hours worked. Capital stocks are measured as end-of-year book values using the perpetual inventory method. Energy consumption is used as

a proxy for material demand for productivity shocks, which are unobserved by econometricians but observable to each establishment. All nominal values of outputs, intermediate inputs, energy consumption, and capital stocks are deflated by each price index. Finally, the deflators of the output price (2011=100), input price (2011=100), and investment price (2010=100) are constructed using the price indices available from the Bank of Japan, and all monthly price indices are averaged yearly.

Markup estimation requires labor share data. Total wage payments are also surveyed and directly observed in the data. Wage payments are deflated by the output price index (2011=100). This study calculates labor share as the ratio of total wage payments to value added. Moreover, it calculates the wage per worker by dividing the total wage payments by the total number of employees as a control variable.

Figure 7 shows the distribution of establishment characteristics between exporters and non-exporters for 2015. Figure 7(a) shows that the markup distribution is similar for exporters and non-exporters, which differs from the findings of De Loecker and Warzynski (2012). Figure 7(b) shows that, on average, exporters have higher productivity than non-exporters. Figure 7(c) shows that exporters are large-sized establishments than non-exporters. Figure 7(d) shows that exporters pay higher wages than non-exporters.

Tables 1 and 2 present the descriptive statistics for the variables used in the empirical analysis. Table 1 presents the variables used to analyze the extensive margins of exports. Table 2 presents the variables used to analyze the intensive margins of exports. The extensive margin of exports compares establishments that initiated exports recently and non-exporters. There are two export–entry variables. The intensive margin of exports considers only the exporters during this period. Therefore, the number of observations is reduced to approximately 45,000. Although this study uses establishment-level microdata, capital is defined at the firm level.

[Tables 1–2; Figure 1–7]

5. Results and Discussion

5.1. Extensive Margin Results

Table 3 presents the estimation results of the export entry probit model. The dummy variable for export entry considers a new exporter as an establishment that does not export before the two periods $(t-2)$ and initiated exports at time t. The baseline group includes establishments that do not export before the two periods or at time t. The study now discusses the effects of export spillovers on export entries.

Columns (1)–(3) of Table 3 show that the number of neighboring exporters within the same industry positively affects export entry at the 1% level. This variable becomes non-significant when we consider the other specifications of neighboring exporters. Columns (4) and (6) of Table 3 show that the share of

neighboring exporters in the same industry within the same municipality and within 8 km of the establishment location has statistically significant and positive effects on export entry, but not within 2 km of the establishment location. In columns (8) and (9) of Table 3, neighboring export values do not significantly affect the decision to initiate exports, whereas neighboring export values within the same industry are statistically significant at the 1% level in column (7) of Table 3. The selection of geographical units may be a source of bias when considering the geographical spillover effects.

This study finds that export spillovers show a distance decay in columns (2) and (3) of Table 3, which is consistent with Hu and Tan (2016). Comparing the distance thresholds between 2 km and 8 km, the coefficient parameter becomes larger in smaller areas, suggesting that the inter-firm relationship is stronger.

Table 4 shows the estimation results of the export entry probit model using the dummy variable of export entry, considering the new exporter as an establishment that do not export before four periods ($t-4$) and started an export at time t. The baseline group includes establishments that do not export before the four periods, or at time t.

Similarly, columns (1)–(3) of Table 4 show that the local export spillover remains statistically significant at the 5% level. The basic results for the shares of neighboring exporters and neighboring export values are similar to those in Table 3.

All the inter-industry neighboring exporter variables are non-significant even at the 10% level, except in column (7) of Table 4, suggesting no local export spillover between the industries in Tables 3 and 4.

Furthermore, Tables 3 and 4 provide important findings regarding the extensive margins of exports relating to establishment characteristics. TFP, establishment size, and average wage are statistically significant at the 1% level, suggesting that large and productive establishments are likely to enter the export market, which is consistent with the theoretical studies by Melitz (2003), Melitz and Ottaviano (2008), Behrens et al. (2014, 2017), and the empirical studies by De Loecker (2007) and Rodríguez-Pose et al. (2013). However, markups do not affect the decision to initiate exports. Moreover, exporters pay higher wages than domestic establishments.

In summary, this study finds evidence for export spillover on export entry. Extending Koenig's (2009) framework concerning intra- and inter-industry spillovers, this study reveals that the number of neighboring exporters in the same industry affects the export decisions of other non-exporters, whereas it finds no evidence regarding inter-industry export spillovers. One possible explanation for this is the global production network. Exporters in geographically small areas may have complementary relationships.

[Tables 3–4]

5.2. Intensive Margin Results

Table 5 presents the OLS estimation results of the intensive margin analysis. As shown in Figures 4–6, this study finds that the share of neighboring exporters and neighboring export values have statistically significant effects on export values in columns (4)–(9) of Table 5. The choice of geographical unit does not affect the results. However, OLS estimates may suffer from omitted variable bias if unbearable factors are not controlled for in the regression analysis. This study uses the FE estimation as the main result.

Table 6 presents the results of FE estimation. By controlling for unobservable factors and relying on time variations within the establishment to identify the export spillover effect, this study finds that neighboring export values have a significant effect on export values in columns (7) and (9) of Table 6. Moreover, the area FE are controlled for by the FE estimation. Although the coefficients of the share of neighboring exporters are statistically significant at the 1% level in the OLS estimation, they are not in the FE estimation in columns (4)–(6) of Table 6. Additionally, the number of neighboring exporters is statistically non-significant in columns (1)–(3) of Table 6.

Our estimation results suggest that higher export values generate export spillovers across exporters by lowering variable trade costs. One possible explanation is that larger export values, rather than the number of exporters, sustain the economic foundation for export expansion, such as logistics, which lowers variable trade costs.

Tables 5 and 6 provide results on the intensive margin of exports in terms of establishment characteristics. Markup, TFP, establishment size, and average wage are statistically significant at the 1% level, suggesting that the establishment factors mainly explain export activities. These findings are consistent with the theoretical studies by Melitz (2003) and empirical studies by Koenig (2009) and Koenig et al. (2010). High productivity and large establishments lead to more exports. While markups do not affect the decision to initiate exports, exporters with high markups export more.

[Table 5–6]

6. Conclusion

This study investigates whether neighboring exporters affect the propensity for export entry and increase export values. Melitz's (2003) theoretically study states that export initiation requires fixed entry costs and only highly productive firms can export to earn positive profits. Empirical studies also provide supporting evidence. Previous studies further highlight the role of information spillovers from exporters to non-exporters, which lower entry costs. If neighboring firms are exporters, the required information for export initiation is easily accessible to other domestic firms. As prior empirical studies have provided mixed evidence on

spillovers from neighboring exporters, this study focuses on intra- and inter-industry spillovers for further validation. It employs a geocoding technique to identify establishment locations, allowing for the construction of exporter agglomeration variables in a continuous geographical space.

Using microdata of manufacturing establishments in Japan, this study evinces the intra-industry export spillover effect on extensive and intensive margins but not the inter-industry export spillover. An important finding is that export initiation is affected by the proximity of neighboring exporters in the same industry but not by neighboring export values in the same industry. Neighboring export values in the same industry positively affect export values that are not affected by the number of neighboring exporters in the same industry. Another important finding is that establishment characteristics such as TFP and establishment size firmly explain the extensive and intensive margins of exports.

The limitations of this study are as follows. This study focuses on the establishments with 30 or more employees to estimate the TFP. It is important to understand how neighboring exporters affect the export decision of smaller establishments. Although this study highlights geographic spillovers, the information spillover channel through a firm network is not distinguished due to data limitations. Geographic proximity is strongly associated with firm-to-firm transactions. Further studies based on detailed firm network data are needed.

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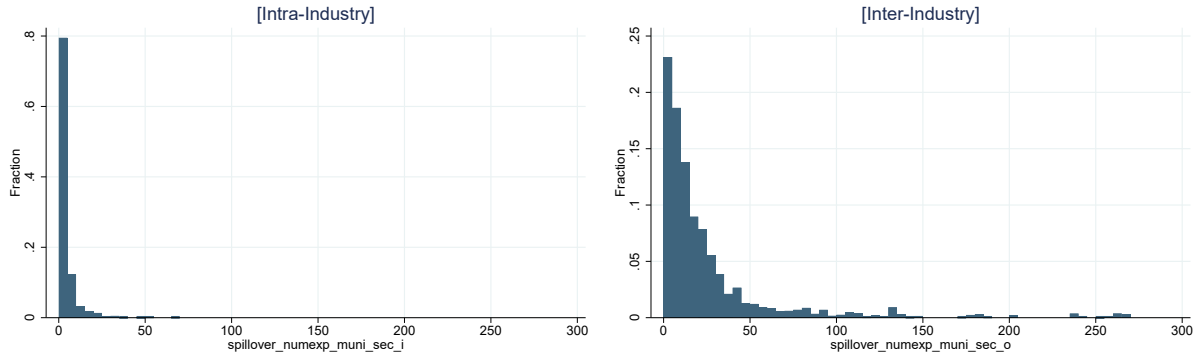
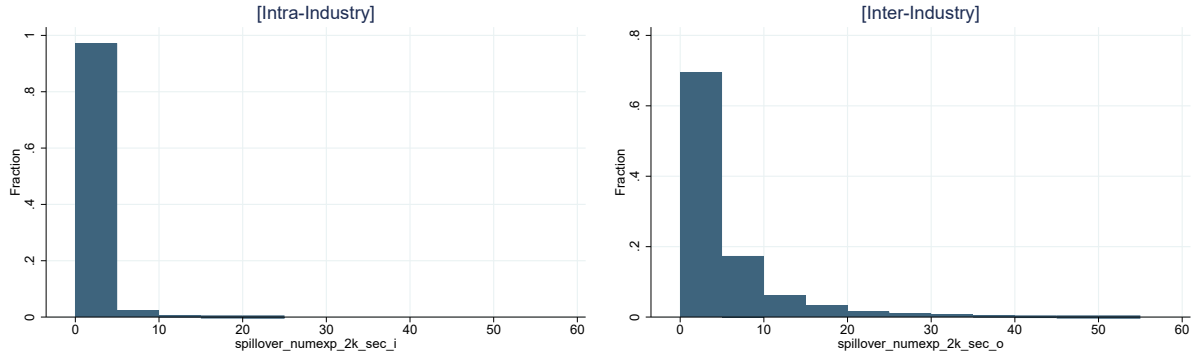
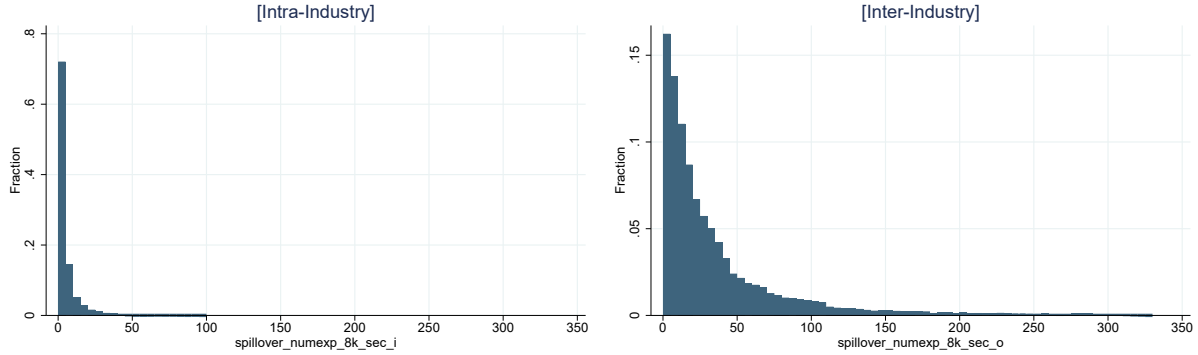


(a) Number of Neighboring Exporters within Municipality



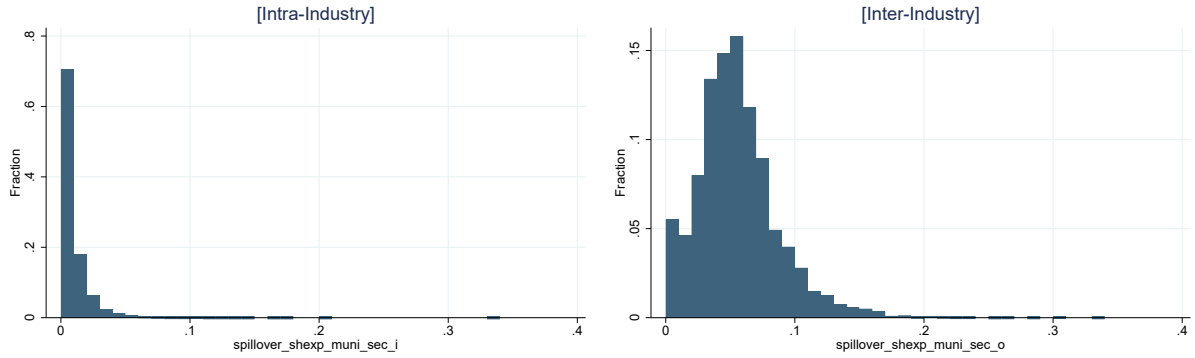
(b) Number of Neighboring Exporters within 2 km



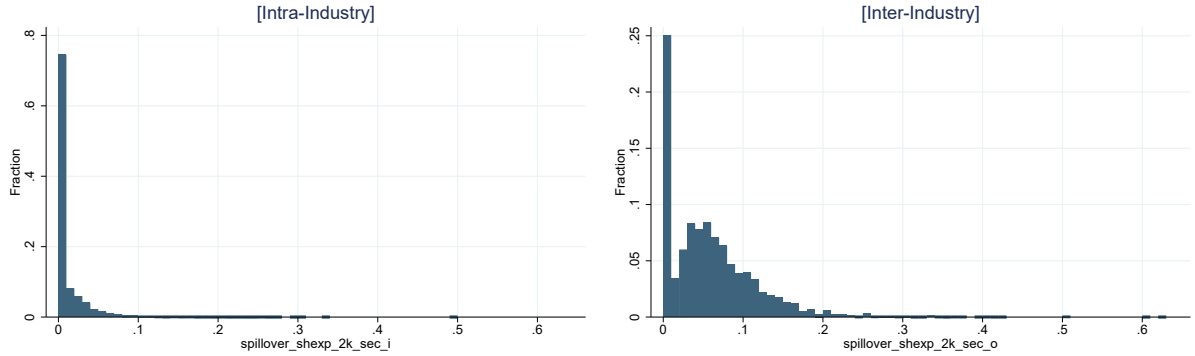
(c) Number of Neighboring Exporters within 8 km

Figure 1. Histogram of Number of Neighboring Exporters in 2018

Note: Author's creation.



(a) Share of Neighboring Exporters within Municipality



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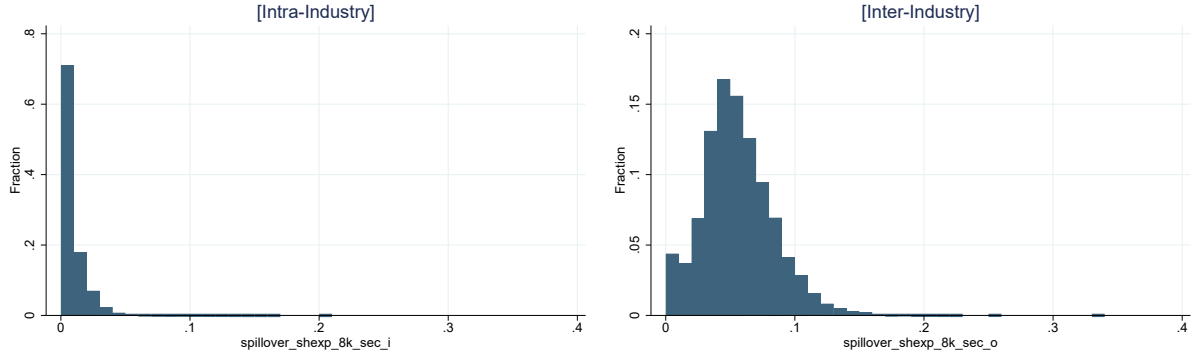
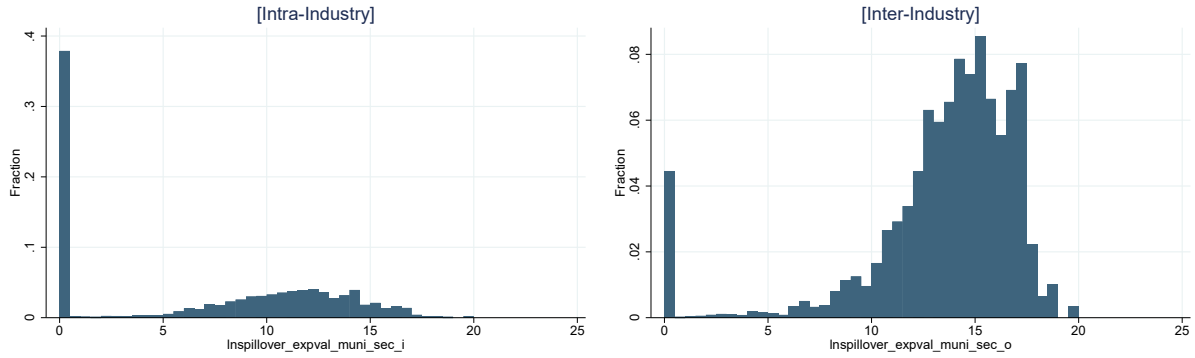


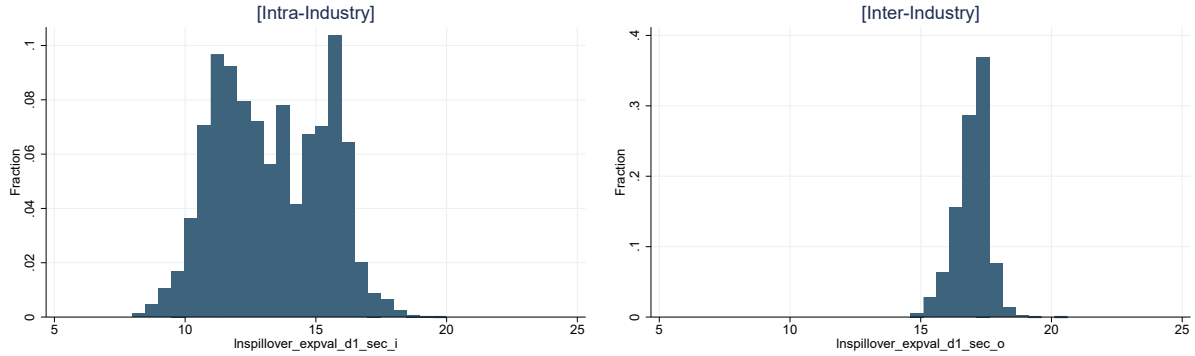
(c) Share of Neighboring Exporters within 8 km

Figure 2. Histogram of Share of Neighboring Exporters in 2018

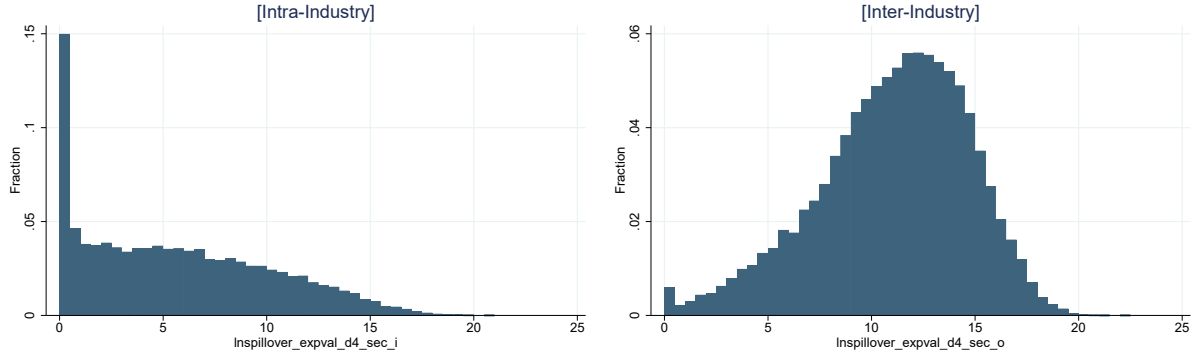
Note: Author's creation.



(a) Total Export Values within Municipality



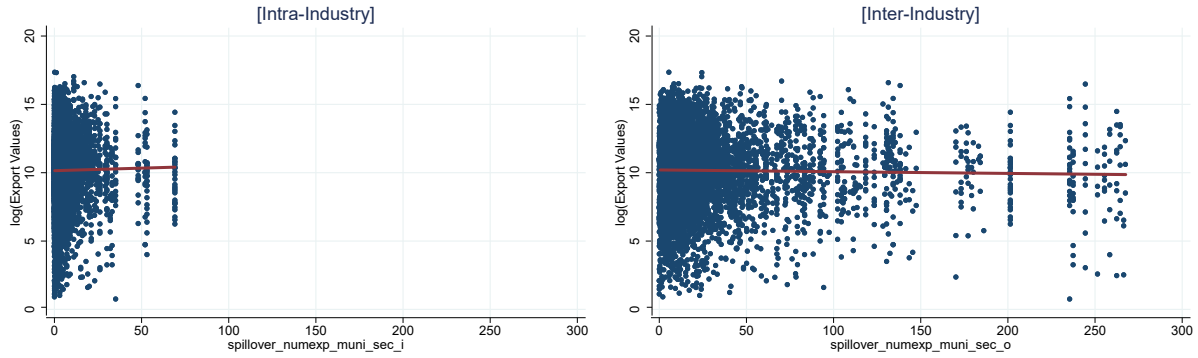
(b) Export Values based on Market Potential Form ($\delta = 1$)



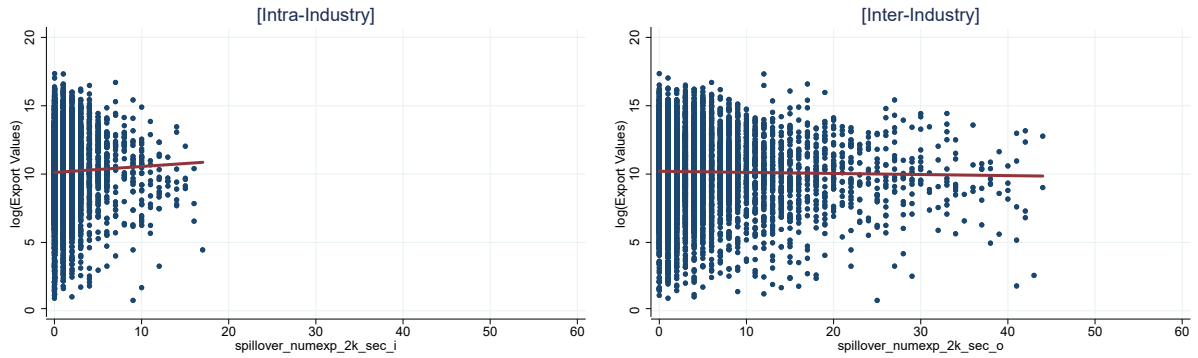
(c) Export Values based on Market Potential Form ($\delta = 4$)

Figure 3. Histogram of Neighboring Export Values in 2018

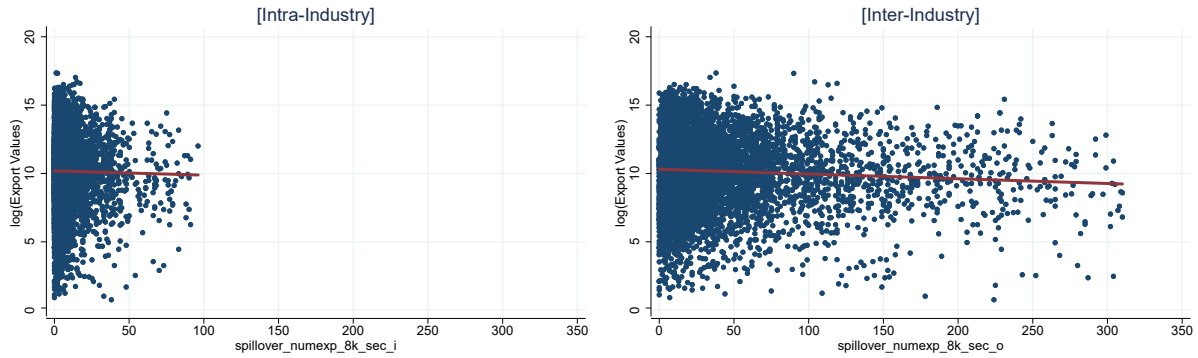
Note: Author's creation.



(a) Number of Neighboring Exporters within Municipality



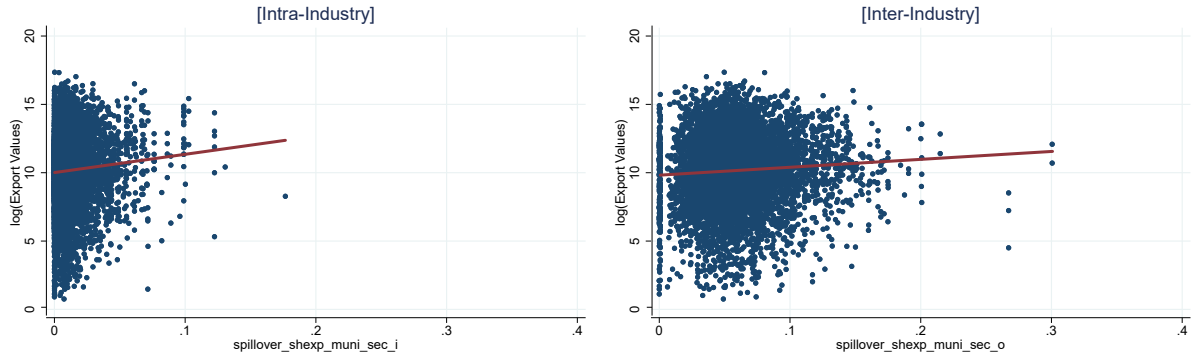
(b) Number of Neighboring Exporters within 2 km



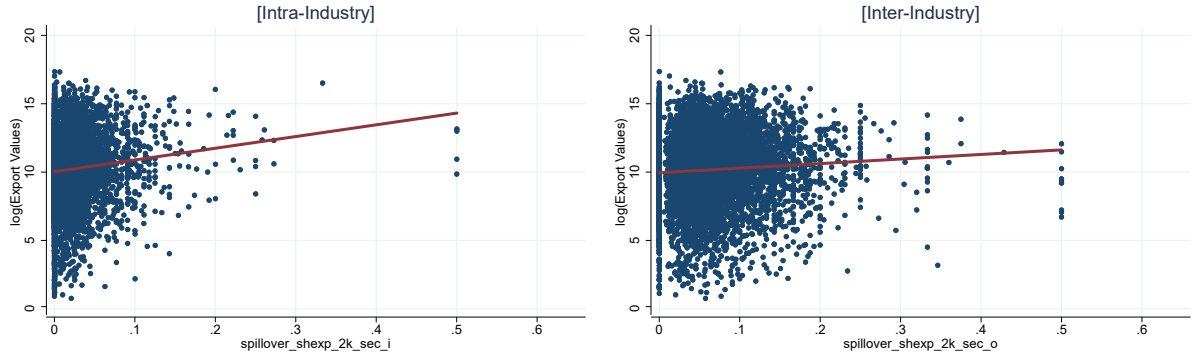
(c) Number of Neighboring Exporters within 8 km

Figure 4. Scatterplot of Export Values and Number of Neighboring Exporters in 2018

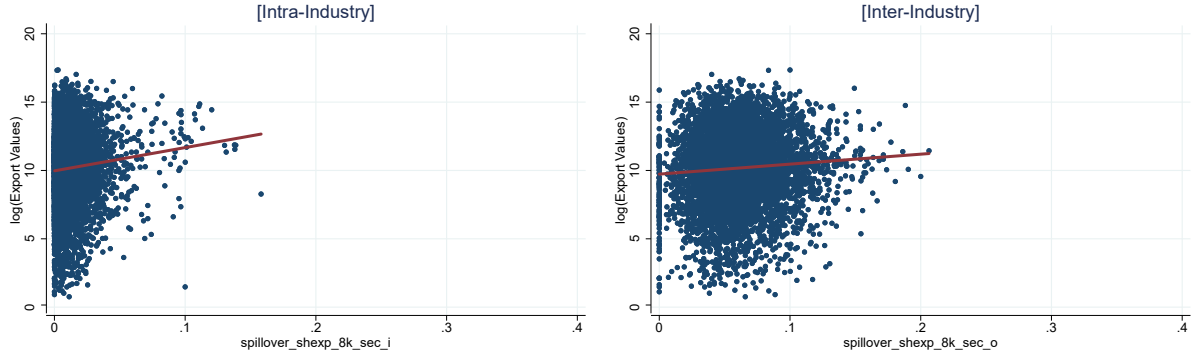
Note: Author's creation.



(a) Share of Neighboring Exporters within Municipality



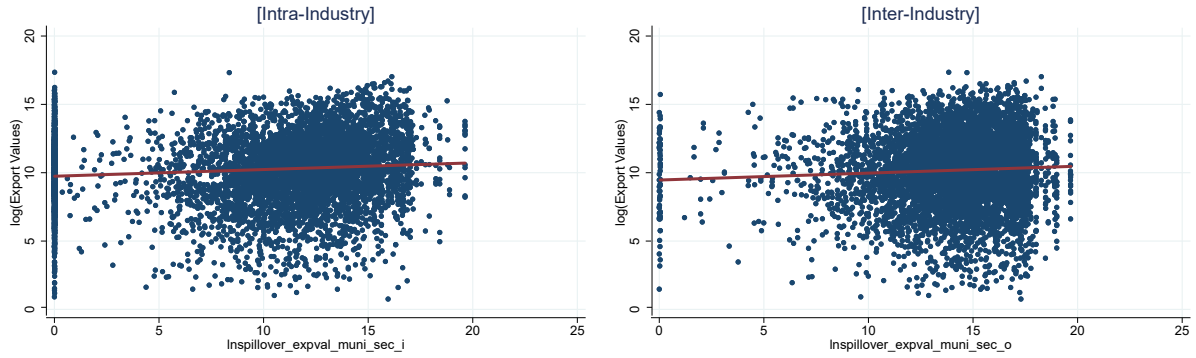
(b) Share of Neighboring Exporters within 2 km



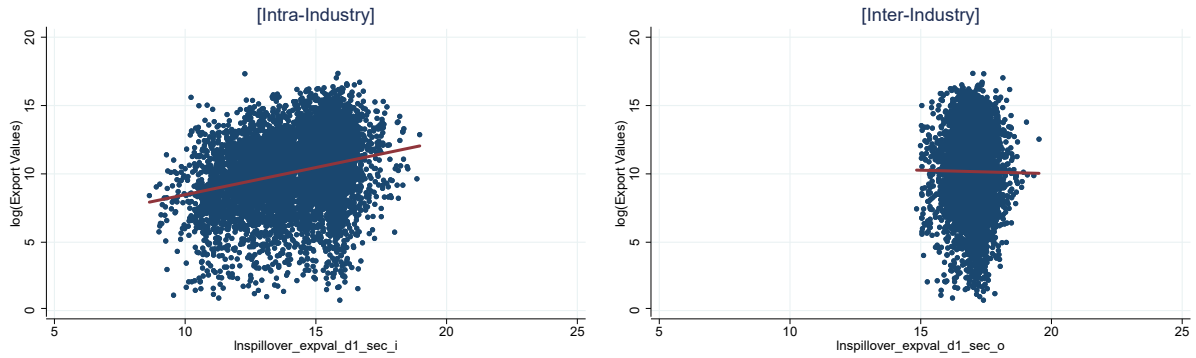
(c) Share of Neighboring Exporters within 8 km

Figure 5. Scatterplot of Export Values and Number of Neighboring Exporters in 2018

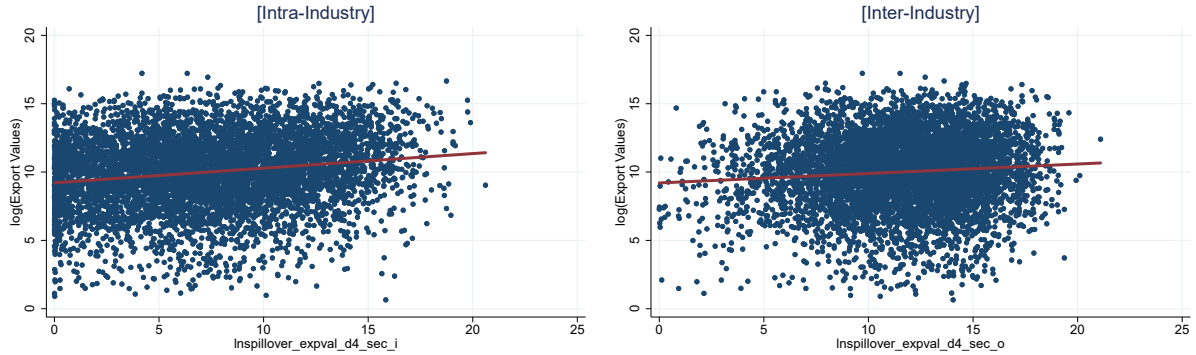
Note: Author's creation.



(a) Total Export Values within Municipality



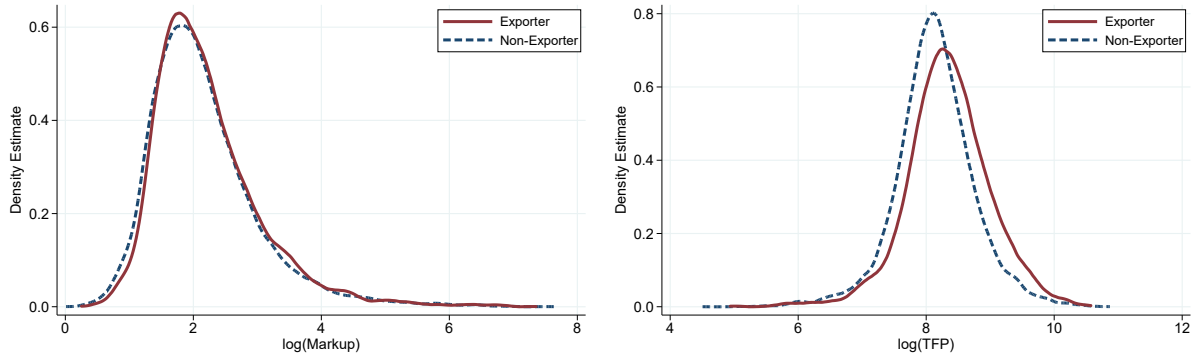
(b) Export Values based on Market Potential Form ($\delta = 1$)



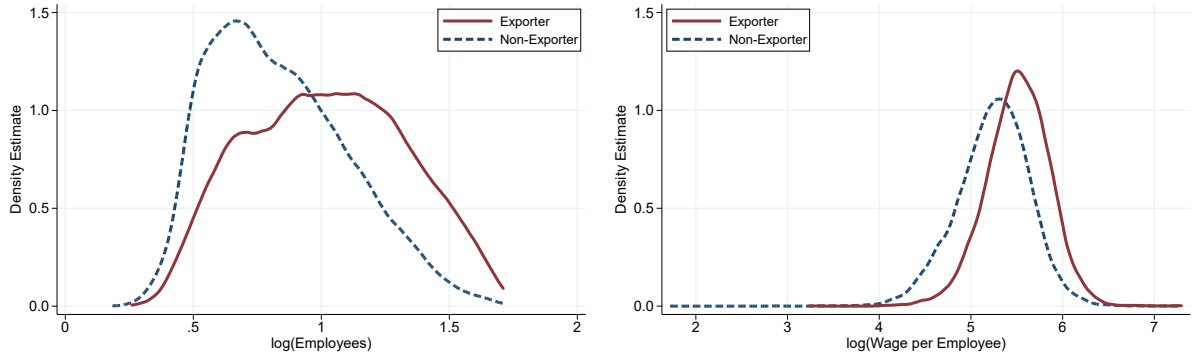
(c) Export Values based on Market Potential Form ($\delta = 4$)

Figure 6. Scatterplot of Export Values and Neighboring Export Values in 2018

Note: Author's creation.



(a) log(Markup) (b) log(TFP)



(c) log(Employees) (d) log(Wage per Employee)

Figure 7. Establishment Characteristics Between Exporters and Non-Exporters in 2018

Note: Author's creation.

Table 1. Descriptive Statistics for Extensive Margin Analysis

Variables	Obs.	Mean	S.D.	Min	Median	Max
Establishment characteristics						
Dummy of Export Entry (Lag 2)	142,146	0.02	0.13	0.00	0.00	1.00
Dummy of Export Entry (Lag 3)	99,334	0.02	0.14	0.00	0.00	1.00
Dummy of Export Entry (Lag 4)	68,911	0.01	0.12	0.00	0.00	1.00
Dummy of Export Entry (Forward 1, Lag 4)	48,721	0.01	0.12	0.00	0.00	1.00
log(Markup)	141,102	0.71	0.35	-4.41	0.71	2.03
log(TFP)	141,209	8.16	0.60	4.51	8.14	10.87
log(Employees)	142,146	0.87	0.27	0.18	0.84	1.85
log(Wage)	142,145	5.24	0.38	2.82	5.26	7.30
log(Capital)	140,779	8.75	1.96	0.00	8.41	18.93
Dummy of Munti-Establishments	142,146	0.40	0.49	0.00	0.00	1.00
Neighboring Exporters within Industries						
Number of Neighboring Exporters within Municipality	142,146	2.72	5.75	0.00	1.00	73.00
Number of Neighboring Exporters within 2 km	142,099	0.54	1.27	0.00	0.00	23.00
Number of Neighboring Exporters within 8 km	142,099	3.80	7.34	0.00	1.00	97.00
Share of Neighboring Exporters within Municipality	142,146	0.01	0.01	0.00	0.00	0.50
Share of Neighboring Exporters within 2 km	142,099	0.01	0.02	0.00	0.00	0.50
Share of Neighboring Exporters within 8 km	142,099	0.01	0.01	0.00	0.00	0.50
log(Neighboring Export Values within Municipality + 1)	142,133	6.23	5.97	0.00	7.02	20.28
log(Neighboring Export Values, Market Potential + 1, d=1)	142,099	12.93	2.11	7.31	12.57	20.16
log(Neighboring Export Values, Market Potential + 1, d=4)	142,086	5.07	4.39	0.00	4.27	21.01
Neighboring Exporters between Industries						
Number of Neighboring Exporters within Municipality	142,146	22.68	36.26	0.00	11.00	270.00
Number of Neighboring Exporters within 2 km	142,099	3.87	5.63	0.00	2.00	51.00
Number of Neighboring Exporters within 8 km	142,099	33.36	45.61	0.00	17.00	333.00
Share of Neighboring Exporters within Municipality	142,146	0.05	0.03	0.00	0.04	0.40
Share of Neighboring Exporters within 2 km	142,099	0.05	0.05	0.00	0.04	0.63
Share of Neighboring Exporters within 8 km	142,099	0.05	0.03	0.00	0.05	0.33
log(Neighboring Export Values within Municipality + 1)	142,146	13.14	4.15	0.00	14.08	20.28
log(Neighboring Export Values + 1, Market Potential, d=1)	142,099	16.86	0.64	14.31	16.94	20.82
log(Neighboring Export Values + 1, Market Potential, d=4)	142,093	10.66	3.73	0.00	11.05	23.05

Note: The panel dataset covers the period from 2012 to 2019.

Table 2. Descriptive Statistics for Intensive Margin Analysis

Variables	Obs.	Mean	S.D.	Min	Median	Max
Establishment characteristics						
log(Export Values)	45,460	9.98	2.64	0.47	10.14	17.22
log(Markup)	44,935	0.74	0.33	-1.38	0.72	2.00
log(TFP)	44,810	8.33	0.67	4.59	8.32	10.86
log(Employees)	45,460	1.03	0.31	0.25	1.03	1.72
log(Wage)	45,460	5.49	0.34	2.56	5.50	8.02
log(Capital)	45,366	10.18	2.56	0.00	9.21	18.93
Dummy of Other Establishments	45,460	0.50	0.50	0.00	0.00	1.00
Neighboring Exporters within Industry						
Number of Neighboring Exporters within Municipality	45,460	4.53	8.45	0.00	2.00	72.00
Number of Neighboring Exporters within 2 km	45,404	1.00	1.83	0.00	0.00	19.00
Number of Neighboring Exporters within 8 km	45,404	6.78	10.96	0.00	3.00	97.00
Share of Neighboring Exporters within Municipality	45,460	0.01	0.01	0.00	0.01	0.20
Share of Neighboring Exporters within 2 km	45,404	0.01	0.03	0.00	0.00	0.50
Share of Neighboring Exporters within 8 km	45,404	0.01	0.01	0.00	0.01	0.16
log(Neighboring Export Values within Municipality + 1)	45,455	8.42	6.00	0.00	10.49	20.28
log(Neighboring Export Values, Market Potential + 1, d=1)	45,404	14.13	1.75	7.77	14.51	19.55
log(Neighboring Export Values, Market Potential + 1, d=4)	45,397	7.24	4.47	-0.01	7.06	20.65
Neighboring Exporters between Industries						
Number of Neighboring Exporters within Municipality	45,460	24.72	36.94	0.00	12.00	267.00
Number of Neighboring Exporters within 2 km	45,404	4.49	5.69	0.00	3.00	45.00
Number of Neighboring Exporters within 8 km	45,404	37.06	44.59	0.00	21.00	328.00
Share of Neighboring Exporters within Municipality	45,460	0.05	0.03	0.00	0.05	0.30
Share of Neighboring Exporters within 2 km	45,404	0.06	0.05	0.00	0.05	0.50
Share of Neighboring Exporters within 8 km	45,404	0.05	0.03	0.00	0.05	0.22
log(Neighboring Export Values within Municipality + 1)	45,452	13.57	3.67	0.00	14.32	20.28
log(Neighboring Export Values + 1, Market Potential, d=1)	45,404	16.92	0.55	14.51	16.96	19.62
log(Neighboring Export Values + 1, Market Potential, d=4)	45,398	11.41	3.37	0.00	11.75	21.18

Note: The panel dataset covers the period from 2012 to 2019.

Table 3. Probit Estimation Results for Extensive Margin Analysis (Lag 2)

	Dependent Variable: Dummy of Export Entry (Lag 2)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values + 1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters within Industry	0.0046***	0.0237***	0.0061***	2.9369***	0.5070	3.3786***	0.0051***	-0.0070	0.0033
	(0.0017)	(0.0065)	(0.0013)	(0.8437)	(0.3871)	(0.9237)	(0.0017)	(0.0153)	(0.0025)
NBR. Exporters between Industry	0.0000	-0.0015	-0.0003	-0.3334	-0.0213	-0.2051	-0.0026	0.0335	0.0014
	(0.0004)	(0.0022)	(0.0003)	(0.3661)	(0.1859)	(0.4407)	(0.0026)	(0.0407)	(0.0030)
log(Markup)	0.0068	0.0032	0.0019	0.0032	0.0049	0.0007	0.0061	0.0070	0.0053
	(0.0323)	(0.0323)	(0.0323)	(0.0323)	(0.0322)	(0.0323)	(0.0322)	(0.0322)	(0.0322)
log(TFP)	0.0613***	0.0609***	0.0612***	0.0605***	0.0607***	0.0608***	0.0611***	0.0607***	0.0607***
	(0.0162)	(0.0162)	(0.0162)	(0.0162)	(0.0162)	(0.0162)	(0.0162)	(0.0162)	(0.0162)
log(Employees)	0.3484***	0.3497***	0.3513***	0.3461***	0.3471***	0.3503***	0.3454***	0.3458***	0.3463***
	(0.0401)	(0.0401)	(0.0401)	(0.0401)	(0.0401)	(0.0401)	(0.0400)	(0.0400)	(0.0400)
Log(Wage)	0.2508***	0.2474***	0.2467***	0.2497***	0.2520***	0.2479***	0.2508***	0.2538***	0.2499***
	(0.0361)	(0.0362)	(0.0362)	(0.0362)	(0.0362)	(0.0362)	(0.0361)	(0.0361)	(0.0362)
Log(Capital)	0.0348***	0.0349***	0.0354***	0.0351***	0.0348***	0.0350***	0.0350***	0.0348***	0.0347***
	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)
D(1=Munti-Establishments)	-0.0631***	-0.0626***	-0.0629***	-0.0630***	-0.0636***	-0.0635***	-0.0631***	-0.0637***	-0.0638***
	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0215)
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	135,120	135,078	135,078	135,120	135,078	135,078	135,098	135,078	135,046
Number of Establishments	35,877	35,864	35,864	35,877	35,864	35,864	35,877	35,864	35,864
Pseudo R2	0.0934	0.0935	0.0939	0.0935	0.0931	0.0936	0.0933	0.0930	0.0930

Note: Standard errors clustered at the establishment level are in the parentheses. The explanatory variables are measured in time $t-1$. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively. The dummy variable of export entry (lag2) takes the value of 1 for $Y_{it}=1, Y_{i,-1}=0, Y_{i,t-2}=0$ and 0 for $Y_{it}=0, Y_{i,-1}=0, Y_{i,t-2}=0$, where Y_{it} is the export status (1/0) of establishment i in year t. NBR indicates the neighborhood.

Table 4. Probit Estimation Results for Extensive Margin Analysis (Lag 4)

	Dependent Variable: Dummy of Export Entry (Lag 4)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values + 1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters within Industry	0.0057**	0.0259**	0.0062***	2.7429**	0.5072	4.0790***	0.0089***	-0.0048	0.0036
	(0.0026)	(0.0103)	(0.0021)	(1.2120)	(0.5269)	(1.3252)	(0.0026)	(0.0252)	(0.0038)
NBR. Exporters between Industry	-0.0002	-0.0044	-0.0011**	-0.5641	-0.0411	-0.6529	-0.0084**	-0.0410	-0.0017
	(0.0005)	(0.0034)	(0.0005)	(0.5815)	(0.2758)	(0.6575)	(0.0038)	(0.0655)	(0.0045)
log(Markup)	0.0918*	0.0877*	0.0842*	0.0895*	0.0908*	0.0859*	0.0901*	0.0911*	0.0906*
	(0.0477)	(0.0477)	(0.0478)	(0.0476)	(0.0475)	(0.0477)	(0.0477)	(0.0475)	(0.0475)
log(TFP)	0.1166***	0.1161***	0.1164***	0.1159***	0.1156***	0.1163***	0.1166***	0.1159***	0.1156***
	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0255)
log(Employees)	0.2883***	0.2888***	0.2907***	0.2847***	0.2849***	0.2893***	0.2837***	0.2839***	0.2846***
	(0.0611)	(0.0612)	(0.0612)	(0.0611)	(0.0611)	(0.0612)	(0.0611)	(0.0611)	(0.0611)
Log(Wage)	0.2415***	0.2394***	0.2388***	0.2405***	0.2435***	0.2382***	0.2398***	0.2459***	0.2420***
	(0.0541)	(0.0542)	(0.0541)	(0.0540)	(0.0542)	(0.0542)	(0.0541)	(0.0540)	(0.0542)
Log(Capital)	0.0243***	0.0246***	0.0250***	0.0249***	0.0244***	0.0250***	0.0251***	0.0246***	0.0245***
	(0.0081)	(0.0082)	(0.0081)	(0.0082)	(0.0082)	(0.0082)	(0.0082)	(0.0081)	(0.0082)
D(1=Munti-Establishments)	-0.0734**	-0.0720*	-0.0723*	-0.0728**	-0.0737**	-0.0723**	-0.0737**	-0.0739**	-0.0737**
	(0.0369)	(0.0369)	(0.0369)	(0.0369)	(0.0368)	(0.0369)	(0.0369)	(0.0368)	(0.0368)
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	63,784	63,765	63,765	63,784	63,765	63,765	63,779	63,765	63,754
Number of Establishments	20,011	20,006	20,006	20,011	20,006	20,006	20,011	20,006	20,005
Pseudo R2	0.0775	0.0777	0.0779	0.0775	0.0770	0.0780	0.0782	0.0770	0.0769

Note: Standard errors clustered at the establishment level are in the parentheses. The explanatory variables are measured in time $t-1$. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively. The dummy variable of export entry (lag4) takes the value of 1 for $Y_{it}=1, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,-3}=0, Y_{i,t-4}=0$ and 0 for $Y_{it}=0, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,-3}=0, Y_{i,t-4}=0$, where Y_{it} is the export status (1/0) of establishment i in year t. NBR indicates the neighborhood.

Table 5. OLS Estimation Results for Intensive Margin Analysis

	Dependent Variable: log(Export Values)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values + 1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters within Industry	0.0046	0.0282***	0.0034	3.7211**	3.0287***	4.2437***	0.0123***	0.1708***	0.0254***
	(0.0029)	(0.0107)	(0.0024)	(1.4595)	(0.6184)	(1.5808)	(0.0035)	(0.0377)	(0.0049)
NBR. Exporters between Industry	-0.0003	-0.0054	-0.0015**	1.6134**	0.7169**	1.3714	0.0062	-0.0116	0.0020
	(0.0008)	(0.0043)	(0.0007)	(0.7282)	(0.3572)	(0.9050)	(0.0060)	(0.0885)	(0.0064)
log(Markup)	0.8824***	0.8754***	0.8691***	0.8772***	0.8660***	0.8736***	0.8838***	0.8688***	0.8762***
	(0.0711)	(0.0712)	(0.0714)	(0.0710)	(0.0709)	(0.0711)	(0.0711)	(0.0712)	(0.0712)
log(TFP)	0.6008***	0.6002***	0.5997***	0.6001***	0.5984***	0.5988***	0.6005***	0.5972***	0.5981***
	(0.0259)	(0.0259)	(0.0259)	(0.0258)	(0.0258)	(0.0259)	(0.0259)	(0.0259)	(0.0259)
log(Employees)	2.9480***	2.9547***	2.9539***	2.9474***	2.9657***	2.9539***	2.9421***	2.9534***	2.9506***
	(0.0844)	(0.0845)	(0.0845)	(0.0843)	(0.0843)	(0.0845)	(0.0844)	(0.0845)	(0.0845)
Log(Wage)	1.2724***	1.2709***	1.2732***	1.2717***	1.2613***	1.2707***	1.2631***	1.2619***	1.2534***
	(0.0759)	(0.0759)	(0.0760)	(0.0758)	(0.0759)	(0.0760)	(0.0760)	(0.0760)	(0.0759)
Log(Capital)	0.1978***	0.1977***	0.1976***	0.1965***	0.1951***	0.1964***	0.1968***	0.1959***	0.1958***
	(0.0110)	(0.0110)	(0.0110)	(0.0110)	(0.0110)	(0.0110)	(0.0110)	(0.0110)	(0.0110)
D(1=Munti-Establishments)	-0.0836**	-0.0849**	-0.0826**	-0.0844**	-0.0869**	-0.0866**	-0.0844**	-0.0861**	-0.0888**
	(0.0400)	(0.0401)	(0.0402)	(0.0400)	(0.0400)	(0.0401)	(0.0400)	(0.0400)	(0.0400)
Establishment Fixed Effect	No	No	No	No	No	No	No	No	No
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	44,197	44,141	44,141	44,197	44,141	44,141	44,185	44,141	44,129
Number of Establishments	10,178	10,166	10,166	10,178	10,166	10,166	10,177	10,166	10,165
Adjusted R2	0.4591	0.4595	0.4595	0.4595	0.4604	0.4596	0.4597	0.4601	0.4604

Note: Standard errors clustered at the establishment level are in the parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

NBR indicates the neighborhood.

Table 6. Fixed Effect Estimation Results for Intensive Margin Analysis

	Dependent Variable: log(Export Values)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values + 1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters within Industry	-0.0012	-0.0028	-0.0024	0.2409	0.7864*	2.1573	0.0049*	0.1497***	0.0114***
	(0.0038)	(0.0107)	(0.0034)	(1.0578)	(0.4507)	(1.6004)	(0.0028)	(0.0344)	(0.0044)
NBR. Exporters between Industry	0.0004	-0.0041	0.0002	1.1421*	0.2469	0.9979	0.0045	0.0754	-0.0001
	(0.0017)	(0.0046)	(0.0015)	(0.6556)	(0.3218)	(0.7082)	(0.0056)	(0.0999)	(0.0063)
log(Markup)	0.4939***	0.4925***	0.4921***	0.4937***	0.4930***	0.4926***	0.4978***	0.4875***	0.4942***
	(0.0608)	(0.0608)	(0.0608)	(0.0608)	(0.0608)	(0.0607)	(0.0608)	(0.0608)	(0.0608)
log(TFP)	0.3779***	0.3771***	0.3771***	0.3780***	0.3772***	0.3772***	0.3779***	0.3762***	0.3765***
	(0.0163)	(0.0163)	(0.0163)	(0.0163)	(0.0163)	(0.0163)	(0.0163)	(0.0162)	(0.0163)
log(Employees)	2.3422***	2.3515***	2.3516***	2.3423***	2.3534***	2.3516***	2.3437***	2.3528***	2.3544***
	(0.1311)	(0.1311)	(0.1311)	(0.1312)	(0.1310)	(0.1310)	(0.1313)	(0.1312)	(0.1310)
Log(Wage)	0.6268***	0.6297***	0.6289***	0.6257***	0.6297***	0.6291***	0.6301***	0.6256***	0.6328***
	(0.0613)	(0.0615)	(0.0614)	(0.0613)	(0.0614)	(0.0614)	(0.0613)	(0.0615)	(0.0613)
Log(Capital)	0.0347*	0.0321	0.0322	0.0352*	0.0325	0.0324	0.0336	0.0338	0.0314
	(0.0208)	(0.0208)	(0.0208)	(0.0208)	(0.0208)	(0.0207)	(0.0208)	(0.0208)	(0.0208)
D(1=Munti-Establishments)	-0.0391	-0.0395	-0.0395	-0.0389	-0.0401	-0.0394	-0.0389	-0.0409	-0.0392
	(0.0259)	(0.0259)	(0.0259)	(0.0259)	(0.0259)	(0.0259)	(0.0259)	(0.0259)	(0.0259)
Establishment Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	44,197	44,141	44,141	44,197	44,141	44,141	44,185	44,141	44,129
Number of Establishments	10,178	10,166	10,166	10,178	10,166	10,166	10,177	10,166	10,165
Within R2	0.0619	0.0620	0.0620	0.0621	0.0621	0.0621	0.0620	0.0628	0.0621

Note: Standard errors clustered at the establishment level are in the parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

NBR indicates the neighborhood.

Online Appendix for

Local Export Spillovers Within and Between Industries in Japan

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Appendix A TFP and Markup Estimation

The theoretical background of productivity and markup estimation is based on the study by Ackerberg, Caves, and Frazer (2015) and De Loecker and Warzynski (2012). Suppose that firms demand two factors (labor and capital) for production. Firm i minimizes costs of labor and capital inputs to produce output.

Consider the value added trans-log production function as follows:

$$\log v_{it} = \beta_t + \beta_\ell \log \ell_{it} + \beta_k \log k_{it} + \beta_{\ell\ell}(\log \ell_{it})^2 + \beta_{kk}(\log k_{it})^2 + \beta_{\ell k} \log \ell_{it} \log k_{it} + \omega_{it} + e_{it}, \quad \text{(A.1)}$$

where v_{it} is the value-added of establishment i in year t, ℓ_{it} is the labor, and k_{it} is the capital stock. The error term is assumed to consist of two components: ω_{it} is a productivity shock which is unobserved by the econometricians but observable to the establishment i, and e_{it} is a sequence of idiosyncratic shock which is not observable by the establishment i before the input decision-making.

Obtaining consistent parameter estimates $(\hat{\beta}_t, \hat{\beta}_\ell, \hat{\beta}_k, \hat{\beta}_{\ell\ell}, \hat{\beta}_{kk}, \hat{\beta}_{\ell k})$ of the trans-log production function by the Ackerberg-Caves-Frazer approach, this study estimates the logarithm of TFP as follows:

$$\log\left(\widehat{\mathrm{TFP}}_{it}\right) = \log v_{it} - \hat{\beta}_\ell \log \ell_{it} - \hat{\beta}_{\ k} \log k_{it} - \hat{\beta}_{\ell\ell}(\log \ell_{it})^2 - \hat{\beta}_{kk}(\log k_{it})^2 - \hat{\beta}_{\ell k} \log \ell_{it} \log k_{it}. \quad \text{(A.2)}$$

Labor and capital elasticities in the trans-log production function are calculated as follows:

$$\theta_{it}^{\ell} = \frac{\partial \log v_{it}}{\partial \log \ell_{it}} = \hat{\beta}_\ell + 2\hat{\beta}_{\ell\ell} \log \ell_{it} + \hat{\beta}_{\ell k} \log k_{it}. \quad \text{(A.3)}$$

and

$$\theta_{it}^{k} = \frac{\partial \log v_{it}}{\partial \log \ell_{it}} = \widehat{\beta}_k + 2\widehat{\beta}_{kk} \log k_{it} + \widehat{\beta}_{\ell k} \log \ell_{it}. \quad \text{(A.4)}$$

Unlike the Cobb–Douglas production function, labor and capital elasticities in the trans-log production function vary across the establishments.

De Loecker and Warzynski (2012) propose a method for markup estimation using the labor elasticity of output and labor share through the TFP estimation procedure. The labor share π_{it}^{ℓ} is calculated as the ratio of total wage payment and value added. Finally, the markup is calculated as follows:

$$\mu_{it} = \frac{\theta_{it}^{\ell}}{\pi_{it}^{\ell}}. \quad \text{(A.5)}$$

Note that the ratio of labor elasticity of output and labor share is equal to one under the perfect competition assumption. See Kondo (2018) for details of TFP and markup estimation using the Census of Manufacture in Japan.

Figure A.1 shows the labor and capital elasticities of output based on the trans-log production function and the labor share by industry.

[Figure A.1]

Appendix B Additional Estimation Results for Extensive Margin

Tables B.1–B.2 present additional estimation results of intensive margin analyses.

[Tables B.1–B.2]

Appendix C Heckman Sample Selection Model Estimation Results

Table C.1 presents estimation results of intensive margin analyses based on the Heckman sample selection model.

[Table C.1]

Appendix D The Case of All Industries

D.1 Extensive Margin of Export

Tables D.1–D.4 present estimation results of extensive margin analyses.

[Tables D.1–D.4]

D.2 Intensive Margin of Export

Tables D.5–D.7 present estimation results of extensive margin analyses.

[Tables D.5–D.7]

Appendix E Geocoding Results

Table E.1 presents the geocoding accuracy results of establishment locations in the dataset.

[Table E.1]

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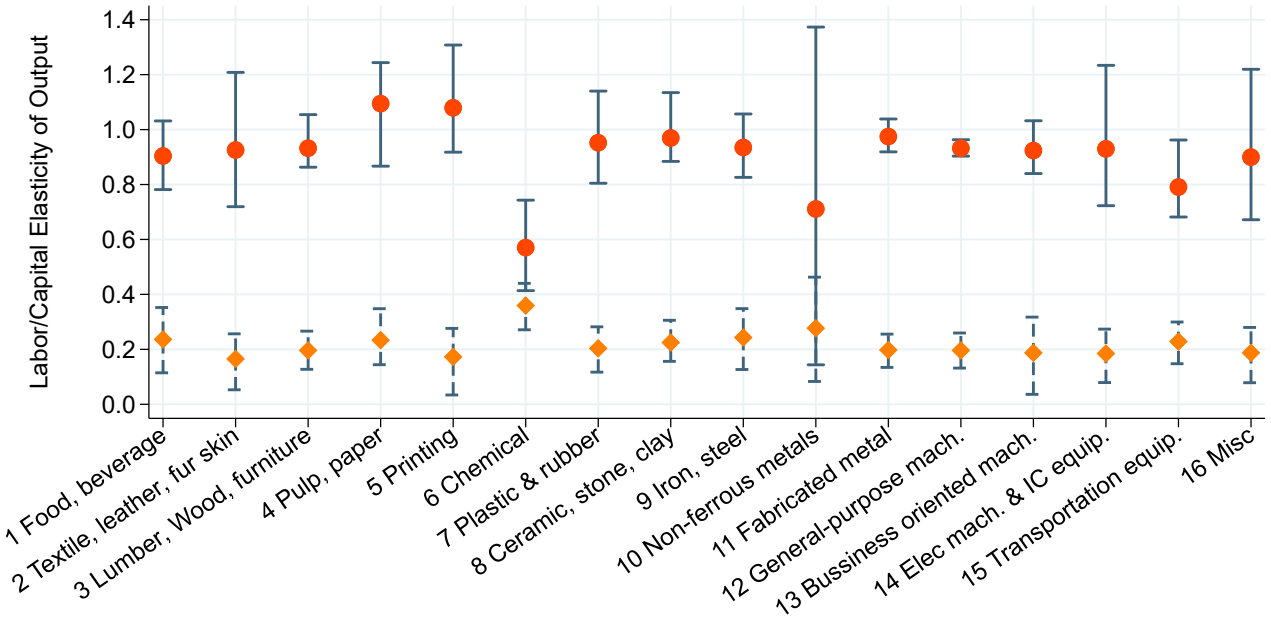
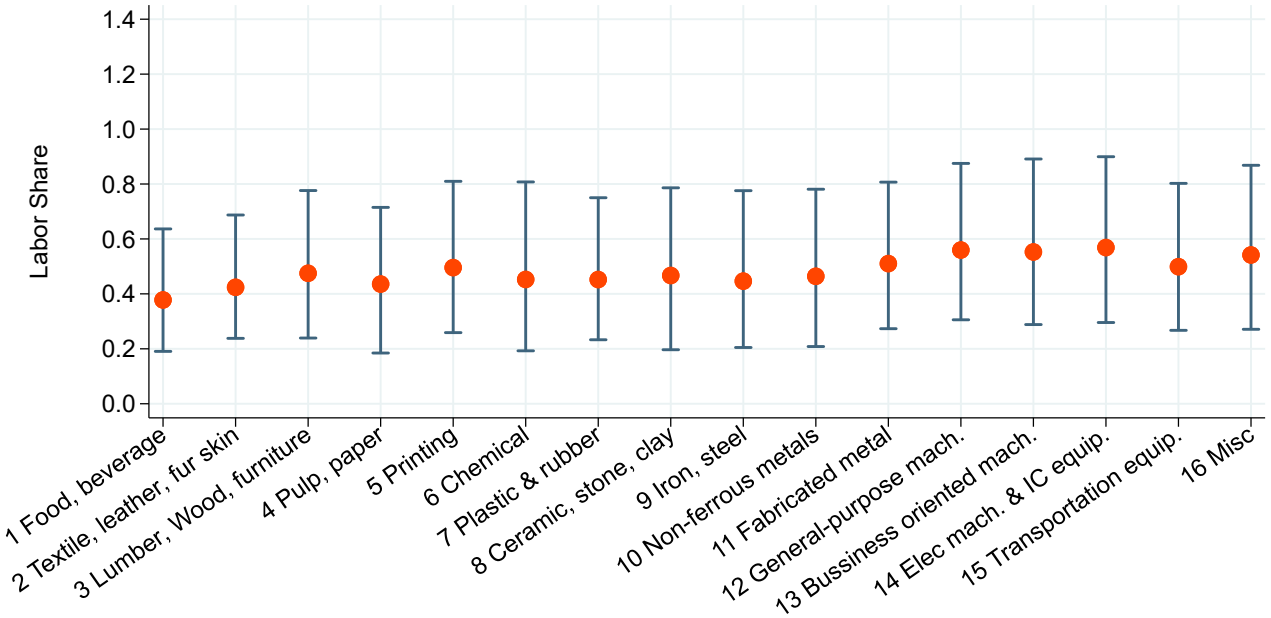


(a) Labor and Capital Elasticity of Output



(b) Labor Share

Figure A.1. TFP and Markup Estimation by Sector

Note: Author's creation. The labor and capital elasticity of output are $\partial \log v_{it} / \partial \log \ell_{it}$ and $\partial \log v_{it} / \partial \log k_{it}$ of Equation (**1**). The circle and diamond markers represent the average labor and capital elasticities of output, respectively. The lines represent the 5–95 percentile interval of the estimated elasticities.

Table B.1. Probit Estimation Results for Extensive Margin Analysis (Lag3) with Intra- and Inter-Industry Spillover

	Dependent Variable: Dummy of Export Entry (lag 3)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values+1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters within Industry	0.0059***	0.0246***	0.0072***	2.5316***	0.4529	3.1768***	0.0064***	-0.0126	0.0022
	(0.0020)	(0.0080)	(0.0016)	(0.9774)	(0.4593)	(1.0817)	(0.0020)	(0.0181)	(0.0029)
NBR. Exporters between Industries	-0.0004	-0.0045*	-0.0009**	-0.3157	-0.0862	-0.6912	-0.0047	-0.0177	-0.0014
	(0.0004)	(0.0026)	(0.0004)	(0.4380)	(0.2167)	(0.5191)	(0.0030)	(0.0477)	(0.0035)
log(Markup)	0.0358	0.0324	0.0295	0.0347	0.0358	0.0320	0.0359	0.0369	0.0359
	(0.0374)	(0.0374)	(0.0375)	(0.0373)	(0.0373)	(0.0374)	(0.0373)	(0.0373)	(0.0373)
log(TFP)	0.0993***	0.0995***	0.0994***	0.0990***	0.0993***	0.0997***	0.0997***	0.0993***	0.0993***
	(0.0194)	(0.0194)	(0.0194)	(0.0194)	(0.0194)	(0.0194)	(0.0194)	(0.0193)	(0.0194)
log(Employees)	0.3761***	0.3784***	0.3808***	0.3732***	0.3755***	0.3788***	0.3732***	0.3750***	0.3754***
	(0.0476)	(0.0477)	(0.0477)	(0.0476)	(0.0476)	(0.0477)	(0.0476)	(0.0476)	(0.0476)
Log(Wage)	0.2485***	0.2459***	0.2442***	0.2484***	0.2502***	0.2467***	0.2482***	0.2530***	0.2500***
	(0.0427)	(0.0428)	(0.0427)	(0.0426)	(0.0427)	(0.0427)	(0.0426)	(0.0426)	(0.0427)
Log(Capital)	0.0307***	0.0309***	0.0314***	0.0309***	0.0307***	0.0311***	0.0310***	0.0308***	0.0308***
	(0.0063)	(0.0064)	(0.0063)	(0.0063)	(0.0064)	(0.0064)	(0.0063)	(0.0063)	(0.0064)
D(1=Munti-Establishments)	-0.0459*	-0.0453*	-0.0452*	-0.0458*	-0.0469*	-0.0464*	-0.0465*	-0.0471*	-0.0472*
	(0.0258)	(0.0258)	(0.0258)	(0.0258)	(0.0258)	(0.0258)	(0.0258)	(0.0258)	(0.0258)
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	94,001	93,973	93,973	94,001	93,973	93,973	93,989	93,973	93,956
Number of Establishments	29,341	29,332	29,332	29,341	29,332	29,332	29,341	29,332	29,332
Pseudo R2	0.0941	0.0942	0.0948	0.0940	0.0937	0.0942	0.0942	0.0937	0.0936

Note: Standard errors clustered at the establishment level are in the parentheses. The explanatory variables are measured in time $t-1$. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively. The dummy variable of export entry (lag4) takes the value of 1 for $Y_{it}=1, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,-3}=0$ and 0 for $Y_{it}=0, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,-3}=0$, where Y_{it} is the export status (1/0) of establishment i in year t. NBR indicates the neighborhood.

Table B.2. Probit Estimation Results for Extensive Margin Analysis (Forward 1, Lag4) with Intra- and Inter-Industry Spillover

	Dependent Variable: Dummy of Export Entry (forward 1, lag 4)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values+1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters within Industry	0.0060*	0.0173	0.0056**	3.3209**	0.4158	3.1880*	0.0117***	-0.0357	0.0004
	(0.0031)	(0.0128)	(0.0026)	(1.4988)	(0.6464)	(1.7084)	(0.0032)	(0.0302)	(0.0047)
NBR. Exporters between Industries	0.0002	-0.0049	-0.0009	-1.3026*	-0.3570	-1.2822	-0.0128***	-0.0934	-0.0049
	(0.0007)	(0.0044)	(0.0007)	(0.7593)	(0.3626)	(0.8434)	(0.0046)	(0.0821)	(0.0056)
log(Markup)	0.0791	0.0726	0.0701	0.0731	0.0761	0.0702	0.0738	0.0760	0.0754
	(0.0587)	(0.0586)	(0.0589)	(0.0586)	(0.0584)	(0.0585)	(0.0587)	(0.0585)	(0.0584)
log(TFP)	0.1272***	0.1261***	0.1261***	0.1263***	0.1258***	0.1269***	0.1270***	0.1259***	0.1259***
	(0.0308)	(0.0309)	(0.0309)	(0.0309)	(0.0309)	(0.0309)	(0.0309)	(0.0309)	(0.0309)
log(Employees)	0.3817***	0.3801***	0.3824***	0.3776***	0.3771***	0.3824***	0.3774***	0.3778***	0.3779***
	(0.0767)	(0.0767)	(0.0768)	(0.0766)	(0.0767)	(0.0767)	(0.0766)	(0.0767)	(0.0767)
Log(Wage)	0.2227***	0.2227***	0.2202***	0.2206***	0.2265***	0.2207***	0.2197***	0.2320***	0.2269***
	(0.0664)	(0.0665)	(0.0663)	(0.0662)	(0.0664)	(0.0663)	(0.0662)	(0.0663)	(0.0665)
Log(Capital)	0.0344***	0.0349***	0.0353***	0.0356***	0.0352***	0.0357***	0.0357***	0.0351***	0.0352***
	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)
D(1=Munti-Establishments)	-0.0875*	-0.0863*	-0.0860*	-0.0858*	-0.0866*	-0.0860*	-0.0866*	-0.0868*	-0.0874*
	(0.0494)	(0.0494)	(0.0495)	(0.0495)	(0.0494)	(0.0495)	(0.0496)	(0.0494)	(0.0494)
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	44,250	44,236	44,236	44,250	44,236	44,236	44,245	44,236	44,227
Number of Establishments	17,893	17,888	17,888	17,893	17,888	17,888	17,893	17,888	17,887
Pseudo R2	0.0877	0.0872	0.0876	0.0878	0.0870	0.0877	0.0891	0.0872	0.0867

Note: Standard errors clustered at the establishment level are in the parentheses. The explanatory variables are measured in time $t-1$. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively. The dummy variable of export entry (forward 1 and lag 4) takes the value of 1 for $Y_{i,t+1}=1, Y_{it}=1, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,t-3}=0, Y_{i,t-4}=0$ and 0 for $Y_{i,t+1}=0, Y_{it}=0, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,t-3}=0, Y_{i,t-4}=0$, where Y_{it} is the export status (1/0) of establishment i in year t. NBR indicates the neighborhood.

Table C.1. Heckman Two-Stage Estimation Results for Intensive Margin Analysis with Intra- and Inter-Industry Spillover

	Dependent Variable: log(Export Values)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values+1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters within Industry	0.0056*	0.0327***	0.0045*	4.2938***	3.2852***	4.9991***	0.0137***	0.1733***	0.0274***
	(0.0029)	(0.0108)	(0.0024)	(1.4604)	(0.6228)	(1.5804)	(0.0035)	(0.0378)	(0.0050)
NBR. Exporters between Industries	-0.0004	-0.0056	-0.0015**	1.6169**	0.7369**	1.4049	0.0048	-0.0105	0.0016
	(0.0008)	(0.0043)	(0.0007)	(0.7293)	(0.3578)	(0.9049)	(0.0060)	(0.0887)	(0.0064)
log(Markup)	0.8781***	0.8711***	0.8647***	0.8727***	0.8613***	0.8685***	0.8796***	0.8648***	0.8717***
	(0.0712)	(0.0712)	(0.0715)	(0.0710)	(0.0710)	(0.0711)	(0.0711)	(0.0712)	(0.0712)
log(TFP)	0.6223***	0.6216***	0.6213***	0.6213***	0.6197***	0.6200***	0.6221***	0.6185***	0.6198***
	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)
log(Employees)	3.0629***	3.0685***	3.0690***	3.0606***	3.0800***	3.0682***	3.0568***	3.0661***	3.0663***
	(0.0844)	(0.0845)	(0.0845)	(0.0843)	(0.0842)	(0.0844)	(0.0844)	(0.0845)	(0.0844)
Log(Wage)	1.3291***	1.3267***	1.3296***	1.3278***	1.3175***	1.3266***	1.3203***	1.3185***	1.3102***
	(0.0759)	(0.0759)	(0.0761)	(0.0758)	(0.0760)	(0.0761)	(0.0760)	(0.0760)	(0.0759)
Log(Capital)	0.2096***	0.2094***	0.2095***	0.2082***	0.2067***	0.2080***	0.2087***	0.2075***	0.2077***
	(0.0110)	(0.0110)	(0.0110)	(0.0110)	(0.0111)	(0.0110)	(0.0110)	(0.0110)	(0.0110)
D(1=Munti-Establishments)	-0.0994**	-0.1003**	-0.0984**	-0.1000**	-0.1025**	-0.1022**	-0.1002**	-0.1015**	-0.1048***
	(0.0401)	(0.0402)	(0.0402)	(0.0401)	(0.0401)	(0.0402)	(0.0401)	(0.0401)	(0.0401)
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	294,074	293,934	293,934	294,074	293,934	293,934	293,960	293,934	293,830
Number of Selected Obs.	44,197	44,141	44,141	44,197	44,141	44,141	44,185	44,141	44,129
Rho	0.1017	0.1007	0.1018	0.1007	0.1012	0.1010	0.1020	0.1004	0.1029

Note: Standard errors clustered at the establishment level are in the parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

NBR indicates the neighborhood.

Table D.1. Probit Estimation Results for Extensive Margin Analysis (Lag2)

	Dependent Variable: Dummy of Export Entry (lag 2)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values+1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters in All Industries	0.0005**	0.0022	0.0005	0.1994	0.0771	0.4358	0.0015	-0.0160	0.0004
	(0.0003)	(0.0019)	(0.0003)	(0.3332)	(0.1663)	(0.3999)	(0.0026)	(0.0417)	(0.0029)
log(Markup)	0.0097	0.0071	0.0088	0.0061	0.0056	0.0053	0.0069	0.0058	0.0060
	(0.0322)	(0.0322)	(0.0322)	(0.0322)	(0.0322)	(0.0322)	(0.0322)	(0.0322)	(0.0322)
log(TFP)	0.0611***	0.0607***	0.0611***	0.0606***	0.0608***	0.0605***	0.0606***	0.0609***	0.0608***
	(0.0162)	(0.0162)	(0.0162)	(0.0162)	(0.0162)	(0.0162)	(0.0162)	(0.0162)	(0.0162)
log(Employees)	0.3456***	0.3460***	0.3455***	0.3446***	0.3460***	0.3457***	0.3442***	0.3463***	0.3458***
	(0.0400)	(0.0400)	(0.0400)	(0.0400)	(0.0400)	(0.0400)	(0.0400)	(0.0401)	(0.0401)
Log(Wage)	0.2533***	0.2525***	0.2532***	0.2534***	0.2529***	0.2528***	0.2533***	0.2540***	0.2533***
	(0.0361)	(0.0361)	(0.0361)	(0.0361)	(0.0361)	(0.0361)	(0.0361)	(0.0362)	(0.0362)
Log(Capital)	0.0348***	0.0348***	0.0350***	0.0348***	0.0348***	0.0347***	0.0348***	0.0349***	0.0348***
	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)	(0.0054)
D(1=Munti-Establishments)	-0.0634***	-0.0637***	-0.0637***	-0.0634***	-0.0639***	-0.0640***	-0.0633***	-0.0636***	-0.0638***
	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0215)
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	135,120	135,078	135,078	135,120	135,078	135,078	135,119	135,078	135,068
Number of Establishments	35,877	35,864	35,864	35,877	35,864	35,864	35,877	35,864	35,864
Pseudo R2	0.0931	0.0931	0.0931	0.0930	0.0930	0.0930	0.0930	0.0930	0.0930

Note: Standard errors clustered at the establishment level are in the parentheses. The explanatory variables are measured in time $t-1$. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively. The dummy variable of export entry (lag2) takes the value of 1 for $Y_{it}=1, Y_{i,-1}=0, Y_{i,t-2}=0$ and 0 for $Y_{it}=0, Y_{i,-1}=0, Y_{i,t-2}=0$, where Y_{it} is the export status (1/0) of establishment i in year t. NBR indicates the neighborhood.

Table D.2. Probit Estimation Results for Extensive Margin Analysis (Lag3)

	Dependent Variable: Dummy of Export Entry (lag 3)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values+1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters in All Industries	0.0003	-0.0003	0.0001	0.1323	0.0133	0.0049	0.0004	-0.0589	-0.0030
	(0.0003)	(0.0023)	(0.0003)	(0.3945)	(0.1951)	(0.4692)	(0.0030)	(0.0489)	(0.0034)
log(Markup)	0.0392	0.0364	0.0369	0.0370	0.0364	0.0365	0.0372	0.0358	0.0365
	(0.0373)	(0.0373)	(0.0374)	(0.0373)	(0.0373)	(0.0373)	(0.0373)	(0.0373)	(0.0373)
log(TFP)	0.0992***	0.0993***	0.0993***	0.0990***	0.0993***	0.0993***	0.0990***	0.0995***	0.0996***
	(0.0193)	(0.0193)	(0.0193)	(0.0193)	(0.0194)	(0.0194)	(0.0193)	(0.0193)	(0.0194)
log(Employees)	0.3729***	0.3744***	0.3743***	0.3724***	0.3744***	0.3744***	0.3723***	0.3762***	0.3754***
	(0.0476)	(0.0476)	(0.0476)	(0.0476)	(0.0476)	(0.0476)	(0.0476)	(0.0476)	(0.0476)
Log(Wage)	0.2511***	0.2514***	0.2513***	0.2514***	0.2512***	0.2513***	0.2514***	0.2532***	0.2533***
	(0.0426)	(0.0426)	(0.0426)	(0.0426)	(0.0427)	(0.0426)	(0.0426)	(0.0427)	(0.0427)
Log(Capital)	0.0307***	0.0307***	0.0307***	0.0306***	0.0307***	0.0307***	0.0307***	0.0308***	0.0310***
	(0.0063)	(0.0063)	(0.0063)	(0.0063)	(0.0063)	(0.0064)	(0.0063)	(0.0063)	(0.0063)
D(1=Munti-Establishments)	-0.0467*	-0.0473*	-0.0473*	-0.0467*	-0.0473*	-0.0473*	-0.0466*	-0.0469*	-0.0472*
	(0.0258)	(0.0258)	(0.0258)	(0.0258)	(0.0258)	(0.0258)	(0.0258)	(0.0258)	(0.0258)
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	94,001	93,973	93,973	94,001	93,973	93,973	94,001	93,973	93,966
Number of Establishments	29,341	29,332	29,332	29,341	29,332	29,332	29,341	29,332	29,332
Pseudo R2	0.0936	0.0936	0.0936	0.0936	0.0936	0.0936	0.0936	0.0937	0.0937

Note: Standard errors clustered at the establishment level are in the parentheses. The explanatory variables are measured in time $t-1$. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively. The dummy variable of export entry (lag4) takes the value of 1 for $Y_{it}=1, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,-3}=0$ and 0 for $Y_{it}=0, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,-3}=0$, where Y_{it} is the export status (1/0) of establishment i in year t. NBR indicates the neighborhood.

Table D.3. Probit Estimation Results for Extensive Margin Analysis (Lag4)

	Dependent Variable: Dummy of Export Entry (lag 4)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values+1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta=1$)	MP($\delta=4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters in All Industries	0.0005	-0.0002	-0.0003	-0.0258	0.0550	0.2176	-0.0030	-0.0351	-0.0024
	(0.0004)	(0.0029)	(0.0004)	(0.5234)	(0.2462)	(0.5940)	(0.0038)	(0.0651)	(0.0044)
log(Markup)	0.0941**	0.0913*	0.0898*	0.0914*	0.0912*	0.0913*	0.0905*	0.0911*	0.0915*
	(0.0475)	(0.0475)	(0.0476)	(0.0475)	(0.0475)	(0.0475)	(0.0475)	(0.0475)	(0.0475)
log(TFP)	0.1162***	0.1157***	0.1156***	0.1158***	0.1156***	0.1155***	0.1160***	0.1158***	0.1160***
	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0255)	(0.0255)
log(Employees)	0.2846***	0.2836***	0.2839***	0.2837***	0.2837***	0.2834***	0.2842***	0.2841***	0.2839***
	(0.0611)	(0.0611)	(0.0611)	(0.0611)	(0.0611)	(0.0611)	(0.0611)	(0.0611)	(0.0611)
Log(Wage)	0.2437***	0.2448***	0.2449***	0.2443***	0.2444***	0.2445***	0.2450***	0.2458***	0.2463***
	(0.0540)	(0.0540)	(0.0540)	(0.0540)	(0.0541)	(0.0540)	(0.0540)	(0.0541)	(0.0542)
Log(Capital)	0.0244***	0.0245***	0.0245***	0.0245***	0.0244***	0.0244***	0.0246***	0.0246***	0.0247***
	(0.0082)	(0.0081)	(0.0081)	(0.0081)	(0.0082)	(0.0082)	(0.0081)	(0.0081)	(0.0082)
D(1=Munti-Establishments)	-0.0740**	-0.0740**	-0.0741**	-0.0739**	-0.0742**	-0.0742**	-0.0740**	-0.0738**	-0.0740**
	(0.0368)	(0.0368)	(0.0368)	(0.0368)	(0.0368)	(0.0368)	(0.0368)	(0.0368)	(0.0368)
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	63,784	63,765	63,765	63,784	63,765	63,765	63,784	63,765	63,758
Number of Establishments	20,011	20,006	20,006	20,011	20,006	20,006	20,011	20,006	20,006
Pseudo R2	0.0771	0.0770	0.0770	0.0769	0.0770	0.0770	0.0770	0.0770	0.0770

Note: Standard errors clustered at the establishment level are in the parentheses. The explanatory variables are measured in time $t-1$. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively. The dummy variable of export entry (lag4) takes the value of 1 for $Y_{it}=1, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,-3}=0, Y_{i,t-4}=0$ and 0 for $Y_{it}=0, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,-3}=0, Y_{i,t-4}=0$, where Y_{it} is the export status (1/0) of establishment i in year t. NBR indicates the neighborhood.

Table D.4. Probit Estimation Results for Extensive Margin Analysis (Forward 1, Lag4)

	Dependent Variable: Dummy of Export Entry (forward 1, lag 4)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values+1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta=1$)	MP($\delta=4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters in All Industries	0.0009*	-0.0018	-0.0002	-0.5206	-0.2155	-0.4558	-0.0052	-0.0558	-0.0059
	(0.0005)	(0.0037)	(0.0005)	(0.6672)	(0.3198)	(0.7565)	(0.0046)	(0.0818)	(0.0054)
log(Markup)	0.0812	0.0749	0.0747	0.0763	0.0767	0.0759	0.0743	0.0752	0.0759
	(0.0585)	(0.0585)	(0.0587)	(0.0584)	(0.0584)	(0.0584)	(0.0585)	(0.0584)	(0.0584)
log(TFP)	0.1269***	0.1258***	0.1256***	0.1261***	0.1259***	0.1261***	0.1263***	0.1258***	0.1264***
	(0.0308)	(0.0309)	(0.0309)	(0.0308)	(0.0309)	(0.0308)	(0.0309)	(0.0309)	(0.0309)
log(Employees)	0.3776***	0.3761***	0.3763***	0.3760***	0.3754***	0.3761***	0.3774***	0.3773***	0.3772***
	(0.0766)	(0.0766)	(0.0766)	(0.0766)	(0.0766)	(0.0766)	(0.0766)	(0.0766)	(0.0767)
Log(Wage)	0.2251***	0.2272***	0.2266***	0.2263***	0.2278***	0.2271***	0.2273***	0.2281***	0.2301***
	(0.0663)	(0.0663)	(0.0663)	(0.0663)	(0.0663)	(0.0663)	(0.0663)	(0.0664)	(0.0666)
Log(Capital)	0.0345***	0.0348***	0.0347***	0.0351***	0.0352***	0.0350***	0.0349***	0.0349***	0.0353***
	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)	(0.0100)
D(1=Munti-Establishments)	-0.0882*	-0.0880*	-0.0880*	-0.0873*	-0.0874*	-0.0876*	-0.0877*	-0.0873*	-0.0875*
	(0.0494)	(0.0494)	(0.0494)	(0.0494)	(0.0494)	(0.0494)	(0.0494)	(0.0494)	(0.0494)
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	47,047	46,994	46,994	47,047	46,994	46,994	44,916	46,994	46,994
Number of Establishments	17,990	17,981	17,981	17,990	17,981	17,981	17,378	17,981	17,981
Pseudo R2	0.0965	0.0958	0.0958	0.0960	0.0960	0.0960	0.0962	0.0958	0.0958

Note: Standard errors clustered at the establishment level are in the parentheses. The explanatory variables are measured in time $t-1$. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively. The dummy variable of export entry (forward 1 and lag 4) takes the value of 1 for $Y_{i,t+1}=1, Y_{it}=1, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,t-3}=0, Y_{i,t-4}=0$ and 0 for $Y_{i,t+1}=0, Y_{it}=0, Y_{i,-1}=0, Y_{i,t-2}=0, Y_{i,t-3}=0, Y_{i,t-4}=0$, where Y_{it} is the export status (1/0) of establishment i in year t. NBR indicates the neighborhood.

Table D.5. OLS Estimation Results for Intensive Margin Analysis

	Dependent Variable: log(Export Values)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values+1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters in All Industries	0.0004	0.0005	-0.0007	1.9950***	1.2882***	1.9984**	0.0213***	0.1091	0.0284***
	(0.0005)	(0.0035)	(0.0006)	(0.6675)	(0.3248)	(0.8020)	(0.0062)	(0.0903)	(0.0063)
log(Markup)	0.8856***	0.8822***	0.8742***	0.8793***	0.8714***	0.8760***	0.8866***	0.8853***	0.8838***
	(0.0711)	(0.0712)	(0.0714)	(0.0710)	(0.0710)	(0.0711)	(0.0711)	(0.0712)	(0.0711)
log(TFP)	0.6001***	0.5996***	0.5989***	0.6002***	0.5997***	0.5992***	0.6010***	0.6001***	0.6005***
	(0.0258)	(0.0259)	(0.0258)	(0.0258)	(0.0258)	(0.0259)	(0.0258)	(0.0259)	(0.0259)
log(Employees)	2.9441***	2.9480***	2.9490***	2.9458***	2.9610***	2.9499***	2.9382***	2.9439***	2.9435***
	(0.0844)	(0.0845)	(0.0845)	(0.0843)	(0.0843)	(0.0844)	(0.0844)	(0.0846)	(0.0845)
Log(Wage)	1.2763***	1.2781***	1.2784***	1.2736***	1.2633***	1.2730***	1.2634***	1.2746***	1.2543***
	(0.0759)	(0.0760)	(0.0760)	(0.0759)	(0.0760)	(0.0760)	(0.0759)	(0.0760)	(0.0758)
Log(Capital)	0.1975***	0.1975***	0.1972***	0.1965***	0.1953***	0.1964***	0.1971***	0.1973***	0.1953***
	(0.0110)	(0.0110)	(0.0110)	(0.0110)	(0.0111)	(0.0110)	(0.0110)	(0.0110)	(0.0111)
D(1=Munti-Establishments)	-0.0828**	-0.0837**	-0.0813**	-0.0833**	-0.0853**	-0.0850**	-0.0839**	-0.0846**	-0.0875**
	(0.0400)	(0.0401)	(0.0402)	(0.0400)	(0.0400)	(0.0401)	(0.0400)	(0.0401)	(0.0400)
Establishment Fixed Effect	No	No	No	No	No	No	No	No	No
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	44,197	44,141	44,141	44,197	44,141	44,141	44,191	44,141	44,137
Number of Establishments	10,178	10,166	10,166	10,178	10,166	10,166	10,178	10,166	10,166
Adjusted R2	0.4590	0.4592	0.4593	0.4594	0.4599	0.4595	0.4596	0.4593	0.4602

Note: Standard errors clustered at the establishment level are in the parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

NBR indicates the neighborhood.

Table D.6. Heckman Two-Stage Estimation Results for Intensive Margin Analysis

	Dependent Variable: log(Export Values)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values+1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters in All Industries	0.0004	0.0011	-0.0007	2.0966***	1.3578***	2.1719***	0.0210***	0.0999	0.0163**
	(0.0005)	(0.0035)	(0.0006)	(0.6677)	(0.3254)	(0.8014)	(0.0062)	(0.0905)	(0.0081)
log(Markup)	0.8819***	0.8787***	0.8709***	0.8753***	0.8670***	0.8716***	0.8826***	0.8812***	0.9477***
	(0.0711)	(0.0712)	(0.0714)	(0.0710)	(0.0710)	(0.0711)	(0.0712)	(0.0712)	(0.0869)
log(TFP)	0.6215***	0.6210***	0.6203***	0.6215***	0.6211***	0.6204***	0.6224***	0.6215***	0.1846***
	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0329)
log(Employees)	3.0580***	3.0619***	3.0628***	3.0590***	3.0754***	3.0631***	3.0521***	3.0581***	0.7482***
	(0.0844)	(0.0845)	(0.0845)	(0.0843)	(0.0843)	(0.0844)	(0.0844)	(0.0846)	(0.1099)
Log(Wage)	1.3336***	1.3352***	1.3357***	1.3304***	1.3201***	1.3296***	1.3208***	1.3323***	0.1718*
	(0.0759)	(0.0760)	(0.0760)	(0.0759)	(0.0760)	(0.0760)	(0.0759)	(0.0760)	(0.0946)
Log(Capital)	0.2092***	0.2092***	0.2090***	0.2082***	0.2069***	0.2080***	0.2089***	0.2091***	-0.0339**
	(0.0110)	(0.0110)	(0.0110)	(0.0110)	(0.0111)	(0.0110)	(0.0110)	(0.0110)	(0.0144)
D(1=Munti-Establishments)	-0.0985**	-0.0993**	-0.0970**	-0.0990**	-0.1010**	-0.1006**	-0.0996**	-0.1001**	0.2117***
	(0.0401)	(0.0402)	(0.0402)	(0.0401)	(0.0401)	(0.0401)	(0.0401)	(0.0402)	(0.0510)
Establishment Fixed Effect	No	No	No	No	No	No	No	No	No
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	294,074	293,934	293,934	294,074	293,934	293,934	294,015	293,934	293,890
Number of Selected Obs.	44,197	44,141	44,141	44,197	44,141	44,141	44,191	44,141	44,137
Rho	0.1014	0.1013	0.1013	0.1009	0.1015	0.1007	0.1014	0.1014	-0.9578

Note: Standard errors clustered at the establishment level are in the parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

NBR indicates the neighborhood.

Table D.7. Fixed Effect Estimation Results for Intensive Margin Analysis

	Dependent Variable: log(Export Values)								
	Neighboring Export Variable:								
	Number of Neighboring Exporters			Share of Neighboring Exporters			log(Neighboring Export Values+1)		
	Muni.	2 km	8 km	Muni.	2 km	8 km	Muni.	MP($\delta = 1$)	MP($\delta = 4$)
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NBR. Exporters in All Industries	0.0001	-0.0039	-0.0001	1.0051*	0.3634	1.1796*	0.0050	0.1317	0.0055
	(0.0016)	(0.0044)	(0.0014)	(0.5954)	(0.2704)	(0.6691)	(0.0064)	(0.1076)	(0.0066)
log(Markup)	0.4941***	0.4924***	0.4922***	0.4939***	0.4928***	0.4925***	0.4979***	0.4923***	0.4956***
	(0.0608)	(0.0608)	(0.0608)	(0.0608)	(0.0608)	(0.0608)	(0.0608)	(0.0608)	(0.0608)
log(TFP)	0.3779***	0.3771***	0.3772***	0.3781***	0.3772***	0.3773***	0.3777***	0.3771***	0.3768***
	(0.0163)	(0.0163)	(0.0163)	(0.0163)	(0.0163)	(0.0163)	(0.0163)	(0.0163)	(0.0163)
log(Employees)	2.3418***	2.3513***	2.3514***	2.3433***	2.3519***	2.3516***	2.3408***	2.3524***	2.3517***
	(0.1311)	(0.1310)	(0.1311)	(0.1312)	(0.1310)	(0.1310)	(0.1311)	(0.1311)	(0.1311)
Log(Wage)	0.6273***	0.6295***	0.6294***	0.6263***	0.6291***	0.6285***	0.6306***	0.6297***	0.6331***
	(0.0614)	(0.0614)	(0.0614)	(0.0613)	(0.0614)	(0.0614)	(0.0613)	(0.0615)	(0.0614)
Log(Capital)	0.0347*	0.0321	0.0322	0.0353*	0.0325	0.0324	0.0342	0.0324	0.0316
	(0.0208)	(0.0208)	(0.0208)	(0.0208)	(0.0208)	(0.0207)	(0.0208)	(0.0208)	(0.0207)
D(1=Munti-Establishments)	-0.0392	-0.0395	-0.0396	-0.0392	-0.0399	-0.0393	-0.0391	-0.0397	-0.0394
	(0.0259)	(0.0259)	(0.0259)	(0.0259)	(0.0259)	(0.0259)	(0.0259)	(0.0259)	(0.0259)
Establishment Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	44,197	44,141	44,141	44,197	44,141	44,141	44,191	44,141	44,137
Number of Establishments	10,178	10,166	10,166	10,178	10,166	10,166	10,178	10,166	10,166
Within R2	0.0620	0.0620	0.0620	0.0621	0.0621	0.0621	0.0619	0.0620	0.0619

Note: Standard errors clustered at the establishment level are in the parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent level, respectively.

NBR indicates the neighborhood.

Table E.1. Geocoding Results

Geocoding Accuracy Level	Obs.	Percent
4. Perfect Match with Aza-Chome	6,073	4.27
5. Estimate Match with Block Number	3,878	2.73
6. Perfect Match with Block Number	48,101	33.84
7. Estimate Match with Lot and House Numbers	3,112	2.19
8. Perfect Match with Lot and House Numbers	80,982	56.97
Total	142,146	100

Note: The number of observations corresponds to that of Dummy of Export Entry (lag2) in Table 1. The d ataset covers the period from 2012 to 2019.