Tax processes or tax payments? Firm responses to a VAT threshold

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Motivation

For many countries value-added tax (VAT) is the most important source of tax revenue – this is especially true in LMICs

- VAT generally viewed as production and revenue-efficient but potentially heavy compliance costs
- This often motivates a sales threshold below which registration is voluntary, which may cost revenue and distort production networks
- There is little empirical evidence on these compliance costs, especially in LMICs

More generally, there is still relatively limited evidence on how taxpayers respond in LMICs

- Could be very different to US and Europe due to enforcement capacity and competing informal sector

This paper

Studies cross-sectional and temporal variation in the 'notch' created by a VAT exemption threshold in India

- Use three sources of variation to study the role of tax liabilities vs compliance costs
- Apply methods from the 'bunching' literature to estimate behavioural responses
- Adapt a simple structural framework to estimate structural parameters

Preview of results

We show clear evidence of firms avoiding entering the VAT system, and that this is driven by tax liabilities rather than compliance costs using:

- Variation in VAT rates across similar firms
- Variation in firm types for the same VAT rates
- Variation in VAT rates over time

Parameter estimates suggest VAT compliance costs are negligible in this context, while the elasticity of the tax base is estimated at 0.11-0.28

Related literature

VAT thresholds: Keen and Mintz (2004), Onji (2009), Liu et al. (2021), Asatryan and Peichl (2017), Harju, Matikka, and Rauhanen (2019), Velayudhan (2019)

Bunching: Kleven and Waseem (2013), Chetty et al. (2011), Saez (2010)

Compliance costs: Aghion et al. (2017), Benzarti (2020), Harju, Matikka, and Rauhanen (2019)

Tax and development: Best et al. (2015), Gadenne, Nandi, and Rathelot (2019), Kleven and Waseem (2013), Carillo, Pomeranz and Singhal (2017), Bachas and Soto (2018)

Outline

1. Introduction
2. Context and Data
3. Main Results
4. Parameter Estimates

Sales taxation in West Bengal

The context is West Bengal, India, over the period 2010-16.

- A state of 90 million in the east of India
- In 2015/16, general sales taxes accounted for 60% of internally generated revenue in West Bengal.

A dual system of sales taxation:

- Value Added Tax (VAT): registered firms charge on their taxable sales but can deduct VAT paid on their inputs
  - 4 main VAT schedules for commodities: exempt, 1%, 4% and 12.5% (at the start of the study period)
- Turnover Tax (ToT): a fixed tax rate of 0.25% charged on all sales, with no allowance for deducting input tax.

VAT vs ToT

Firms required to pay VAT if turnover exceeds INR 5 million (GBP 60,000)

- Smaller firms exempted to reduce compliance and admin costs, and widen the tax net – a feature of 75/105 systems in Asatryan and Peichl (2017)

Crossing this sales thresholds creates discontinuous changes in:

- **Tax liabilities**: the size of this tax 'notch' depends on commodities bought and sold
- **Compliance costs**: VAT firms file a 15 page tax return quarterly and must provide detail on who they trade with, whereas ToT is filed annually and the return is a few pages

Data

6 years of tax returns from the Directorate of Commercial Taxes:

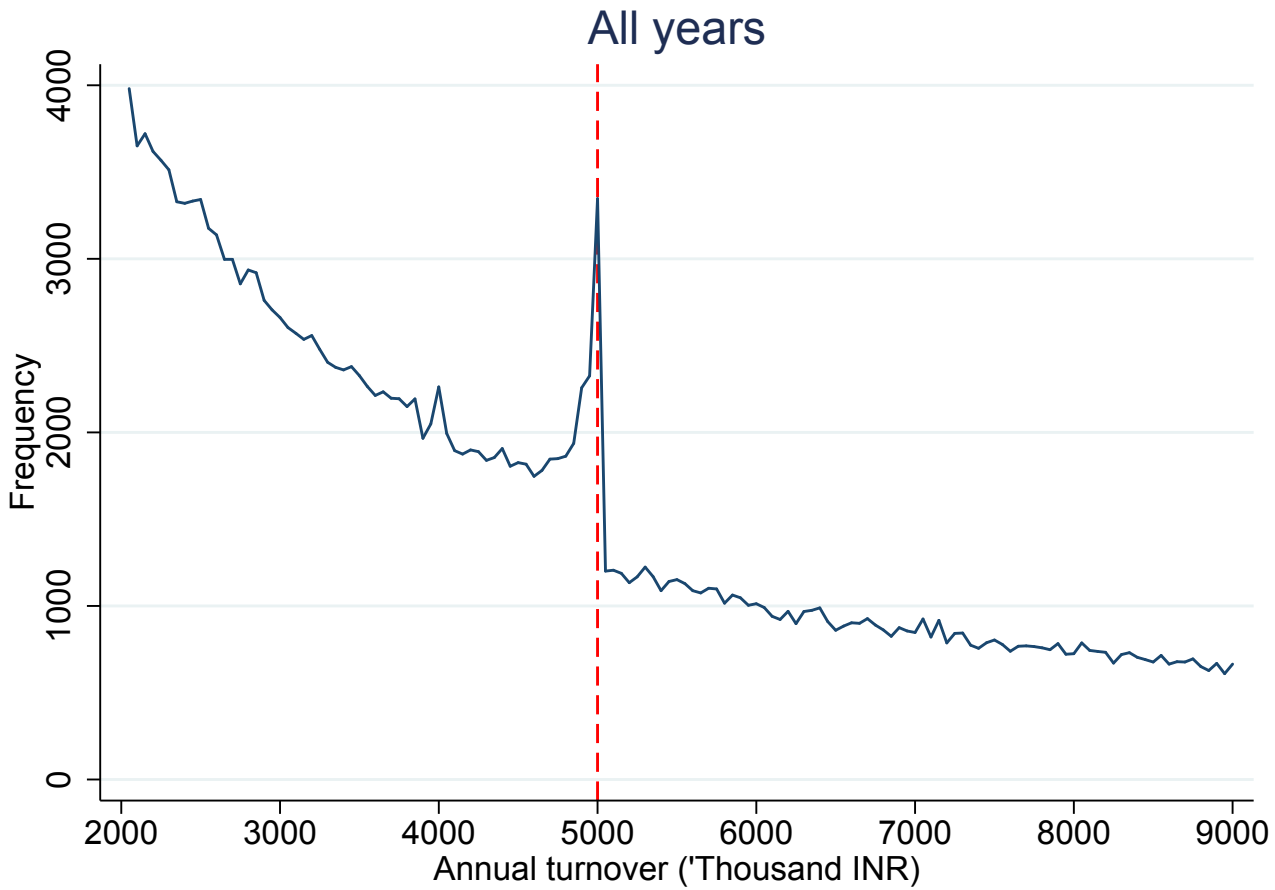
- 880,000 observations and 200,000 unique firms in total

The data covers:

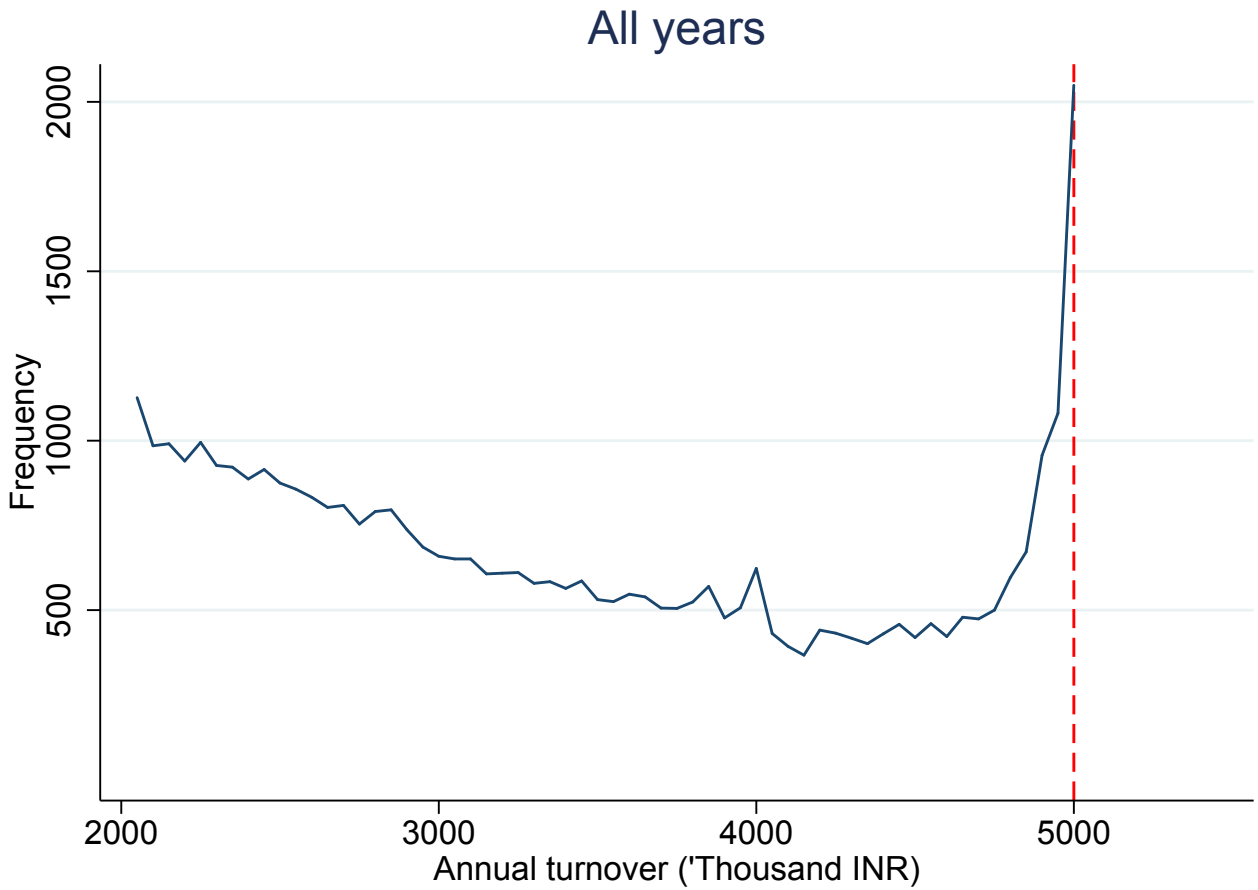
- Full tax returns: information on total sales, inputs and main commodities sold.
- Trade data: VAT firms also report their trading partners when this exceeds INR 50,000, which allows distinguishing B2B sales/inputs (VAT is reclaimable) from other transactions

Descriptive Stats

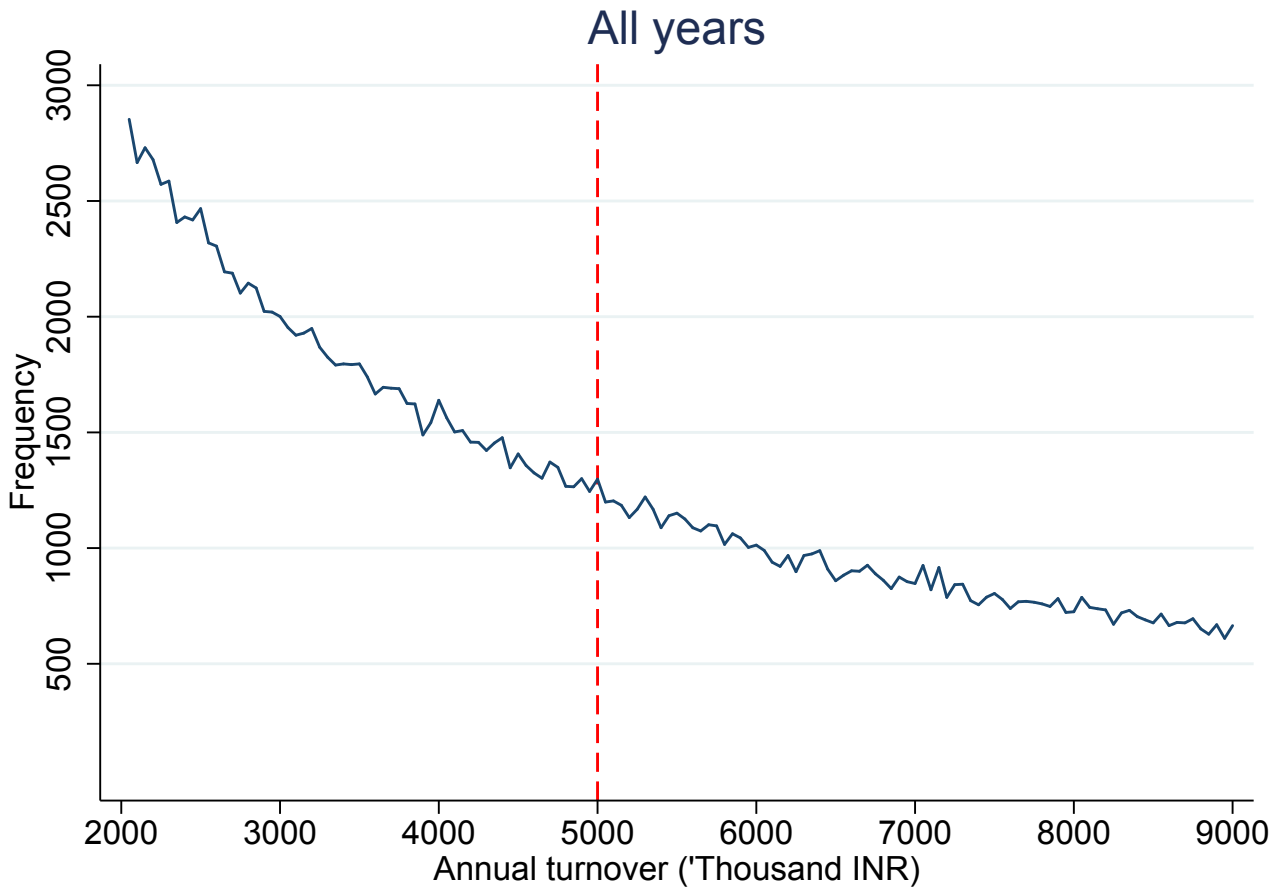
Bunching below the threshold



ToT firms bunch...



...VAT firms do not



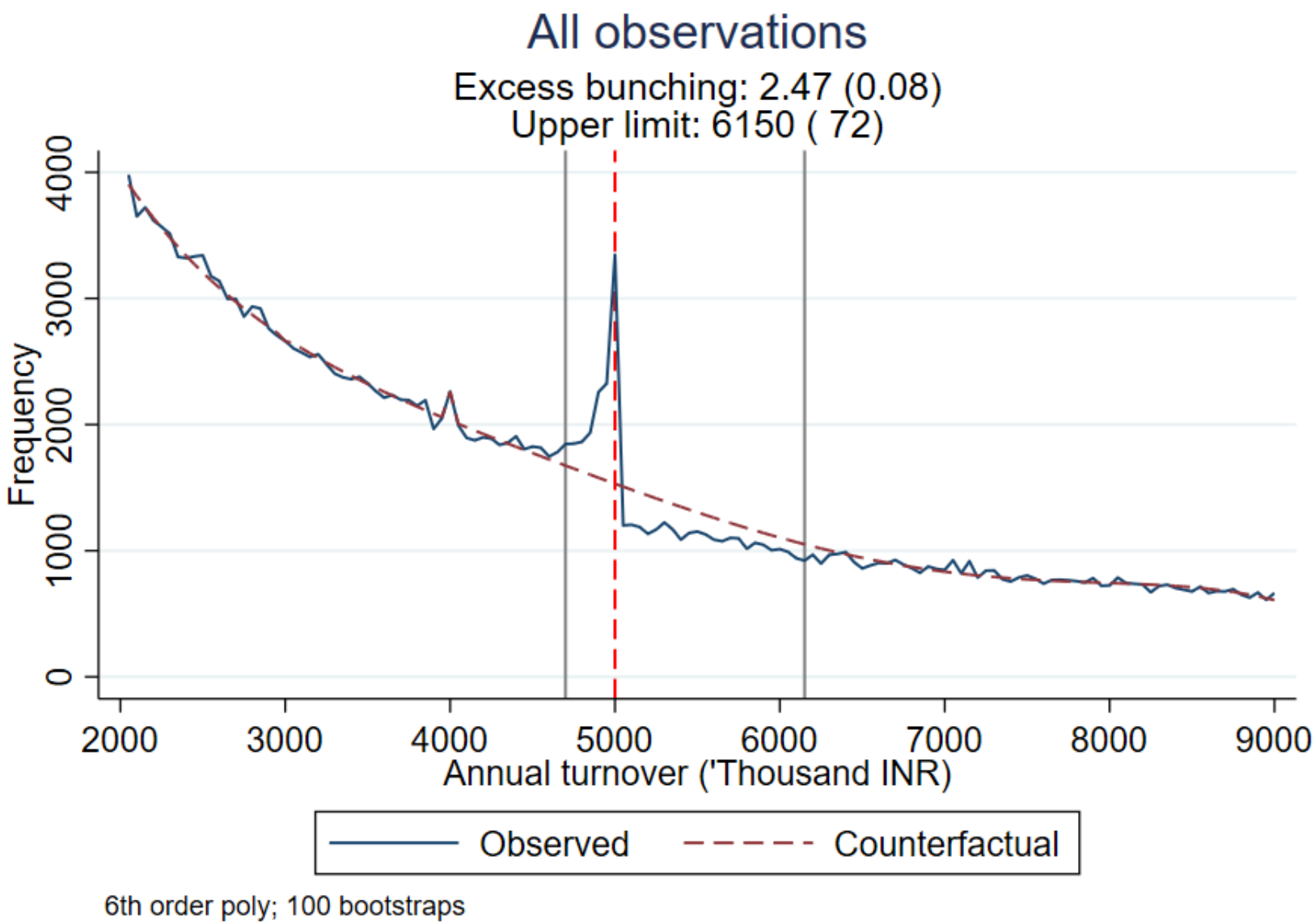
Estimating bunching responses

To estimate behavioural responses in this data, we use methods from the bunching literature which estimate the 'excess mass' of observations below the threshold x^*.

1. Identify the 'lower limit' of bunching by visual inspection
2. Excluding the bunching region, fit a flexible polynomial to the firm distribution
3. Upper limit – which identifies behavioural response of marginal buncher – identified by an interative procedure which increases the upper limit until the excess mass below is equal to missing mass above the threshold
4. Standard errors estimated with a bootstrap procedure

Bunching estimation

Results: full sample



Cross-sectional variation (I)

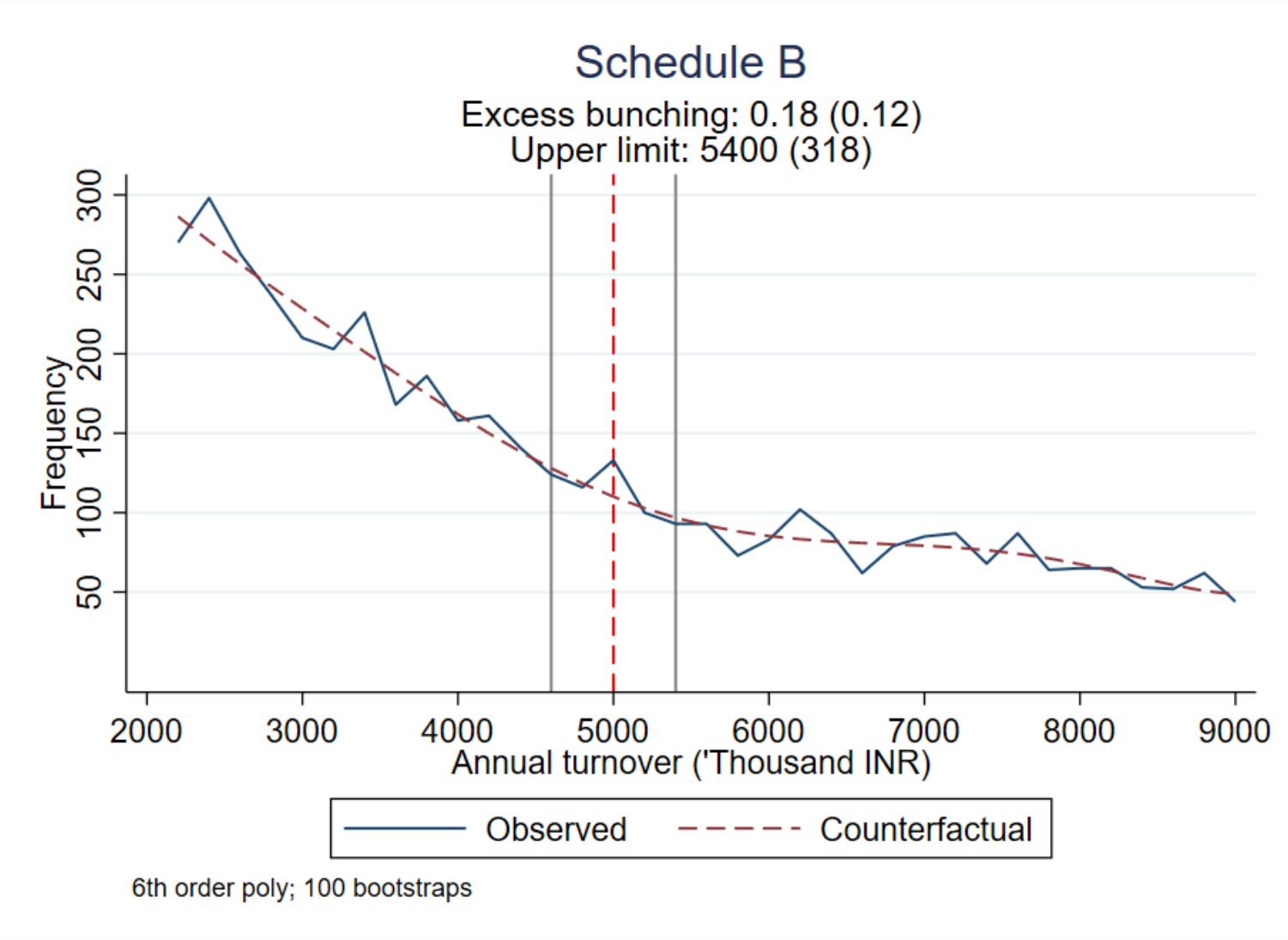
Different commodities attract different VAT rates, and both VAT and ToT firms report the commodities that they sell

- The main 'commodity' a firm sells accounts for a very large proportion of their total sales
- This generates cross-sectional variation in the tax notch
- Focus on wholesalers and retailers

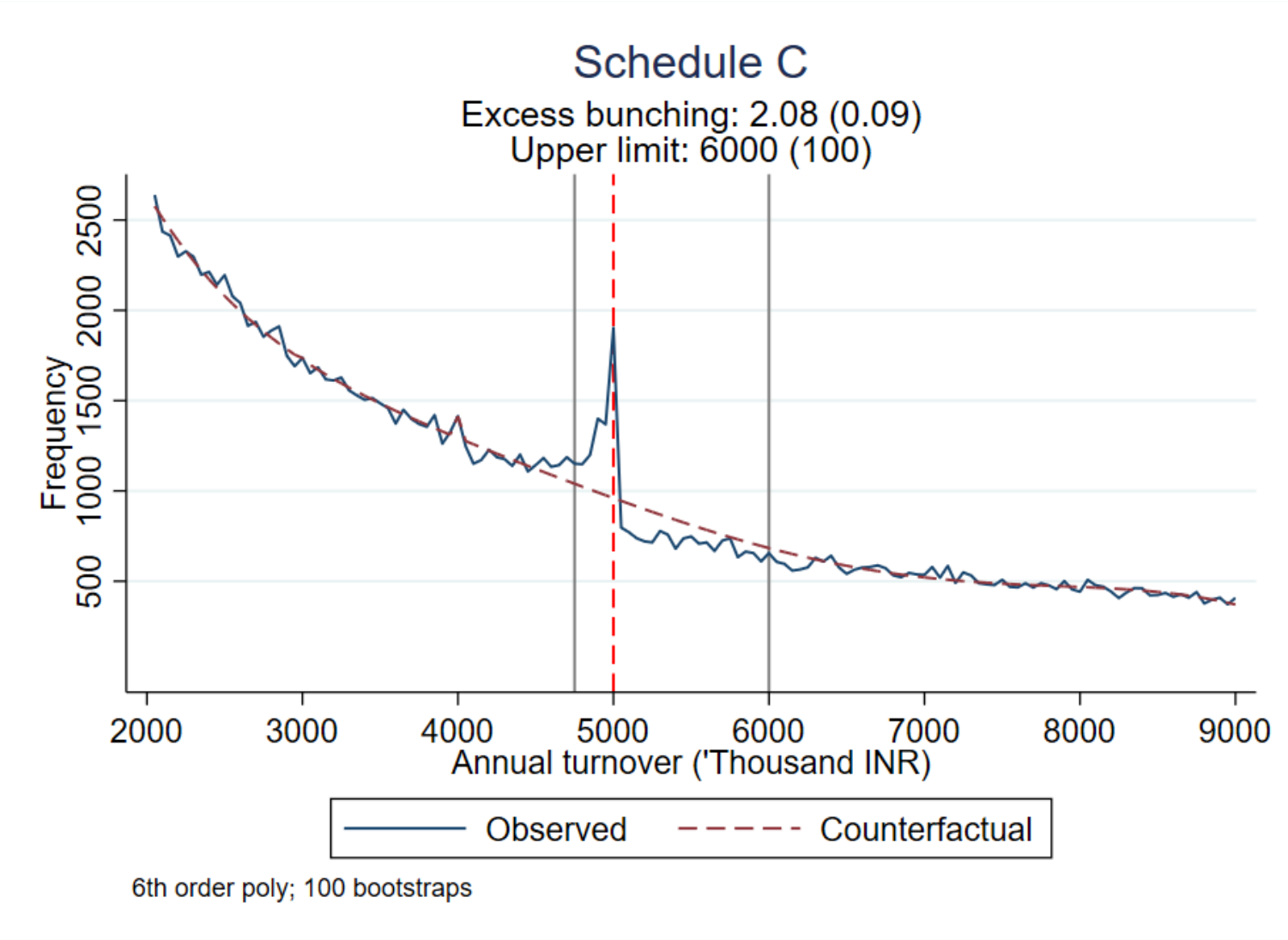
In practice, some ToT firms (approx 20%) don't provide this information

- We impute based on trade partners - results unaffected
- Note that ToT firms selling different commodities don't have differential incentives to provide this information

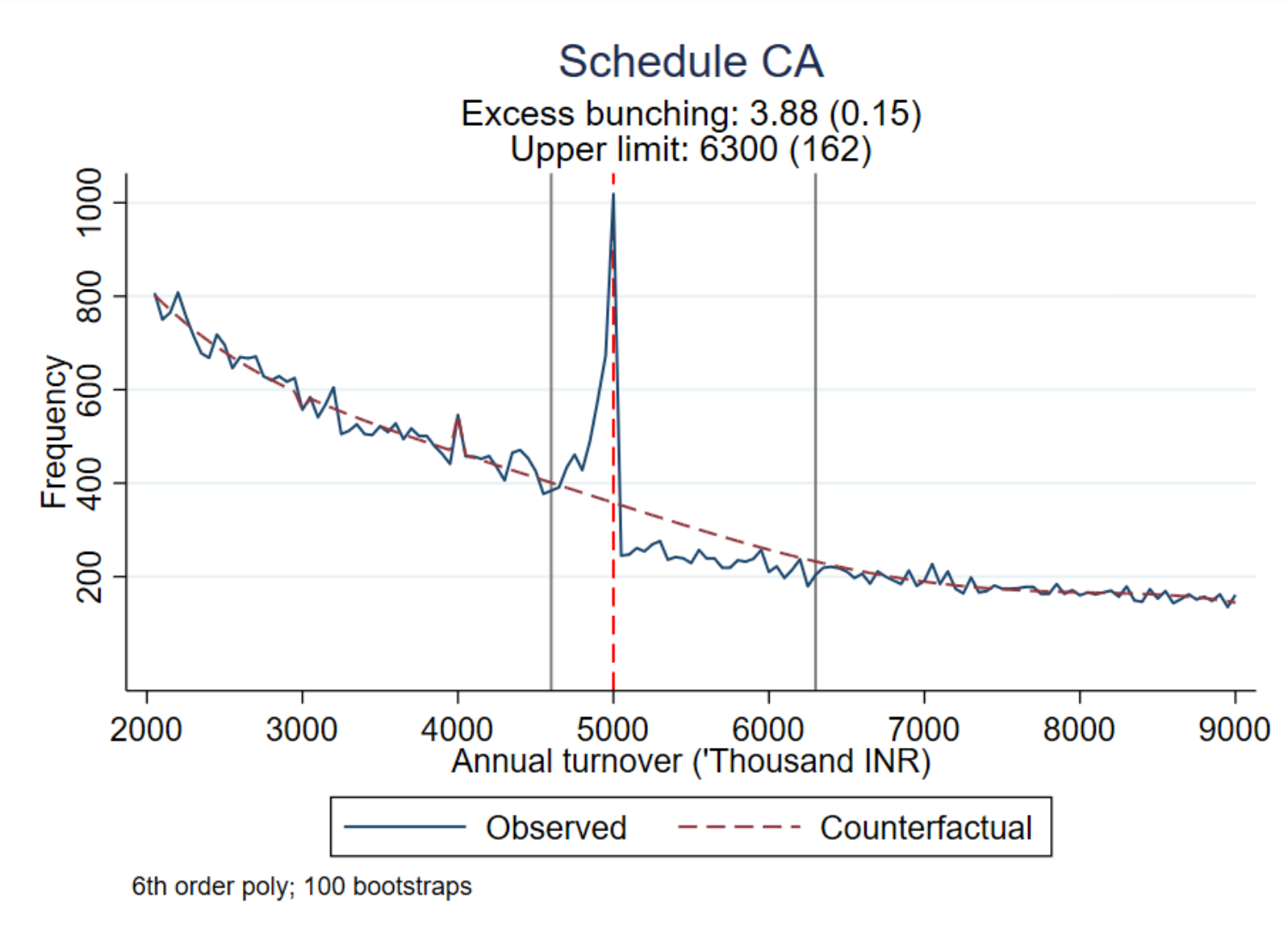
Low VAT firms



Medium VAT firms



High VAT firms



Robustness

Cross-sectional variation (II)

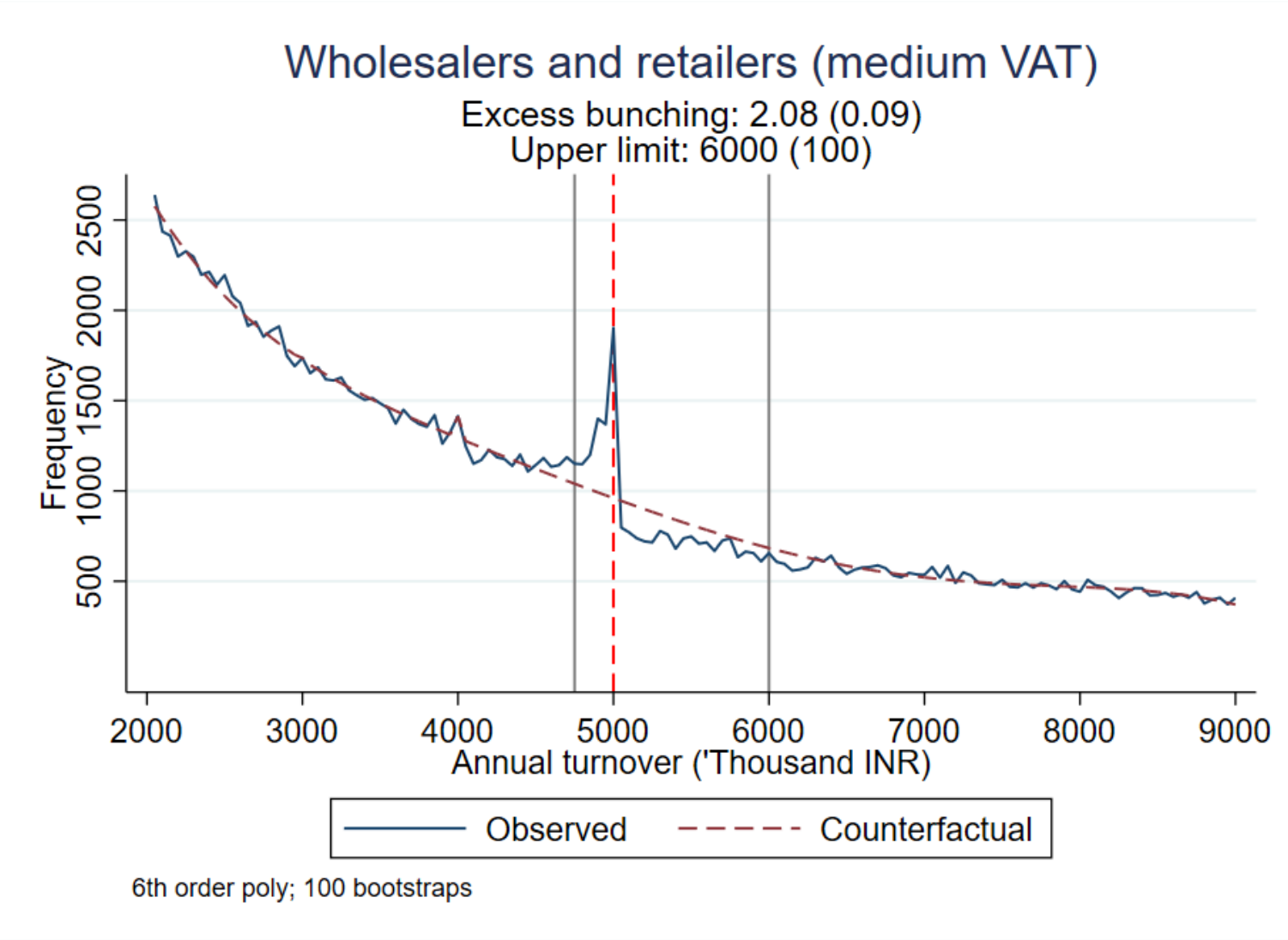
A second source of cross-sectional variation comes from different firm types within the same tax bracket

- In particular, distinguish between retailers/wholesalers and manufacturers
- Main difference is that the former sell primarily to non-VAT clients

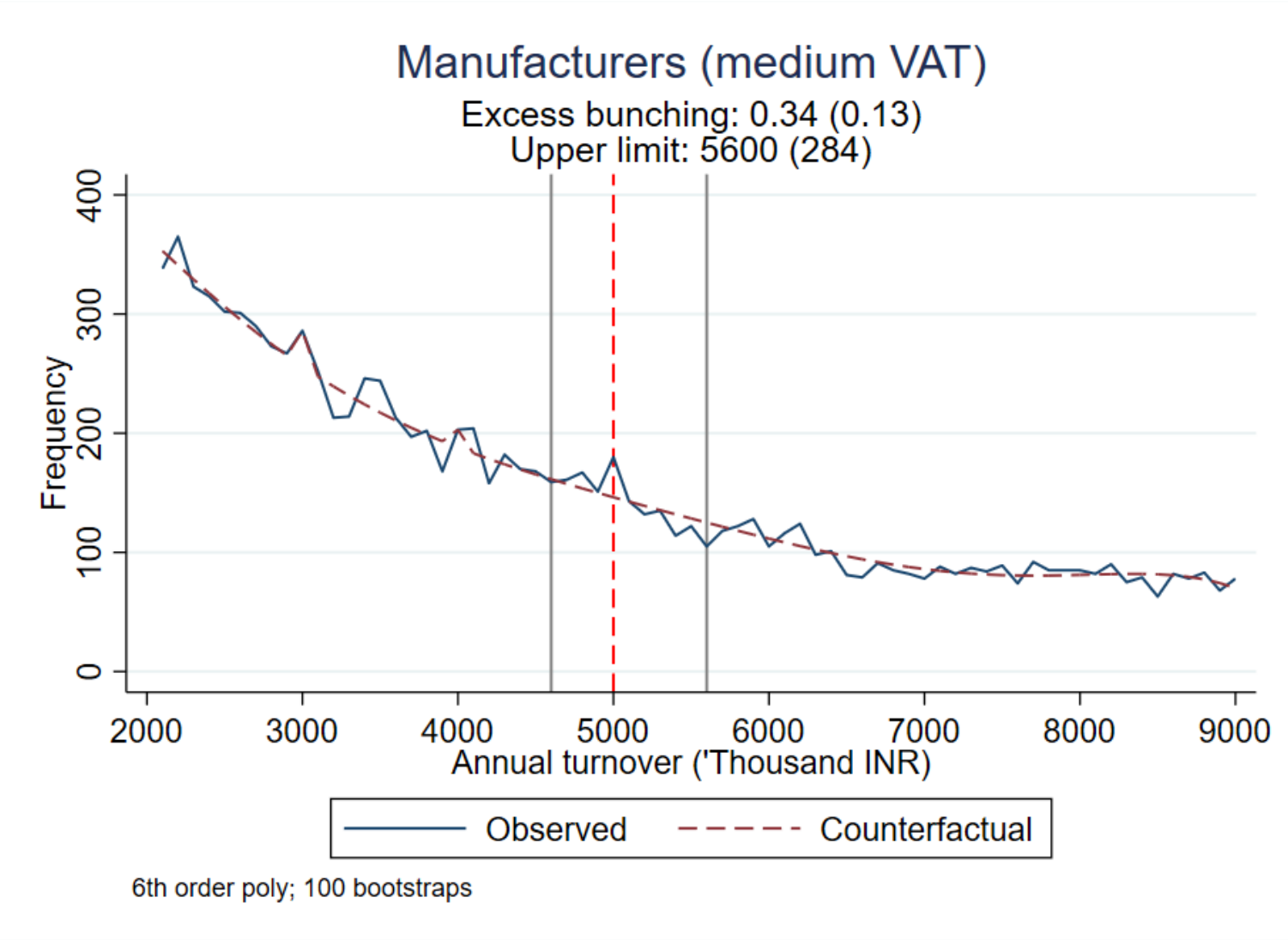
Consider differences in responses to VAT for different firm types with same output VAT rate

- Focus on 'medium VAT' firms where sample size is largest

Wholesale and retail



Manufacturers



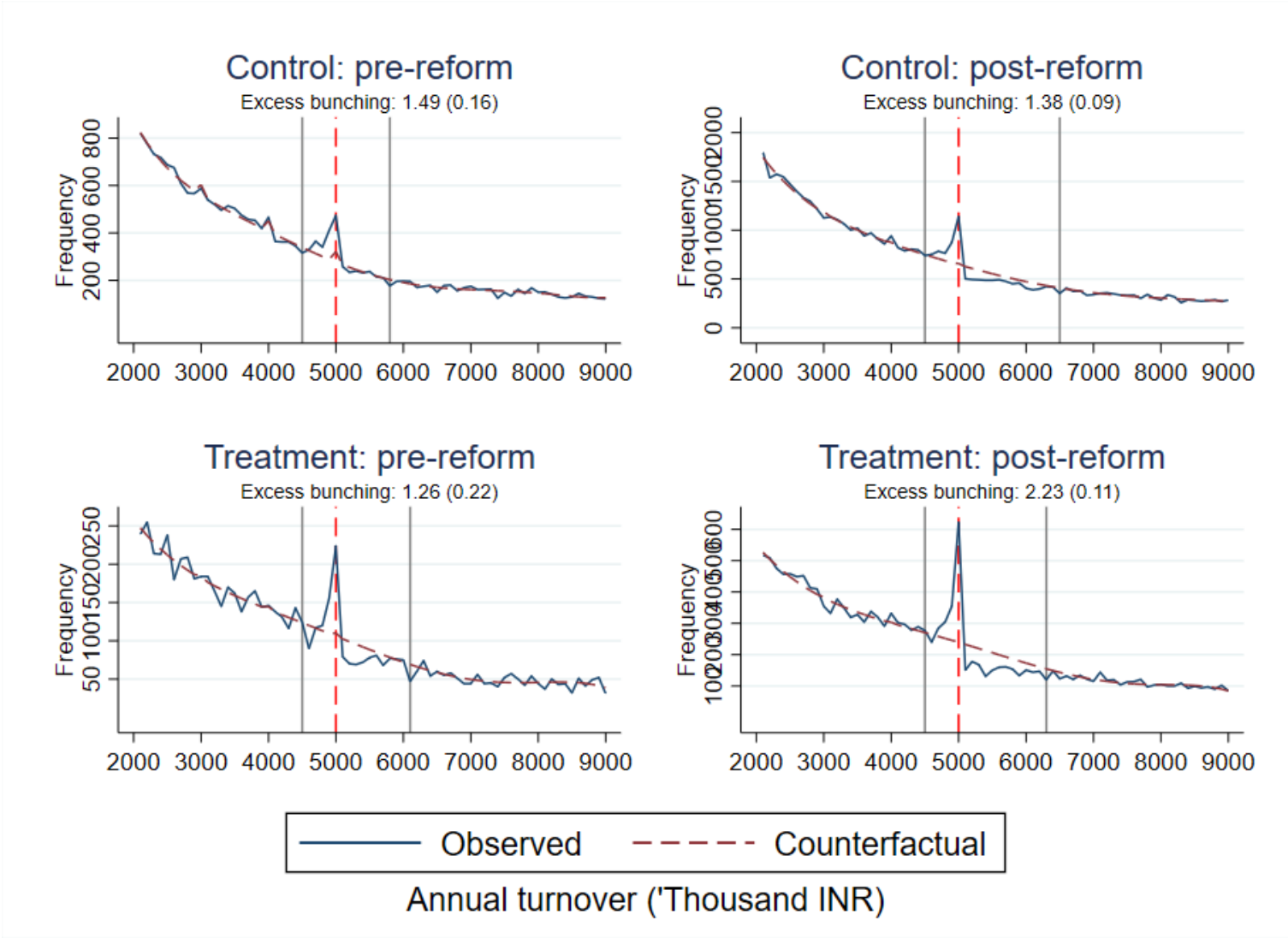
Temporal variation

It's possible that some unobserved heterogeneity across firms of different types could contribute to cross-sectional patterns.

A difference-in-difference-in-bunching approach provides additional evidence to address this concern.

- 12.5% rate was increased to 13.5% in late 2010 while other rates held constant
- Compare bunching of firms selling in this bracket to other brackets, pre- and post-reform
- DID estimate is positive at 1.08 (0.30) but small sample sizes make parameter estimates noisy

Difference-in-difference



Estimating parameters

For this we need a structural framework. We use a simple model (adapted from Harju, Matikka, and Rauhanen (2019), and Kleven and Waseem (2013) before that) that:

- Describes the incentives of business owners around the VAT registration threshold in terms of taxes and compliance costs
- Provides a framework for estimating parameters of interest from observed behavioural responses

A couple of changes:

- Incorporate dual tax system and variation in output VAT
- Account for trading partners: ToT firms pay input VAT and VAT firms do not

Model

Business owners of productivity a maximise utility from producing output x from inputs α:

$$u(x) = (1-\alpha)x - T_j(x,\alpha,s) - \theta_j(x,\alpha) - \phi(x)$$

- $T_j(x,\alpha,s)$ are tax payments incurred by the business, which depend on their tax scheme $j \in \{v,c\}$
- $\theta_j(x,\alpha)$ are compliance costs
- Production of output associated with iso-elastic disutility:

$$\phi(x) = \frac{a}{1+1/\epsilon}\left(\frac{(1-\alpha)x}{a}\right)^{1+1/\epsilon}$$

Model

Utility of business owner who would not voluntarily register for VAT in absence of the threshold:

$$u(x) = \begin{cases} x - \alpha x - \alpha t_{i,s} x - t_r x - \theta_c(1-\alpha) - \phi(x), & \text{if } x \leq x^* \\ x(\frac{1}{1+t_{o,s}}) - \alpha x - \theta_v(1-\alpha) - \phi(x), & \text{if } x > x^* \end{cases}$$

From maximising utility below and above the threshold:

$$x_{opt} = \begin{cases} x(1-\alpha) = a(1 - t_{c,s} - \theta_c)^{\epsilon}, & \text{if } x \leq x^* \\ x(1-\alpha) = a(1 - t_{v,s} - \theta_v)^{\epsilon}, & \text{if } x > x^* \end{cases}$$

If ability a is smoothly distributed, either of these conditions implies a smooth sales distribution in the absence of the threshold.

Model

To interpret behavioural responses observed in the data, consider the choice of type M ('marginal buncher') firms, with ability $a^* + \Delta a^*$:

$$u_N = (1 - t_{c,s} - \theta_c)(1 - \alpha)x^* - \frac{a^* + \Delta a^*}{1 + 1/\epsilon}\left(\frac{x^*(1-\alpha)}{a^* + \Delta a^*}\right)^{1+1/\epsilon}$$

$$u_M = (1 - t_{v,s} - \theta_v)^{\epsilon+1}(a^* + \Delta a^*)\left(1 - \frac{\epsilon}{\epsilon + 1}\right)$$

Setting $u_N = u_M$ gives the following indifference condition:

$$\frac{1}{1 + \frac{\Delta x_N^*}{x^*}} - \frac{\epsilon}{\epsilon + 1}\left[\frac{1}{1 + \frac{\Delta x_N^*}{x^*}}\right]^{1+1/\epsilon} - \frac{1}{\epsilon + 1}\left[\frac{1 - t_{v,s} - \theta_v}{1 - t_{c,s} - \theta_c}\right]^{\epsilon+1} = 0$$

Indifference condition

For the marginal buncher:

$$\frac{1}{1+\frac{\Delta x_N^*}{x^*}} - \frac{\epsilon}{\epsilon+1}\left[\frac{1}{1+\frac{\Delta x_N^*}{x^*}}\right]^{1+1/\epsilon} - \frac{1}{\epsilon+1}\left[\frac{1-t_{v,s}-\theta_v}{1-t_{c,s}-\theta_c}\right]^{\epsilon+1} = 0$$

This does not have an analytical solution but a numerical solution can be found by calibrating observable parameters using estimated Δx_N^* from different samples.

- Calibrate average values for ($t_{v,s}$ and $t_{c,s}$) from outside the bunching region, and assume a value for θ_c
- Use transactions data to account for the fact that no VAT is liable on B2B sales

Parameter estimates

Table: Parameter estimates from cross-sectional evidence

Variation:	Tax elasticity	Compliance costs
Tax rate	0.28	-0.05
	(0.125)	(0.033)
Firm type	0.11	0.03
	(0.065)	(0.030)

- Harju, Matikka, and Rauhanen (2019) estimate an elasticity of 0.02; UK evidence is in a similar range to my estimates
- Compliance costs of 0.14 (approx 1300 euros) in Harju, Matikka, and Rauhanen (2019); the same cash terms compliance costs would require an estimate of over 0.10 here

Summary

In West Bengal, businesses avoid entering the VAT system due to the tax liabilities they would incur rather than increased compliance costs.

- Three types of evidence point towards this conclusion
- Elasticity estimates are higher than estimated elsewhere
- Compliance costs of VAT (relative to simplified scheme) are relatively unimportant in this context

This suggests scope to reduce the registration threshold without overburdening small firms, while also increasing revenues and reducing production and supply chains distortions.

Descriptive Statistics

Table: Descriptive statistics

	Small VAT		Turnover tax	
Annual turnover	2586	(1134)	2581	(1216)
Input share:				
- all inputs	0.823	(0.224)	0.853	(0.206)
- West Bengal inputs	0.723	(0.317)	0.853	(0.206)
VAT suppliers:				
- number	2.907	(2.988)	2.394	(2.457)
- share of inputs	0.576	(0.392)	0.518	(0.393)
VAT clients:				
- number	1.490	(2.929)	0.050	(0.306)
- share of sales	0.237	(0.339)	0.008	(0.066)
Main commodity share*:				
- in reported commodities	0.969	(0.096)	0.992	(0.053)
- in turnover	0.755	(0.309)	0.960	(0.156)
Total tax rate	0.018	(0.336)	0.002	(0.000)
Kolkata	0.322	(0.467)	0.151	(0.358)
Observations	179557		69243	

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Bunching estimation

Polynomial estimation:

$$c_j = \sum_{i=0}^{p} \beta_i (x_j)^i + \sum_{x_L}^{x_H} \gamma_i \cdot \mathbb{1}(y_j = i) + \sum_{r \in R} \alpha_r \mathbb{1}(\frac{x_j}{r} \in \mathbb{W}) + e_j$$

Counterfactual density:

$$\hat{c}_j = \sum_{i=1}^{7} \hat{\beta}_i (x_j)^i + \sum_{r \in R} \hat{\alpha} \cdot \mathbb{1}(\frac{x_j}{r} \in \mathbb{W})$$

Excess bunching:

$$\hat{b}(x^*) = \frac{\sum_{i=x_L}^{x^*} (c_j - \hat{c}_j)}{\sum_{i=x_L}^{x^*} \hat{c}_j / N_j}$$

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Robustness

Lower limit of bunching	All	Low VAT	Medium VAT	High VAT
3700	1.49 (0.23)	0.50 (1.25)	1.21 (0.56)	2.08 (0.37)
3800	1.46 (0.28)	0.36 (1.27)	1.18 (0.35)	2.06 (0.50)
3900	1.39 (0.17)	0.26 (1.00)	1.16 (0.14)	1.97 (0.20)
4000	1.33 (0.16)	0.41 (1.61)	1.10 (0.14)	1.90 (0.16)
4100	1.24 (0.10)	0.00 (0.42)	0.99 (0.06)	1.81 (0.20)
4200	1.31 (0.07)	-0.22 (0.42)	1.09 (0.02)	1.82 (0.19)
4300	1.35 (0.10)	-0.12 (0.55)	1.14 (0.03)	1.88 (0.16)
4400	1.34 (0.07)	-0.15 (0.39)	1.15 (0.06)	1.84 (0.14)
4500	1.31 (0.06)	0.01 (0.32)	1.12 (0.06)	1.69 (0.08)
4600	1.31 (0.03)	0.11 (0.18)	1.10 (0.07)	1.73 (0.10)
4700	1.22 (0.04)	0.18 (0.20)	0.99 (0.06)	1.79 (0.10)

Table: Excess bunching estimates with alternative bunching regions

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