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Size-dependent VAT, Compliance Costs, and Firm Growth*

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Abstract

We examine how firms' responses to a size-dependent tax policy depend on their productivity and compliance costs. To do so, we explore the value-added tax (VAT or Consumption Tax) in Japan, which gives firms an exemption from filing a consumption tax report and remitting tax to the tax authority if their sales are at or below a certain threshold. We use a massive firm-level dataset from Japan to test the following empirical hypotheses that are based on our theoretical analyses. First, firms are more likely to restrain their sales at the threshold, which results in "bunching", if their productivity is in the middle range. Second, such middle-productivity firms are more likely to bunch when the compliance cost is higher. The estimation results support these hypotheses and indicate that firm-level heterogeneity, both in terms of productivity and compliance cost, matters for the bunching of these firms.

Keywords: Size-dependent tax policy; Compliance costs; Firm growth: Knowledge spillover

JEL classification: H32, H26, L25

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1. Introduction

Many countries provide small and medium enterprises (SMEs) with exemptions for their value-added taxes (VAT). As of 2014, 29 of 34 OECD member countries gave such exemptions (Harju et al., 2016). Specifically, these countries allow firms with sales at or below a certain threshold not to register for the VAT, exempt them from filing a VAT report, and/or from remitting at least a part of their VAT, although the threshold varied considerably across countries (Harju et al. 2016). In most of these countries, firms whose sales exceed the threshold have to register for the VAT and remit it as measured by the sales tax minus a refund of the intermediate input tax.

Whether firms choose their sales at or below the VAT threshold or not is driven by the tax benefit and costs associated with the VAT. First, if they choose to restrain their sales at or below the threshold, they can obtain a fund being equivalent to the VAT (i.e., tax benefits) because they do not need to remit it to the government. Although they bear taxes on intermediate goods that the government does not refund, their net tax benefits from not registering are positive as far as their value added is positive.[1] If they choose their sales above the threshold, they lose these tax benefits because they have to remit the VAT to the government. Second, the firms that choose their sales above the threshold incur its compliance costs. Such compliance costs consist of, for example, the expense of internal time by employees on tax-related activities and explicit fees for external tax services. The extant estimates of such compliance costs are substantial. In 20 member countries of European Union, for example, the estimated average ratios of compliance costs for direct and indirect enterprise taxes to sales and to tax revenues for micro-sized enterprises with the number of staff less than 10 and sales (or total assets) at or below 2M

[1] Firms with sales at or below the threshold can register for the VAT in order to claim a refund for taxes on intermediate goods. Small firms that yield negative value added, though scarce, are likely to do so.

EUR are 2.6% and 53.6%, respectively (European Commission, 2018).[2]

The existence of compliance costs and the tax benefits most likely give firms an incentive to keep their sales at the threshold. A number of studies have already found that firms respond to such a size-dependent VAT by "bunching." Here bunching describes the situation where firms' sales are clustered at the threshold level (Onji 2009 for Japan; Harju et al. 2016 for Finland; Liu et al. 2017 for the U.K.). The presence of bunching indicates that some firms do not want to increase their sales beyond the threshold in order to enjoy tax benefits and to avoid compliance costs. A few recent studies have further reported how this bunching interacts with firm-level heterogeneity in tax benefits that are represented by, for example, the smallness of the refund for the tax on intermediate goods. Specifically, Harju et al. (2016) and Liu et al. (2017) find that firms with lower intermediate input-to-sales ratios are more likely to bunch because they could reclaim less tax on intermediate goods even if they register for the VAT.

Regarding the role of compliance costs in the context of bunching, Harju et al. (2016) show that the Finnish reform of their VAT reduced compliance costs and lowered the extent of bunching. One issue we would like to highlight here is the fact that, while their study clearly identifies the association between the compliance costs and bunching, they do not consider the firm-level heterogeneity in compliance costs but exclusively focus on a country-level shock to the compliance costs.

Against these background discussions, we explicitly study the firm-level heterogeneity that is associated with the compliance costs and answer the following two questions. First, controlling for compliance costs, how does the firms' productivity affect

[2] European Commission (2018) focus on the following member counties: Austria, Belgium, Czechia, Estonia, Finland, France, FYROM, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

their bunching? Second, controlling for productivity, how do the compliance costs, which could vary among firms, affect their bunching? Regarding the second question, we further ask a more specific one. Namely, we test whether the larger opportunity of getting knowledge about VAT reporting through transactions with trading partners, which likely reduces the compliance costs, affects firms' bunching. Examining these questions empirically helps us understand the role of firm-level heterogeneity in compliance costs in the context of bunching, which the literature currently does not.

The Japanese VAT is well-suited to examine these questions. In Japan, the government has set the VAT threshold at 10 million JPY (about 90 thousand USD) of taxable sales that is the fifth largest among the 34 OECD member countries as of 2014 (Harju et al., 2016). Therefore, many firms are likely to bunch at the threshold. Further, the compliance costs are substantial: they must keep books and file the VAT report at least once a year and preserve these books and bills for several years. The firms likely will need to consult with and to get advice from tax accountants. Thus, we can immediately presume that Japanese firms bunch at the tax threshold. In fact, as Figure 1 indicates, bunching clearly exists just below the threshold in the distribution of Japanese firms' sales.[3] Such clear bunching among a large number of firms allows us to examine various firm-level heterogeneities including the level of the compliance cost.

In the empirical analyses, we use a massive firm-level dataset from Japan and focus on firms whose sales are less than or equal to 150 million JPY, which is far larger than the VAT threshold, to exclude firms whose productivity is very high. We first estimate the degree of bunching for each geographical area in Japan, i.e., prefecture, and then regress this estimate on prefecture-level characteristics. Our findings can be

[3] Figure 1 depicts data from Tokyo Shoko Research Ltd (TSR).

summarized as follows. First, after controlling for the compliance cost, we confirm that the degree of bunching is higher if the typical firm's productivity for each prefecture, which is represented by the median value of sales for the prefecture, is lower. Unlike the studies that report the association between firm size and bunching, our finding is based on the empirical analysis explicitly controlling for the compliance cost. Second and more importantly, we confirm that the degree of bunching is higher if the compliance cost is higher, where the compliance cost is represented by the average sales of tax accountant offices per firm in prefecture. Further, this correlation between bunching and the compliance cost is stronger in prefectures that fall in the middle ranges of the median values of sales, which we refer as a proxy for productivity. We also confirm that the degree of bunching is lower when firms in that prefecture transact with firms located in prefectures with less bunching. We interpret the last finding as indicating that knowledge on VAT reporting transmits through trading partners and contributes to reducing compliance costs.

We further explore firms' responses to the size-dependent VAT through firm-level regressions that use as the dependent variable an SME dummy that indicates the firm's sales is at or below the VAT threshold. We find that firms are more likely to be an SME as the compliance cost is higher, where we measure the compliance cost by the number of suppliers per employee of the firm. As a related important detail, firms with middle-range productivity, which is represented by the lagged sales, are likely to be an SME as a response to an increase in the compliance cost. Further, firms are less likely to be an SME if they transact with better-performing suppliers, which again indicates that knowledge on VAT reporting comes from transactional relationships and contributes to reducing compliance costs.

The rest of the paper is organized as follows: In section 2, we provide a theoretical background on how productivity and compliance costs affect firms' bunching and derive testable hypotheses from it. Section 3 describes the method that we use in our analysis. Section 4 presents the data, and section 5 presents the empirical results from prefecture-level and firm-level analyses. Lastly, section 6 concludes the paper and includes potential avenues for future research.

2. Theoretical Background

In this section, we theoretically illustrate how the change in compliance costs affect firms' decisions on whether to exceed the threshold of sales and pay the VAT or to keep sales at or below the threshold and avoid the VAT. To do so, we conduct comparative statics by using the model of Keen and Mintz (2004), which we sketch below. The detailed setup of the model is described in Appendix 1.

Their model assumes that individuals allocate their endowment of time to the production of taxed goods or untaxed goods. The production function of the taxed goods is strictly increasing and strictly concave. While the productivity associated with the production of the taxed goods is different across individuals, that of the untaxed good is constant.[4]

On the one hand, if the tax-exclusive value of the gross output of the taxed goods exceeds a threshold, the individuals must remit the VAT to the tax authority under the tax system. In addition to this tax remittance, the individuals with the larger volume of the taxed goods than a threshold incur compliance costs that are composed both of a

[4] The untaxed good can be interpreted as leisure. With this interpretation, the constant productivity of the untaxed good reflects a competitive labor market, where the wage rate is constant regardless of the level of the demand for labor.

fixed cost and a variable cost proportional to the output. On the other hand, if the sales of the individuals with taxed goods are below the threshold, they can sell them at the sum of the producer price and the sales tax. In this case, they cannot obtain a refund for the tax on the intermediate goods. By solving the individuals' optimization problem in choosing the labor input level for maximizing their profits, Keen and Mintz (2004) show that the level of output chosen by individuals depends on their productivity.

As the most important theoretical implication obtained from the model, the change in compliance costs differently affects the output level chosen by the individuals with different productivity level. To visualize how the compliance cost affects the individuals' choice of output level, Figure 2 shows the profits on the output. The thin and thick lines denote the profit that individuals earn when the compliance costs are low and high, respectively, while the dashed line represents the hypothetical profit that individuals would earn under the provision of exemption from filing the VAT report and remitting the VAT.

We classify individuals into three categories depending on their productivity in order to explain how they react to change in the compliance costs. Panel A accounts for individuals with *low productivity* and shows that they do not change their optimal output level in response to an increase in the compliance costs. This is simply because their optimal level of the output is below the threshold and is not affected by the compliance costs. Panel B accounts for individuals with *middle productivity* and shows that they reduce their output level to the threshold (z) in response to an increase in the compliance costs. Panel C accounts for individuals with *high productivity* and shows they do not change the optimal output level when the compliance costs increase.

Based on the theoretical illustration above, we test the following hypothesis:

Hypothesis 1. ***Given the level of compliance costs, firms with middle productivity are more likely to restrain their sales at the threshold for the VAT than firms with low or high productivity.***

This hypothesis states that there are a certain number of firms always bunching if the level of the compliance cost is constant. The next hypothesis accounts for the case in Panel C of Figure 2.

Hypothesis 2. ***As the compliance costs are lower (higher), firms with middle-productivity are less (more) likely to restrain their sales at the threshold.***

Regarding Hypothesis 2, we consider two ways to measure the change in the compliance costs. The first measure represents the direct compliance cost, such as the consulting fees for tax accountants or the number of the trading partners. As firms trade more trading partners, they need more time to prepare the tax declaration. The second measure represents the opportunity of getting knowledge about VAT reporting from the transactions of trading partners. The latter measure leads to the following additional hypothesis:

Hypothesis 2'. ***If firms with middle productivity have the opportunity of getting knowledge about VAT reporting, they are less likely to restrain their sales at the threshold.***

3. Empirical Strategy

3.1 Bunching estimate

Given that we do not have information on whether an individual firm registers for the VAT or not, we test the hypotheses presented in Section 2 using the following methods. First, we focus on firms whose sales are at or below 150 million JPY from a large firm-level dataset to exclude firms whose productivity is very high. Then, given the presumption that each prefecture in Japan has large heterogeneity in terms of business environment including the access to accounting services, we estimate the degree of bunching for each region by using the method developed by Chetty et al. (2011) and Kleven and Waseem (2013). As a unit of region, we use each of the 47 prefectures in Japan, considering that firms are likely to consult with tax accountants within the prefecture they locate in. For each prefecture, we estimate the counterfactual distribution by regressing the following equation and excluding the region around the threshold $(z_L, z_H]$ from the regression:

$$c_j = \sum_{i=0}^{q} \beta_i \cdot (z_j)^i + \sum_{i=z>z_L}^{z_H} \gamma_i \cdot \mathbf{1}[z_j = i] + \varepsilon_j$$

(1)

where c_j is the number of firms in sales bin j with a width of 1 million JPY, z_j is the upper value of sales in bin j, and q is the order of the polynomial. We set q=10 and determine the lower limit of the excluded interval (z_L) based on visual observations of the sales distribution. The z_L represents the point in the sales distribution where bunching begins. The estimated excess mass at or just below the threshold is obtained as follows:

$\hat{B}_E = \sum_{j=z>z_L}^{z^*} (c_j - \hat{c}_j)$

(2)

Following Kleven and Waseem (2013), we determine the upper limit of the excluded interval (z_H) such that the estimated excess mass equals the estimated missing mass above the threshold:

$\hat{B}_M = \sum_{j=z>z^*}^{z_H} (\hat{c}_j - c_j)$

We apply this convergence condition by starting from a small value of z_H and increasing it gradually until $\hat{B}_E \approx \hat{B}_M$. This condition assumes that firms that bunch at or just below the threshold come from the region above it. The estimate of the prefecture-level bunching is calculated as follows:

$$Bunch = \frac{\hat{B}_E}{\sum_{j=z>z_L}^{z^*} \hat{c}_j / N_j} \qquad (3)$$

where N_j is the number of bins within $(z_L, z^*]$. Figure 3 illustrates the bunching estimate. We calculate a standard error for the bunching estimate using a residual-based bootstrap procedure.

3.2 Prefecture-level estimation

In order to investigate whether firms with lower productivity are more likely to bunch just below the threshold or not (Hypothesis 1), we estimate the following prefecture-level equation:

$$Bunch_j/SE_j = \alpha + \beta LOGMED\_SALES_j + \gamma GFPT_j + \boldsymbol{\lambda X_j} + \varepsilon_j \tag{4}$$

where the dependent variable is the bunching estimate in prefecture j standardized by its standard error. With standardization, the dependent variable becomes larger as it is more precisely estimated. Among the explanatory variables, $LOGMED\_SALES_j$ is the natural logarithm of the median value of the firm's sales in prefecture j, which is the average size measured by output depending on the firm's attributes in prefecture j such as productivity, markup, financial constraint and so forth. $GFPT_j$ is the guidance fee to tax accountants per firm in prefecture j, which is a proxy for the average compliance costs of firms in prefecture j. Hypotheses 1 and 2 predict that $LOGMED\_SALES_j$ and $GFPT_j$ should have negative and positive coefficients, respectively. $\boldsymbol{X_j}$ is a vector of the following prefecture-level attributes: (1) the median value of firms' profit-to-sales ratios in prefecture j, (2) the median value of firms' value added (VA) to sales ratios in prefecture j, and (3) the natural logarithm of gross prefectural product (GPP) per capita in prefecture j. We expect the signs of the coefficients for these control variables to be the following. First, we expect the profit ratio to have a negative coefficient, because firms with higher profit ratios likely have higher market power and can sell their goods at prices increased by the VAT. Although a higher profit ratio may also indicate higher VA, we control for it as the second variable. We expect the VA ratio to have a positive coefficient because firms do not have an incentive to choose their sales above the threshold (or register for the VAT) in order to reclaim the tax on intermediate goods if their VA ratio is higher and hence if the refund for the tax on intermediate goods is smaller. Third, we expect GPP per capita to have a negative coefficient as it is another proxy for productivity.

Next, in order to investigate whether firms with middle-productivity are more likely to bunch in response to an increase in the compliance costs (Hypothesis 2), we estimate the following prefecture-level equation:

$$Bunch_j/SE_j = \sum_{q=1}^{4} \beta_q SALES\_Q_{qj} + \sum_{q=1}^{4} \gamma_q SALES\_Q_{qj} \times GFPT_j + \boldsymbol{\lambda X_j} + \varepsilon_j \qquad (5)$$

where $SALES\_Q_{qj}$ is a dummy equal to one if $LOGMED\_SALES_j$ falls in the range between the q-1th quartile and the qth quartile, and zero otherwise; and $SALES\_Q_{qj} \times GFPT_j$ is the intesection between the qth quartile dummy and the compliance cost. Hypothesis 2 posits that $SALES\_Q_{qj} \times GFPT_j$ has a positive and larger coefficient for the second quartile range of sales. In addition, because we limit our sample to firms with sales at or below 150 million JPY, $SALES\_Q_{qj} \times GFPT_j$ may have positive coefficients for the third and fourth quartiles as well.

Third, to test Hypothesis 2', we measure the opportunity of getting knowledge by using the information on the location of the firm's trading partners. Regarding this issue, Chetty et al. (2013) show that the degree of bunching is a proxy for the extent of local knowledge about filing of tax return for the personal income tax. They assume that individuals in the region with the higher degree of bunching know more about the income tax system given the assumption that individuals with less knowledge could not choose their earnings at the lower limit of an interval which give them the maximum earned income tax credit. In the present paper, we do not assume that firms located in prefectures with the higher degree of bunching know more about the VAT system. We would rather assume that firms located in prefectures with the lower degree of bunching know more about VAT reporting, which is associated with lower compliance cost. Also, firms located in prefectures with a higher degree of bunching are presumed to know less about it. We should note that the assumption made in Chetty et al. (2013) is not necessarily inconsistent with ours. Suppose we are facing the situation illustrated in the Panel B of Figure 2. What Chetty et al. (2013) illustrates is the case where firms with less knowledge about the VAT system cannot find if the optimal level output is "z". Once the firms know more about the tax system, those firms are assumed to realize the optimal level of their output. In the present paper, given our conjecture that firms are more likely to optimize their output than individual persons do, we do not assume such a sub-optimal choice but rather assume that each firm is optimizing the level of their output given their compliance cost. Based on this presumption, we assume that if firms located in prefectures with lower knowledge transact with firms in prefectures with higher knowledge, the former firms have a better chance to obtain more knowledge from the latter firms and thereby can lower their compliance costs. To explicitly test this presumption, we focus on firms in prefectures where the degree of bunching is higher than the median and then compare the bunching estimates of firms connected to the firms in prefectures where the degree of bunching is lower than the median (firms with higher knowledge) and that of firms connected to firms in prefectures where the degree of bunching is higher than the median (firms with lower knowledge).

3.3 Firm-level estimation

To further investigate firms' responses to the VAT, we use a firm-level panel dataset. Because information on whether a firm registers for the VAT or not is not available, we construct a dummy (*SME*) as a proxy for non-registration that equals one if a firm’s sales are at or below the threshold. Using SME as the dependent variable, we first estimate the following equation:

$$SME_{it} = \alpha + \sum_{r=2}^{4} \beta_r SALES_{R_{rit-1}} + \gamma NUMPARTNER_{it-1}$$

$$+\boldsymbol{\lambda X_{it-1}} + year_t + \varepsilon_{it} \quad (6)$$

where $SALES\_R_{rit-1}$ is the *r*th range dummy that is defined as follows:

$$SALES\_R_{2it-1} = \begin{cases} 1 & \text{if firm i's sales} > 9 \text{ M JPY and firm i's sales} \leq 10 \text{ M JPY} \\ 0 & \end{cases}$$

$$SALES\_R_{3it-1} = \begin{cases} 1 & \text{if firm i's sales} > 10 \text{ M JPY and firm i's sales} \leq 30 \text{ M JPY} \\ 0 & \end{cases}$$

$$SALES\_R_{4it-1} = \begin{cases} 1 & \text{if firm i's sales} > 30 \text{ M JPY and firm i's sales} \\ 0 & \text{otherwise} \end{cases}$$

All the independent variables are lagged one year. The first variable $SALES\_R_{rit-1}$ (*r*=2,3,4) indicates the firm’s size as measured by its lagged sales that are likely to depend on its productivity, markup, financial constraint, and so forth. We alternatively use $LOGSALES_{it-1}$ that is the natural logarithm of sales for the size. Figure 1 indicates that firms with low or middle productivity are likely to be SMEs. Because the coefficient of $SALES\_R_{rit-1}$ measures the difference in the impact of each sales range on the firm’s choice of being an SME from that of the benchmark sales range of

$$SALES\_R_{1it-1} = \begin{cases} 1 & \text{if firm i's sales} \leq 9 \text{ M JPY} \\ 0 & \text{otherwise} \end{cases}$$

, it should have a negative coefficient with a larger absolute value for a higher range of sales. We also expect that $LOGSALES_{it-1}$ should have a negative coefficient. The second variable $NUMPARTNER_{it-1}$ is the number of either suppliers or customers standardized by the number of employees, which is a proxy for both productivity and compliance costs. Productivity is likely to become higher as the number of trading partners increase. On the other hand, filing documents for transactions is likely to be more costly as the number of the transaction partners increase. Because we control for firms' productivity by $SALES\_R_{rit-1}$ to some extent, $NUMPARTNER_{it-1}$ is supposed to have a positive coefficient (Hypothesis 2). The $\boldsymbol{X_{it-1}}$ is a vector of the profit-to-sales ratio and the VA-to-sales ratio. We expect the profit and the VA ratios to have a negative and positive coefficient, respectively, as in the prefecture-level estimation.

Next, to examine whether firms' responses to the compliance costs depend on productivity, as Hypothesis 2 posits, we estimate the following fixed-effect model:

$$SME_{it} = \alpha + \sum_{r=2}^{4} \beta_r SALES\_R_{rit-1} + \sum_{r=1}^{4} \gamma_r SALES\_R_{rit-1} \times NUMPARTNERS_{it-1} + \boldsymbol{\lambda X_{it-1}} + f_i + year_t + \varepsilon_{it} \quad (7)$$

where $SALES\_R_{rit-1} \times NUMPARTNER_{it-1}$ is the intersection between the *r*th range dummy and the number of transaction partners (i.e., suppliers or customers). To the extent that $NUMPARTNER_{it-1}$ represents compliance costs, Hypothesis 2 posits that $SALES\_R_{rit-1} \times NUMPARTNER_{it-1}$ has a positive coefficient for a range of sales when $SALES\_R_{3it-1} = 1$ that indicates the sales are just above the threshold. It may also take a positive coefficient when $SALES\_R_{4it-1} = 1$ because we restrict our sample to firms with sales less than 150 million JPY.

Third, to test Hypothesis 2', we measure the opportunity of getting knowledge about VAT reporting by using the information on the performance of the firm's transaction partners. We presume that firms that trade with better performing partners are more likely to acquire knowledge on the VAT. As the partners' performance measures, we use the median values of the partners' (i.e., either suppliers' or customers') sales growth rate and natural logarithm of sales at *t*-1. Using these variables, we estimate the following fixed-effect model:

$$SME_{it} = \alpha + \sum_{r=2}^{4} \beta_r SALES\_R_{rit-1} + \boldsymbol{\gamma PARTNER\_PERFORM_{it-1}} \\ + NUMPARTNER_{it-1} + \boldsymbol{\lambda X_{it-1}} + f_i + year_t + \varepsilon_{it} \quad (8)$$

where $\boldsymbol{PARTNER\_PERFORM_{it-1}}$ denotes a vector of the partners' performance measures. Hypothesis 2' posits that each variable in $\boldsymbol{PARTNER\_PERFORM_{it-1}}$ has a negative coefficient.

In addition, in order to examine whether firms' responses to getting knowledge about VAT reporting depend on productivity, we estimate the following fixed-effect model:

$$SME_{it} = \alpha + \sum_{r=2}^{4} \beta_r SALES\_R_{rit-1} \\ + \sum_{r=1}^{4} \gamma_r SALES\_R_{rit-1} \times \boldsymbol{PARTNER\_PERFORM_{it-1}} \\ + NUMPARTER_{it-1} + \boldsymbol{\lambda X_{it-1}} + f_i + year_t + \varepsilon_{it} \quad (9)$$

where $SALES_R_{rit-1} \times \boldsymbol{PARTNER_PERFORM_{it-1}}$is the intesection between the *r*th range dummy and a vector of the partners' performance measures. To the extent that the higher $\boldsymbol{PARTNER\_RERFORM_{it-1}}$ represents the lower compliance costs, $SALES\_R_{rit-1} \times \boldsymbol{PARTNER\_PERFORM_{it-1}}$ has a negative and smaller coefficient when $SALES\_R_{3it-1} = 1$ (and $SALES\_R_{4it-1} = 1$).

4. Data

The firm-level data we use comes from Tokyo Shoko Research Ltd (TSR) that is one of the largest Japanese credit reporting agencies. The dataset covers both the listed and unlisted firms in Japan and comprises more than one million firms with basic attributes such as sales in each year. It also contains information on the firms' suppliers and customers in the order of their subjective importance for each firm up to 24 at the maximum.

In order to secure enough observations for each prefecture, we use data for the period from 2009 to 2014. Given the VAT threshold of 10 million JPY, we focus on the firms with sales less than or equal to 150 million JPY. We exclude the industries that conduct nontaxable transactions such as the finance, insurance, real estate, education, medical welfare, public service industries. The total number of firm-year observations is 916,556 over the sample period.

The prefecture-level data comes from various sources. First, the average guidance fee for the tax accountant per firm (GFPT) comes from the Ministry of Internal Affairs and Communications. We define GFPT as the total sales of the tax accountant offices and the certified public accountant offices divided by the total number of firms as of 2011. Second, data on the GPP per capita is provided by the Cabinet Office. We use GPP per capita as of 2011.

5. Empirical Results

5.1 Prefecture-level estimation

5.1.1 Bunching estimates and other prefecture-level variables

The estimates of prefecture-level bunching defined by Equation (3) are depicted in Figure 4.[5] The figure indicates a large variation in the degree of bunching across prefectures that range from above 0.5 to almost zero. For most prefectures, the bunching estimates are positive and significantly different from zero. They are precise for most of the prefectures, but their standard deviations are large for some prefectures. This is the reason we standardize them. Table 1 shows the descriptive statistics of the prefecture-level data we use. It shows that the mean value of the standardized bunching estimates is 4.866.

Figure 5 shows $GFPT_j$ by prefecture. It also shows a large variation across prefectures. Table 1 shows that the average guidance fee is 199,000 JPY, which is not negligible for small firms.

5.1.2 The effects of productivity and compliance costs on bunching

Columns (1) to (3) in Table 2 show the regression results for Equation (4). In Column (1), $LOGMED\_SALES_j$ is the only explanatory variable. Its coefficient is

[5] We also show the bunching estimates, bootstrap standard errors, and the lower and upper limits of the excluded intervals in Table A1 of Appendix. We set the lower limit of the excluded interval at 9M JPY. The upper limit of the excluded interval ranges from 11M JPY to 20M JPY.

negative and significant that indicates firms are more likely to bunch at or below the threshold if their productivity is lower. In Columns (2), $GFPT_j$ is an additional explanatory variable. The coefficient for $LOGMED\_SALES_j$ is still negative and significant. In addition, the coefficient for $GFPT_j$ is positive and significant that indicates firms are more likely to bunch if the compliance cost is higher. In Columns (3), the median values of the firm's profit-to-sales ratio and its VA-to-sales ratio and the natural logarithm of GPP per capita are added to the explanatory variables. While the control variables do not have significant coefficients, $LOGMED\_SALES_j$ and $GFPT_j$ still have significantly negative and positive coefficients, respectively. The negative coefficients for $LOGMED\_SALES_j$ support Hypothesis 1. We also confirm that the positive coefficients for $GFPT_j$ show that higher compliance costs tend to induce firms' bunching on average.

5.1.3 The effects of compliance costs on lower productivity firms' bunching

Column (4) of Table 2 shows the regression results for Equation (5). It shows that while the interaction of $SALES\_Q_{qj}$ and $GFPT_j$ is not significant for the first quantile of $LOGMED\_SALES_j$, their interactions for the the second to the fourth quantile are positive and significant. Further, the coefficients for the interactions are smaller as the quantiles of $LOGMED\_SALES_j$ are larger. These results are consistent with Hypothesis 2 that posits that middle-productivity firms are likely to bunch at or just below the threshold in response to an increase in the compliance costs and that firms with lower productivity among them are more sensitive to compliance costs.

5.1.4 The effects of knowledge on lower productivity firms' bunching

According to Hypothesis 2, the firms located in a prefecture that has a higher level of bunching can be regarded as those that have "less knowledge" on VAT reporting, and thus are associated with higher compliance cost. In this subsection, we restrict our sample to the firms that have "less knowledge" and have information on suppliers or customers. First, we restrict our sample to the firms that have information on their suppliers. Figure 6 shows the distribution of sales by dividing the firms in this sample depending on whether their median supplier is located in the prefectures with "less knowledge" or with "more knowledge." The figure shows that the degree of bunching is larger for the firms whose median supplier is located in a prefecture with "less knowledge." Table 3 shows the bunching estimates for the firms whose median supplier is located in a "more knowledge" prefecture and those whose median supplier is located in a "less knowledge" prefecture. The bunching estimators are 0.106 and 0.306 for the former and the latter, the latter of which is statistically significant.

Next, we restrict our sample to the firms that have information on their customers. Figure 7 shows the distribution of sales by dividing the firms in this sample by the degree of their median customer's knowledge that we judge based on their location. The figure shows that the degree of bunching is larger for the firms whose customer has "less knowledge." Table 4 shows the bunching estimates for the firms whose median customer is located in a "more knowledge" prefecture and those whose main customer is located in a "less knowledge" prefecture. Table 4 shows that the bunching estimators are 0.187 and 0.388 for the former and the latter, the latter of which is larger although both estimates are statistically significant.

These results indicate that firms that have "less knowledge" get more knowledge about VAT reporting from their suppliers and customers that have "more knowledge" that in turn, reduces the compliance costs and thereby stops the bunching. This is consistent with Hypothesis 2’.

5.2 Firm-level estimation results

Table 5 shows the descriptive statistics for the firm-level variables. Panels A and B show the firms whose suppliers’ and customers’ information is available, respectively. The share of firm-years in our sample for which sales is at or below the threshold is 4.5% and 5.6% in Panels A and B, respectively.

5.2.1 Suppliers’ role

Table 6 shows the firm-level regression results using the number of suppliers as $NUMPARTNER_{it-1}$. Columns (1) and (2) show the regression results for Equation (6). In Column (1), $LOGSALES_{it-1}$, $NUMPARTNER_{it-1}$, and the control variables are included as the explanatory variables. While the coefficient for $LOGSALES_{it-1}$ is negative and significant, that of $NUMPARTNER_{it-1}$ is positive and significant, as we expected. Among the control variables, the coefficients for the profit-to-sales and the VA-to-sales ratios are significant with positive and negative signs, respectively, which is contrary to our expectation. In Columns (2), we use the range dummies of sales in year t-1 instead of $LOGSALES_{it-1}$ itself and find that the second to the fourth range dummies have negative and significant coefficients and their absolute values are larger for larger ranges. These results support Hypothesis 1. The coefficient for $NUMPARTNER_{it-1}$ is still positive and significant that indicates a larger number of suppliers increases compliance costs that in turn, induces firms to keep their sales at or below the threshold.

The coefficients for the profit-to-sales and the VA-to-sales ratios are not significant in this case.

Next, Column (3) shows the regression results for Equation (7). It shows that all the interactions of $SALES\_R_{rit-1}$ and $NUMPARTNERS_{it-1}$ for ranges of sales above the threshold (i.e., the third and the fourth range) have positive and significant coefficients and that their size decreases with the ranges. Further, the size of the coefficients is larger for $SALES\_R_{3it-1} = 1$ than that for $SALES\_R_{4it-1} = 1$. These results are consistent with Hypothesis 2 that posits that middle-productivity firms are likely to restrain their sales at or below the threshold in response to an increase in the compliance costs. The coefficients for the profit-to-sales and the VA-to-sales ratios are significant with negative and positive signs, respectively, as we expected.

Third, Column (4) shows the regression results for Equation (8). In $\boldsymbol{PARTNER\_PERFORM_{it-1}}$, the median value of the suppliers' sales growth rate has a negative and significant coefficient at the 10% level while that of the suppliers' log of sales is not significant. The former result means that as the suppliers' sales grow, the firm's productivity increases and/or the compliance costs decrease through knowledge spillovers that in turn, makes firms less likely to restrain their sales at or below the threshold.

Fourth, Column (5) shows the regression results for Equation (9). It shows that all the interactions of $SALES\_R_{rit-1}$ and the median value of supplier's sales growth rate for the fourth range of sales have negative and significant coefficients at the 1% level. This result means that firms with middle productivity are less likely to bunch in response to a decrease in the compliance costs as the result of getting knowledge about VAT reporting through transactions with suppliers that have higher performance.

5.2.2 Customers' role

Table 7 shows the firm-level regression results that use the number of customers as $NUMPARTNER_{it-1}$. The specification of each column is the same as that in Table 6. In Column (1), the coefficient for $LOGSALES_{it-1}$ is negative and significant, while that of $NUMPARTNER_{it-1}$ is positive but not significant. Among the control variables, the coefficients for the profit-to-sales and the VA-to-sales ratios are both significant with positive and negative signs, respectively, which is contrary to our expectation. In Columns (2), the second to the fourth range dummies of sales have negative and significant coefficients, and their absolute values are larger for higher ranges. These results support Hypothesis 1. The coefficient for $NUMPARTNER_{it-1}$ is positive and significant in this case.

Next, Column (3) that the coefficients of the interactions of $SALES\_R_{rit-1}$ and $NUMPARTNERS_{it-1}$ for the fourth range of sales is positive and sigificant at the 10% level. This result somewhat supports hypothesis 2 that posits that middle-productivity firms are likely to restrain their sales at or below the threshold.

Third, Column (4) shows that the customers' sales growth or log of sales does not have a significant coefficient.

Fourth, Column (5) shows that the coefficients for the interactions of $SALES\_R_{rit-1}$ and customers' sales growth are not significant.

In sum, while the results from using the number of customers are consistent with those from using the number of supplliers, the statistical power is weak for the former. In addition, the customers' performance, which is measured by either their sales growth or log of sales, does not significantly affect the firms' decision on whether to restrain their sales at or below the threshold or not.

6. Conclusion

We examine how firms react to a size-dependent tax policy. To do so, we examine the VAT in Japan that gives firms an exemption from taxation when their sales are below a threshold. Using a massive firm-level dataset from Japan, we confirm, first, that firms are more likely to restrain their sales at the threshold ("bunch") if their productivity is in the middle range. Second, we also confirm that middle-productivity firms are more likely to bunch when the compliance cost is higher. Our empirical analyses using region-level bunching estimates and firm-level sales values support these hypotheses provided our theoretical underpinnings. As an important detail associated with the second hypothesis, we further obtain evidences that indicate knowledge on VAT reporting transmits through trading partners and thus contributes to reducing compliance costs.

These results jointly illustrate that firms optimally respond to the size-dependent VAT policy with taking into account their productivity and the compliance cost they are facing. Given the bunching of firms restraining their output potentially hinders firm growth, and thus the aggregate economic activity, it is useful to identify the potential measures we can take for lowering such bunching. Our empirical analysis suggests measures effectively lowering the compliance cost would be one potential remedy to achieve this.

Appendix 1. Setup of the Keen and Mintz (2004) model

Individuals allocate their endowment of unit time between the production of taxed goods and untaxed, numeraire goods. The production technology of the taxed goods is represented by $f(nL)$, where $f(\cdot)$ is strictly increasing and strictly concave, and n and L respectively denote productivity and the time allocated to the production of the taxed goods. The production of the taxed goods requires some fixed number of units λ of intermediate good per unit output. Denoting the producer prices of the taxed goods and the intermediate goods by P and P_I, respectively, the value added of the taxed goods is $(P-\lambda)f(nL)$. On the other hand, the production of the untaxed goods is represented by the linear function, $w(1-L)$, where w and $1-L$ denote productivity and the time allocated to the production of the untaxed goods, respectively.

If the tax-excusive value of the gross output of the taxed goods exceeds the threshold z, the individuals must remit the VAT at the rate of τ. Further, they incur compliance costs that are composed of a fixed cost and a variable cost proportional to the output: $\Gamma + \gamma f(nL)$. If their sales are below the threshold, they can sell their taxed goods at the price of $(1+\tau)P$ but cannot obtain a refund for the tax on inputs.

The individuals' problem is to choose L to maximize

$$\pi = \rho f(nL) + w(1-L)$$

where

$$\rho = \begin{cases} P^E \equiv (1+\tau)(P-\lambda) & if \quad Pf(nL) < z \\ P^T \equiv P - \lambda - \gamma & if \quad Pf(nL) \geq z \end{cases}$$

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Table 1. Descriptive statistics of prefecture-level variables

Variable	Obs	Mean	S.D.	Min	Max
Standardized buncing estimator	47	4.866	3.033	-1.028	13.573
Natural logarithm of sales (median)	47	3.879	0.175	3.413	4.319
Guidance fee payment to tax accountant per firm (GFPT, unit:1M JPY)	47	0.199	0.109	0.087	0.766
Profit-to-sales ratio (median, unit:%)	47	1.404	0.837	0.144	3.996
VA-to-sales ratio (median, unit:%)		12.914	3.105	1.898	16.477
Natural logarithm of GPP per capital	47	1.266	0.178	0.928	2.027

Notes: Standardized bunching estimaor is defined as a bunching esimator divided by its standard error. GPP per capita denotes gross prefectural product per capita.

Table 2. Prefecture-level regression results

	Dependent variable: standardized bunching estimator			
	(1)	(2)	(3)	(4)
Natural logarithm of sales (median)	-9.535 ***	-10.808 ***	-9.040 ***	
	(2.198)	(2.311)	(1.981)	
Guidance fee payment to tax accountant per firm (GFPT)		6.800 **	13.313 ***	
		(2.563)	(4.588)	
SALES_Q1*GFPT				-19.215
				(16.600)
SALES_Q2*GFPT				34.964 **
				(13.596)
SALES_Q3*GFPT				30.268 ***
				(11.193)
SALES_Q4*GFPT				10.650 *
				(5.837)
Profit-to-sales ratio (median)			0.566	0.927
			(0.507)	(0.554)
VA-to-sales ratio (median)			-0.148	-0.151
			(0.089)	(0.114)
Natural logarithm of GPP per capital			-4.973	-4.099
			(3.111)	(3.987)
constant	41.856 ***	45.439 ***	44.703 ***	
	(8.608)	(8.934)	(9.124)	
SALES_Qq	No	No	No	Yes
R-squared	0.301	0.355	0.437	0.853
Number of obs	47	47	47	47

Notes: Standardized bunching estimaor is defined as a bunching esimator divided by its standard error. GPPC denotes gross prefectural product per capita. SALES_Qq (q=1,2,3,4) is a dummy variable taking the value of one if the natural logarithm of firm's sales (median) is betwenn the i-1th quartile and the ith quartile, and taking the value of zero otherwise. Robust standard error in parentheses. ***significant at 1%, **significant at 5%, *significant at 10%.

Table 3. Bunching estimators for firms with “less knowledge” classified by their median supplier’s degree of knowledge

	Bunching estimators	Bootstrap standard errors		Excluded interval (Unit: 1M JPY)		Obs
(1) Firms whose median supplier is located in a "more knowledge" prefecture	0.106	0.080		9	12	32,845
(2) Firms whose median supplier is located in a "less knowledge" prefecture	0.306	0.026	***	9	19	215,937

Table 4. Bunching estimates for firms with “less knowledge” classified by their median customer’s degree of knowledge

	Bunching estimators	Bootstrap standard errors		Excluded interval (Unit: 1M JPY)		Obs
(1) Firms whose median customer is located in a "more knowledge" prefecture	0.187	0.058	***	9	15	41,925
(2) Firms whose median customer is located in a "less knowledge" prefecture	0.388	0.019	***	9	18	262,933

Table 5. Descriptive statistics of firm-level variables

Panel A: Sample for firms whose supplier's information is available

Variable	Obs	Mean	S.D.	Min	Max
SME (t)	378,052	0.045	0.207	0	1
Natural logarithm of sales (t-1)	378,052	3.995	0.844	-6.908	11.489
Number of suppliers per employee (t-1)	378,052	0.792	0.817	0.0004	53
Profit-to-sales ratio (t-1)	378,052	-0.082	16.658	-8081	1
VA-to-sales ratio (t-1)	378,052	0.067	12.162	-6742	2.670
Median value of supplier's sales growth rate (t-1)	353,332	1.046	0.915	0	99.99
Median value of supplier's ln sales (t-1)	353,332	6.588	2.468	-2.526	16.203

Panel B: Sample for firms whose customer's information is available

Variable	Obs	Mean	S.D.	Min	Max
SME (t)	466,127	0.056	0.230	0	1
Natural logarithm of sales (t-1)	466,127	3.862	0.867	-4.828	11.489
Number of customers per employee (t-1)	466,127	0.929	0.956	0	38.5
Profit-to-sales ratio (t-1)	466,127	-0.139	73.663	-49792	2.074
VA-to-sales ratio (t-1)	466,127	0.001	73.658	-49792	3.831
Median value of customer's sales growth rate (t-1)	421,261	1.072	1.217	0	99.99
Median value of customer's ln sales (t-1)	421,261	7.055	2.324	-6.908	17.001

Notes: SME is a dummy variable taking the value of one if a firm' s sales is less than or equal to the threshold (10 million JPY), and taking the value of zero if a firm's sales is more than the threshold and less than or equal to 150 million JPY.

Table 6. Firm-level regression results using suppliers' information

	Dependent variable: SME(t)				
	(1)	(2)	(3)	(4)	(5)
Natural logarithm of sales (t-1)	-0.1170 ***				
	(0.0007)				
SALES_R2 (t-1)		-0.2234 ***	-0.0404 **	-0.0480 ***	-0.0659 **
		(0.0099)	(0.0176)	(0.0124)	(0.0261)
SALES_R3 (t-1)		-0.6300 ***	0.0965 ***	0.0984 ***	0.0958 ***
		(0.0042)	(0.0110)	(0.0083)	(0.0086)
SALES_R4 (t-1)		-0.7090 ***	0.0889 ***	0.0847 ***	0.0818 ***
		(0.0040)	(0.0110)	(0.0084)	(0.0087)
Number of suppliers per employee (t-1)	0.0071 ***	0.0050 ***		0.0047 ***	0.0047 ***
	(0.0005)	(0.0004)		(0.0011)	(0.0011)
SALES_R1*number of suppliers (t-1)			0.0053		
			(0.0069)		
SALES_R2*number of suppliers (t-1)			0.0030		
			(0.0117)		
SALES_R3*number of suppliers (t-1)			0.0098 ***		
			(0.0022)		
SALES_R4*number of suppliers (t-1)			0.0034 ***		
			(0.0009)		
Profit-to-sales ratio (t-1)	0.0001 **	-0.00002	-0.0003 ***	-0.0004	-0.0004
	(0.0001)	(0.0001)	(0.0000)	(0.0003)	(0.0003)
VA-to-sales ratio (t-1)	-0.0001 **	-0.00001	0.0003 ***	0.0006	0.0006
	(0.0001)	(0.0001)	(0.0001)	(0.0006)	(0.0007)
Median value of supplier's sales growth rate (t-1)				-0.0004 *	
				(0.0002)	
Median value of supplier's ln sales (t-1)				-0.0001	-0.0001
				(0.0003)	(0.0003)
SALES_R1*supplier's sales growth (t-1)					-0.0029
					(0.0018)
SALES_R2*supplier's sales growth (t-1)					0.0141
					(0.0218)
SALES_R3*supplier's sales growth (t-1)					-0.0005
					(0.0004)
SALES_R4*supplier's sales growth (t-1)					-0.0002 ***
					(0.0001)
Constant	0.5169 ***	0.7116 ***	-0.0514 ***	-0.0494 ***	-0.0467 ***
	(0.0033)	(0.0041)	(0.0108)	(0.0084)	(0.0086)
Year dummies	Yes	Yes	Yes	Yes	Yes
Firm-level fixed effects	No	No	Yes	Yes	Yes
R-squared	0.2306	0.4229	0.0143	0.0141	0.0141
Number of obs	378,052	378,052	378,052	353,332	353,332

Notes: SME is a dummy variable taking the value of one if a firm' s sales is less than or equal to the threshold (10 million JPY), and taking the value of zero if a firm's sales is more than the threshold and less than or equal to 150 million JPY. SALES_Rr is the rth range dummy taking the value of one if a firm's sales is in the rth range , and taking the value of zero otherwise. We divide firm's sales into four ranges: (0, 9M JPY], (9M JPY, 10M JPY], (10M JPY, 30M JPY], and (30M JPY, Max]. Robust standard errors in parentheses of columm (1)-(2). Clustered robust standard errors in parentheses of column (3)-(5). ***sighnificant at 1%, **significant at 5% *significant at 10%.

Table 7. Firm-level regression results using customers' information

	Dependent variable: SME(t)				
	(1)	(2)	(3)	(4)	(5)
Natural logarithm of sales (t-1)	-0.1347 ***				
	(0.0006)				
SALES_R2 (t-1)		-0.2368 ***	-0.0738 ***	-0.0638 ***	-0.0635 ***
		(0.0075)	(0.0131)	(0.0098)	(0.0114)
SALES_R3 (t-1)		-0.6915 ***	0.0604 ***	0.0537 ***	0.0537 ***
		(0.0031)	(0.0087)	(0.0076)	(0.0083)
SALES_R4 (t-1)		-0.7608 ***	0.0503 ***	0.0429 ***	0.0426 ***
		(0.0030)	(0.0087)	(0.0077)	(0.0083)
Number of customers per employee (t-1)	0.0001	0.0031 ***		0.0012 *	0.0012 *
	(0.0004)	(0.0003)		(0.0007)	(0.0007)
SALES_R1*number of customers (t-1)			0.0016		
			(0.0043)		
SALES_R2*number of customers (t-1)			0.0070		
			(0.0066)		
SALES_R3*number of customers (t-1)			0.0015		
			(0.0012)		
SALES_R4*number of customers (t-1)			0.0007 *		
			(0.0004)		
Profit-to-sales ratio (t-1)	0.0089 ***	0.0071 ***	-0.0031 **	-0.0029	-0.0029
	(0.0028)	(0.0023)	(0.0015)	(0.0020)	(0.0020)
VA-to-sales ratio (t-1)	-0.0089 ***	-0.0071 ***	0.0031 **	0.0029	0.0029
	(0.0028)	(0.0023)	(0.0015)	(0.0019)	(0.0019)
Median value of customer's sales growth				0.0000	
rate (t-1)				(0.0004)	
Median value of customer's ln sales (t-1)				-0.0001	-0.0001
				(0.0003)	(0.0003)
SALES_R1*customer's sales growth (t-1)					-0.0001
					(0.0030)
SALES_R2*customer's sales growth (t-1)					-0.0004
					(0.0043)
SALES_R3*customer's sales growth (t-1)					-0.0002
					(0.0012)
SALES_R4*customer's sales growth (t-1)					0.0002
					(0.0002)
Constant	0.5913 ***	0.7670 ***	0.0018	0.0054	0.0056
	(0.0031)	(0.0032)	(0.0085)	(0.0076)	(0.0082)
Year dummies	Yes	Yes	Yes	Yes	Yes
Firm-level fixed effects	No	No	Yes	Yes	Yes
R-squared	0.2555	0.4896	0.0092	0.0079	0.0079
Number of obs	466,127	466,127	466,127	421,261	421,261

Notes: SME is a dummy variable taking the value of one if a firm' s sales is less than or equal to the threshold (10 million JPY), and taking the value of zero if a firm's sales is more than the threshold and less than or equal to 150 million JPY. SALES_Rr is the rth range dummy taking the value of one if a firm's sales is in the rth range , and taking the value of zero otherwise. We divide firm's sales into four ranges: (0, 9M JPY], (9M JPY, 10M JPY], (10M JPY, 30M JPY], and (30M JPY, Max]. Robust standard errors in parentheses of columm (1)-(2). Clustered robust standard errors in parentheses of column (3)-(5). ***sighnificant at 1%, **significant at 5% *significant at 10%.

Table A1 Results of bunching estimation

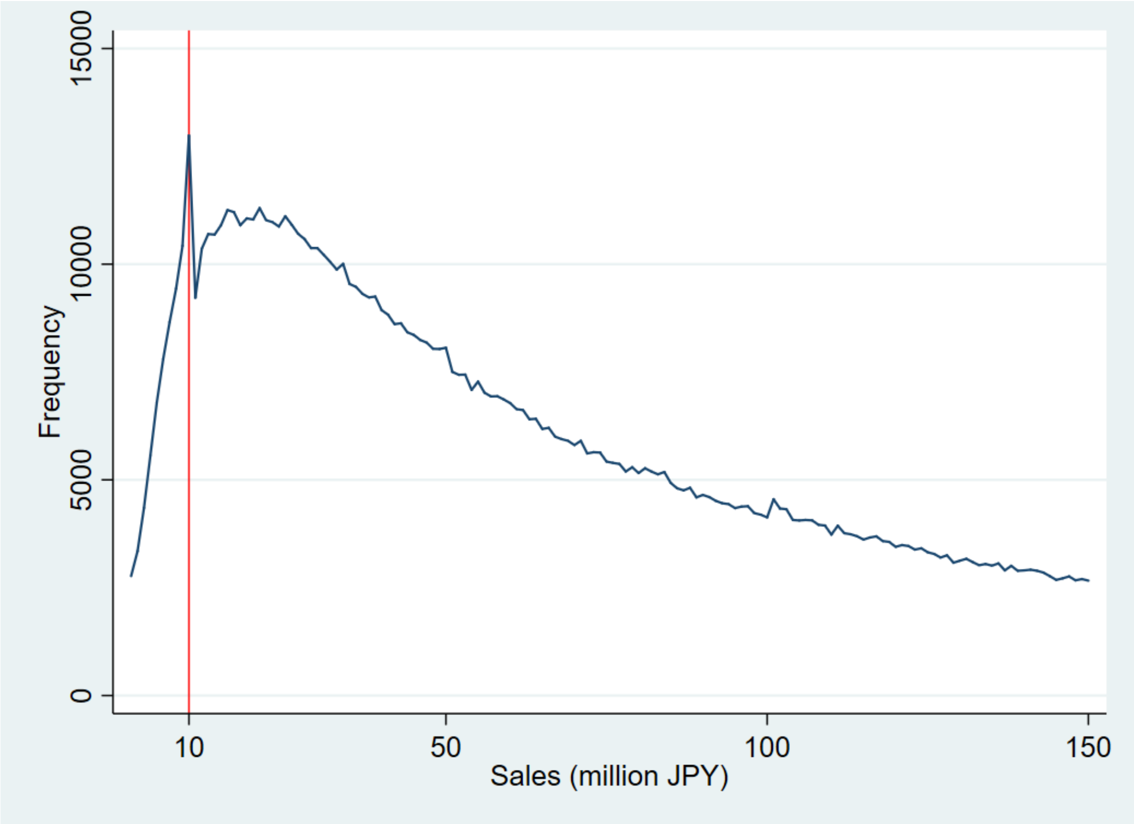
Whole sample: 2009-2014

	Bunching estimators	Bootstrap standard errors		Excluded interval (Unit: 1M JPY)		Obs
Total	0.285	0.020	***	9	18	916,556

Sample separated by each prefecture: 2009-2014

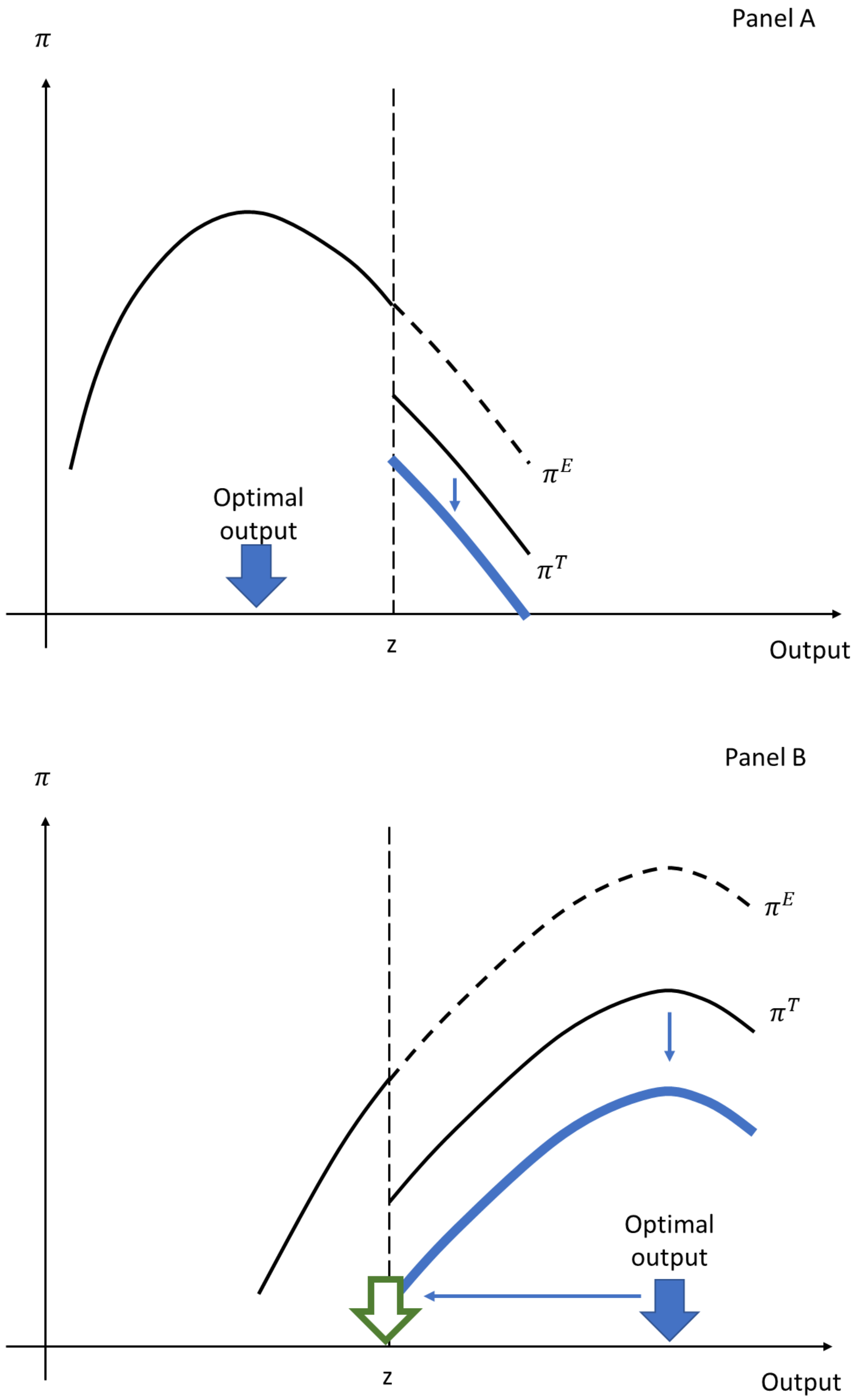
Prefecture	Bunching estimators	Bootstrap standard errors		Excluded interval (Unit: 1M JPY)		Obs
Hokkaido	0.321	0.039	***	9	19	49,148
Aomori	0.221	0.041	***	9	11	21,017
Iiwate	0.286	0.129	**	9	11	8,590
Miyagi	0.415	0.100	***	9	16	20,034
Akita	-0.105	0.102		9	11	8,854
Yamagata	0.319	0.049	***	9	18	13,960
Fukushima	0.240	0.083	***	9	12	15,578
Ibaraki	0.158	0.061	***	9	19	15,215
Tochigi	0.165	0.048	***	9	12	14,070
Gunma	0.232	0.043	***	9	12	22,733
Saitama	0.241	0.044	***	9	14	34,363
Chiba	0.224	0.109	**	9	13	21,606
Tokyo	0.265	0.060	***	9	15	45,011
Kanagawa	0.194	0.079	**	9	11	21,278
Niigata	0.274	0.049	***	9	19	34,775
Toyama	0.315	0.075	***	9	13	13,570
Ishikawa	0.229	0.058	***	9	17	17,450
Fukui	0.561	0.097	***	9	18	9,049
Yamanashi	0.538	0.526		9	11	7,429
Nagano	0.316	0.048	***	9	14	19,891
Gifu	0.087	0.039	**	9	11	23,703
Shizuoka	0.219	0.043	***	9	20	40,405
Aichi	0.140	0.061	**	9	11	39,904
Mie	0.361	0.041	***	9	20	17,916
Shiga	0.445	0.039	***	9	19	17,728
Kyoto	0.419	0.072	***	9	14	11,013
Osaka	0.415	0.049	***	9	13	33,288
Hyogo	0.386	0.058	***	9	14	29,868
Nara	0.606	0.045	***	9	12	12,779
Wakayama	0.376	0.078	***	9	11	6,454
Tottori	0.201	0.129		9	12	6,161
Shimane	0.178	0.101	*	9	13	8,483
Okayama	0.365	0.184	*	9	13	7,242
Hiroshima	0.269	0.037	***	9	20	41,611
Yamaguchi	0.255	0.049	***	9	12	16,760
Tokushima	0.130	0.089		9	11	6,107
Kagawa	0.173	0.053	***	9	11	13,620
Ehime	0.304	0.046	***	9	12	18,416
Kochi	0.162	0.153		9	11	6,742
Fukuoka	0.324	0.037	***	9	16	44,507
Saga	0.190	0.051	***	9	12	9,700
Nagasaki	0.316	0.066	***	9	12	15,458
Kumamoto	0.587	0.047	***	9	11	17,199
Oita	0.202	0.087	**	9	13	12,744
Miyazaki	0.297	0.042	***	9	18	16,738
Kagoshima	0.184	0.060	***	9	12	18,889
Okinawa	0.586	0.094	***	9	16	9,500

Figure 1. Distribution of sales for the whole sample: 2009-2014



Source: the data provided by TSR

Figure 2. The effect of the fixed compliance cost on the choice of output level



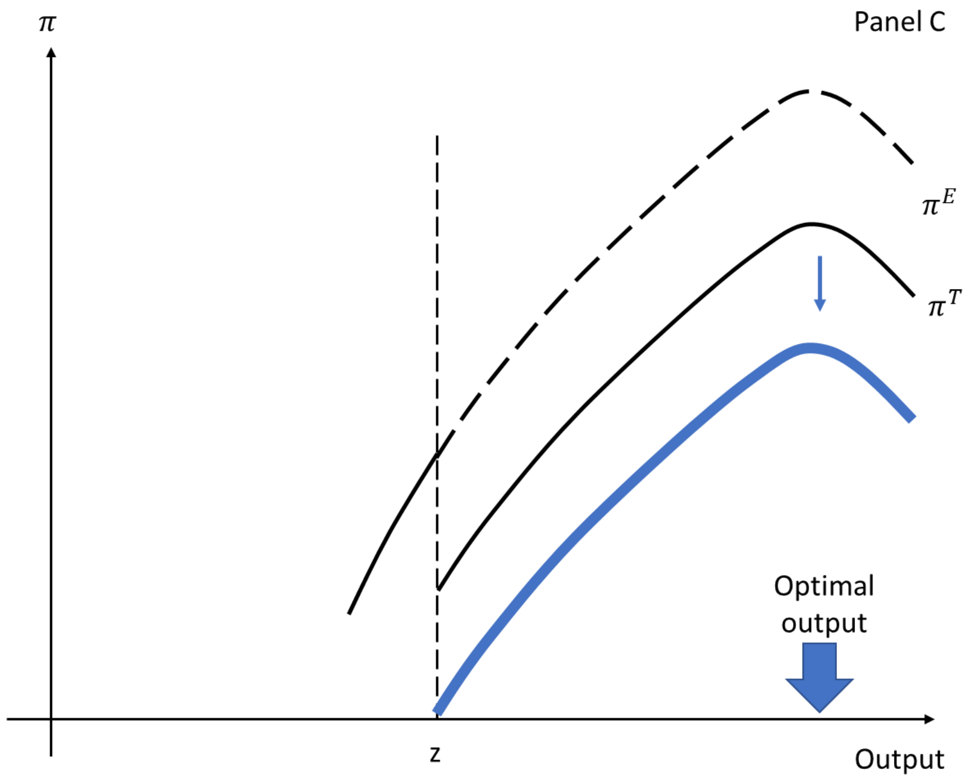
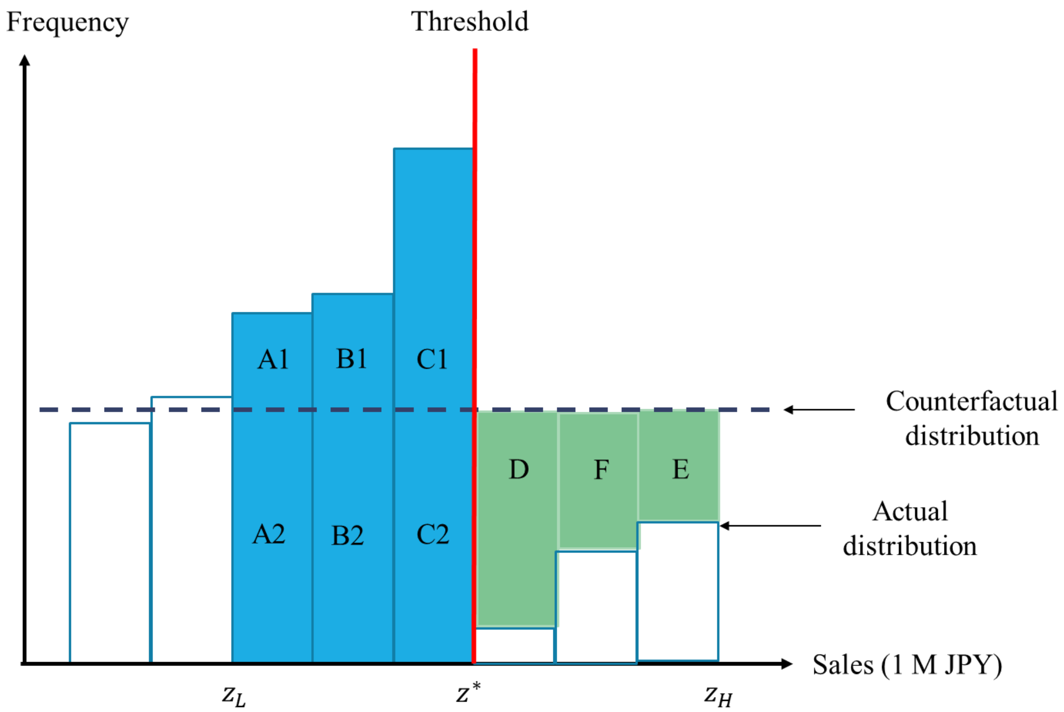

π
Panel C
π^E
π^T
Optimal
output
z
Output

Figure 3. Bunching estimate



Bunching estimate=(A1+B1+C1)/((A2+B2+C2)/3), where A1+B1+C1 is the excess mass at or just below the threshold and approximately equals the missing mass above the threshold (D+F+E).

Figure 4. Bunching estimators by prefecture

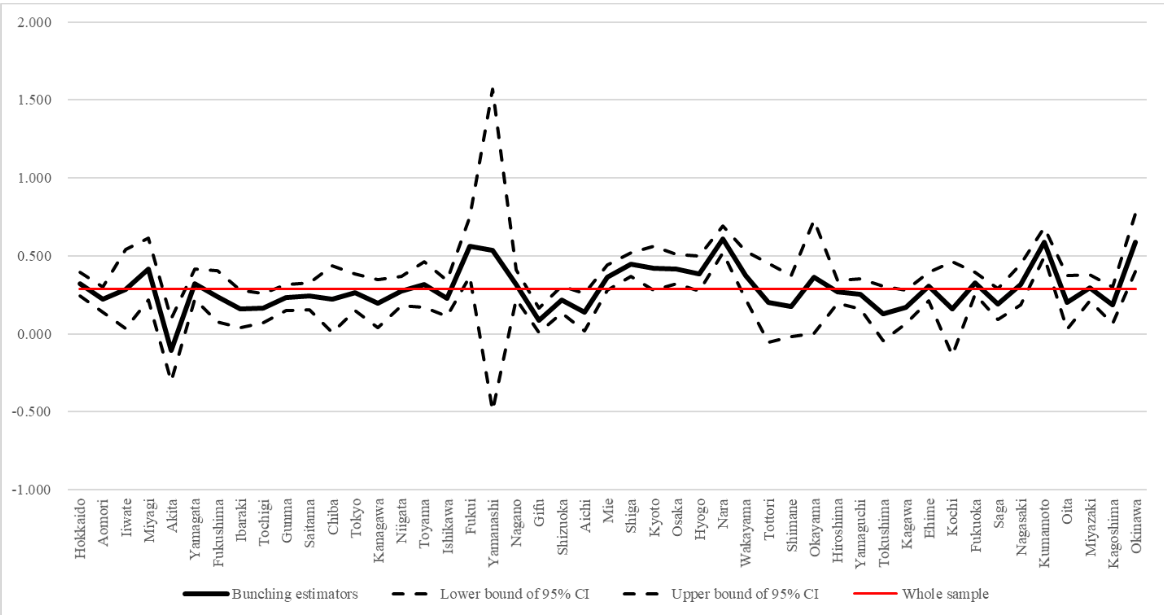


Figure 5. Guidance fee payment to tax accountants per firm (GFPT): Unit 1 M JPY

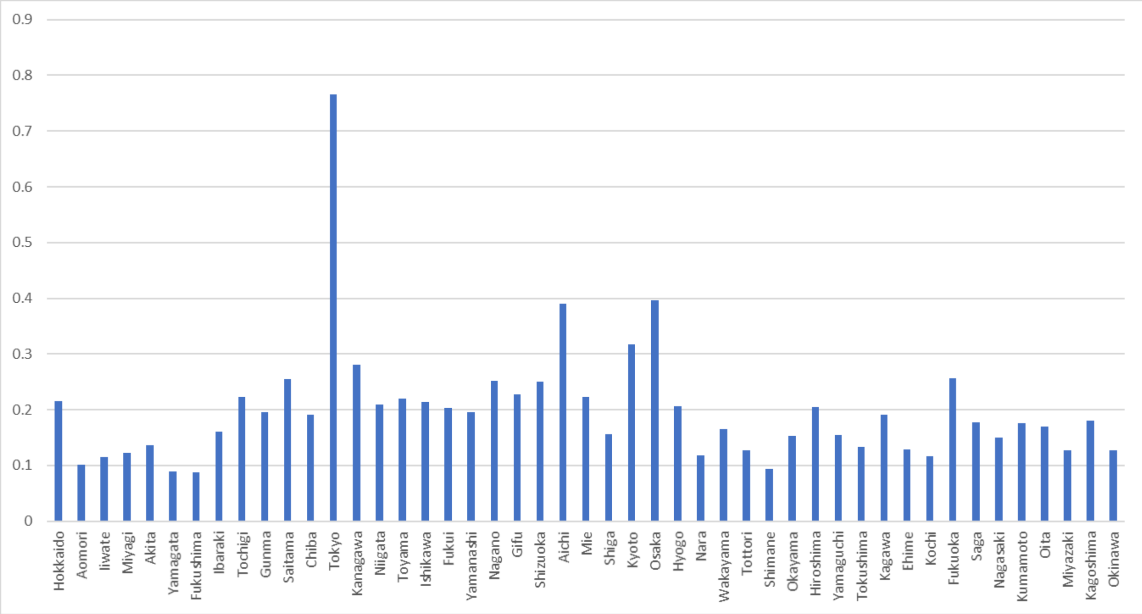


Figure 6. Distribution of sales for firms that have “less knowledge” by their main supplier’s degree of knowledge

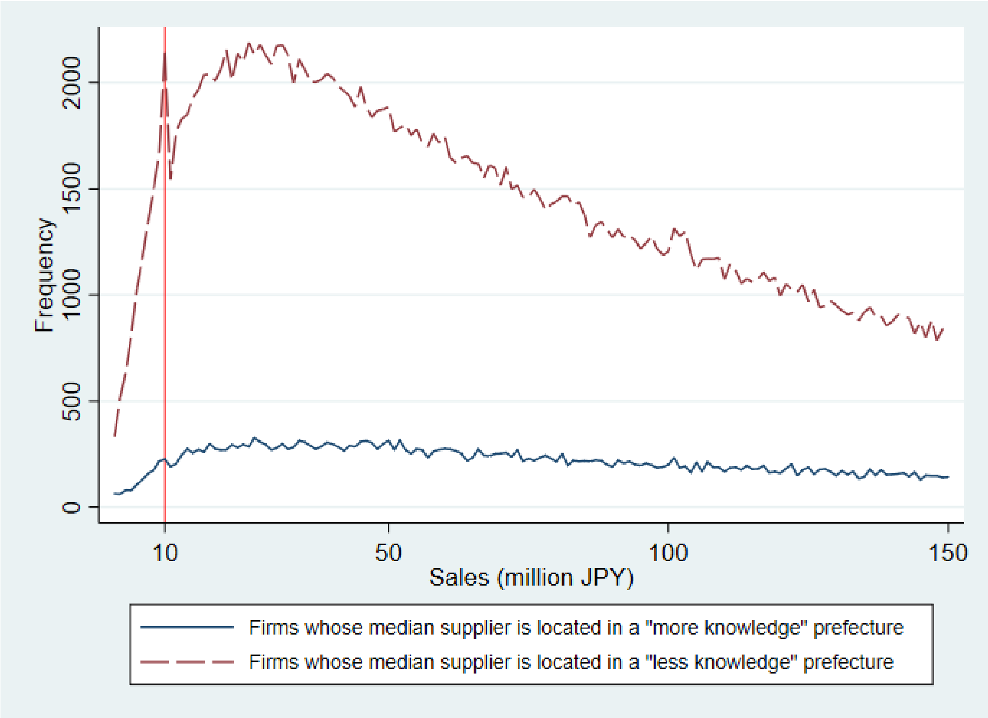


Figure 7. Distribution of sales for firms that have “less knowledge” by their main customer’s degree of knowledge