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Regional Variations in Productivity Premium of Exporters: Evidence from plant-level data

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Abstract

Exporters are more productive than non-exporters. Although this is a stylized fact, little is known on regional variations within a country. Based on plant-level longitudinal data covering all manufacturing industries in all regions of Japan, this paper finds that the productivity premium of exporters tends to be significantly smaller in regions proximate to the core and in regions with higher market potential. We have also confirmed that our principal findings are consistent with plant-level entry/exit dynamics. The export decision is not completely determined by the firm's own productivity; it is also affected by local market size and export costs.

Keywords: Productivity premium; Exporter; Plant-level data; Distance; Core-periphery structure
JEL Classifications: F1; R12; L25

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1. Introduction

Exporters are more productive than non-exporters. This is a stylized fact already firmly established by many previous studies of a wide range of data sources since Bernard and Jensen (1995).[1] The Economic geography literature, on the other hand, shows that the average productivity of firms/plants is higher in the core than in the periphery, even within the same country. Based on Japanese plant-level longitudinal data, this paper examines whether the productivity premium of exporters relative to non-exporters varies with distance from the core within a country.

The productivity premium of exporters is the most critical ingredient in the heterogeneous-firm trade theory since Melitz (2003). As discussed, for example, by Roberts and Tybout (1997), exporters require "transportation, customs, and shipping services, as well as information on prices, potential buyers, and product standards or requirements in other countries" (p.550). Also, as Amiti and Weinstein (2011) investigate, there are greater risks involved in exporting, which lead exporters to largely depend on trade finance. Among these costs for exporting, shipping and wholesaler services are easily accessible in the core area and many banks provide enough trade finance to firms in central business districts. Likewise, transport costs should be lower when the exporter is located near an international port/airport. Knowledge spillovers from other local exporters should contribute to the improvement of the exporter's knowledge on foreign markets. The profit from domestic sales, which affects a firm's export decision, should also differ widely across regions within the same country. These suggest that the productivity gap between exporters and non-exporters should vary depending on the location.

This paper compares the productivity premium of exporters relative to non-exporters

[1] There is already an extensive survey literature summarizing the research on this topic . Wagner (2012) surveys recent studies since 2006, for example.

across prefectures in Japan. To preview our principal findings, the exporter premium tends to be significantly larger in regions distanced from the core (Tokyo or Osaka) and in regions with lower market potential. This indicates that a firm needs to attain a wider productivity advantage over non-exporters when exporting from remote or poorer regions compared with a firm located proximate to the agglomerated core in the same country. We confirm that our principal findings on prefecture-level exporter premium are consistent with plant-level entry/exit dynamics. Our findings will hopefully enrich the exporter-non-exporter dichotomy in the international trade literature by introducing the core-periphery dimension of economic geography.

While this paper focuses on cross-regional comparison within a country, international comparison is another important research topic on the spatial variations in the exporter premium. The International Study Group on Exports and Productivity (ISGEP) (2008) compares the productivity premium across 14 countries, including both developed and developing countries.[2] Their study finds that "productivity premia are larger in countries with lower export participation rates, with more restrictive trade policies, lower per capita GDP, less effective government and worse regulatory quality, and in countries exporting to relatively more distant markets" (p.596). Our cross-regional comparison complements their cross-country comparison, as we do not need to control for institutional or regulatory variations but still observe substantial market size variations within Japan.[3]

The rest of this paper is organized as follows. Section 2 briefly reviews related studies and explains our motivations for the current research. Section 3 describes our plant-level and regional data and summarizes descriptive statistics. Section 4 reports empirical results from

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2 The developed countries under their investigation are all in Europe, while Chile, China, and Columbia are the developing countries in their sample. Japan is not included in their analysis.

3 Their cross-country analysis of the impacts of regulatory quality and government effectiveness is inevitably affected by measurement errors in constructed proxies. Average tariff is not a sufficiently reliable index for trade openness either.

comparisons of productivity premium across prefectures and discusses their relations with economic geography. Section 5 analyses plant-level dynamics behind observed productivity premium. Section 6 adds discussion and then the final section provides concluding comments.

2. Previous literature and our motivations

This section briefly reviews previous literature on the exporter premium, especially in the geography context, and explains our motivations for the current research.

As we have referred to in the Introduction, ISGEP (2008) is a milestone study on the spatial comparison of the exporter productivity premium. While they compare various countries by constructing proxies for regulatory qualities, we concentrate on the geography effect within Japan. The investigation of Japan, *not* a federated country, is suitable for our purpose, as the central government has a strong authority in imposing nationally common regulation covering all regions. This advantage should be noted, as constructed regulation proxies are inevitably contaminated by measurement errors. Additionally, even though we concentrate on within-country differentials, market size varies sufficiently widely across regions in Japan. For instance, Tokyo or Osaka, as a prefecture, is larger in GDP than many countries in the sample of ISGEP (2008).[4] Consequently, this paper compares regions with virtually uniform regulatory quality but with substantial market size variations.

In another international investigation, Waugh (2009) argues that poor countries face higher costs to export compared with rich countries, and finds that these asymmetric trade frictions are quantitatively important in the observed large income differences across countries.[5]

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[4] Eight out of 14 countries sampled in ISGEP (2008) have a lower GDP than Tokyo and/or Osaka. The countries with a lower GDP than Tokyo as of 2008 are Belgium, Sweden and Austria. The countries with a lower GDP than Tokyo and Osaka are Denmark, Ireland, Slovenia, Columbia and Chile.

[5] Waugh (2009) reports that a good exported from U.S.A. costs 62 percent less (not more due to higher wage costs) than a good exported from the average country. Similarly Pomfret and Sourdin

While his analysis concentrates on the aggregated country-level, we exploit plant-level data.

Another research line closely related with ours is the analysis of local export spillovers.[6] The empirical evidence on this topic, however, has been mixed (e.g. Aitken et al. 1997; Barrios et al. 2003; Bernard and Jensen 2004; Greenaway and Kneller 2008; Koenig et al. 2010).[7] All the previous studies along this line analyzed the impact of other local exporters on the firm's export decision within a given region, but none has examined the exporter productivity premium and its variability with geographic factors, such as the distance from the core.[8]

In another study linking exporting with geography, Lovely et al. (2005) finds that exporter headquarters are significantly more agglomerated when firms export to smaller countries. Their finding indicates that the spatial concentration of corporate headquarters alleviates the information gathering burden for exporting. This paper shares with their analysis an interest in the linkage between intra-national geography and international trade.

The focus on the productivity gap between exporters vs. non-exporters clearly differentiates this paper from previous research on local export spillovers. Our cross-regional comparison within a country helps us concentrate on the geography effect by bypassing numerous and often-unobservable differences in the regulatory environment. As the productivity advantage of exporters is the key component in the new trade theory based on firm

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(2010) find large country-by-country variation of trade costs.

6 While several previous studies analyzed the impact of foreign multinationals on local export spillovers, this paper does not discuss this issue as our plant-level data derived from the Annual Survey has no information on ownership.

7 Aitken et al. (1997) find a significant relation only with *multinational* exporters (not exporters in general) in Mexican states. Barrios et al. (2003) find that R&D spillovers have positive effects on firms' exports but detect little evidence on export spillovers in Spain. For U.S. plants, Bernard and Jensen (2004) report a surprisingly negative or insignificant relation with the state's share of exporters. On the other hand, Greenaway and Kneller (2008) and Koenig et al. (2010) find that the number of exporters in the same area has a significantly positive impact on the firm's export decision in the U.K. and France, respectively.

8 As far as the authors know, almost all the previous research on export spillovers depends on the contrast between within versus out of a prefixed administrative unit. As an exceptional analysis of geographical decay, Koenig et al. (2010) find that the spillover effect is almost three times smaller for a firm locating in the same region but in a different area, where France is divided into 22 broadly-defined regions and 341 detailed areas.

heterogeneity, our focus on this premium will certainly contribute to the improvement of trade theory, especially in its relation with economic geography.

3. Description of data

This section is devoted to the explanation of our micro-data derived from Japan's *Annual Survey of Manufacturers* (Kogyo Tokei in Japanese). This survey covers all the plants with no less than four employees every year across all manufacturing industries. Since the extremely small-sized plants with less than four employees are unlikely to export and produce negligible volumes of output, their omission is unlikely to affect our conclusion on economic geography. We focus on the longitudinal plant-level data from recent surveys available at the time of our research: 2002-2008.[9]

The government's survey contains basic information on plant-characteristics[10], such as output (shipment), export[11], employment (number of regular employees), capital (tangible fixed assets), and material expenditures[12]. As the survey collects data on capital only for plants with no less than twenty employees, we inevitably omit small-sized plants when estimating Total Factor Productivity (TFP).[13]

The territory of Japan is divided into 47 prefectures, each of which roughly corresponds to a NUTS2 region. In the benchmark case, this paper compares the productivity premium of exporters vs. non-exporters across prefectures. As a robustness check, comparable results are reported not only for all prefectures but also for major cities. Every prefecture has its capital city,

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9 This survey had not collected export data until 2000.

10 As the survey collects data from each plant and has no information on corporate headquarters, it is difficult to aggregate our plant-level data to the firm level. Koenig et al. (2010) confirm that the difference between single-plant vs. multi-plant firms is not significant.

11 The destination of export is not identified in the survey. Transaction-level data of custom clearance statistics are not disclosed in Japan.

12 Material expenditures are reported combined with spending on fuel and electricity.

13 In a similar study, Koenig et al. (2010) also omit firms with less than 20 employees in the French case.

by which we measure the distance between prefectures. The central area of Tokyo prefecture is composed of 23 wards (special districts) that are not normally defined as a city per se, ;however, this paper treats these 23 wards combined as a "city." The summary statistics are reported in Table 1.

4. Empirical results from prefecture-level comparisons

4.1. Exporter premium

The productivity premium of exporters relative to non-exporters is estimated for each prefecture by the following regression as in ISGEP (2008):

$$TFP_{jt} = \alpha + \beta \cdot EXP_{jt} + \gamma Z_{jt} + \varepsilon_{jt} . \qquad (1)$$

The plant is indexed by *j*. *TFP* is Total Factor Productivity estimated for each plant by the method of Olley and Pakes (1996) applied to the longitudinal plant-level data for t = 2002 to 2008. Our use of TFP improves the productivity measurement, as ISGEP (2008) depends on labor productivity due to international data constraints. *EXP* is the dummy for exporters (taking the value "1" for plants exporting their products, zero otherwise).[14] The error term is expressed by ε. Equation (1) is estimated for each prefecture by including all the plants located in the prefecture. The coefficient on the exporter dummy β, estimated for each prefecture, is our key parameter: the productivity premium of exporters in the prefecture. Other control variables are summarized by the vector *Z*, which are plant size (employment), its squared term, capital-labor ratio, year dummies, and the two-digit sector dummies.[15] Our result from prefecture-level estimations confirms the established finding: exporters are more productive than non-exporters

[14] We will discuss entry into and exit from exports in Section 5.

[15] Our main results are based on the premium estimated from pooled OLS, as most of the premium is absorbed in plant effects when we estimate the fixed-effects model. Much smaller point estimates by fixed effects compared with pooled OLS are also confirmed by previous studies including ISGEP (2008).

in every prefecture in Japan. The productivity advantages of exporters are reported for all 47 prefectures in Appendix Table.

4.2. Relations with distance and market potential

4.2.1. Scatter plots

This section investigates whether the productivity premium of each prefecture is affected by geographic factors. The first geographic variable we consider is the most direct one: the geographic distance from the core. We define Tokyo and Osaka as the core of the Japanese economy. Many large-sized firms locate their headquarters in the political center Tokyo, partly attracted by the agglomeration of government agencies in the nation's capital. Tokyo accounted for 18% of GDP and 10% of the population of Japan in 2008, while Osaka had 8% of GDP and 7% of the population. Osaka is the center of West Japan due to its legacy as the national commercial center, although recently the Japanese economy has become more mono-centric in the political center Tokyo. This is possibly due to the development of transportations/communication systems and due to globalization.[16] We measure the great-circle minimum distance from Tokyo or Osaka to each prefecture's capital city.

Figure 1 displays 47 prefectures as a scatter plot in the premium-distance space. Though the premia tend to distribute over wider ranges in remote prefectures, this graph clearly shows that the productivity premium of exporters tends to be small in locations proximate to the core.[17] Figure 1 also presents scatter plots for the exporter premium in terms of wage and capital

[16] Osaka has recently been slightly surpassed by Kanagawa in the population ranking, but Kanagawa is located directly adjacent to Tokyo and should be regarded as a part of the Greater Tokyo Metropolitan area.

[17] Export destinations tend to be further than domestic destinations. Based on U.S. plant-transaction data, Holmes and Stevens (2010) report that this distance effect accounts for more than half of the observed plant-size difference between exporters vs. non-exporters.

intensity.[18] In line with the productivity graph, the premium of exporters tends to be smaller in prefectures closer to the core. In other words, exporters are distinctively more productive and intensive in physical and human capital than non-exporters when they are located further from the core.

As another graph in Figure 1, we show the export participation (percentage of exporters among all plants in each prefecture). In prefectures closer to the core, more plants tend to export their products. Combined with the other graphs shown in Figure 1, this indicates that fewer plants pass the productivity threshold for exporting when their locations are further distanced from the core.

Another geographic variable we examine is the market potential (Harris, 1954) defined by the weighted average of income levels of regions, with inverse distance as weights as follows:

$$MP_{rt} \equiv \sum_{m=1}^{47} \frac{GDP_{mt}}{D_{rm}} \qquad (2)$$

where D_{rm} is geographical distance between capitals of prefectures r and m.[19] This index, which varies continuously across all regions, alleviates the possible arbitrariness of our treating Tokyo and Osaka as the core in the previous graph. Figure 2 portrays the relationship with market potential. As expected, the productivity premium of exporters tends to be smaller in regions with richer market potential. As in the previous graph, wider variability is once again observed in regions with low market potential. The same patterns are observed in TFP as well as wage and capital intensity. Figure 2 also shows that more plants tend to participate in exporting

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18 Similar to equation (1), wage is now the dependent variable and then the estimated coefficient of EXP, β, is defined as the wage premium. Wage is defined by total wage payment divided by the number of regular employees. No data disaggregated by skills or occupations are available in the survey. Capital intensity is measured by tangible fixed assets divided by the number of employees.

19 When $m = r$, the internal distance is calculated by $\frac{2}{3}\sqrt{\frac{Area}{\pi}}$ where "Area" denotes area of the prefecture r (See Combes and Overman, 2004).GDP at prefectural level is taken from the Annual Report on Prefectural Accounts (Cabinet Office of Japan).

activity in prefectures with higher market potential. As previous studies have already established that exporters are more productive as well as more capital-intensive and pay higher wages, this paper will concentrate on the relationship between geographic location and the productivity premium in what follows.

4.2.2. Regressions

Table 2 statistically confirms the visual impressions in Figures 1 and 2 by regressions. The dependent variable is the productivity premium of exporters in each prefecture. The right-hand side variables of the regressions are the distance from the core in the first column and the market potential of each prefecture in the second column.[20] As these two variables are highly correlated, we include only one of them, not both in the same regression. The relations observed in the previous two graphs are confirmed statistically significant at any conventional significance level, though we must be cautious in discussing regression results from the limited number in the sample (47 prefectures).[21] These cross-regional results are consistent with international comparisons of the relations with distance by ISGEP (2008), while we have additionally considered the market potential of each region.

Next, this paper adds other relevant variables to the regressions. First, we examine the impact of regional income differences. Column (3) of the table shows the significantly positive effect of GDP per capita of the region. While ISGEP (2008) found that exporter premium is larger in poorer countries, their regressions do not control for market potential. As in Europe, high-income countries are often located in regions of the world with higher market potential. Our regression disentangles the home regions income from the incomes of surrounding regions

[20] To check the non-linearity, we have also included squared-term but found it insignificant (omitted from the table).
[21] Although we have also added them in our regressions, squared terms of distance and of market potential turn out to be statistically insignificant.

(inversely-weighted by distance). The regression result shows that the productivity premium of exporters is especially large in rich regions with low market potential. This finding is consistent with the interpretation that only highly-productive firms export their products in such regions since many firms earn a lot from the local market and find difficulties selling to other regions. On the other hand, many firms, including those with relatively low-productivity, are exporting from low-income regions with high market potential.

Second, this paper investigates the impact of regional differences in factor endowments. This analysis is motivated by the standard Heckscher-Ohlin international trade theory. As shown in column (4) of Table 2, the capital-labor ratio is not statistically significant.[22] Although we have replaced the capital-labor ratio by labor, capital, or public capital, none are significantly related with the exporter premium (omitted from the table for brevity). Endowment differentials are not controlled for in the international comparison by ISGEP (2008). As cross-regional differentials in factor endowments are naturally narrower within Japan than those between different countries, the insignificant relationship with factor endowments is as expected.

As local export spillovers have been extensively examined in the existing literature, this paper next adds the share of exporters in the region. As shown in column (5) of Table 2, the productivity premium is not significantly related with the export participation ratio of the prefecture.[23] The local exporter share remains insignificant even if we replace market potential by distance from the core. This finding of an insignificant local export spillover effect is consistent with other plant-level studies by Aitken et al. (1997) on Mexico, Barrios et al. (2003) on Spain and Bernard and Jensen (2004) on U.S., although previous reviews have shown the existing evidence to be mixed. This result can be regarded as additional support for our focus on

[22] Capital and labor at prefectural level is taken from the Annual Report on Prefectural Accounts (Cabinet Office of Japan).

[23] Our prefecture-level result does not necessarily exclude the possibility of spillovers at a more local level such as those in the neighborhood.

the distance effect instead of the dichotomy between the same vs. other regions.

Based on these preliminary results, we re-estimate the export premium using equation (1). However, unlike previous prefecture-by-prefecture estimations, we now pool all plants in Japan and instead take into account the distance from Tokyo and Osaka. Table 3 reports the results from the regression including the interactive term between the exporter dummy and distance. The magnitudes reported in column (3) indicate that the negative effect of distance from the core is substantial for non-exporters but negligible for exporters, as the positive coefficient on the interactive term for exporters offsets the negative coefficient on distance.

The last column of this table introduces the interactive term with the dummy for the core-periphery regions. The average productivity of exporters in the core is not considerably different from that of exporters in the periphery.[24] On the other hand, non-exporters in the core are on average substantially more productive than non-exporters in the periphery. Therefore, as shown in columns (3) and (4), the observed regional difference in the productivity premium of exporters relative to non-exporters is mainly driven by 1) the core-periphery productivity gap among non-exporters and 2) small core-periphery gap among exporters.

First, the productivity premium in the regions proximate to the core is likely to be slimmer since the productivity of any plant, not only exporter but also non-exporters alike, tends to be higher in the core either due to agglomeration externality economies or self-selection of productive firms, as Combes et al. (2010) investigate in French cities. Then, although plants located in the core are productive on average, the threshold productivity level for exporting appears to be common irrespective of the location of the exporter. Profits from shipments to large domestic markets in the core or in surrounding rich regions might induce firms to

[24] Here, core is defined as Greater Tokyo (Tokyo, Kanagawa, Saitama, and Chiba), Greater Osaka (Osaka, Kyoto, and Hyogo) and Aichi prefecture.

concentrate on domestic sales.[25] While the data limitation prohibits us from identifying the specific mechanism, there are ample reasons for our observed regional variations in productivity premium of exporters.

4.2.3. Productivity distributions

While we have examined the premium in terms of averages, the distributional information will enrich our investigations. Figure 3 displays Kernel-smoothed density graphs of TFP distributions of exporters versus non-exporters for representative prefectures.[26]

The contrast is obvious between core and periphery. In the core (Tokyo and Osaka), the productivity distribution of exporters largely overlaps with that of non-exporters, although that of exporters appears slightly to the right of that of non-exporters. The heavy overlap of distributions between exporters and non-exporters is also observed at the more detailed city level in Tokyo and Osaka. In contrast, the gap between distributions is apparently sharp in peripheral prefectures (Miyazaki and Kochi in this figure). This visual impression is clearly consistent with our previous results from the productivity premium based on the averages. The graphs also suggest that the core-periphery gap in the productivity premium appears to be due to the relatively high productivity of non-exporters in the core rather than the low productivity of exporters in the periphery. This interpretation is consistent with our view that agglomeration economies improve productivity of plants irrespective of their exporting status.

4.2.4. Comparison of cities

[25] High-productivity plants agglomerate in the core but low-productivity plants are dispersed over periphery. Productive plants are sensitive to variations in market access while market-crowding effects of regional competition are the same for plants at any productivity level, as Saito et al. (2011) theoretically show.

[26] Okubo and Tomiura (2012) finds that industrial policies for relocating plants out of congested cores affect productivity distributions by attracting relatively unproductive plants in the case of Japan.

To check the robustness of our results from prefecture-level comparisons, this section compares more detailed geographic units: cities. We focus on the following major cities: (a) capital cities of prefectures, (b) cities with no less than 0.2 million population, and (c) other economic centers.[27] To concentrate on industrial locations, we exclude commuter towns (residential cities located in suburban areas for people commuting to urban centers) even if they have more than 0.2 million residents. Figure 4 plots the exporter premium and the distance from the core at the city level. This graph clearly echoes our previous finding at the prefecture level.[28]

5. Plant-level analyses

While the previous section has compared the exporter premium at the aggregated prefecture level, this section examines variations at the individual plant level. We investigate entry/exit dynamics as well as productivity growth of individual plants. We also distinguish plants operated as the single plant of the firm from multiple plants. The propensity-score matching method is applied to select comparable plants. These plant-level analyses are critical in controlling for plant heterogeneity.

5.1. Entry/exit dynamics at the plant level

The analysis of the plant's export entry/exit is important since productivity comparison might be complicated by plant-level dynamics. Especially in the comparison with exporters, this issue should not be ignored. As suggested in the learning-by-exporting literature such as Roberts and Tybout (1997), exporters are likely to raise their productivity after the start of their exporting. We need to control for this effect in our comparison of the exporter premium.

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[27] The list of cities in the category (c) is available upon request.

[28] The statistical significance of this negative relation is safely confirmed by the cross-city regression.

Table 4 reports the estimation results from a random-effect panel probit specified below:

$$EXP_{jt} = \alpha + \beta \cdot TFP_{j,t-1} + \gamma \cdot SIZE_{j,t-1} + \delta_1 EXP_{j,t-1} + \delta_2 EXP_{j,t-2} + u_{jt}\,. \qquad (3)$$

The dependent variable *EXP* is the exporter status (the export dummy taking the value one when the plant is exporting). The plant size *SIZE* is measured in terms of employment. Sector dummies are also included. The error term is denoted by *u*. The plant and the year are indexed by *j* and *t*, respectively. The same specification shown above is estimated at the plant level separately for core and periphery, as the productivity premium differs across regions. The persistent effect of past export experience is confirmed as in previous studies (e.g. Robert and Tybout, 1997). The most notable result in Table 4 is that, while TFP is significantly positive in peripheral regions (defined in various ways), TFP turns out to be insignificant in Tokyo or Osaka, at prefecture or city level. Furthermore, even among the regions outside of Tokyo-Osaka, the estimated coefficient on TFP is largest in the most peripheral regions and relatively low in regions closer or adjacent to Tokyo or Osaka.[29] This finding of a statistically significant effect of productivity in the previous year on the export decision in the next year only in peripheral regions is line with our previous finding of a larger productivity premia of exporters in those regions.

Next, we examine the plant's exit from exporting in order to complement the entry analysis reported above. Similar to equation (3), Table 5 displays the random-effect panel probit results with the exit dummy as the dependent variable. On the right-hand side of the regression, we include plant's TFP as well as plant size, plant's average wage, and region's exporter share

[29] Prefectures in the "Periphery 1" category are distanced from Tokyo or Osaka by more than 300 kilometers and have no city with more than one million population. Prefectures having cities with more than one million population are added to the "Periphery 2" group. In both cases, Okinawa prefecture is excluded. "Periphery 3" are prefectures distanced from the three industrial centers (Tokyo, Osaka, or Nagoya city (in Aichi prefecture)) by more than 100 kilometers. "Core+Surrounding" is defined as Aichi, Greater Tokyo (Tokyo, Kanagawa, Saitama, and Chiba), and Greater Osaka (Osaka, Kyoto, and Hyogo).

(all one-year lagged). Year dummies and sector dummies are also added but omitted from the table. As in the previous table, we detect the significant effect of TFP on exit from exporting only in peripheral regions, though the statistical significance appears to be partly affected by the definition of periphery in this case. We also find that smaller plants and plants in regions with fewer exporters are significantly more likely to exit from exporting.

5.2. Plant productivity growth

This section examines the effect of export entry/exit on the plant's productivity growth by the following plant-level regression:

$$Gr\left(TFP_{jt}\right) = \alpha + \beta \cdot ExpDynamics_{jt} + \gamma_1 Size_{jt-1} + \gamma_2 TFP_{jt-1} + v_j \,. \qquad (4)$$

The dependent variable is the TFP growth from the previous year. *ExpDynamics* represents the vector of dummies for exporter status transition (start, keep, or stop exporting) from the previous year. Plant size and TFP, both one-year lagged, are included as additional controls. Year dummies and sector dummies are also added. The error term is denoted by *v*.

Table 6 displays the fixed effect regression results. In Tokyo or Osaka, at prefecture or city level, the effect of starting to export or continuing to export is not statistically significant, although productivity significantly declines in plants after they stop exporting. On the other hand, a significant positive impact on productivity growth is observed in plants starting or continuing to export when they operate in the peripheral regions. As in the previous table, among the regions outside of Tokyo-Osaka, the magnitude of the estimated coefficient on *START* or *KEEP* decreases with the proximity to the core. This result cements the robustness of our previous findings on the productivity premium.

5.3. Robustness

5.3.1 Single vs. multiple plants

While all plants have been combined in our analyses, this section investigates whether a plant is operated as the single plant or one of multiple plants of the firm, and how this affects our previous findings on the export-productivity relationship. As export decisions of other plants operated by the same firm are likely to affect whether or not the plant exports its product, the impact of productivity on exporting should be diluted in firms with multiple plants. The *Annual Survey of Manufactures* identifies whether each plant is a single plant or one of multiple plants of the firm, though the survey contains no data on the firm (corporate headquarters) or other plants under the same ownership.[30]

Table 7 reports the coefficient on TFP in the equations (3) and (4) estimated separately for single plants and multiple plants. As expected, the TFP coefficient in the export decision regression is estimated larger in the single-plant case than in the case of multiple plants in any periphery. As a more important point to note, in both the upper panel for the export decision equation (3) and the lower panel for the productivity growth equation (4) in Table 7, we confirm the previous finding; the relationship with TFP is statistically significant only in the periphery, defined in various ways. Consequently, our principal result on the core-periphery gap remains robust even if we control for possible differences between single plant firms and plants that are part of multiple plant firms.

5.3.2. Propensity-score matching of plants

We employ the matching technique to select a pair of comparable plants from our sample. The matching is important since exporters and non-exporters may differ due to various factors unobservable for econometricians. Among many heterogeneous non-exporters, we select similar

[30] As a result, one cannot aggregate our plant data to the firm level or link data of multiple plants operated by the same firm.

plants for comparison with exporters. Similarly, plants located in the core and those in peripheral regions may differ according to unobservable factors other than TFP. To consider these differences, we conduct two ways of matching as reported below.

First, Table 8 presents the average effect of the treatment on the treated group (exporters in this case), namely ATT, in logarithm TFP within each region. We select comparable plants based on propensity scores and compare the average productivity of exporters relative to non-exporters within this limited sample for each region (with core or periphery defined in various alternative ways). ATT reported in this table confirms that the difference between exporters and non-exporters is statistically significant only in periphery, however we define the periphery (city or prefecture level). The differential increases in locations more distanced from the core among the peripheries variously defined. Thus, our previous results are confirmed even after plant matching.

Second, Table 9 reports ATT with plants located in the core as the treatment group. The average productivity of the plants in the core is compared with that of plants in other regions combined (in upper panel) or that of plants in the periphery defined in three ways (Periphery 1, 2, and 3) (in lower panel of Table 9) within exporters, non-exporters, and irrespective of the plant's exporting status, respectively. The stylized fact of high average productivity in the core is confirmed in the "All" column. The most notable point in this table is, however, that the average productivity is significantly higher in the core among non-exporters but not among exporters. In our sample, exporters in the core turn out to be rather unproductive compared with exporters in the periphery. This result is consistent with our regression previously reported in Table 3. We have confirmed that the core-periphery productivity gap is driven by non-exporters. This finding is in line with our prior, as the productivity of non-exporters tends to be highly sensitive to local markets. The observed cross-regional variations in exporter premium are thus likely to be strongly influenced by differences in local market conditions.

6. Discussions

Although it is difficult to pin down the exact causal mechanism within our limited data, our findings show that the export decision is not completely determined by productivity, as simplified by Melitz (2003), but also significantly affected by local market size. Productive firms become exporters if they are in poor regions or regions with low market potential, but comparably productive firms located in cores may concentrate on local sales. Large local market size or profitable domestic sales appears to prevent productive firms from engaging in risky export operations, which are exposed to unpredictable exchange rate fluctuations, risks in export markets and costly information gathering. Firms in the periphery face difficulties in finding profitable market opportunities in the home country, possibly due to costly domestic transport to distanced core markets or due to intense competition among local rival firms over limited local markets.

As another interpretation, export costs might be lower for firms in the core than in the periphery. Related to the current trade literature, one possible reason for this could be varying access to trade finance, while another explanation stems from access to intermediaries for facilitating trade. As discussed in Amiti and Weinstein (2011), trade finance is definitely important for exporters: “exporters depend on trade finance to make sales abroad because of the greater risks associated with exporting coupled with the higher need for working-capital finance (p.1858)”. As a result, trade finance by healthier banks can increase firm’s exports. Turning to our study, distance from core within Japan has a negative correlation with bank access. Appendix Figure 1 plots distance from core and bank access at prefectural level. As a firm’s location moves closer to central Tokyo and Osaka, the firm is more likely to have better access to trade finance, facilitating exports. Even if they are not productive in the core, their location in the core gives them export status. The second interpretation calls on the use of intermediaries as proposed by Ahn et al.(2011). Smaller firms can access export markets by using intermediaries (e.g. wholesalers) and this helps expand the extensive margin of trade. Using this conjecture, the core in Japan has more wholesales while there are less in the periphery (See Appendix Figure 2). Thus firm's located closer to the core find it easier to enter export markets by using intermediaries. Using these interpretations, we suggest that export status in the core is not completely decided by productivity but influenced by large local market size and lower export costs and thus the exporter's premium is slim in the core.

The interpretation introduced above appears plausible, but we need to be careful before reaching the final conclusion for the following reasons. First, productive firms are likely to concentrate in the core through self-selection. Then, firms in the core and periphery are heterogeneous irrespective of their export status. Second, with our limited data from the manufacturing survey, we cannot control for variations in transport costs across various export destinations. The threshold productivity level for exporting is likely to be higher when the firm exports to distanced countries with little information. Furthermore, since export costs and financial information are not included in the manufacturing survey, we cannot investigate export behaviors in more detail. It will be informative if future studies are able to disentangle these effects.

7. Concluding remarks

This paper has investigated how the productivity advantage of exporters compared with non-exporters differs across locations within Japan. Our plant-level estimation results have demonstrated that the productivity premium tends to be significantly larger when the plant is located in a region with lower market potential or one that is distanced further from the core. Relatively productive plants in the core choose to concentrate on the domestic market. This finding has deep implications for various policy areas such as export promotion, international competitiveness, or regional development. To derive time-series variations, it will be fruitful to investigate a natural experiment case, such as before-vs.-after the drastic trade liberalization that has occurred in recent decades. This is one of the prime tasks left for future research.

Acknowledgement

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Reference

Ahn, J.B, Khandelwal, A.K. and Wei, S-J. (2011) “The role of intermediaries in faciliating trade”, *Journal of International Economics* 84, 73-85.

Aitken, B., Hanson, G., and Harrison, A. (1997) “Spillovers, foreign direct investment, and export behavior,” *Journal of International Economics* 43, 103-132.

Amiti, M and Weinstein, D.E. (2011) “Exports and Financial Shocks”, *Quarterly Journal of Economics* 126, 1841-1877.

Barrios, S., Görg, H., and Strobl, E. (2003) “Explaining firms’ export behaviour: R&D, spillovers and the destination market,” *Oxford Bulletin of Economics and Statistics* 65(4), 475-496.

Bernard, A., and Jensen, J.B. (1995) “Exporters, jobs, and wages in U.S. manufacturing:

1976-1987," *Brookings Papers on Economic Activities: Microeconomics 1995*, 67-119.

Bernard, A., and Jensen, J.B. (2004) "Why some firms export," *Review of Economics and Statistics* 86 (2), 561-569.

Combes, P.-Ph., Duranton, G., Gobillon, L., Puga, D., and Roux, S. (2010) "The productivity advantages of large cities: Distinguishing agglomeration from firm selection," CEPR Discussion Paper.

Combes, P., and Overman, H. (2004) "The spatial distribution of economic activities in the European Union," In: Henderson, J., and Thisse, J. (Eds), *Handbook of Regional and Urban Economics*, Vol.4, Elsevier, 2845-2909.

Greenaway, D., and Kneller, R. (2008) "Exporting, productivity and agglomeration," *European Economic Review* 52, 919-939.

Harris, C. (1954) "The market as a factor in the localization of industry in the United States," *Annals of American Geographers* 64, 315-348.

Holmes, T., and Stevens, J. (2010) "Exports, borders, distance, and plant size," NBER Working Paper No.16046.

International Study Group on Exports and Productivity (ISGEP) (2008) "Understanding cross-country differences in exporter premia: Comparable evidence for 14 countries," *Review of World Economics* 144(4), 596-635.

Koenig, P., Mayneris, F., and Poncet, S. (2010) "Local export spillovers in France," *European Economic Review* 54, 622-641.

Lovely, M., Rosenthal, S., and Sharma, S. (2005) "Information, agglomeration, and the headquarters of U.S. exporters," *Regional Science and Urban Economics* 32, 167-191.

Melitz, M. (2003) “The impact of trade on intra-industry reallocations and aggregate industry productivity, “ *Econometrica* 71(6), 1695-1725

Olley, S., and Pakes, A. (1996) “The dynamics of productivity in the telecommunications equipment industry,” *Econometrica* 64, 1263-1297.

Okubo, T., and Tomiura, E. (2012) “Industrial relocation policy, productivity, and heterogeneous plants: Evidence from Japan,” *Regional Science and Urban Economics* 42, 230-239.

Pomfret, R. and Sourdin, P. (2010) “Why do trade costs vary”, *Review of World Economics* 146, 709-730.

Roberts, M., and Tybout, J. (1997) “The decision to export in Columbia: An empirical model of entry with sunk costs,” *American Economic Review* 87(4), 545-564.

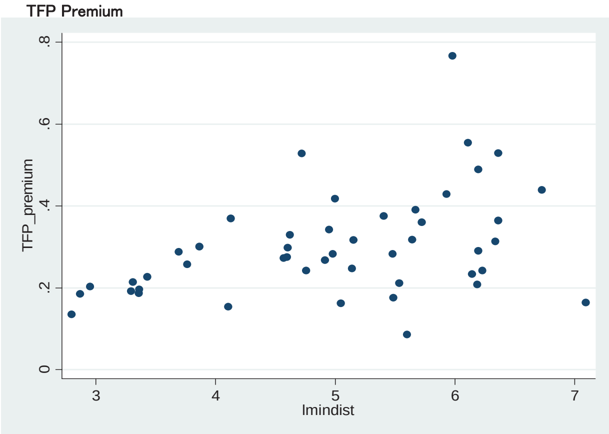
Saito, H., Gopinath, M., and Wu, J. (2011) “Heterogeneous firms, trade liberalization, and agglomeration,” *Canadian Journal of Economics* 44(2), 541-560.

Wagner, J. (2012) “International trade and firm performance: a survey of empirical studies since 2006,” *Review of World Economics* 148, 235-267.

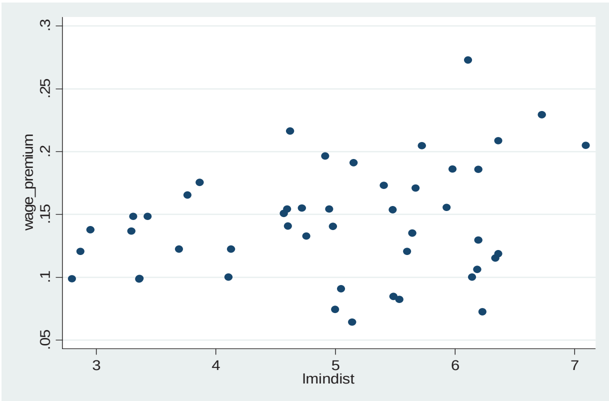
Waugh, M. (2009) “International trade and income differences,” *American Economic Review* 100(5), 2093-2124.

Figure 1: Exporter Premium and Distance from Core (Tokyo or Osaka)

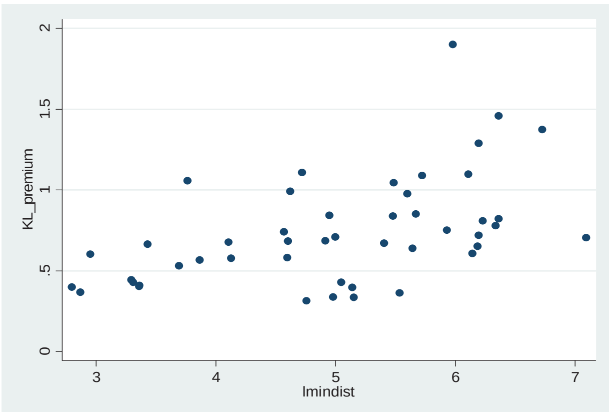
TFP Premium



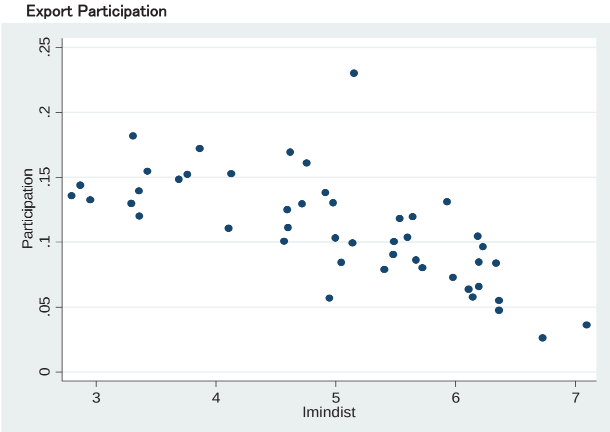
Wage Premium



Capital Intensity Premium



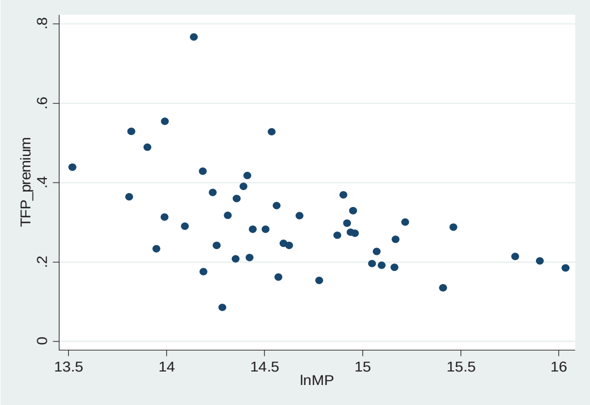
Export Participation



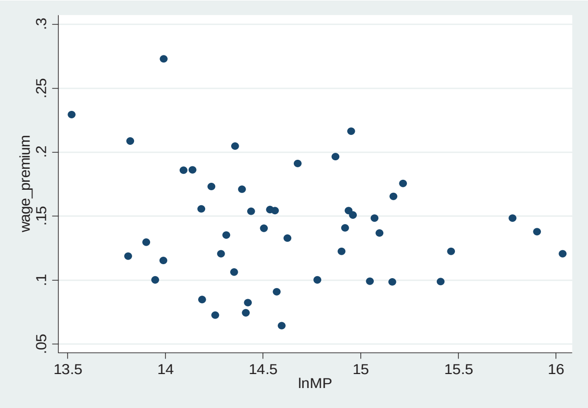
(Note) Minimum distance from Tokyo or Osaka in logarithm is measured on the horizontal axis.

Figure 2: Exporter Premium and Market Potential

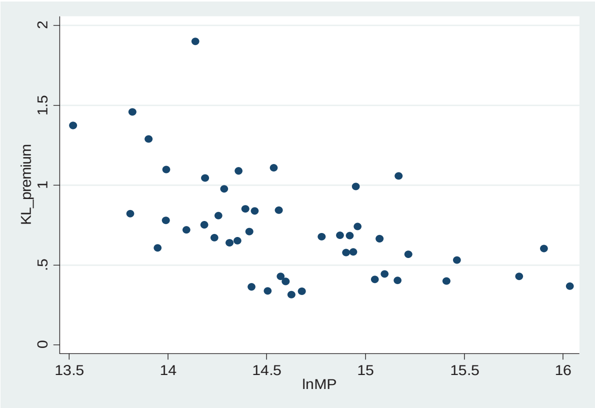
TFP Premium



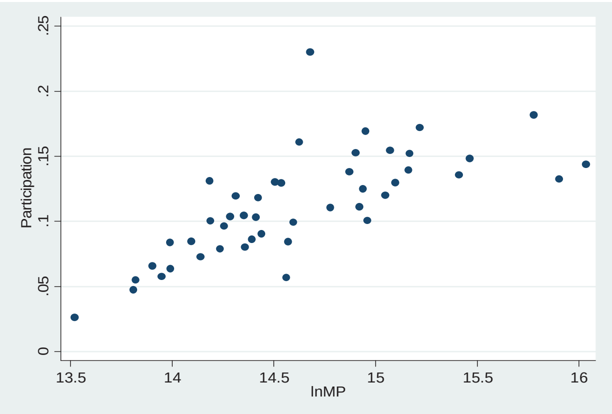
Wage Premium



Capital Intensity Premium



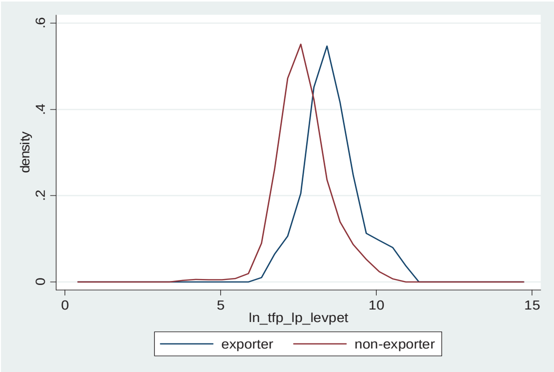
Export Participation



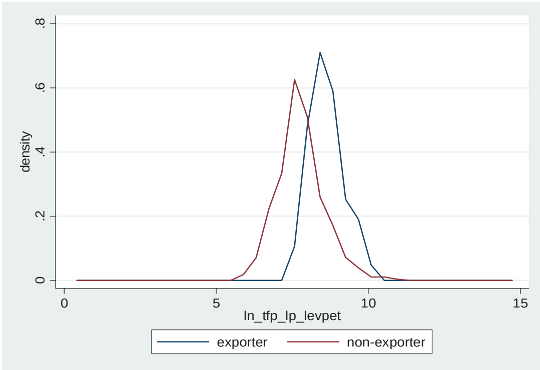
(Note) Market potential is measured in logarithm.

Figure 3: Productivity Distributions of Exporters and Non-exporters

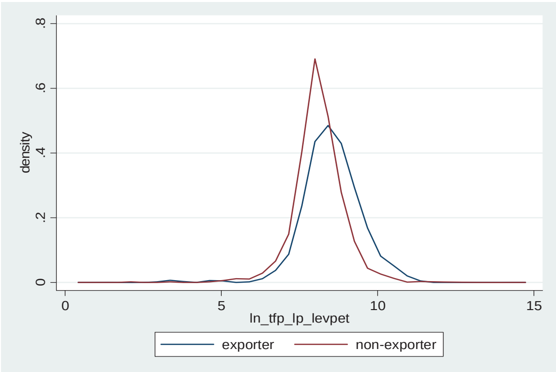
Miyazaki Prefecture



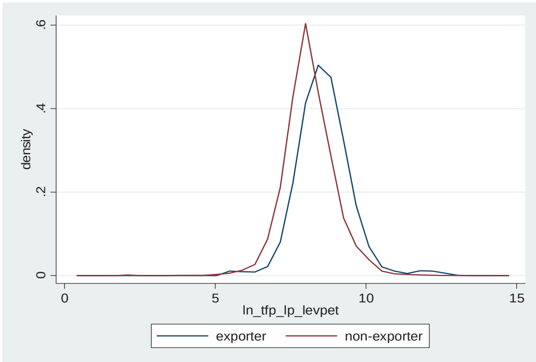
Kochi Prefecture



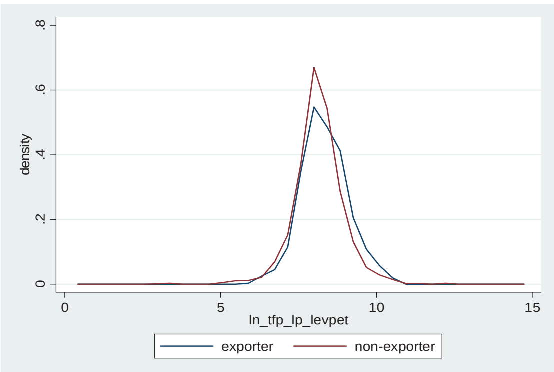
Tokyo Prefecture



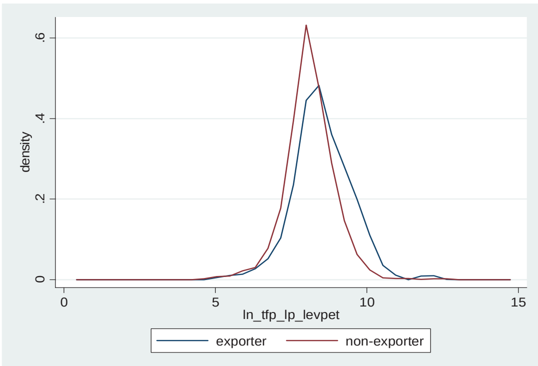
Osaka Prefecture



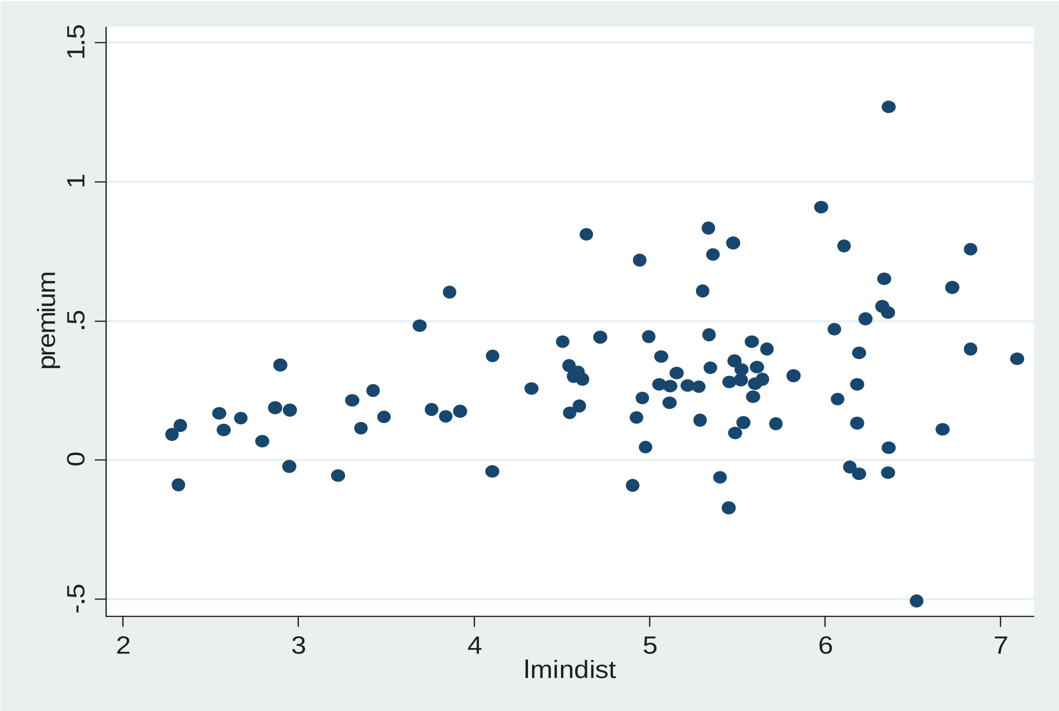
Tokyo City



Osaka City



Figutre 4:　Exporter Premium and Distance at City Level



(Note) Minimum distance from Tokyo or Osaka is measured in logarithm.

Table 1: Basic Statistics

1. Export premium regressions (Prefectural level estimations)

Variable	Obs	Mean	Std.Dev	Min	Max
Premium	47	0.300344	0.12827	0.086009	0.767464
MP (ln)	46	14.62583	0.56638	13.52054	16.03332
Export share	47	0.110955	0.041309	0.026338	0.230159
Income (ln)	47	7.904988	0.140846	7.621653	8.395555
DIST (ln)	47	4.985536	1.140537	2.795177	7.092491
KL (ln)	47	0.938339	0.697684	−0.62783	3.090251

2. Plant level regressions

	Obs	Mean	Std Dev	Min	Max
Exp	325831	0.099015	0.298682	0	1
KL (ln)	325828	5.364978	2.26062	−6.78559	14.03347
Keep	325831	0.083273	0.276295	0	1
Start	325831	0.015741	0.124473	0	1
Stop	325831	0.009192	0.095433	0	1
TFP (ln)	317139	8.059051	0.899087	−5.83914	14.67323
Size (ln)	325831	4.369859	0.79167	0	9.960671
Wage (ln)	325814	5.906991	0.446116	0.750306	12.76187

Table 2: Regressions of Exporter Premium

	1		2		3		4		5	
	coeff	t-value	coeff	t-value	coeff	t-value	coeff	t-value	coeff	t-value
Distance	0.0595	17.74 ***								
MP			−0.111	−3.73 ***	−0.155	−3.66 ***	−0.156	−3.68 ***	−0.132	−2.64 **
Income					0.3252	4.15 ***	0.3325	4.22 ***	0.2885	3 ***
K/L							−0.027	−1.01		
ExporterShare									−0.378	−0.67
Sample	47		46		46		46		46	
R-sq	0.872		0.2401		0.882		0.8855		0.884	
F	314.68		13.9		165.75		110.9		109.27	

(Note) Statistical significance at 1%, 5%, and 10% are expressed by ***, **, and *, respectively.
Okinawa prefectures are dropped in columns (2) to (5)

Table 3: Regressions with Interactive Terms

	1			2			3			4		
	coeff	t-value		coeff	t-value		coeff	t-value		coeff	t-value	
Exp	0.27431	59.58	***	0.26316	57.47	***	−0.06332	−3.77	***			
Exp_Dist							0.07747	20.22	***			
Dist				−0.06976	−80.32	***	−0.07386	−82.84	***			
Exp_Core										0.32489	49.54	***
Exp_Periphery										0.34585	58.1	***
NonExp_Core										0.15707	70.57	***
Sample	545847			545847			545847			545847		
R-sq	0.54			0.54			0.54			0.54		
F	19175.45			19021.17			18503.19			18387.4		

(Notes) All plants in all prefectures are pooled. Dependent variable is TFP. OLS estimation.

$TFP = \alpha + \gamma Z + \beta_1 Exp + \beta_2 Exp\_Dist + \beta_3 Dist$

Coefficients on other variables (size, its squared term, capital-labor ratio, year dummies and sector dummies) are omitted.

Exp_Dist is interractive term of export dummy and the minimum distance from Tokyo or Osaka

Exp_Core (Exp_Periphery) is interactive term of export dummy and core (periphery) dummy.

NonExp_Core is interractive term of non-export dummy and core dummy

Statistical significance at 1%, 5%, and 10% are expressed by ***, **, and *, respectively.

Table 4: Plant-level Regression Results on Export Decision

	Periphery 1		Periphery 2		Periphery 3		Core+Surrounding	
	coeff	z-value	coeff	z-value	coeff	z-value	coeff	z-value
Export t-1	2.4526	30.84 ***	2.4369	39.86 ***	2.4215	76.64 ***	2.2901	79.99 ***
Export t-2	1.121	10.41 ***	1.1331	16.23 ***	1.0491	31.75 ***	1.0326	34.96 ***
TFP t-1	0.1841	5.28 ***	0.1812	7.09 ***	0.1743	12.44 ***	0.0877	6.66 ***
Size t-1	0.0614	1.77 *	0.0881	3.38 ***	0.0908	6.45 ***	0.171	13.1 ***
N of obs.	21161		37129		95246		75775	
N of plants	5114		8973		22925		18396	
Log-likelihood	-1495.2		-2521.3		-8663		-9443.8	
Wald Chi-2	2456.06		5027.69		21158		21609.4	

	Tokyo Pref		Osaka Pref		Tokyo City		Osaka City	
	coeff	z-value	coeff	z-value	coeff	z-value	coeff	z-value
Export t-1	2.5409	24.99 ***	2.1392	32.28 ***	2.5485	18.78 ***	1.9989	16.38 ***
Export t-2	1.0244	9.46 ***	0.9917	14.6 ***	0.9526	6.56 ***	1.0276	8.13 ***
TFP t-1	0.0271	0.62	0.0554	1.67 *	0.0135	0.22	0.0494	0.82
Size t-1	0.2276	5.02 ***	0.2156	6.24 ***	0.1725	2.3 **	0.379	5.28 ***
N of obs.	7615		13126		4736		3734	
N of plants	1906		3231		1195		931	
Log-likelihood	-786.06		-1739.2		-443.7		-493.78	
Wald Chi-2	1918.61		3555.73		1020.3		871.45	

(Notes) Random-effect probit results are shown. Year dummies and sector dummies are omitted.
Statistical significance at 1%, 5%, and 10% are expressed by ***, **, and *, respectively.
Periphery 1is defined as prefectures located more than 300km far from Tokyo or Osaka.
(excluding Okinawa and prefectures having cities with more than one million population (Hokkaido, Miyagi and Fukuoka)
Periphery 2 is defined as prefetcures located more than 300km far from Tokyo or Osaka (excluding Okinawa).
Periphery 3 is defined as prefectures located more than 100km far from Tokyo or Osaka or Nagoya.
Core+Surrounding is defined as Tokyo, Saitama, Chiba, Kanagawa, Aichi, Hyogo, Osaka and Kyoto.

Table 5: Exit from Exporting

	Periphery 1		Periphery 2		Periphery 3		Core+Surrounding	
	coefficient	z-value	coefficient	z-value	coefficient	z-value	coefficient	z-value
TFP	-0.18595	-1.91 *	-0.11008	-1.43	-0.11046	-3.04 ***	-0.00145	-0.05
Size	-0.23331	-2.68 **	-0.14868	-2.25 **	-0.12528	-4.02 ***	-0.24682	-8.53 ***
Wage	0.11914	0.56	-0.05259	-0.32	-0.16823	-2.03 **	-0.2129	-2.96 ***
Exporter share	-1.25558	-3.72 ***	-1.3881	-4.9 ***	-1.27291	-9.92 ***	-1.44469	-10.29 ***
N of obs	1532		2564		9830		11061	
N of groups	421		715		2690		3148	
Loglikelihood	-457.774		-780.855		-3018.75		-3562.31	

	Tokyo & Osaka Prefectures		Tokyo Prefecture		Osaka Prefecture	
	coefficient	z-value	coefficient	z-value	coefficient	z-value
TFP	0.08792	1.38	0.0835	0.61	0.11337	1.47
Size	-0.27024	-4.4 ***	-0.28225	-2.26 **	-0.27739	-3.86 ***
Wage	-0.20112	-1.37	-0.14077	-0.54	-0.11326	-0.61
Exporter share	-1.08316	-3.96 ***	-2.3006	-3.48 ***	-0.6209	-2.05 **
N of obs	2847		1061		1786	
N of groups	847		305		542	
Loglikelihood	-985.474		-250.449		-694.656	

(Notes) Year dummies and sector dummies are included but omitted.
All independent variables are one-year lagged. All exporters at the previous year are covered.
Dependent variable is dummy for exit of exporting. If a plant stops export, the dummy takes unity.

Table 6: Regressions of Productivity Growth

	Periphery 1		Periphery 2		Periphery 3		Core+Surrounding	
	coeff	t-value	coeff	t-value	coeff	t-value	coeff	t-value
Keep	0.07986	3.28 ***	0.0527	2.6 ***	0.03276	3.24 ***	0.00997	3.08 ***
Stop	0.03281	1.09	0.01825	0.71	0.02984	2.41 **	0.0119	−1.21
Start	0.0715	3.01 ***	0.04538	2.27 **	0.02623	2.62 ***	0.00977	3.14 ***
N of plants	25812		44510		116294		93609	
R-sq	0.5055		0.5116		0.5003		0.5078	
F	460.73		815.6		1989.25		1541.27	

	Tokyo& Osaka Pref		Tokyo City		Osaka City	
	coeff	t-value	coeff	t-value	coeff	t-value
Keep	0.01582	0.84	0.02626	0.55	0.00181	0.08
Stop	−0.0563	−2.6 **	−0.0452	−0.73	−0.0407	−1.7 *
Start	0.00678	0.38	−0.0476	−1.02	−0.0005	−0.03
N of plants	25903		5938		16282	
R-sq	0.5273		0.5339		0.5163	
F	477.06		118.68		288.11	

(Notes) Fixed-effect plant-level regression results are shown. See Table 4 for definition of periphery.
TFP, plant size (at time t-1), year dummies, sector dummies are included but omitted from the table.
See notes to Table 4.

Table 7: Multi-plant v.s. Single-plant in TFP Impacts

1. Export Decision (Estimated TFP Coefficients Only)

	Periphery 1 TFP Coefficients	Periphery 2 TFP Coefficients	Periphery 3 TFP Coefficients	Core+Surrounding TFP Coefficients	Tokyo Prefecture TFP Coefficients	Osaka Prefecture TFP Coefficients
Multi-plant	0.1105 **	0.1136 ***	0.0833 ***	0.0254	−0.021	−0.0002
Single-plant	0.209 ***	0.1408 ***	0.1486 ***	0.0554 **	−0.0305	0.0046

(Notes) All other variables are omitted.
z-values are omitted

2. Productivity Growth (Estimated Coefficients Only)

		Periphery 1 Coefficient	Periphery 2 Coefficient	Periphery 3 Coefficient	Core+Surrounding Coefficient	Tokyo Prefecture Coefficient	Osaka Prefecture Coefficient
	Keep	0.0674 *	0.0628 **	0.033 **	0.0231	0.1192 **	−0.0329
Multi-plant	Stop	0.0493	0.0287	0.027	0.0566	0.0577	−0.0295
	Start	0.0906 **	0.0742 **	0.0217	0.0327 **	0.0772	0.0185

		Periphery 1 Coefficient	Periphery 2 Coefficient	Periphery 3 Coefficient	Core+Surrounding Coefficient	Tokyo Prefecture Coefficient	Osaka Prefecture Coefficient
	Keep	0.0955 **	0.047 *	0.0268 **	0.0305 **	−0.0191	0.026
Single-plant	Stop	0.0114	0.0087	0.0359 **	−0.0212	−0.2416 ***	−0.0584
	Start	0.0513 *	0.0044	0.0279 **	0.0188	−0.0177	−0.0198

(Note) Statistical significance at 1%, 5%, and 10% are expressed by ***, **, and *, respectively.
All other variables are omitted.
t-values are omitted.

Table 8: Treatment Effect of Exporting

	ATT Difference	t-value	
Periphery 1	0.2329	2.96	**
Periphery 2	0.19798	3.34	***
Periphery 3	0.16203	5.84	***
Core+Surrounding	0.1168	4.26	***
Tokyo Prefecture	0.14271	1.53	
Osaka Prefecture	0.06055	0.95	
Tokyo City	0.06928	0.61	
Osaka City	0.03879	0.31	
All Japan	0.14441	8.17	***

(Notes) ATT is calculated for TFP in logarithm at 2008. Difference is between exporters and non-exporters in each region.
Balance test is passed. Propensity-score matching is with common support and no replacement option.
First-stage logit regressions include wage, size, size squared, multi-plant dummy, and sector dummies.

Table 9: Treatment Effect of Core Location

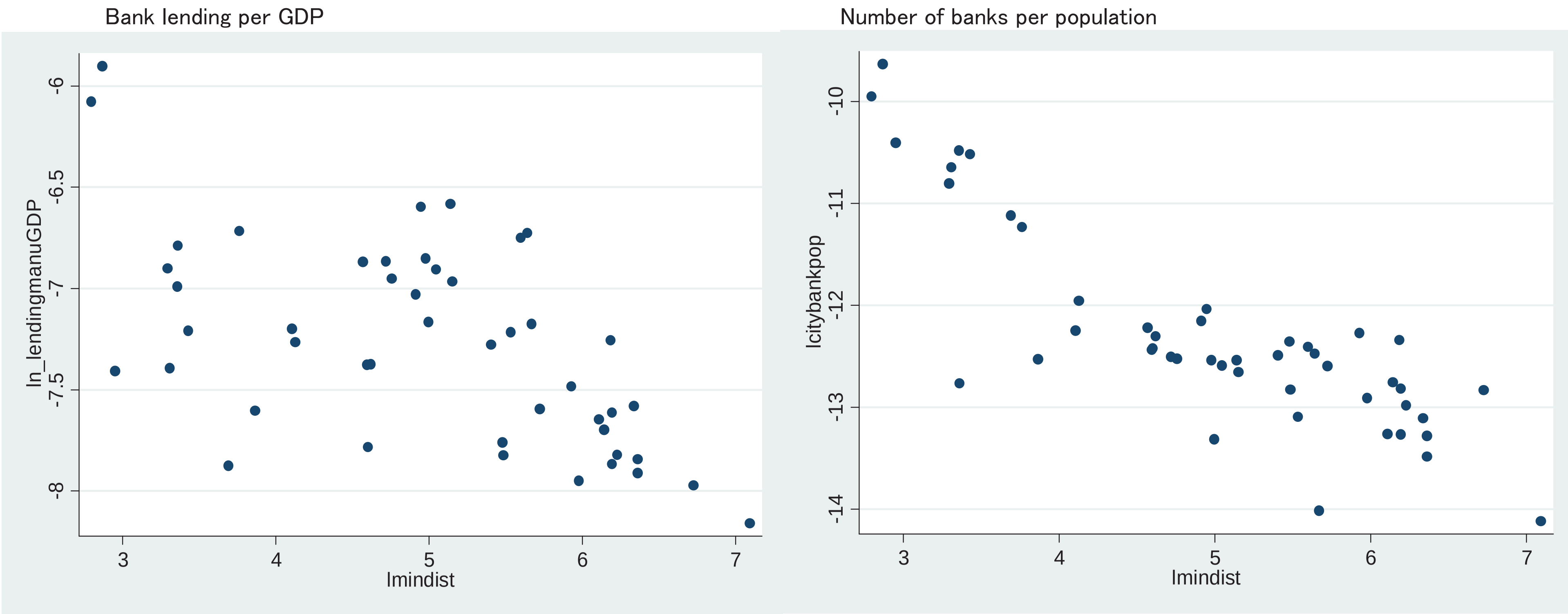
	Exporters		Non-exporters		All	
	ATT					
	Difference	t-value	Difference	t-value	Difference	t-value
Core+Surrounding (excluding Tokyo & Osaka)	−0.05837	−2.09 **	0.14975	17.03 ***	0.12519	14.49 ***
Core+Surrounding	−0.08738	−3.23 ***	0.02675	2.67 **	0.01344	1.38
Tokyo and Osaka Prefectures	−0.13338	−2.33 **	−0.01757	−0.93	−0.01578	−0.85

(Note) ATT difference from all other regions is shown. See notes to Table 8.

	Exporters		Non-exporters		All	
	ATT					
	Differnce	t-value	Difference	t-value	Difference	t-value
Tokyo-Osaka vs. Periphery 1	−0.1847	−2.18 **	0.30261	15.71 ***	0.32984	17.31 ***
Tokyo-Osaka vs. Periphery 2	−0.16308	−2.73 **	0.08067	4.2 ***	0.06762	3.62 ***
Tokyo-Osaka vs. Periphery 3	−0.13124	−2.46 **	0.02072	1.1	−0.00444	−0.24

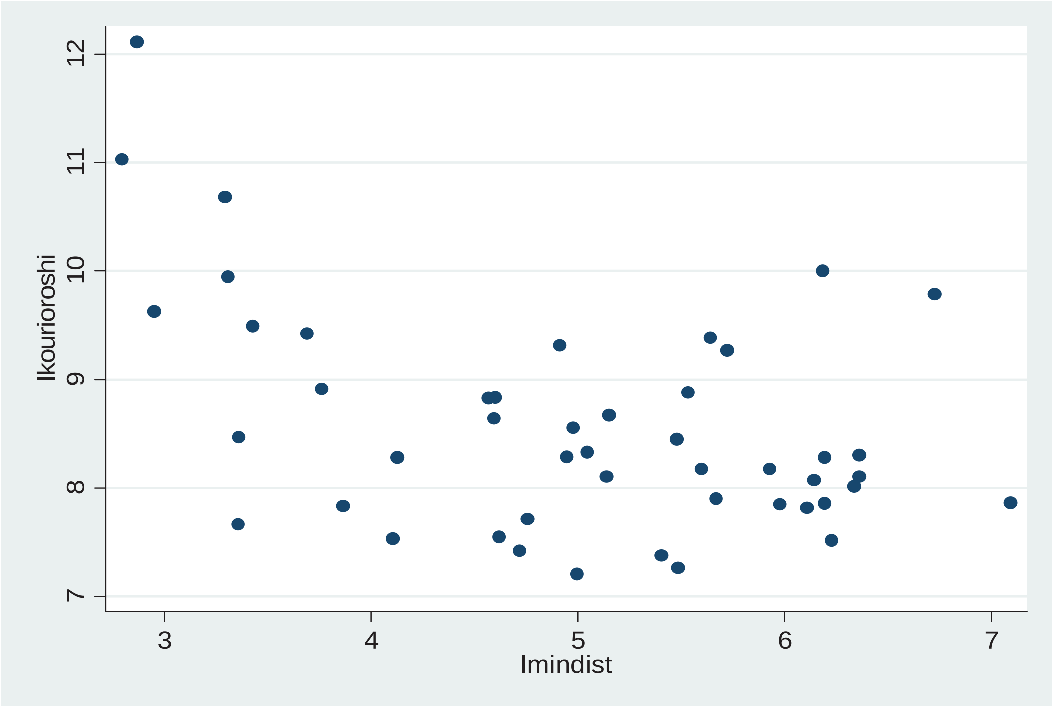
(Note) ATT difference between regions before and after "vs" in the first column is shown. See notes to Table 8.

Appendix Figure 1: Bank Access and Distance from Core (prefectural level)



(Notes) Lending is limited to bank lending to manufacturing in 2008. The number of banks is limited to city banks in 2008.
Data source: Bank of Japan.

Appendix Figure 2: Wholesales and Distance from Core (prefectural level)



(Notes) Total sales of wholesalers as of 2008.
Data source: Ministry of Economy, Trade and Industry

Appendix Table: Exporter Premium of Each Prefecture

Prefecture		Pooled OLS		Fixed effect	
Code	Name	coefficient	t-value	coefficient	t-value
1	Hokkaido	0.438919	6.61	−0.01086	−0.16
2	Aomori	0.528875	6.01	−0.01694	−0.21
3	Iwate	0.233276	4.56	0.203202	3.79
4	Miyagi	0.360411	8.3	0.009416	0.17
5	Akita	0.555049	10.6	0.070986	1.51
6	Yamagata	0.39104	12.27	−0.06106	−2
7	Fukushima	0.283212	9.7	−0.02676	−0.9
8	Ibaraki	0.297982	10.31	0.067458	2.21
9	Tochigi	0.275421	8.71	0.102601	2.92
10	Gunma	0.272476	8.94	0.09438	3.39
11	Saitama	0.203389	11.31	0.045021	2.39
12	Chiba	0.287902	10.82	0.083677	3.07
13	Tokyo	0.185269	8.48	0.094536	3.42
14	Kanagawa	0.213629	11.95	0.025198	1.21
15	Niigata	0.211715	9.13	0.037953	1.57
16	Toyama	0.247025	6.71	0.016342	0.51
17	Ishikawa	0.16262	3.61	0.041847	0.91
18	Fukui	0.242197	6.16	0.149472	3.99
19	Yamanashi	0.329286	8.45	0.011044	0.29
20	Nagano	0.316567	16.51	0.049584	2.43
21	Gifu	0.196028	8.29	0.035973	1.61
22	Shizuoka	0.267849	13.68	0.060445	3.05
23	Aichi	0.191745	12.05	0.045776	3.01
24	Mie	0.369684	11.05	0.046414	1.33
25	Shiga	0.300589	9.62	0.081294	2.58
26	Kyoto	0.257184	7.88	0.034855	1.26
27	Osaka	0.135303	8.79	0.023391	1.46
28	Hyogo	0.227204	10.64	0.078662	3.67
29	Nara	0.186558	3.69	0.025321	0.58
30	Wakayama	0.153603	2.15	−0.08759	−1.32
31	Tottori	0.418114	6.09	0.049148	0.84
32	Shimane	0.175725	2.78	0.102958	1.87
33	Okayama	0.28324	8.54	0.036463	1.18
34	Hiroshima	0.31743	10.32	0.076444	2.4
35	Yamaguchi	0.428968	10.78	0.140273	3.1
36	Tokushima	0.528156	7.6	0.16828	2.82
37	Kagawa	0.342167	5.33	0.087356	1.49
38	Ehime	0.086009	1.65	0.056533	1.08
39	Kochi	0.37569	4.18	0.142763	1.65
40	Fukuoka	0.208218	6.93	0.04151	1.33
41	Saga	0.242298	4.48	0.047492	0.99
42	Nagasaki	0.313124	4.52	0.234341	3.33
43	Kumamoto	0.290195	6.08	0.045043	0.87
44	Oita	0.767464	12.17	0.166585	2.99
45	Miyazaki	0.489354	6.79	0.035211	0.55
46	Kagoshima	0.364247	4.49	0.152374	2.2
47	Okinawa	0.16378	0.88	−0.45493	−2.11
All Japan		0.274312	59.58	0.054274	11.5