Under the Radar
The Effects of Monitoring Firms on Tax Compliance

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Firms as Fiscal Intermediaries

- In modern tax systems, firms act as fiscal intermediaries by:
    - Providing third-party information (on employees, business partners, etc)
    - Collecting and remitting the main taxes (VAT, Inc Tax, CIT)
- Taxing firms is crucial for an effective tax system:
    - Allows the state to deal with a smaller number of agents
    - Lowers the cost of obtaining information
        - Large firms have in intrinsic interest in keeping good records (Kleven, Kreiner, Saez 2015)
        - But do they have an interest in telling the truth to the govt?

No Taxation without Information?

- ▶ Apparent puzzle: high tax compliance despite low audit rates
    - ▶ At odds with Allingham and Sandmo (1972) model of tax evasion

- ▶ Third-party information reporting critical to improve **individual** tax compliance
    - ▶ Experiments: Kleven et al (2011), Slemrod et al (2001)
    - ▶ Theory: Kopczuk & Slemrod (2006), Kleven, Kreiner & Saez (2015)

- ▶ Information reporting may not be enough in the case of **firms**
    - ▶ More complex transactions ⇒ Uncovering evasion also requires *monitoring effort*
        - ▶ i.e., human resources to conduct information cross-checks and tax audits

* Note: the heading of this slide is the title of a recent AER paper, Pomeranz (2015)

Research Questions

- Is third-party information reporting sufficient to ensure high tax compliance by firms?
- To what extent is the tax authority's monitoring effort necessary for effective tax enforcement?
  - Information and audits: Complements or substitutes?
- What are the welfare implications of increasing monitoring effort on firms?
  - Holding information-reporting constant

Institutional Background: Spanish LTU

- Large Taxpayers Unit (LTU) administers and enforces taxation of firms with annual sales above **€6 million**
  - Threshold fixed in *nominal* terms since 1995
- Firms in the LTU (sales > €6m) face:
  - Stricter monitoring: more and better tax audits
  - Same tax schedule (CIT, VAT)
  - Very similar information-reporting requirements (minor differences)
  - LTUs have been promoted by intl orgs (IMF, OECD) to improve tax administration in many countries
- We exploit this notch in tax enforcement intensity for identification

Theoretical Predictions

1. Firms have incentives to bunch below the €6m threshold
   - In order to avoid stricter tax enforcement
   - Response due mainly to sales underreporting, rather than a real production response

2. Stronger response among firms that sell intermediate goods (paper trail) compared to firms that sell to final consumers (little or no paper trail)
   - If 3rd-party reporting exists, audits likely to uncover evasion
   - With no paper trail (final sales, esp. in cash) very hard to detect moderate misreporting

Empirical Revenue Distribution

Pooled data for years 1995-2007
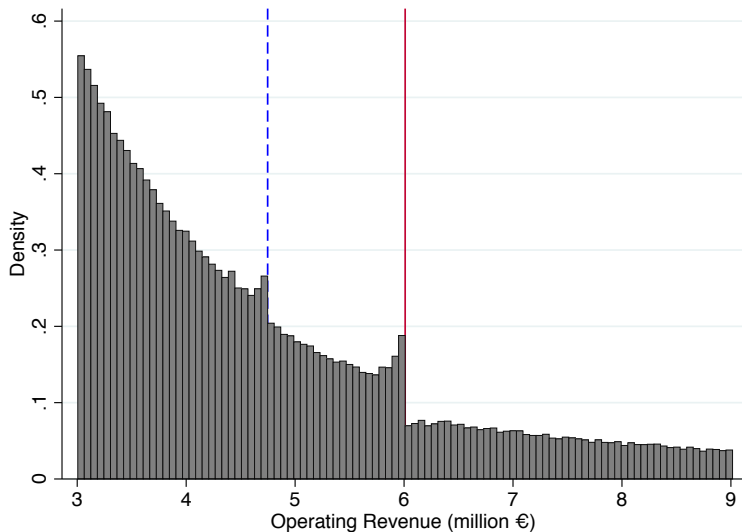
Empirical Revenue Distribution

- ▶ Counterfactual: smoothly decreasing distribution
  - ▶ Consistent with theory (eg, Lucas 1978)
- ▶ Pooled 1995-2007 data. Pattern similar for all years
- ▶ Not due to other policies/regulations:
  - ▶ No bunching response to 5% tax cut for small firms ▶ graphs
- ▶ No "hole" just above threshold
  - ▶ Resource costs of evasion and other frictions
  - ▶ Preferences: honest firms?

Related Work

- ▶ Empirical work on tax evasion by firms:
  - ▶ Pomeranz (2015), Carrillo, Pomeranz and Singhal (2014), Best et al (2014), Naritomi (2013), Devereux, Liu & Loretz (2014)

- ▶ Bunching estimation techniques:
  - ▶ Saez (2010), Kleven & Waseem (2013), Kleven (2015)

- ▶ Effects of size-dependent regulations on firm behavior
  - ▶ Theory: Guner, Ventura & Xu (2008), Restuccia & Rogerson (2008)
  - ▶ Empirics: Onji (2009), Garicano, Le Large, Van Reenen (2013)

Model: Firms and Tax Policy

- **Firms:** production function $y = \psi f(x, z)$, where $\psi \sim \left[\underline{\psi}, \overline{\psi}\right]$
  - ψ = managerial productivity (exogenous)
  - y = revenue from sales (output price normalized to 1)

- **Government:** sets tax on profits, such that

$$\Pi = (1 - t)(y - wx) - qz$$

  - x = deductible inputs; z = nondeductible inputs
  - Taxes create inefficiency by distorting input choices

- **Tax evasion** possible through revenue misreporting:
  - $u \equiv y - \overline{y}$ = underreported revenue ($\overline{y}$ = reported revenue)
  - $\kappa(u)$ = resource costs of evasion
  - θ = penalty rate if evasion is detected (assumed fixed)

Model: Probability of Detection

- **Tax authority:** probability of evasion detection given by

$$\delta = \phi h(u)$$

  - $\phi =$ monitoring effort (for example, resources spent on audits) - **Exogenous**
  - $h(u) =$ technology used to match tax returns to other information trails - **Endogenous**

    - $h_u, h_{uu} > 0$

  - Implicit assumption: ϕ and $h(u)$ are complements

Model: Expected Profits

- **Expected profits** are given by:

$$\mathbb{E}\Pi = \underbrace{(1-t)\left[\psi f\left(x,z\right) - wx\right] - qz}_{\text{"true" after-tax profits}} + \underbrace{\left[1 - \phi h\left(u\right)\left(1+\theta\right)\right] tu - \kappa\left(u\right)}_{\text{exp. return from evasion}}$$

- Mechanisms that contribute to raising tax compliance:
  - Resource costs of evasion $\kappa\left(u\right)$
  - **Deterrence effect** of monitoring effort ϕ, which is complementary to the available technology $h\left(u\right)$
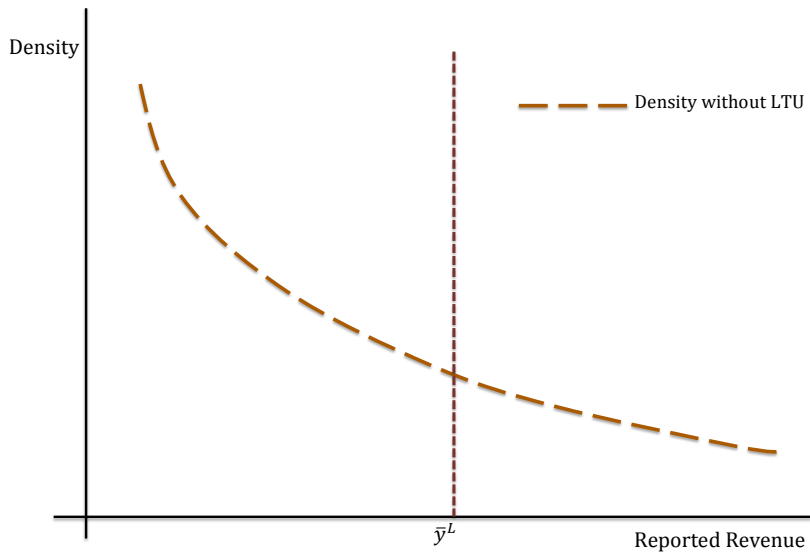
Model: Tax Enforcement Notch

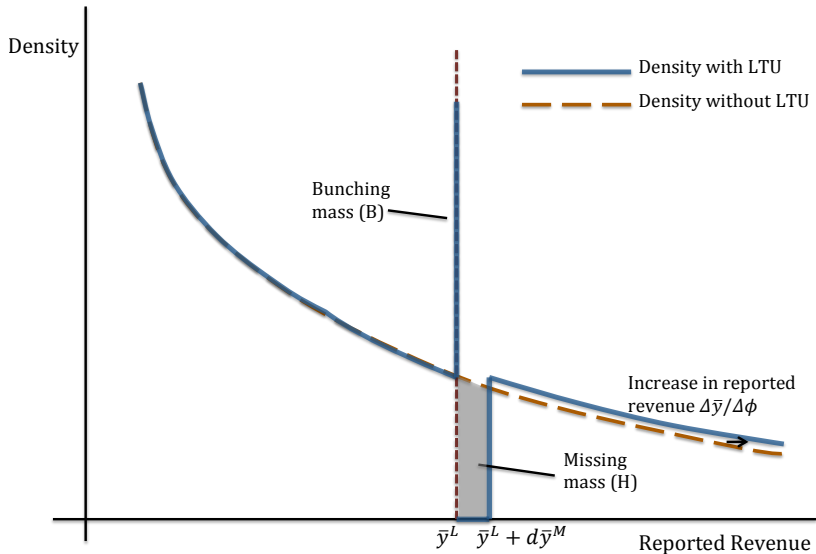- The large taxpayers unit (LTU) introduces a discrete change in monitoring effort at an arbitrary revenue threshold:

$$\delta = \begin{cases} \phi_0 h\left(u\right) & \text{if } \overline{y} \leq y^L \\ \left[\phi_0 + d\phi\right] h\left(u\right) & \text{if } \overline{y} > y^L \end{cases}$$

- Creates a **notch** in tax enforcement intensity
- No change in the enforcement technology $h\left(\cdot\right)$ at the threshold

Theoretical Revenue Distribution (without LTU)

Density

Density without LTU

$\bar{y}^L$

Reported Revenue

Theoretical Revenue Distribution (LTU, homog. firms)

Density

Density with LTU
Density without LTU

Bunching
mass (B)

Increase in reported
revenue $\Delta\bar{y}/\Delta\phi$

Missing
mass (H)

$\bar{y}^L$ $\bar{y}^L + d\bar{y}^M$
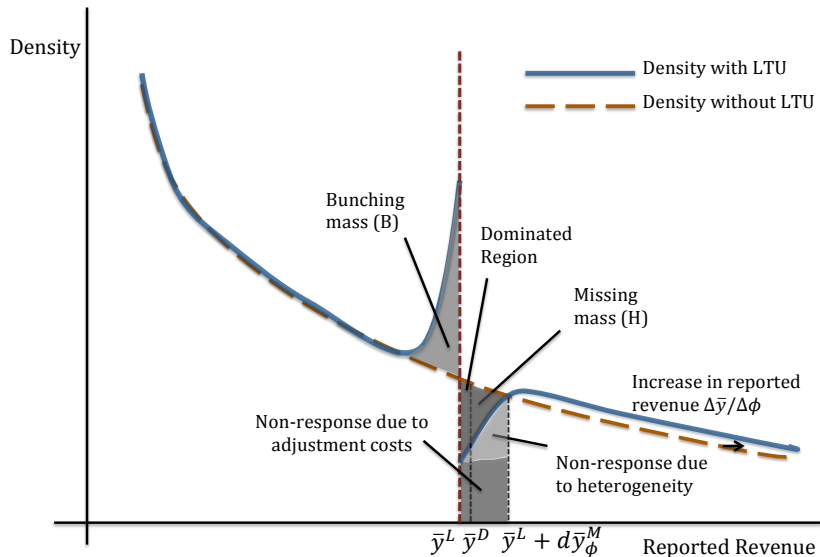
Reported Revenue

Introducing Heterogeneity: Assumptions

1. Heterogeneous "effective" monitoring effort, ϕ

   - Effectiveness of monitoring effort depends on traceability of misreported transactions
   - Retailer selling to final consumer vs Wholesaler selling to other firms

2. Heterogeneous resource costs of evasion, $\kappa(u)$

   - Firms with higher costs of evasion are less responsive to incentives to evade
   - More complex firms (more employees, higher fixed assets) face higher resource costs of evasion (Kleven, Kreiner, Saez 2015)

Heterogeneity: Predictions

1. Different bunching response depending on traceability of misreported transactions

   ▸ Firms with easily traceable transactions have a **stronger** incentive to bunch, because the *effective* jump in enforcement intensity at LTU threshold is larger

2. No "hole" above the LTU threshold

   ▸ For some firms, resource costs of evasion are prohibitive, so they don't respond

# Theoretical Revenue Distribution (Heterogeneous model)

Density

Density with LTU

Density without LTU

Bunching
mass (B)

Dominated
Region

Missing
mass (H)

Increase in reported
revenue $\Delta\bar{y}/\Delta\phi$

Non-response due to
adjustment costs

Non-response due
to heterogeneity

$\bar{y}^L$ $\bar{y}^D$ $\bar{y}^L + d\bar{y}^M_\phi$

Reported Revenue

Context: Spanish Tax Authority

- Highly-developed information systems
  - Similar to comparable EU countries
  - Taxpayers selected for audit based on "risk" criteria
    - Approx. 10% of LTU firms audited each year
    - Less than 1% of non-LTU firms audited each year

- Stagnant workforce (enitre tax authority, not just LTU)
  - Tax authority is **understaffed** relative to EU average

Context: Spanish Tax Administration

Tax Authority Employees per 1000 Workers

Legend:
- Spain
- France
- Germany
- Italy
- UK
- Portugal
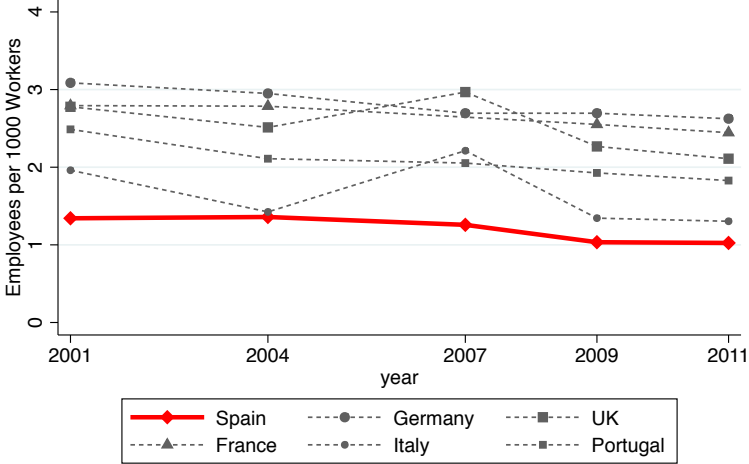
Source: OECD Forum on Tax Administration

Data

- Financial statements submitted to Commercial Registry (compulsory for all firms)
  - Administrative dataset maintained by the Bank of Spain
  - Earlier version used Amadeus – similar data, less disaggregated
- Coverage: 80% of all firms with revenue €3-€9 million
  - Profit & Loss account, balance sheet, sector, location
  - Unbalanced panel for the period 1995-2007
- Accounting vs Fiscal data:
  - Operating revenue in accounting data must match tax returns
  - Taxable profits estimated using profit tax liability and accounting profit

Bunching Estimation Strategy

- ▶ Use bunching techniques for notches
  - ▶ Kleven & Waseem (2013), Kleven (2015)
- ▶ Steps:
  1. Construct counterfactual density:
     - ▶ Fit flexible polynomial to observed density
     - ▶ Exclude interval $[y_{lb}, y_{ub}]$, ensuring that excess bunching mass below threshold (B) equals missing mass above threshold (H)
  2. Use excess bunching as a sufficient statistic for the **reported revenue** response of bunchers

Bunching Estimation Strategy: Counterfactual

b_av = 0.094 (0.005)

b_adj(lb) = 0.276 (0.023)

b_adj(ub) = 0.52
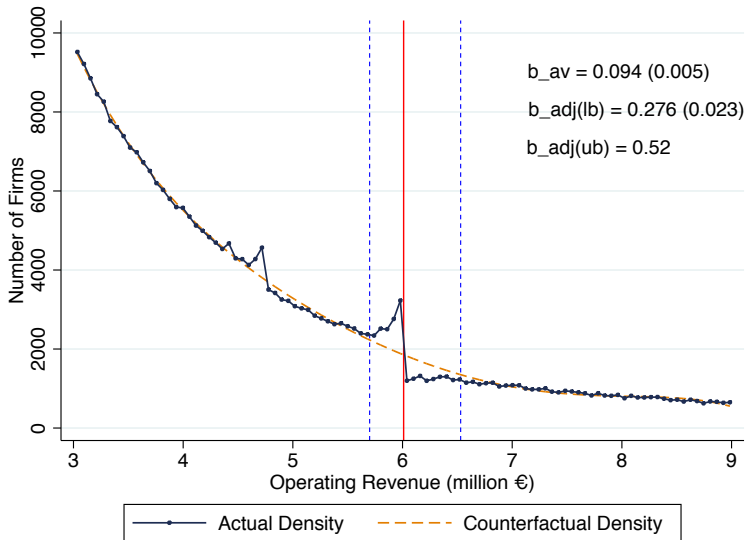
Standard Bunching Estimator

Homogeneous firms; no optimization frictions

- Assume "small" jump in enforcement intensity, $d\phi > 0$
- Some firms from interval $\left(y^L + d\bar{y}\right)$ now bunch at y^L
- Number of excess bunching firms:

$$B = \int_{y^L}^{y^L + d\bar{y}} g_0\left(\bar{y}\right) d\bar{y} \approx g_0\left(y^L\right) d\bar{y}$$

  - $g_0\left(\bar{y}\right)$ is the counterfactual density with no LTU

- Define estimator b:

$$b = \frac{B}{g_0\left(\bar{y}^L\right)} \approx d\bar{y}$$

  - b is the reduction in reported revenue by marginal buncher

Bunching Estimator with Heterogeneity

Heterogeneous "effective" monitoring effort; no optimization frictions

- ▶ Once we introduce heterogeneity in effective monitoring effort ϕ, we re-define the estimator as

$$b_{av} = \frac{B}{g_0\left(\bar{y}^L\right)} \approx \mathbb{E}\left[d\bar{y}_\phi^M\right]$$

  - ▶ b_{av} is the **average response** in reported revenue by the marginal buncher *at each enforcement intensity level*
    - ▶ since there is a continuum of ϕ, this is essentially the average response in the population, estimated locally

# Bunching Estimator with Heterogeneity and Frictions

Heterogeneous "effective" monitoring effort and frictions

- ▶ Some firms do not react due to high resource costs of evasion (and potentially other frictions)
- ▶ Let α denote the proportion of non-optimizing firms (Kleven & Waseem 2013)
  - ▶ Estimated in practice as the ratio of firms observed in $\left[\overline{y}^L, y_{ub}\right]$ compared to the counterfactual ($\alpha \approx 0.8$ in this setting)
- ▶ Then, we can define the estimator:

$$b_{adj}^{lb} = \frac{b_{av}}{(1 - \alpha)} \simeq E\left[d\overline{y}_{\phi}^M\right]$$

- ▶ b_{adj}^{lb} provides a *lower bound* for the **average structural response** (i.e., in a world without resource costs)
- ▶ The *upper bound* is given by the point of convergence between counterfactual and observed density $\left(b_{adj}^{ub}\right)$

Bunching Estimates

b_av = 0.094 (0.005)

b_adj(lb) = 0.276 (0.023)

b_adj(ub) = 0.52
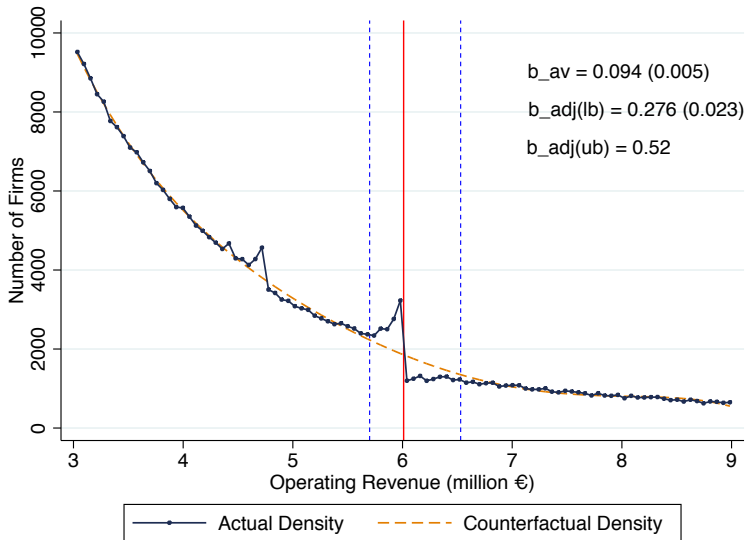
Bunching Estimates

- Firms in the bunching range $(6, 6.5)$ reduce their reported revenue by €94,000 *on average* in response to the LTU threshold

- Some firms do not respond. May be due to:
  - Costs of evasion (eg, operating in cash, extra set of books)
  - Other optimization frictions
  - Preferences (honesty, risk aversion)

- Taking into account all adjustment costs, bunching firms reduce their reported revenue by (€276,000, €520,000) on average
  - Structural response that we would observe *in the absence of adjustment costs*

Reported tax bases: Taxable Profit Margin
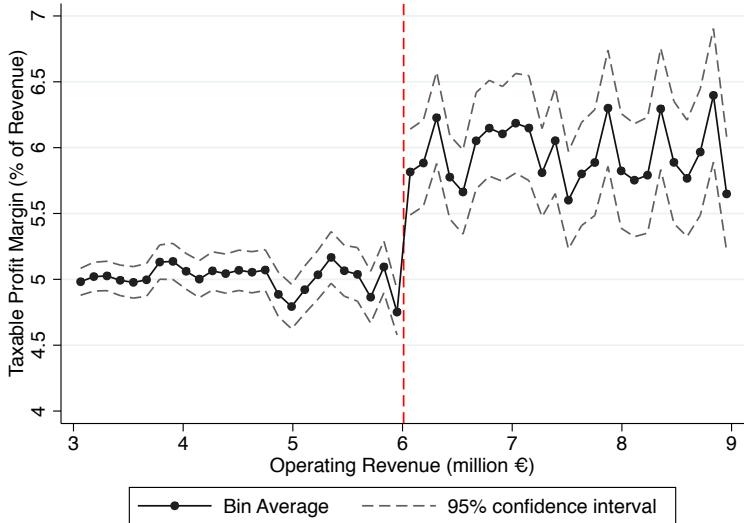
Reported tax bases: Value Added
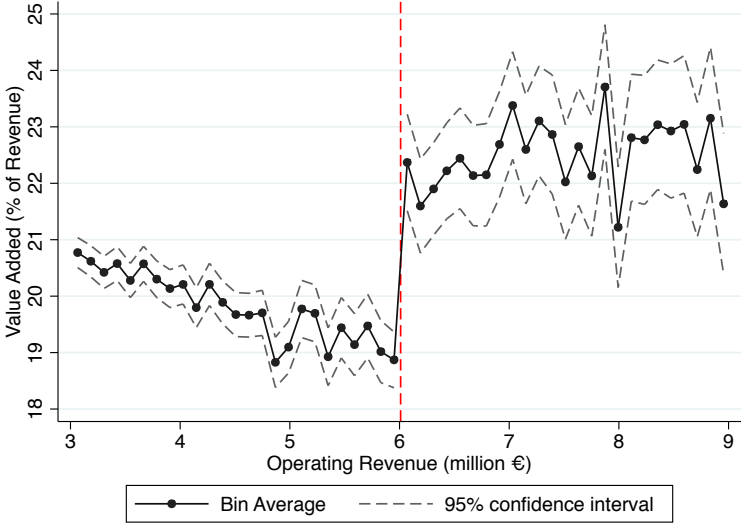
Reported Tax Bases: Interpretation

- ▶ Real vs evasion response:
  - ▶ Strongly suggestive evidence that bunching mostly due to sales underreporting (evasion response)
    - ▶ Rather than real production adjustment
  - ▶ Stable trends beyond the bunching range
    - ▶ Addresses concern of selection bias around the threshold
  - ▶ Firms with higher "true" profits have more incentives to misreport and mimic firms with lower profits
- ▶ Is there also input misreporting?

Input Misreporting Incentives

Baseline model only allows for *revenue* underreporting. Consider incentives for input misreporting:

- **Material input expenditures**: incentives to overreport
    - lower corporate income tax liability
    - lower VAT remitted to government

- **Labor input expenditures**: (weak) incentives to underreport
    - underreport to lower payroll tax (38% rate)
    - overreport to lower CIT (35% rate)
        - workers would not accept overreporting; stringent labor regulations; downward rigidity

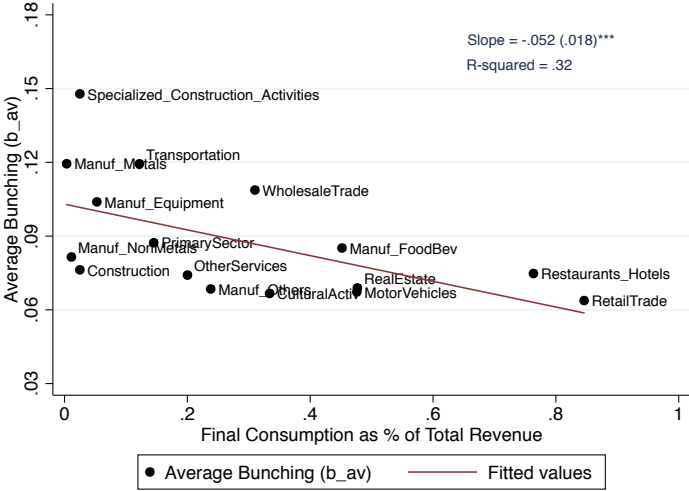## *Reported* Material Input Costs
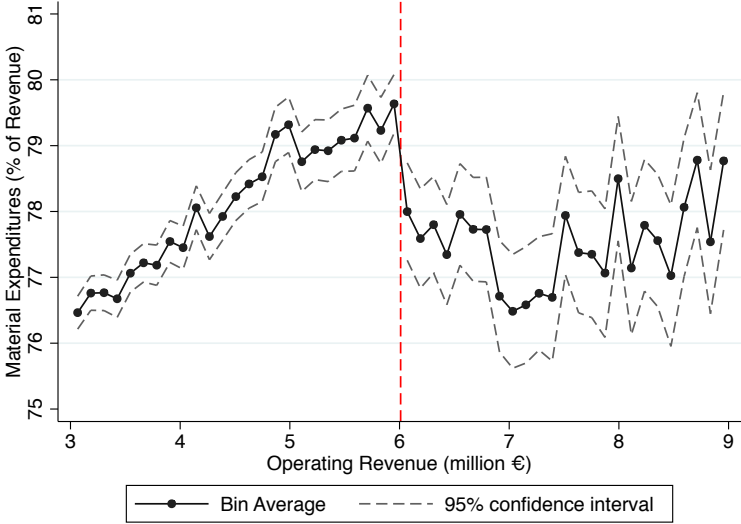
Reported Wage Bill
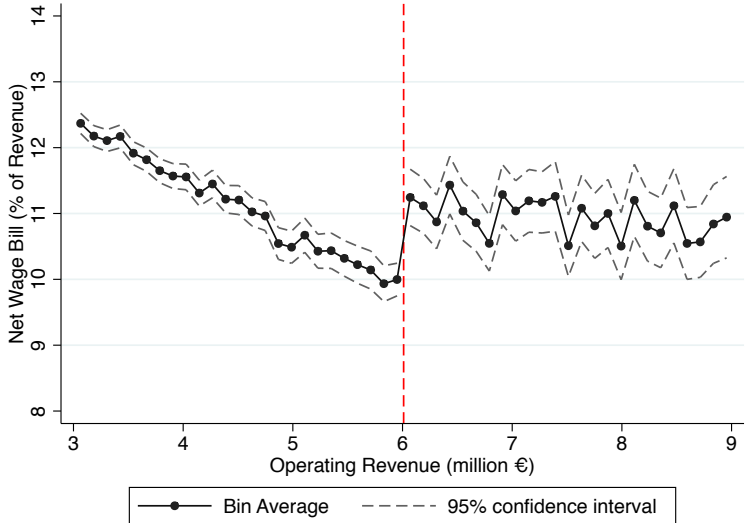
Heterogeneous Responses: Complementarity Result

- To test whether information and audits are complementary, compare behavior of firms at different stages of value chain
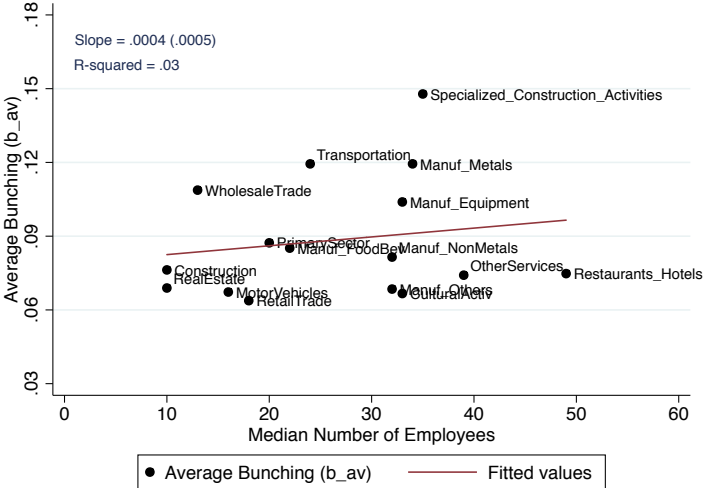- Proxy for position in the value chain using sector-level index:

$$FC_s = \frac{\text{Final Consumer Sales}_s}{\text{Total Sales}_s}$$

  - Sector-level data from input-output tables
- Sectors with lower FC_s (more information) expected to respond more strongly to higher audit effort
  - If information and audits were substitutes, these firms would respond less

Bunching by Sector vs Share of Final Consumer Sales

Slope = -.052 (.018)***
R-squared = .32

Legend: ● Average Bunching (b_av) — Fitted values

X-axis: Final Consumption as % of Total Revenue
Y-axis: Average Bunching (b_av)

Data point labels: Specialized_Construction_Activities, Transportation, Manuf_Metals, Manuf_Equipment, WholesaleTrade, Manuf_NonMetals, PrimarySector, Manuf_FoodBev, Construction, OtherServices, RealEstate, Restaurants_Hotels, Manuf_Others, CulturalActiv, MotorVehicles, RetailTrade

Bunching by Sector vs Median Number of Employees

Scatter plot titled "Average Bunching (b_av)" vs "Median Number of Employees". Annotations: Slope = .0004 (.0005); R-squared = .03. Labeled points include Specialized_Construction_Activities, Transportation, Manuf_Metals, WholesaleTrade, Manuf_Equipment, PrimarySector, Manuf_Food, Manuf_NonMetals, OtherServices, Restaurants_Hotels, Construction, RealEstate, MotorVehicles, RetailTrade, Manuf_Others, CulturalActiv. Legend: Average Bunching (b_av); Fitted values.

Welfare Analysis

- Let social welfare be the sum of firms' expected net profits plus expected tax revenue
    - Assume citizens are firm owners
- What is the net welfare change from increasing monitoring effort across firms and returning the additional revenue lump sum?
    - Additional tax revenue is just a **transfer** ($=$)
    - Reduction in resource costs of evasion ($+$)
    - Administrative cost of additional enforcement ($-$)
    - Increase in distortion from taxes ($-$)
        - Note: if we assumed fixed tax revenue target, then possible to lower tax rates in other tax bases.

Welfare Analysis

- Empirically, no distortion of real production $\Rightarrow \frac{dP}{d\phi} \approx 0$
  - P = gross true profit; ϕ = monitoring effort
  - Simplifies our analysis substantially
- Notice that resource costs & frictions contribute to better compliance
- Final expression:

$$\frac{d\mathbb{E}W}{d\phi} = \underbrace{\int_{\overline{y}_{min}}^{\overline{y}_{max}} \left[-\kappa_u\left(u\right) \frac{du}{d\phi} \right] \cdot g_0\left(\overline{y}\right) d\overline{y}}_{\Delta \text{ resource cost}} - \underbrace{c_\phi\left(\phi\right)}_{\Delta \text{admin cost}} \gtreqless 0$$

Welfare: Marginal Resource Costs of Evasion

- Consider the marginal firm reporting just above $\overline{y}^L$. They could report $\overline{y}^L$ to be in the low monitoring effort regime:
  - Evidence shows that firms below $\overline{y}^L$ report lower tax bases on CIT (1%), VAT (3%) and Payroll Tax (1%)

- Estimating marginal resource costs (Gorodnichenko et al. 2009):

$$\text{Mgl. RC} \approx \frac{\Delta \text{Tax Liability}}{\text{Tax Base}}$$
$$\approx \frac{€19{,}500}{360{,}000} \approx 5.5\%$$

- Welfare gain of including one additional firm in the LTU is:

$$\Delta W = \text{Mgl. RC} \cdot \Delta \text{TaxBase}$$
$$\approx 5.5\% \cdot €60{,}000 \approx €3{,}300$$

Welfare: Administrative Cost of LTU

- Marginal administrative cost of LTU is essentially cost of skilled auditors:
  - Wage of LTU auditor is approx. €60,000-€80,000
  - LTU monitors about 30,000 firms, and has 125 auditors
  - Approximate cost per firm in the LTU:

    $$\Delta W = -€80{,}000/\left(30{,}000/125\right) = -€333$$

    - Note: this is an average cost, but we're interested in the marginal cost. We interpret this as the best approximation.

Welfare Calculation

- ▶ Thought experiment: change in net welfare resulting from adding one firm to LTU:
  - ▶ Marginal reduction in resource costs $\approx €3,300$
  - ▶ Additional administrative cost $\approx €333$
- ▶ Starting from current policy, expanding the scope of the Spanish LTU would be welfare-improving
- ▶ Implication: setting up the LTU seems to be a good policy
 - ▶ Although even harder to do *that* welfare calculation!

Summary of Findings

- Sharp bunching at LTU threshold reveals evasion response to stricter monitoring effort
  - Mainly via underreporting of sales
  - Suggestive evidence of evasion via input misreporting

- Sectors with high % of intermediate sales (easy to trace) feature strongest bunching at tax enforcement notch
  - Information trails are not sufficient to ensure high tax compliance by firms
  - Monitoring effort by the tax authority is a necessary **complement** to achieve this goal

- Devoting more human resources to audits could raise overall welfare
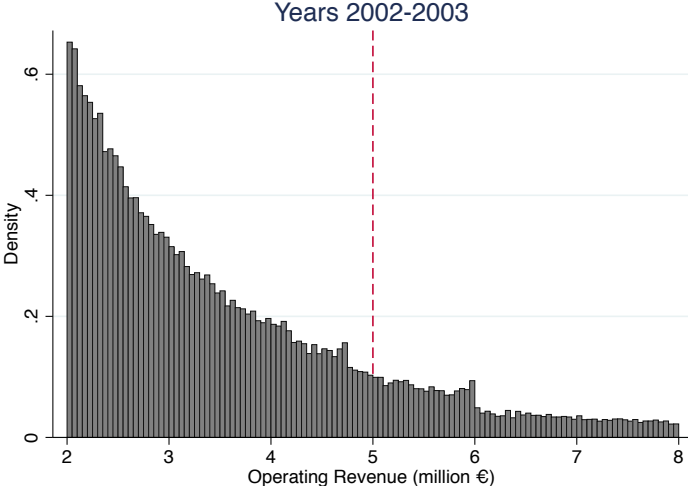 - Starting from current situation in Spain
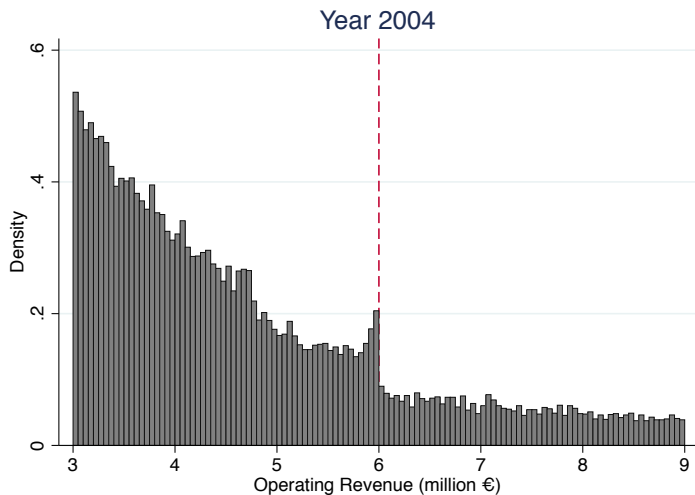
Thank You!

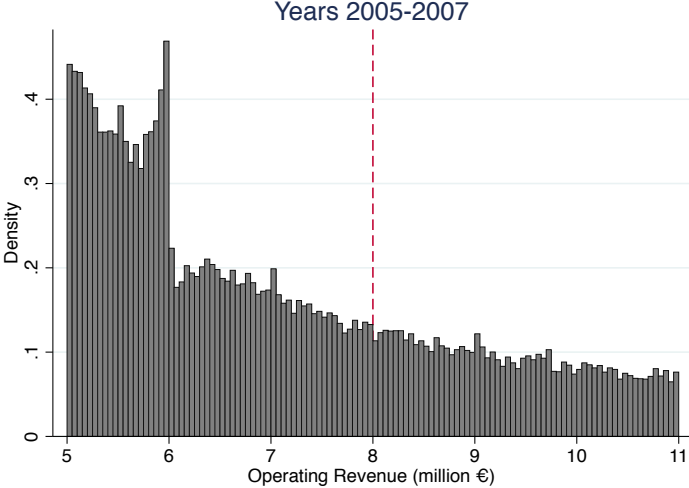# Corporate Tax Benefit Threshold
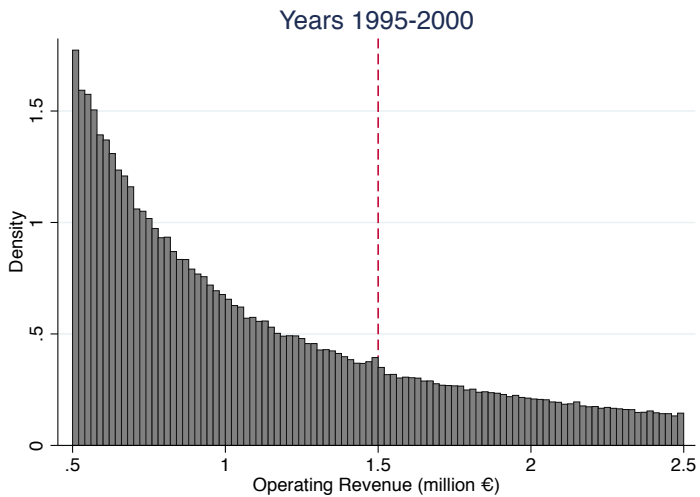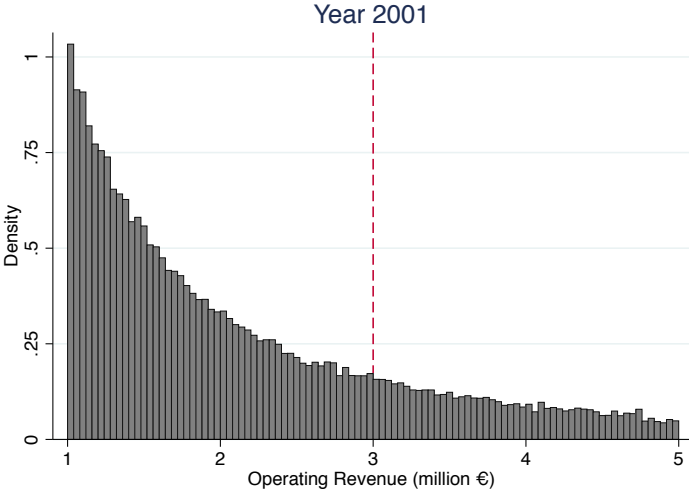
Years 1995-2000

Corporate Tax Benefit Threshold

Year 2001

Corporate Tax Benefit Threshold

Years 2002-2003

Corporate Tax Benefit Threshold

Year 2004

Corporate Tax Benefit Threshold

Years 2005-2007

Sensitivity of Bunching Estimates

- Pick different values for y_{lb} and q (order of the polynomial), and let the data determine y_{ub}:

y_{lb}	y_{ub}	q	$\widehat{b}_{av}$	$\widehat{b}_{adj}^{lb}$
5.30	6.68	4	0.106*	0.306*
	6.68	5	0.094*	0.277*
5.40	6.68	4	0.108*	0.313*
	6.71	5	0.101*	0.297*
5.50	6.59	4	0.106*	0.308*
	6.62	5	0.099*	0.289*
5.60	6.53	4	0.102*	0.296*
	6.59	5	0.096*	0.279*
5.70	6.47	4	0.098*	0.285*
	6.53	**5**	**0.095***	**0.276***
5.80	6.38	4	0.090*	0.257*
	6.41	5	0.089*	0.256*

* Significant at the 1% level

High-Bunching: Specialized Construction Activities

Const_SpecializedAct

b_av = 0.148 (0.018)

b_adj(lb) = 0.301 (0.052)

b_adj(ub) = 0.73

Number of Firms — vertical axis

Operating Revenue (million €) — horizontal axis

Actual Density — Counterfactual Density
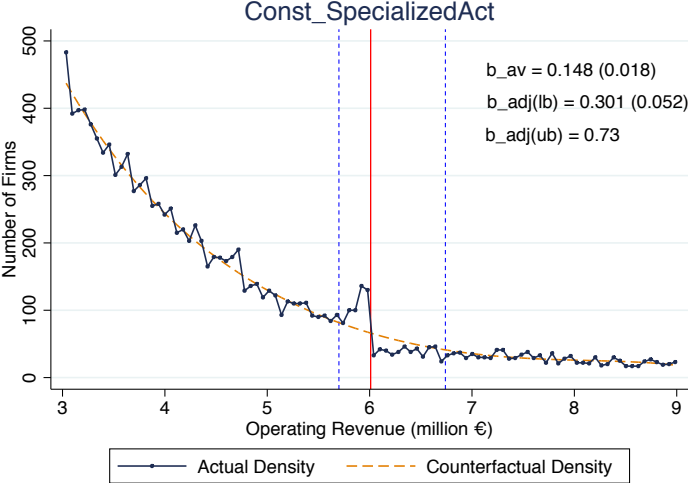
High-Bunching: Manufacturing of Metals

Manuf_Metals

b_av = 0.119 (0.017)
b_adj(lb) = 0.337 (0.077)
b_adj(ub) = 0.46
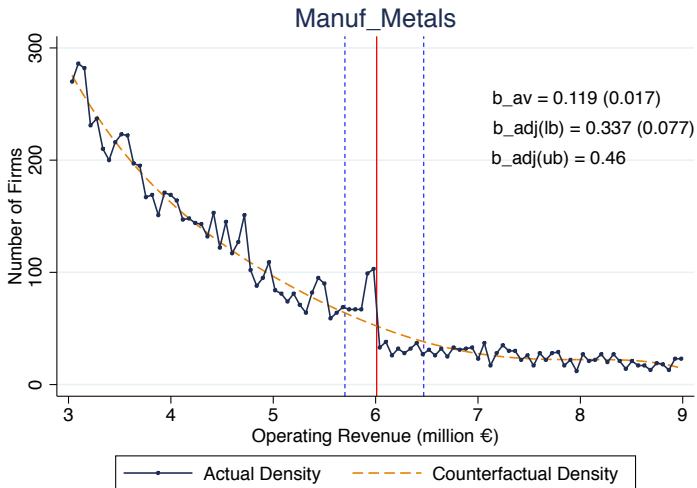
Low-Bunching: Restaurants and Hotels

RestHotels

b_av = 0.075 (0.023)

b_adj(lb) = 0.436 (56.070)

b_adj(ub) = 0.73

Number of Firms (y-axis)

Operating Revenue (million €) (x-axis)

Actual Density — — — Counterfactual Density

Low-Bunching: Retail

RetailTrade

b_av = 0.064 (0.007)

b_adj(lb) = 0.189 (0.030)

b_adj(ub) = 0.28

Number of Firms (y-axis): 0, 200, 400, 600, 800

Operating Revenue (million €) (x-axis): 3, 4, 5, 6, 7, 8, 9

Legend: Actual Density — — Counterfactual Density