

Size-dependent VAT and firm growth

A preliminary analysis

Kaoru HOSONO (Gakushuin Univ.)

Masaki HOTEI (Daito Bunka Univ.)

Daisuke MIYAKAWA (Hitostubashi Univ.)

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Motivation

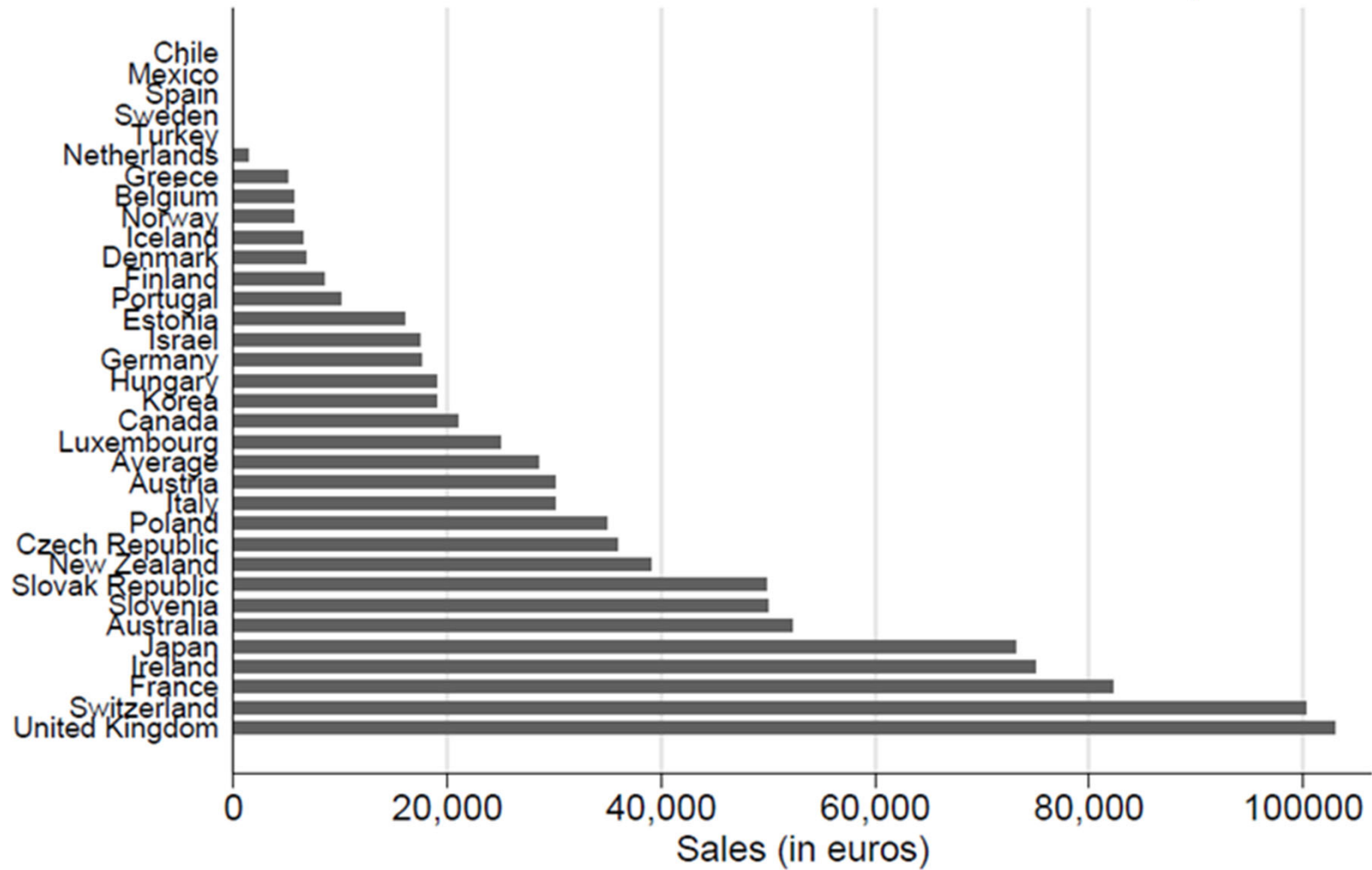
■ Size-dependent VAT

- Many countries provide small and medium enterprises (SMEs) with tax preferences to consider the burden of their compliance costs associated with filing of the VAT return.
- Tax preference: Firms with sales at or below a threshold are exempted from paying (a part of) VAT and avoid filing tax return (incurring compliance costs).
- The levels of the threshold vary considerably across countries. (Harju et al. 2016)

■ Some studies show a bunching just below the threshold in the distribution of firm's sales.

- e.g., Onji 2009 in the case of VAT in Japan; Harju et al. 2016 in the case of VAT in Finland; Liu et al. 2017 in the case of VAT in the U.K.
- Many firms do not want to increase their sales beyond the threshold to acquire tax benefit and to avoid compliance costs.

VAT thresholds in OECD countries in 2014 (in euros)



Source: OECD Statistics

Notes: Harju et al. (2016), p.8

VAT in Japan

■ Calculation of VAT

- Each firm's VAT payment is calculated as 8% (tax rate) of (sales – intermediate input), i.e., sales tax – intermediate input tax credit (refund)

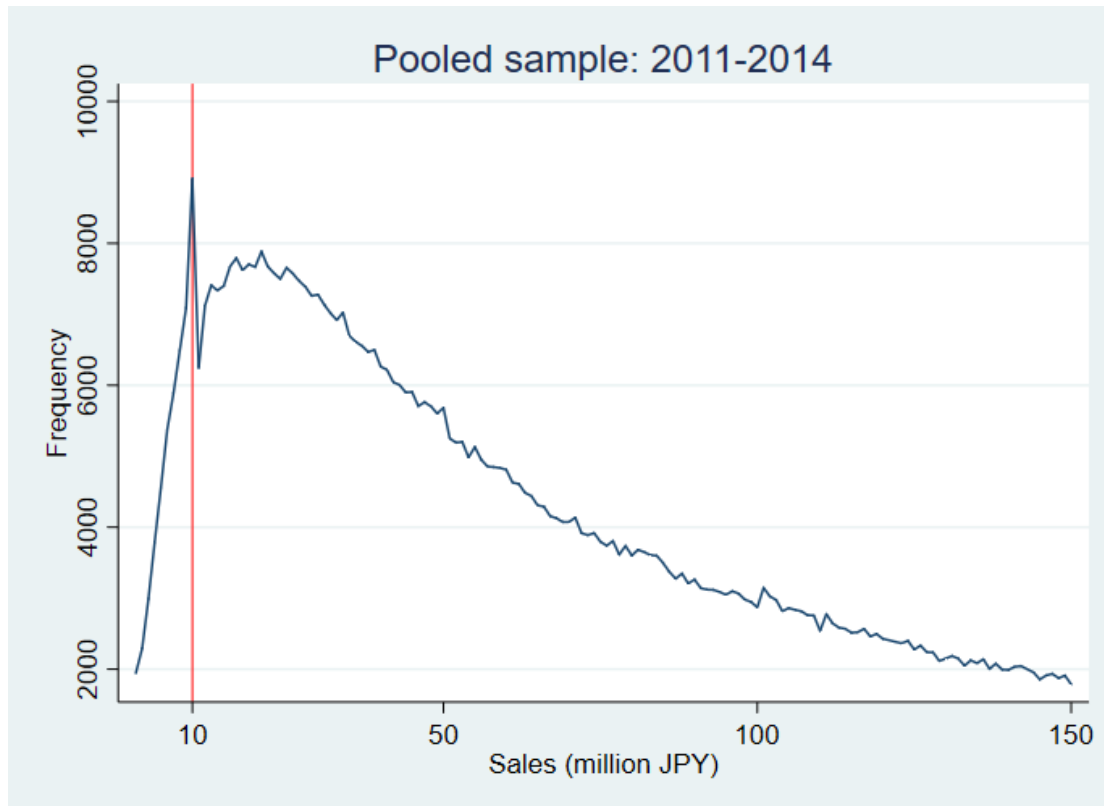
■ VAT exemption

- Firms with sales at or below 10 million JPY (about 90 thousand USD) are exempted from paying sales VAT and avoid filing tax return (incurring compliance costs).
- However, they cannot use intermediate input tax credit.
- They are implicitly allowed to sell their goods at price including tax to compensate the amount of tax which they pay on intermediate input goods.

■ Registration for VAT

- In order to use intermediate input tax credit legally, firms have to register for VAT.
- They have to keep books and file the VAT return at least once a year.
- In addition, they have to preserve these books and bills for several years.
- Therefore, they incur the compliance costs associated with these actions if they register for VAT.

Distribution of firm's sales in Japan



- There is a clear bunching just below the threshold (10 million JPY) in the distribution of firm's sales.
- This suggests that tax benefit and compliance costs associated with filing of tax return prevent a part of firms from growing beyond the threshold.

Research questions

1. When we consider the effects of the compliance costs, what type of firms are likely to bunch just below the threshold.
2. What type of firms are less likely to bunch in response to a decrease in the compliance costs?
3. How does the opportunity of getting knowledge about filing of VAT return, which likely reduces the compliance costs, affect firms' bunching behavior?

Related studies

- Some studies show the intermediate input tax credit affects firms' bunching behavior.
 - Firms with lower intermediate input-to-sales ratios are more likely to bunch just below the threshold because they need less intermediate input tax credit. (e.g., Harju et al. 2016; Liu et al. 2017)
 - However, they do not consider the effects of the compliance costs in their estimation.
- Few studies show how the compliance costs affect firms' bunching behavior.
 - Harju et al. (2016): Finnish VAT reform which reduced the compliance costs made the extent of bunching just below the threshold lower and induced the firms to grow beyond it.
 - However, they don't show what types of firms were more likely to respond to the reduction in the compliance costs.

Theoretical Background

■ Keen and Mintz (2004) model

- Individuals allocate their time (time endowment=1) between the production of the taxed good (L) and some untaxed good ($1-L$).
- The individual's problem:

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

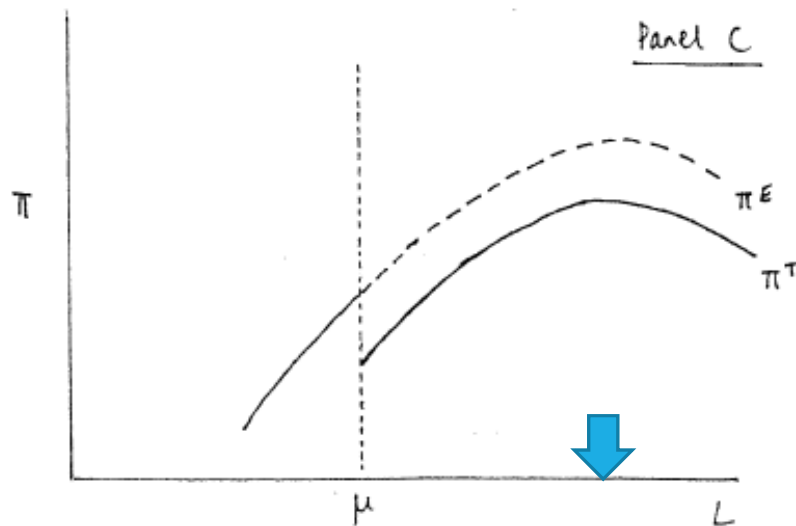
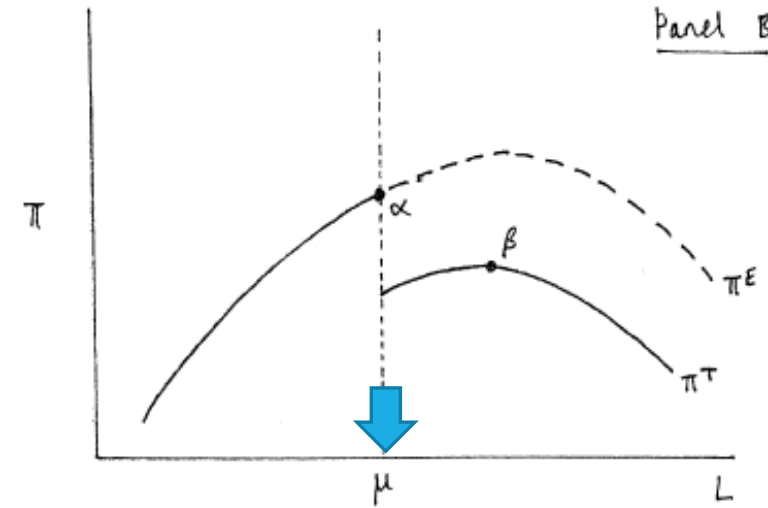
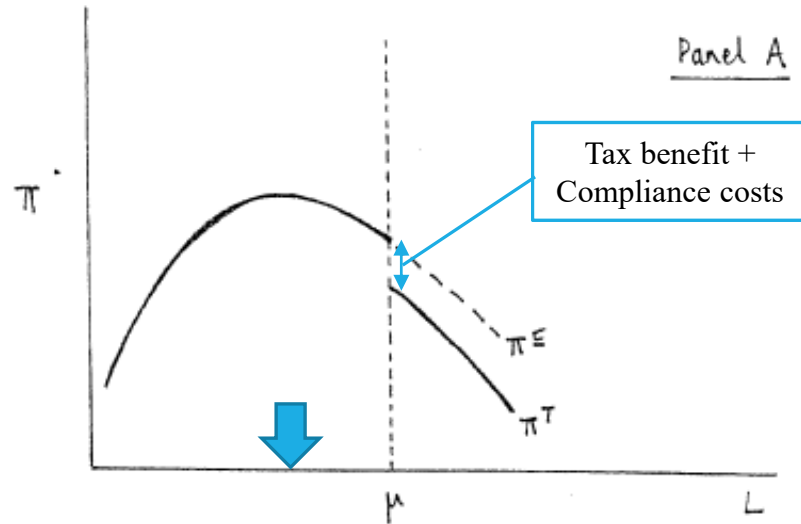
- $w(1-L)$: Earnings from the untaxed sector (Individuals have the same productivity w)
- $\rho f(nL)$: Profits from the taxed sector (Individuals differ in productivity n in producing the taxed good), $f' > 0, f'' < 0$, P =producer price of good, P_I =price of intermediate input, λ =intermediate input-to-output ratio, τ =VAT rate

$$\rho(\text{profits per output}) = \begin{cases} (1 + \tau)(P - P_I \lambda) & \text{if } Pf < z \text{ (threshold)} \\ P - P_I \lambda - \gamma & \text{if } Pf \geq z \text{ (threshold)} \end{cases}$$

- $Pf < z$: Individuals are exempted from paying VAT. They set their price at $(1+\tau)P$ to compensate tax payment on intermediate input.
- $Pf \geq z$: Individuals pay VAT with the compliance costs per output (γ).

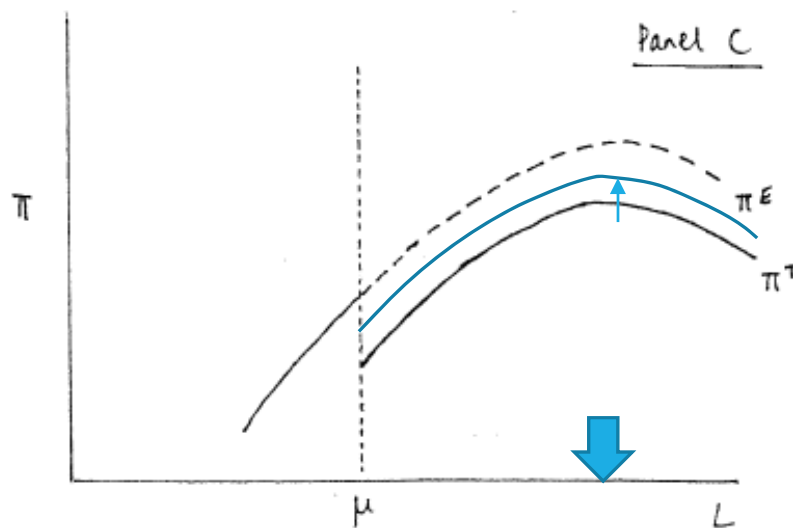
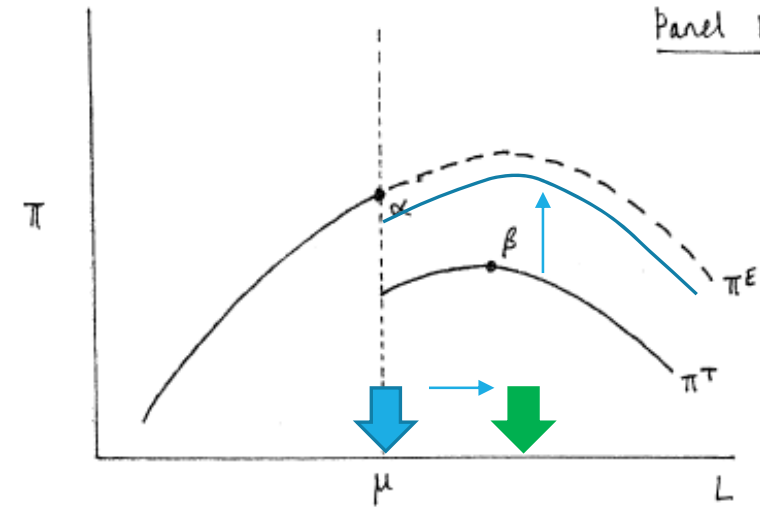
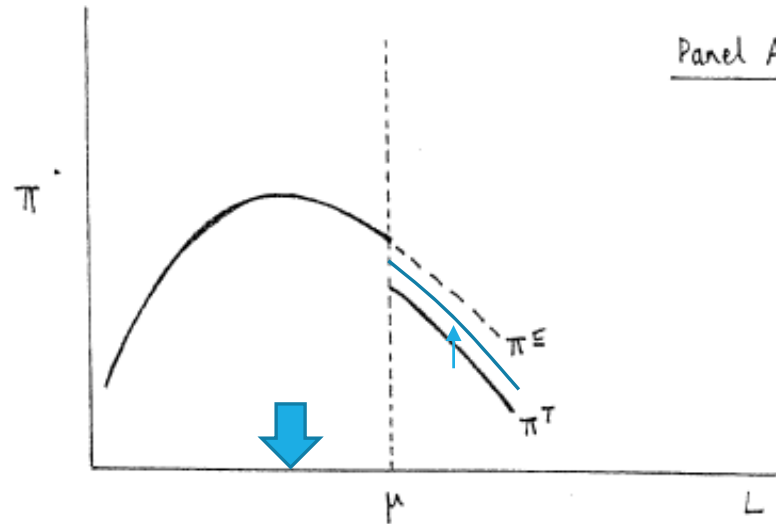
■ Choice of firm size

- Optimal labor input L (output) depends on individual's productivity.
- $z = Pf(n\mu)$: μ is labor input at which output just equals the threshold.



- Panel A (individuals with very low n):
Optimal L (output) $< \mu$ (z)
- Panel B (individuals with low n):
Optimal L (output) $= \mu$ (z)
- Panel C (individuals with high n):
Optimal L (output) $> \mu$ (z)

- The effect of a decrease in the compliance costs on firm size
 - A decrease in the compliance costs moves profit curve upward in the range of labor input above μ .



- Panel A (individuals with very low n): Optimal L (output) doesn't change
- Panel B (individuals with low n): Optimal L (output) increases from the threshold level
- Panel C (individuals with high n): Optimal L (output) doesn't change

Hypotheses

1. If the compliance costs are constant, firms with lower productivity are more likely to bunch just below the threshold. (except for firms with very low productivity)
2. Firms with lower productivity are less likely to bunch in response to a decrease in the compliance costs. (except for firms with very low productivity)
3. Regarding firms with lower productivity, if firms have opportunity of getting knowledge about filing of VAT return, which reduce the compliance costs, they are less likely to bunch.

Empirical model

- Data on whether an individual firm registers for VAT or not are not available.
- We first estimate the degree of bunching for each prefecture using a large firm-level dataset.
- Then, in order to investigate whether firms with lower productivity are more likely to bunch just below the threshold or not, we estimate the following prefecture-level equation:

$$\text{Bunching est.}_j = \alpha + \beta \ln \text{med_sal}_j + \gamma \text{GFPT}_j + \lambda \mathbf{x}_j + \varepsilon_j$$

- *Bunching est._j*: bunching estimate of sales just below the threshold in prefecture j (the degree of bunching)
- *lnmed_sal_j*: natural logarithm of the median value of firm's sales in prefecture j (proxy for the average productivity of firms in prefecture j)
- *GFPT_j*: guidance fee payment to tax accountants per firm in prefecture j (proxy for the average compliance costs of firms in prefecture j)
- *x_j*: the vector of the other prefecture-level attributes
 - The median value of firm's profit-to-sales ratio in prefecture j (proxy for the average market power of firms in prefecture j)
 - Natural logarithm of gross prefectural product per capita in prefecture j

Empirical model (continued)

- In order to investigate whether firms with lower productivity more significantly respond to a decrease in the compliance costs or not, we estimate the following prefecture-level equation:

$$Bunching\ est._j = \sum_{i=1}^4 \beta_i sal_q_i + \sum_{i=1}^4 \gamma_i sal_q_i \times GFPT_j + \lambda x_j + \varepsilon_j$$

- sal_q_i : a dummy variable taking the value of one if the natural logarithm of firm's sales (median) is larger than the $i-1$ th quartile and smaller than or equal to the i th quartile, and taking the value of zero otherwise.
- $sal_q_i \times GFPT_j$: a cross term of the i th quartile dummy (firm's productivity) and the compliance costs

Data

- Bunching estimates., the median values of sales and profit-to-sales ratio
 - We calculate these variables by each prefecture using the data provided by Tokyo Shoko Research Ltd (TSR).
 - It covers both the listed and unlisted firms in Japan.
 - In order to secure an enough number of observations by each prefecture, we use data for the period 2011-2014.
 - We focus on the firms with sales less than or equal to 150 million JPY.
 - We exclude the industries conducting nontaxable transactions such as the finance, insurance, real estate, education, medical welfare, public service industries.
 - The total number of firm-year observation is about 637,000 over the sample period.

2011-2014

Sample	Obs
Analysis firms	637,824
Primary supplier's information is available	286,448
Primary customer's information is available	485,448

Data (continued)

- Guidance fee payment to tax accountant per firm (GFPT)
 - We calculate GFPT in 2011 using the prefecture-level data provided by Ministry of Internal Affairs and Communications.
 - We define GFPT as total sales of the tax accountant offices (and the accounting offices) divided by total number of firms.
- Gross prefectural product per capita (GPPC)
 - We calculate GPPC in 2011 using the data provided by Cabinet Office

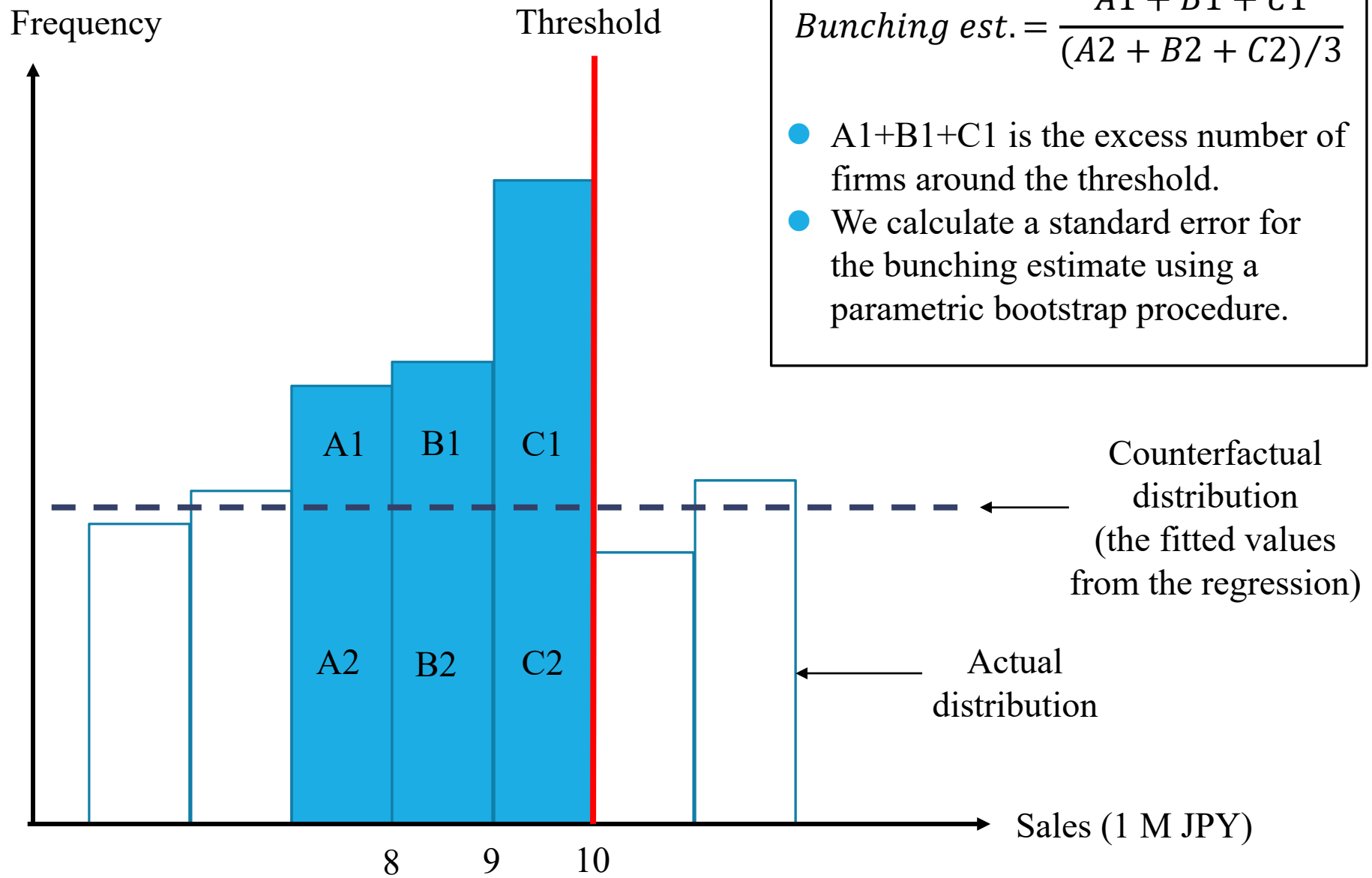
Bunching estimation

■ Bunching estimation method

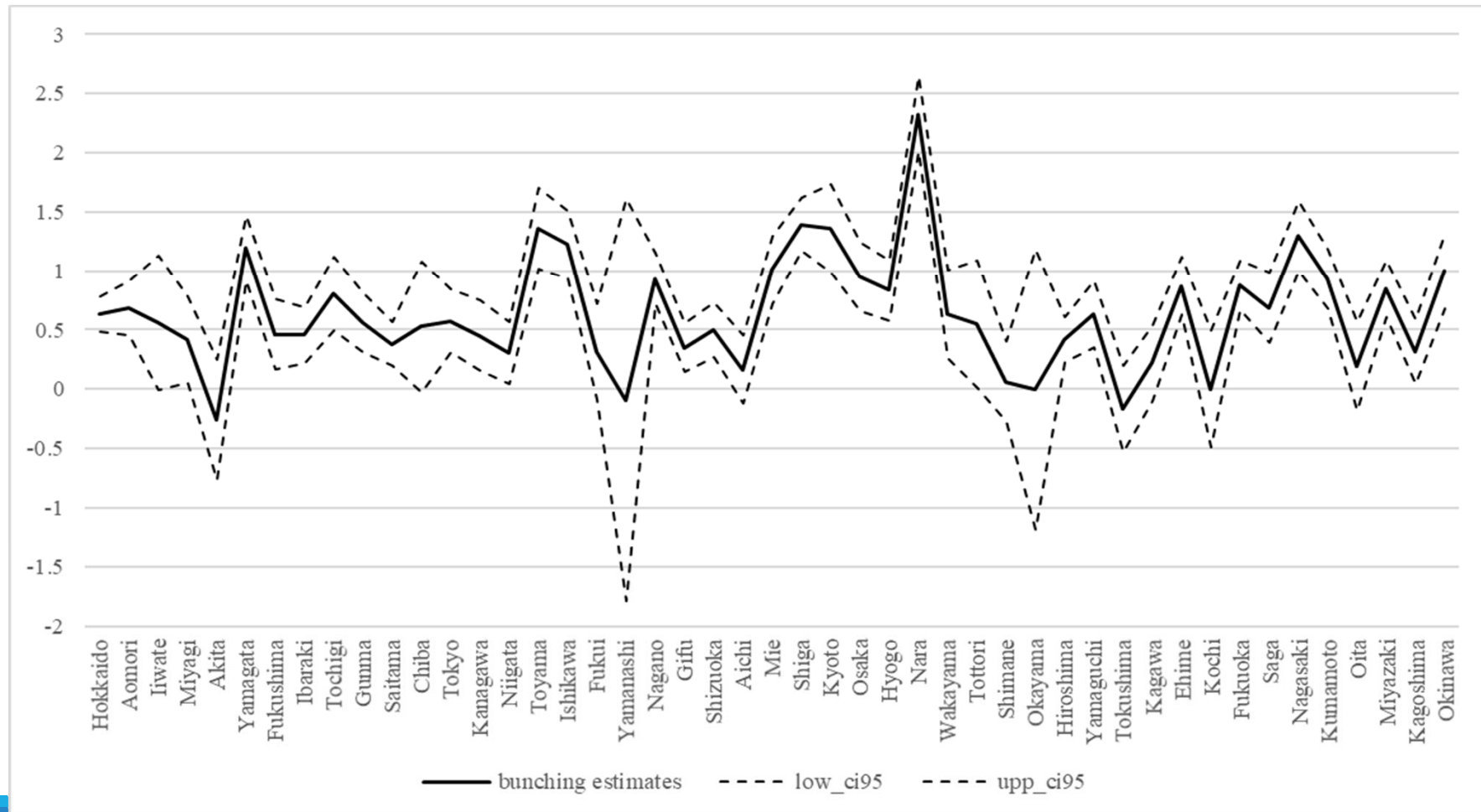
- In order to calculate the degree of bunching, we conduct bunching estimation following Chetty et al. (2011).
- We estimate the counterfactual distribution as the fitted values from the following equation:

$$C_j \cdot \left(1 + \mathbf{1}[j > 0] \frac{\hat{B}_N}{\sum_{j=1}^{\infty} C_j} \right) = \sum_{i=0}^q \beta_i \cdot (Z_j)^i + \sum_{i=-R}^0 \gamma_i \cdot \mathbf{1}[Z_j = i] + \varepsilon_j$$

- C_j : the number of firms in sales bin j with width of 1 million JPY
- Z_j : an upper value of sales in bin j relative to 10 million JPY
- q : the order of the polynomial $\Rightarrow q=6$
- R : the width of the excluded region around the threshold $\Rightarrow R=2$
- $\hat{B}_N = \sum_{j=-R}^0 (C_j - \hat{C}_j) = \sum_{i=-R}^0 \hat{\gamma}_i$: the excess number of firms around the threshold
- Considering that firms bunching around the threshold come from the area to the right of the threshold, we inflate the number of firms in bin j by $\hat{B}_N / \sum_{j=1}^{\infty} C_j$ if $j > 0$ in estimating the counterfactual distribution.
- We estimate this equation by iteration and recalculate \hat{B}_N until it reaches a fixed point ($\hat{B}_N = 0$ at first).
- The bunching estimate is defined as follows: $Bunching\ est. = \frac{\hat{B}_N}{\sum_{j=-R}^0 \hat{C}_j / (R+1)}$



Bunching estimates by prefecture

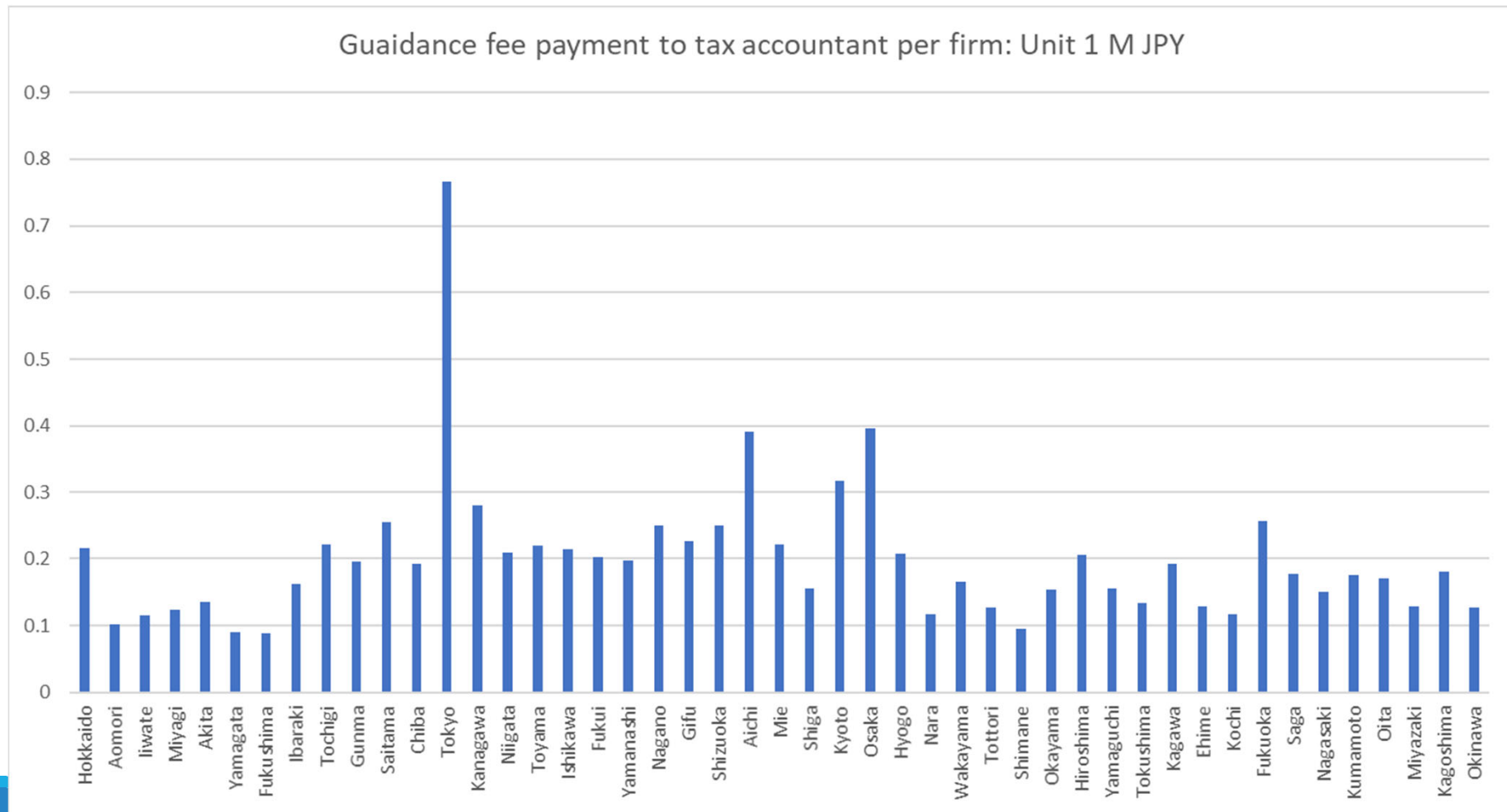


Summary statistics

Variable	Obs	Mean	Median	Min	Max
Buncing estimates	47	0.633	0.562	-0.260	2.325
Natural logarithm of sales (median)	47	3.878	3.860	3.411	4.374
Guidance fee payment to tax accountant per firm (GFPT, unit:1M JPY)	47	0.199	0.181	0.087	0.766
Profit-to-sales ratio (median, unit:%)	47	1.853	1.715	0.417	4.067
Natural logarithm of GPPC	47	1.266	1.255	0.928	2.027

Notes: GPPC denotes gross prefectural product per capita.

Guidance fee payment to tax accountant per firm by prefecture



Estimation results of regression

Dependent variable: bunching estimates				
	(1)	(2)	(3)	(4)
Natural logarithm of sales (median)	-1.430 *** (0.451)	-1.642 *** (0.493)	-0.822 ** (0.359)	
Guidance fee payment to tax accountant per firm (GFPT)		0.963 ** (0.436)	2.774 *** (0.759)	
Sal_q1*GFPT				-4.005 (2.620)
Sal_q2*GFPT				5.745 ** (2.418)
Sal_q3*GFPT				4.045 ** (1.661)
Sal_q4*GFPT				2.392 *** (0.841)
Profit-to-sales ratio (median)			0.263 *** (0.078)	0.262 *** (0.076)
Natural logarithm of GPPC			-1.300 *** (0.461)	-1.063 * (0.545)
constant	6.180 *** (1.764)	6.807 *** (1.890)	4.426 *** (1.612)	
Sal_qi	No	No	No	Yes
R-squared	0.258	0.299	0.509	0.852
Number of obs	47	47	47	47

Notes: GPPC denotes gross prefectural product per capita. Sal_qi (i=1,2,3,4) is a dummy variable taking the value of one if the natural logarithm of firm's sales (median) is larger than the i-1th quartile and smaller than or equal to the ith quartile, and taking the value of zero otherwise. Robust standard error in parentheses. ***significant at 1%, **significant at 5%, *significant at 10%.

Estimation results of regression (continued)

■ Equation (1)

- The coefficient of the median values of firm's sales (logarithmic value) is negative and statistically significant.

■ Equation (2)

- When controlling the effects of the compliance costs, the coefficient of the median value of firm's sales remains negative and statistically significant.
- Given the compliance costs, prefectures with lower median value of firm's sales are likely to have the higher degree of bunching

■ Equation (3)

- When controlling the other prefecture-level attributes as well as the compliance costs, the coefficient of the median value of firm's sales remains negative and statistically significant.
- These results are consistent with our hypothesis that firms with lower productivity are more likely to bunch just below the threshold.

Estimation results of regression (continued)

■ Equation (4)

- The coefficient of the cross term of the 1st quartile dummy of firm's sales and compliance costs are not statistically significant.
- The other coefficients of the cross terms are positive and statistically significant. The size of the coefficient becomes smaller as prefecture-level firm's sales become larger.
- These results are consistent with our hypothesis that firm with lower productivity (except for extremely low productivity) were less likely to bunch in response to a decrease in compliance costs.

The effects of knowledge on the bunching behavior

- The degree of bunching is a proxy for the extent of local knowledge about filing of tax return. (Chetty et al. 2013)
 - Firms located in prefectures with a lower degree of bunching are likely to know more about filing of VAT return. (firms with higher knowledge)
 - Firms located in prefectures with a higher degree of bunching are likely to know less about filing of VAT return. (firms with lower knowledge)
- If firms located in prefectures with lower knowledge transact with firms in prefectures with higher knowledge, the former firms may obtain more knowledge from the latter firms and thereby can lower compliance costs.
 - We focus on firms in prefectures where the degree of bunching is higher than the median. (firms with lower knowledge)
 - We compare bunching estimate of firms connected to 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).

Firms located in prefecture with a lower degree of bunching
↓
Firms with higher knowledge about filing of tax return

Firms located in prefecture with a higher degree of bunching
↓
Firms with lower knowledge about filing of tax return

median

Primary supplier or Primary customer

Knowledge transmission (which reduce compliance costs)

Firm

Stop bunching

Firm

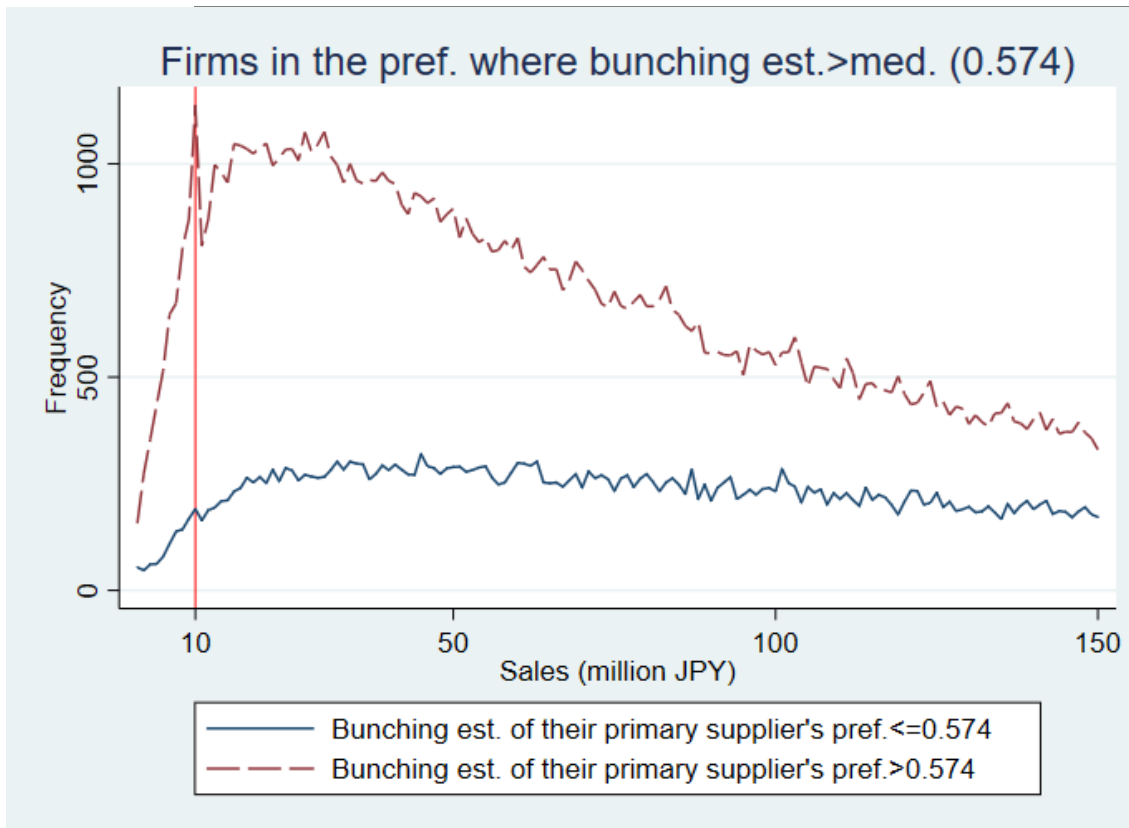
Continue to bunch

No knowledge transmission

Primary supplier or Primary customer

The degree of bunching

Bunching est. with or without the chance of getting knowledge



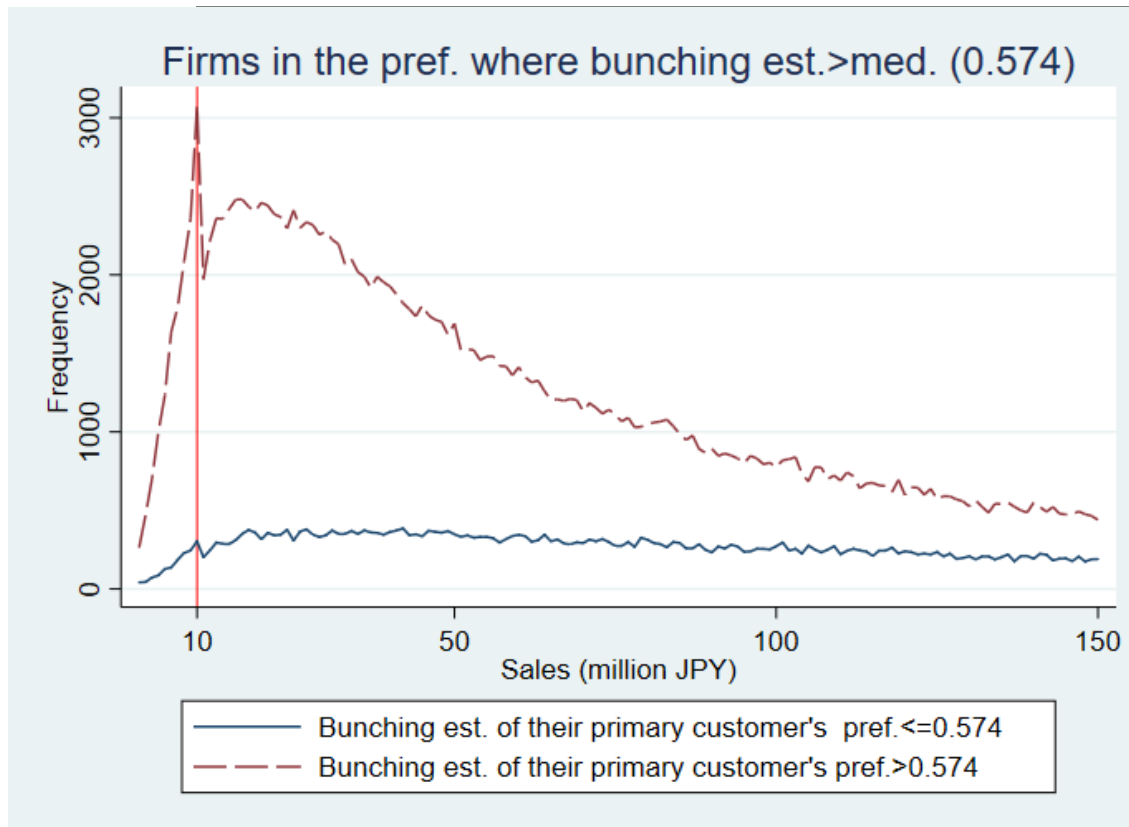
■ We focus on firms with lower knowledge, which have their suppliers.

- Bunching estimate of firms connected to primary suppliers with higher knowledge is smaller than that of firms connected to primary suppliers with lower knowledge.
- This result suggests that firms get more knowledge about the filing of VAT return from primary suppliers with higher knowledge, which reduces the compliance costs, and are less likely to bunch.

Firms in the prefectures where the bunching estimates > median (0.574)

	Excess number of firms	Bunching estimates	Standard error
(1) Bunching estimates of their primary supplier's prefecture ≤ 0.574	32	0.207	0.181
(2) Bunching estimates of their primary supplier's prefecture > 0.574	523	0.686	0.071

Bunching est. with or without the chance of getting knowledge (continued)



■ We focus on firms with lower knowledge, which have their customers.

- Bunching estimate of firms connected to primary customers with higher knowledge is smaller than that of firms connected to primary customers with lower knowledge.
- This result suggests that firms get more knowledge about the filing of VAT return from primary customers with higher knowledge, which reduces the compliance costs, and are less likely to bunch.

Firms in the prefectures where the bunching estimates > median (0.574)

	Excess number of firms	Bunching estimates	Standard error
(1) Bunching estimates of their primary customer's prefecture ≤ 0.574	143	0.677	0.171
(2) Bunching estimates of their primary customer's prefecture > 0.574	1920	1.026	0.061

Conclusion

1. Controlling for the compliance costs, prefectures with lower median value of firm's sales are likely to have the higher extent of bunching, suggesting that low productivity firms are more likely to bunch.
2. Prefectures with lower median value of firm's sales are less likely to bunch in response to a decrease in compliance costs, suggesting that low productivity firms respond more to changes in compliance costs.
3. If firms located in prefectures with higher bunching are connected to firms located in prefectures with lower bunching, they are less likely to bunch, suggesting that knowledge about filing of VAT return transmits from high-knowledge to low-knowledge firms through transaction relationships.

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