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Market Externalities of Tax Evasion

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Market Externalities of Tax Evasion*

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Abstract

This paper presents evidence of market externalities of tax evasion: firms' tax non-compliance distorts the outcomes of their competitors. Using novel administrative data on the universe of Italian firms, we compute a tax evasion proxy as the fraction of individual firms that manipulate their revenue to meet eligibility criteria for preferential tax regimes. Our empirical approach uses policy-induced changes in tax notches' size to predict the fraction of non-compliant firms in each market. We find that non-compliant firms lead to significant revenue and productivity losses for their competitors, who then pass on some of this burden to their workers. This unfair competition harms aggregate productivity, partly due to a worsening of allocative efficiency. Our findings show that cracking down on tax evasion not only increases tax revenue and promotes tax fairness, but can also enhance market efficiency by leveling the playing field.

Keywords: tax evasion, market competition, preferential tax regimes.

JEL Classification: H26, H25, D22, D43.

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1 Introduction

Tax evasion is a major barrier to economic efficiency and fiscal sustainability. By diverting resources away from public budgets, it limits the development of fiscal capacity (Besley and Persson 2013), compromising the ability of governments to invest in essential public services. Moreover, it exacerbates income inequality and erodes tax equity (Slemrod 2007, Alstadsæter et al. 2019, Alstadsæter et al. 2022, Bachas et al. 2024), placing a disproportionate tax burden on law-abiding citizens and businesses that fulfill their fiscal responsibilities (Gordon and Li 2009, Best et al. 2015, Rubolino 2023).

Less attention, however, has been paid to the distortions tax evasion can create in product markets. By lowering the effective tax rate for non-compliant firms, tax evasion can distort competition, allowing evaders to undercut prices and gain a competitive advantage over their competitors.¹ This might misallocate resources by rewarding non-compliant firms, potentially stifling productivity in the broader economy (Restuccia and Rogerson 2017). Yet, despite its relevance, the literature offers no empirical evidence on the market-level spillovers of tax evasion, largely due to data limitations and the difficulty of measuring firm-level compliance (see Slemrod 2007, 2019 for reviews).

This paper aims to fill this gap by documenting the market externalities of tax evasion: how tax non-compliance by some firms distorts the outcomes of their competitors. We focus on a unique setting in Italy, where individual firms face a sharp revenue threshold for access to preferential tax regimes.² Many firms manipulate reported revenues to remain below this threshold, a behavior known as “bunching”. Using a novel administrative dataset on the universe of Italian firms over the 2005–2019 period, we construct a proxy for market-level tax evasion based on this bunching behavior. The individual firms included in our data, such as electricians, plumbers, or IT consultants, offer an excellent testing ground. These businesses, which make up nearly one-fourth of the Italian workforce, heavily rely on cash transactions and self-report their income, making evasion feasible (OECD 2023). Moreover, these firms typically operate locally in a specific business activity, thus allowing us to define their relevant market precisely.

A central element of our analysis is the use of bunching behavior as a proxy for tax evasion. While bunching does not exclusively capture misreporting, a growing body of research supports its interpretation as a meaningful indicator of evasion, particularly in

¹Slemrod (2007) provides an interesting example of how the opportunity for noncompliance can distort resource allocation: “Because the income from house painting can be done on a cash basis and is therefore harder for the IRS to detect, this occupation is more attractive than otherwise. The supply of eager housepainters bids down the market price of a house painting job. Thus, the amount of taxes evaded overstates the benefit of being a tax-evading housepainter. The biggest loser in this game is the scrupulously honest (or risk-averse) housepainter, who sees his or her wages bid down by the unscrupulous competition, but who dutifully pays taxes.” (p. 42).

²In many countries, small unincorporated firms are subject to simplified tax schemes that apply only if reported revenues fall below a specified cutoff (see OECD (2023) for a survey). These regimes typically involve flat tax rates, reduced filing requirements, and exemptions from bookkeeping or VAT obligations. While designed to ease compliance burdens for small businesses, such regimes also create strong incentives for firms to under-report revenue in order to remain eligible.

settings where firms face limited monitoring and enforcement (Saez 2010, Kleven and Waseem 2013, Best et al. 2015, Almunia and Lopez-Rodriguez 2018, Bachas and Soto 2021, Aghion et al. 2024, Lobel et al. 2024). In our context, several empirical tests reinforce this interpretation. First, we find that reported revenue responds strongly and quickly to changes in the eligibility cutoff, while input costs remain unchanged, suggesting that the response is not driven by real economic adjustments. Second, bunching is attenuated in industries where third-party reporting is more prevalent, consistent with misreporting being harder when transactions are more visible to tax authorities. Third, bunching firms are disproportionately likely to report round revenue figures: a pattern frequently associated with fabricated reports. Finally, we document a strong correlation between the intensity of bunching and independent measures of tax evasion.³

We then examine how variation across markets in the prevalence of individual bunching firms affects the performance of their competitors, defined as those operating in the same municipality-industry market that are ineligible for preferential regimes due to their legal form.⁴ These firms include general partnerships and limited liability companies, which are subject to stricter accounting obligations and closer scrutiny by tax authorities, making them less prone to engage in tax evasion. The key empirical challenge lies in isolating variation in bunching behavior that is plausibly exogenous to underlying market conditions. To address this, we construct a shift-share instrument based on cross-market differences in exposure to changes in the size of the tax notch (the gap in average tax rates between preferential and ordinary regimes), which strongly predict bunching behavior. Variation emerges from policy changes in eligibility rules over time, across industries, and by firm age, which differently affect markets based on their fixed demographic and industrial composition. We complement this strategy with an event-study design leveraging the expansion of eligibility to older firms, allowing us to transparently assess our identifying assumptions.

We find that tax evasion by individual bunching firms generates substantial negative spillovers on their competitors, particularly those of similar size. On average, each euro of underreported revenue by bunching firms leads to approximately €1.13 in lost revenue for the rest of the economy. This effect is consistent with a reallocation of market shares: by gaining an artificial cost advantage, bunching firms can undercut rivals on price and crowd out their demand. Competitors respond by compressing markups and reducing their wage bill, thus passing part of the burden onto workers. These labor cost adjustments occur along both the extensive (employment) and intensive (wages) margins. The nature of these responses, coupled with heterogeneity analyses, suggests a genuine real-

³Yet, if some of the observed bunching response is attributable to labor supply adjustments rather than tax evasion, our estimates would be conservative. In such cases, individual firms' reduced labor supply would give their competitors an advantage.

⁴Italian tax law (Article 10-bis of Law No. 212/2000) explicitly prohibits access to preferential regimes through merely formal changes lacking economic substance, such as altering legal form or artificially splitting or downsizing a business.

location of market shares, rather than a retaliatory increase in tax non-compliance.⁵

This unfair competition has also a detrimental effect on the productivity of competitor firms. Moreover, the whole market becomes less productive as non-compliant firms become more prevalent. Following the decomposition approach proposed by [Melitz and Polanec \(2015\)](#), we show that the aggregate (market-level) productivity loss mostly comes from a deterioration in the performance of incumbent firms. We also find a significant impact on allocative efficiency, with a decrease in the covariance between firm productivity and size. Therefore, in markets more exposed to tax evasion, there is a lower tendency for workers to move from smaller and less productive firms (including self-employed solo workers) to relatively larger and more productive firms.

Our paper contributes to various strands of the existing literature. The studies most closely related focus on the causes and implications of tax evasion (see [Andreoni et al. \(1998\)](#), [Alm \(2012\)](#), and [Slemrod \(2019\)](#) for reviews). [Slemrod \(2019\)](#) emphasizes the role of firms, and, in particular small firms, as one of the most “understudied empirical issues” in tax evasion. To the best of our knowledge, we offer the first empirical evidence of how tax evasion distorts resource allocation among non-compliant and compliant firms. Our findings suggest that cracking down on tax evasion is desirable not only for raising tax collections and ensuring tax equity (see, e.g., [Alstadsæter et al. 2019](#), [Guyton et al. 2021](#), [Alstadsæter et al. 2022](#)), but also for preventing non-compliant firms from enjoying an artificial cost advantage over their compliant counterparts. This distortion creates an uneven competitive landscape, which hinders firm growth and market efficiency.

Our findings also relate to studies showing bunching responses of firms and the self-employed to tax notches and kinks. This rapidly growing literature was initiated by [Saez \(2010\)](#), who shows that self-employed earners respond to tax incentives created by the EITC in the U.S. (see, e.g., [Chetty et al. 2011](#), [Chetty et al. 2013](#), [Kleven and Waseem 2013](#), [Best et al. 2015](#), [Almunia and Lopez-Rodriguez 2018](#), [Harju et al. 2019](#), [Bachas and Soto 2021](#), [Aghion et al. 2024](#), and [Lobel et al. 2024](#)). Experimental evidence indicates that the tax compliance rate is close to 100 percent when there is third-party reporting, but it is much lower when income is self-reported ([Slemrod et al. 2001](#), [Kleven et al. 2011](#)).⁶ The direct implication of these findings is that countries that have more self-employed taxpayers collect lower taxes ([Kleven et al. 2016](#)). Our findings suggest that self-employed non-compliance depresses tax revenue both *directly* and *indirectly* through spillover effects on their competitors.

Finally, our paper contributes to the literature examining the distortions produced by size-dependent regulations. The key finding of these previous works is that institutions

⁵Note that whether this indicates a real reallocation in market shares or a tit-for-tat increase in tax non-compliance behavior does not matter from a pure tax revenue perspective: both scenarios imply a “market externality”, resulting in deteriorated market functionality and tax revenue losses. However, the nature of the response has different normative implications ([Chetty 2009](#)).

⁶See, among others, [Pomeranz \(2015\)](#), [Carrillo et al. \(2017\)](#), [Almunia and Lopez-Rodriguez \(2018\)](#), [Naritomi \(2019\)](#), [Brockmeyer et al. \(2019\)](#), and [Boning et al. \(2020\)](#) for evidence of the role of tax enforcement in reducing tax evasion.

and policies preventing the equalization of the marginal value of inputs across firms can potentially generate large losses in aggregate productivity (Hsieh and Klenow 2009, Restuccia and Rogerson 2017). A series of papers have considered explicit policies or constraints that generate wedges in the allocation of resources across firms (Guner et al. 2008, Bartelsman et al. 2013, Garicano et al. 2016, Bachas et al. 2019). Our findings shed light on the inefficiencies created by preferential tax regimes for individual firms, a policy applied by most countries (OECD 2023). We show that these regimes involve significant under-reporting of revenue that, in turn, harms aggregate productivity.⁷ The implications of our findings are that policies incentivizing firms to remain unincorporated might prevent economies from developing. In this respect, our results are consistent with Jensen (2021), who shows that, as countries develop, their employment structure shifts from self-employment to employees.⁸

The paper is structured as follows. Section 2 describes the data and institutional background. Section 3 presents bunching responses of individual firms on preferential tax regimes. Section 4 examines how these bunching responses affect firm outcomes. Section 5 contains some concluding remarks.

2 Data and Institutional Background

This section presents the data (Section 2.1) and describes the preferential tax regimes for individual firms (Section 2.2).

2.1 Data and Variables

Our data cover the universe of Italian firms operating over the 2005-2019 period. This dataset is the outcome of a collaboration between the Bank of Italy and the Italian National Statistical Agency. It combines information from statistical, administrative, and fiscal sources (see Abbate et al. (2017) for details). The data contain information on key demographic and economic firm-level variables. For each firm, the dataset provides information on the legal form, age, industry classification (5-digit NACE code), location (municipality), and main balance sheet information, including revenue, value-added, labor costs, and the number of employees.

Our dataset is composed of about 65 million observations, covering around 4.3 million firms per year. Table 1 reports summary statistics on the full sample of individual firms, which are those potentially eligible for preferential tax regimes, and non-

⁷It is worth noting that our paper focuses on a specific form of tax evasion: revenue manipulation by individual firms aiming to access preferential tax regimes. While this measure does not capture all forms of tax evasion, we believe it offers a valuable perspective for understanding the broader market implications of tax evasion. Moreover, it should be noted that our paper is not a fully-fledged evaluation of preferential tax regimes. We exploit instead changes in the features of these regimes as exogenous sources of variation for revenue manipulation of individual firms.

⁸Our findings explain the strong association evident both across and within countries on self-employment rates, tax evasion, and productivity. See Figure A1 for visual evidence.

individual firms. An individual firm is an unincorporated business (sole proprietorship) that has just a single owner who pays personal income taxes on profits earned from the business. While the owner is solely responsible for business management, they may employ family members or other employees. Over the period covered in our data, the representative individual firm reports revenue of approximately 92 thousand euros. Non-individual firms include firms with other legal forms, such as general partnerships and limited liability companies. They are not eligible for preferential tax regimes. These firms tend to be larger in size and more productive (as measured by their value added per worker).

Table 1: Summary Statistics of Full Sample

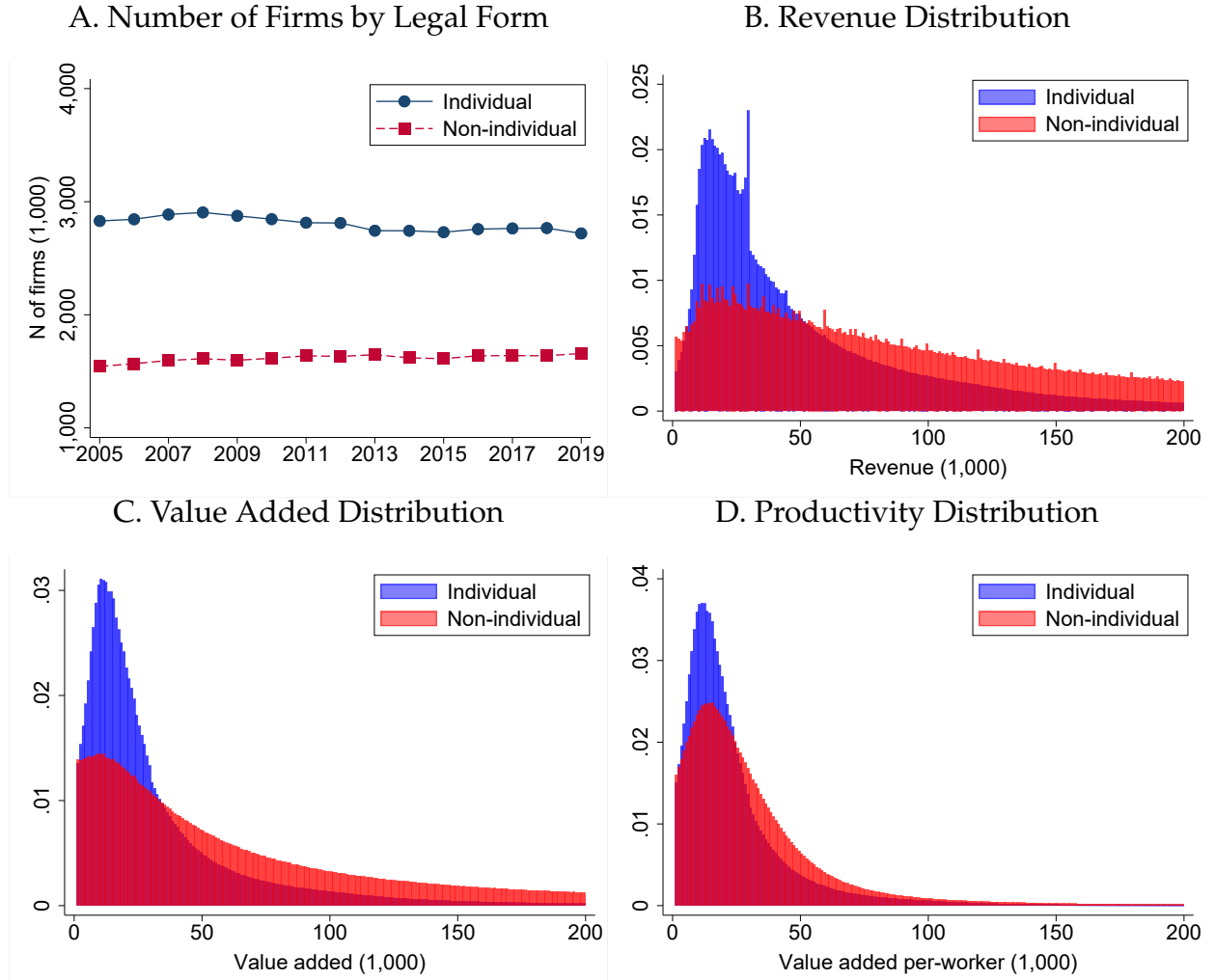
| | Individual firms | | Non-individual firms | |
|--------------------------------|------------------|-----------|----------------------|------------|
| | Mean (1) | SD (2) | Mean (3) | SD (4) |
| Revenue (1,000) | 91.964 | 262.557 | 1,730.782 | 61,626.391 |
| Value-added (1,000) | 34.465 | 82.501 | 407.514 | 16,116.892 |
| Value-added per-worker (1,000) | 21.800 | 50.283 | 37.760 | 903.820 |
| Wage bill (1,000) | 8.850 | 35.431 | 223.093 | 6,618.407 |
| Entry rate | 0.092 | 0.291 | 0.082 | 0.274 |
| Exit rate | 0.094 | 0.298 | 0.077 | 0.265 |
| N of workers | 1.537 | 1.431 | 7.857 | 164.704 |
| N of self-employed | 1.113 | 0.389 | 1.351 | 0.733 |
| N of employees | 0.425 | 1.431 | 6.506 | 164.705 |
| Age | 14.140 | 10.611 | 14.472 | 11.705 |
| Number of observations | 41,211,544 | | 23,711,612 | |

Note: This table shows summary statistics on several firm-level variables on the full sample of individual firms – which are those potentially eligible for preferential tax regimes – and non-individual firms – which are the potential competitors. Data from ISTAT over the 2005-2019 period.

Panel A of [Figure 1](#) shows trends in the number of firms by legal form. The figure shows that trends were fairly stable over our temporal window, with a slight decrease in the number of individual firms. These patterns do not seem to be attributable to the preferential tax regimes, which have had quite similar benefits for *new* businesses. Instead, they are probably attributable to some regulatory interventions that have made it easier to set up limited liability companies over time. As discussed below, this provides reassuring evidence in support of the exclusion restriction of our instrument. If the policy changes we exploit affect business creation or (ad hoc) changes in the legal form, we should observe an *increase* in the number of individual firms.

Panels B, C, and D plot the distribution of revenue, value-added, and value-added per worker for individual and non-individual firms. Two main remarks emerge from these graphs. First, there are clear differences in the moments of the distribution across the two groups of firms. This might stem from various factors, such as the scale of operations, access to capital, regulatory environments, and market reach. This cross-firm heterogeneity suggests that if tax evasion enables individual firms to gain market power over their (on average, larger size) competitors, we could observe significant aggregate distortions if productivity and size are positively correlated, as assumed in classical models of

Figure 1: Descriptive Evidence



Note: Panel A depicts the trend in the number of individual (blue circles) and non-individual (red squares) firms. Panels B, C, and D report the distribution of revenue, value-added, and value-added per worker, respectively, for individual (blue) and non-individual (red) firms. For graphical purposes, panels B, C and D cut the sample at 200,000 of the variable of interest. Authors' calculations, based on data from the Italian Institute of Statistics covering the universe of Italian firms over the 2005-2019 period.

the firm size distribution ([Lucas 1978](#), [Melitz 2003](#)). Second, there is a clear spike in the revenue distribution of individual firms at 30,000 euros. As we will discuss below, this corresponds to where the cutoff determining eligibility for preferential tax regimes was set for most of the period covered in our analysis. It thus provides *prima facie* evidence that preferential tax regimes shape the revenue distribution of individual firms.

2.2 Preferential Tax Regimes for Individual Firms

Over the recent decades, many countries have implemented preferential tax regimes targeting “hard-to-tax” businesses, such as small enterprises, farmers, unincorporated businesses, and the self-employed (see [OECD \(2023\)](#) for an overview). These businesses typically present low incomes and use cash payments, making it difficult for the tax authority to monitor them and ensure compliance. Italy has a long tradition of taxing individ-

ual firms with preferential tax regimes. These regimes have different eligibility criteria, but share certain characteristics. Conditional on reporting revenue below a certain cutoff, they offer a flat tax rate and an industry-specific presumptive tax base. Moreover, these regimes exempt firms from maintaining detailed accounting records, which *de facto* makes them unsuitable for tax audits by the Tax Agency. These regimes are extremely popular among taxpayers, with approximately 74 percent of total individual firms (i.e., around 1.9 million taxpayers) in Italy benefiting from a preferential tax scheme in 2019. During the period covered in the analysis, the Italian government implemented five different preferential tax regimes, which vary in the determination of the eligibility cutoff and the preferential tax rate.⁹

Eligibility criteria. To qualify for the preferential tax regime, firms must meet three main eligibility conditions. First, the firm must have a *legal form* of a sole proprietorship. Firms of any other legal form are not eligible. This exclusion aims to reduce tax optimization behaviors, such as artificially splitting or downsizing the activity of an incorporated business to meet the eligibility requirements.¹⁰ The second condition is based on reporting revenue below an *eligibility cutoff*. This cutoff has significantly changed over time and, in some years, across industries (Figure 2, panel A). Until 2008, the preferential tax regime exclusively targeted businesses reporting up to 30,000 euros of revenue (Law 388/2000). During the 2015-2018 period (Law 140/2014), the revenue cutoff was industry-specific, ranging from a minimum of 15,000 euros to a maximum of 40,000 euros.¹¹ In 2019, Law 145/2018 homogenized the eligibility cutoff across industries and raised it to 65,000 euros.¹² Third, in some years, the preferential tax regime is available only to firms below a certain *age limit*. As shown in panel B of Figure 2, the regime targeted exclusively firms in their first three years of operation until 2007. The regime was then extended to all firms (Law 244/2007) and later restricted to firms younger than five years (Law 98/2011). Finally, the introduction of the “forfettario regime” (Law 140/2014)

⁹These reforms can be considered a sudden and unforeseen change in Italian legislation. Despite being a recurring topic in election campaigns and broader political discourse, the critical eligibility criteria (such as the revenue cutoff, the sector-specific profitability coefficient, and the age threshold) are typically determined at the last minute, and the reforms are approved through emergency decrees. Appendix Table A1 provides an overview of the main features of the preferential tax regimes in force during the period covered in our analysis.

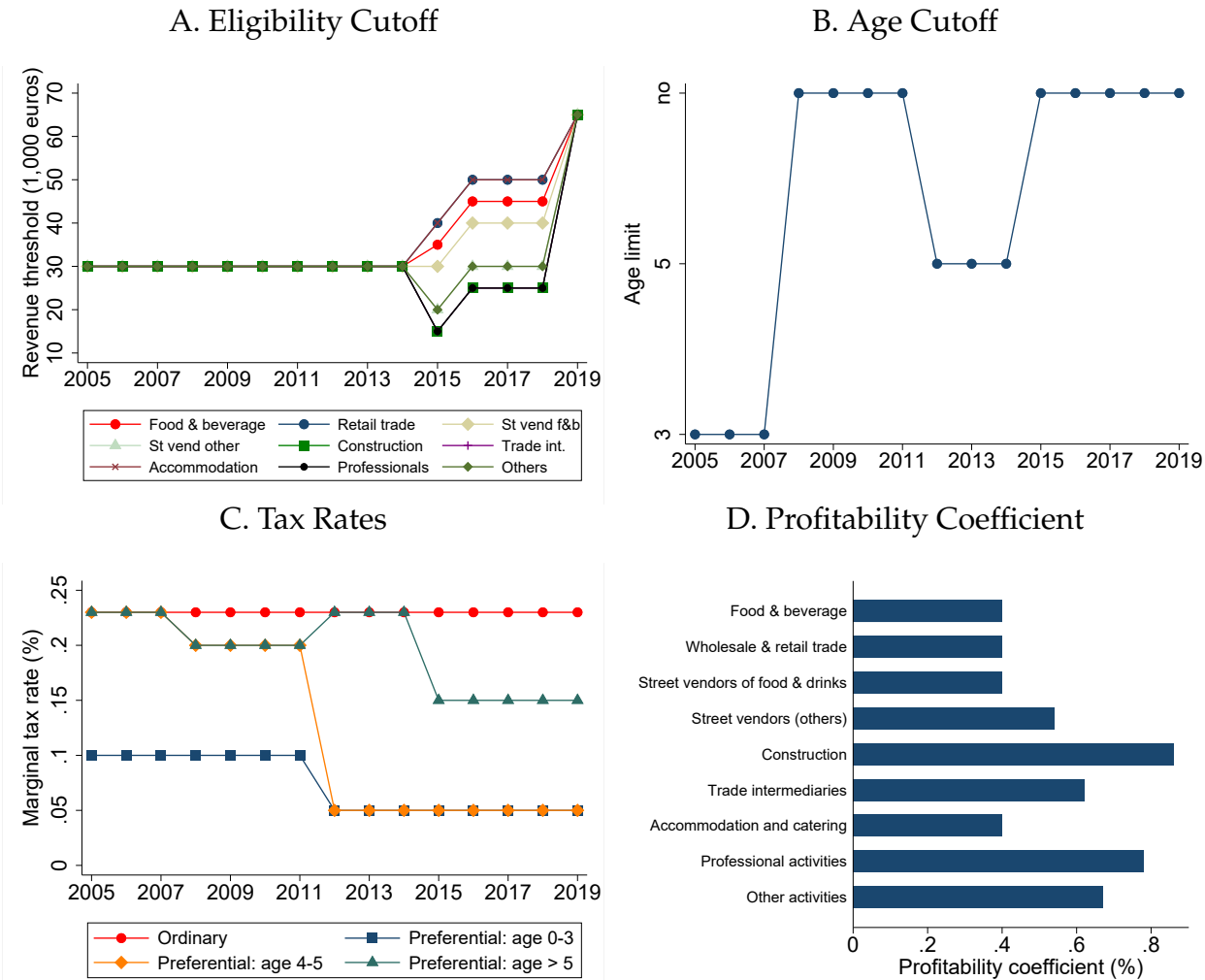
¹⁰A business cannot gain access to preferential treatment simply by converting from another legal form (e.g., a corporation or partnership) into an individual firm, unless the change reflects a real and substantive transformation in the organization and operation of the business. Artificial or temporary changes in legal form intended solely to exploit tax benefits are not recognized for tax purposes (article 10-bis of Law No. 212/2000). Moreover, to avoid the creation of fictitious individual firms (e.g., through within-firm transformations of employee work into self-employment), the government excludes eligibility to individuals who received wage income of at least 30,000 euros over the previous years.

¹¹See Appendix Table A2 for details on the industry-specific revenue cutoff.

¹²Two additional criteria determine eligibility for the post-2015 period. First, firms must not report gross expenses for ancillary work, employee work, and compensation paid to collaborators above 5,000 euros. Second, the total cost of capital goods, gross of depreciation, does not exceed 20,000 euros. However, given the small size of these businesses, these conditions are hardly a constraint for individual firms in practice.

extended again the preferential tax regimes to all firms.¹³

Figure 2: Main Features of the Preferential Tax Regimes for Individual Firms



Note: This figure depicts the main characteristics of the preferential tax regimes for individual firms. Panel A displays the revenue cutoff, determining eligibility for the preferential tax regimes each year and for each economic activity. In panel B, we show the age limit determining eligibility for the preferential tax regimes. Panel C presents trends in the marginal tax rate under the ordinary regime (where the marginal tax rate applied to the first tax bracket of the personal income tax is displayed) and the preferential tax rate for each firm age group. In panel D, we report the industry-specific profitability coefficient, which determines the share of revenue subject to the preferential tax rate. The industries displayed follow the classification made by the Italian government (see Appendix [Table A2](#) for details of the preferential tax regimes by economic activity). Authors’ elaboration based on the tax laws described in Appendix [Table A1](#).

Tax rate. The preferential tax regime replaces the payment of income taxes with a unique, flat, and relatively lower tax rate. The preferential tax rate has varied over time and by the firm’s age. Panel C in [Figure 2](#) compares the preferential tax rate with the bottom marginal tax rate on the personal income tax (the tax rate that a firm reporting revenue just above the eligibility cutoff is likely to pay). For firms younger than three years, the

¹³Individual firms reporting revenue above the threshold are defaulted into the ordinary personal income tax regime, which was changed in 2007 (see Appendix [Table A3](#) for details). The preferential regime ceases to be effective from the year an eligibility requirement is not met.

tax rate was 10 percent until 2012, and 5 percent thereafter (including firms younger than five years since 2012). For firms older than three years (or five years since 2012), the preferential tax regime has applied since 2008 with a tax rate of 20 percent, which was reduced to 15 percent in 2015. Under a pure tax savings perspective, the generosity of the preferential tax regime thus depends on the firm's age.

Tax base. Under the preferential regime, the tax base is defined by the firm's revenue, scaled by an industry-specific profitability coefficient. In panel D of [Figure 2](#), we report the profitability coefficient for each industry (following the classification of the Italian government). The profitability coefficient varies from a minimum of 40 percent for street vendors, the food and beverage industry, and the accommodation and catering industry, to a maximum of 86 percent for the construction and real estate industry. The tax base is thus based not only on the firm-specific output, but also on the presumed profitability that the firm should obtain in its industry. Since taxation of turnover (rather than profit) is advantageous to taxpayers with high profit margins ([Best et al. 2015](#)), the profitability coefficient aims at adjusting for cross-industry heterogeneity in average profitability. The only deductible source of expenses is social security contributions. In comparison, the tax base under the standard regime is defined by individuals' net business income, which is revenue minus costs. This means that the standard regime remains convenient for corporate businesses with large (deductible) costs, such as those with many employees, significant investments, and high operating expenses.

Exemption from value-added tax payments and book-keeping rules. Eligible firms are exempted from value-added tax (VAT) requirements, including VAT payment. This implies that firms do not have to remit the VAT, and they cannot deduct the VAT paid on their inputs. Moreover, firms are exempted from maintaining accounting books, such as annual accounts, bank statements, and cash books. However, they are required to record purchase invoices and to emit VAT invoices for supplies to other VAT-registered businesses. Compared to the standard regime, the preferential regime is thus easier to handle and reduces the amount of red tape imposed on taxpayers.

Ease of misreporting in the preferential regime. The exclusion of eligible firms from maintaining accounting books makes it challenging to perform tax audits. The preferential regime thus *de facto* exempts individual firms from monitoring by the Italian Revenue Agency. As a result, the cost of misreporting revenue under the preferential tax regimes is substantially lower than under the standard regime.¹⁴ This is key for the interpretation

¹⁴Under weak tax enforcement, firms eligible for preferential tax schemes still report some of their revenue for two main reasons. First, tax evasion comes with real resource costs ([Chetty 2009](#)), such as the need to keep separate accounting books to track "black" payments made in cash. Firms that evade taxes may also miss out on business opportunities by refusing credit card or bank payments, as cash transactions are easier to conceal. Second, because some firms use intermediate inputs in production and sell their outputs to other firms, their transactions leave paper trails that cannot be hidden from the authority

of our empirical results. The revenue-based eligibility threshold creates a tax-induced incentive to under-report revenue. This raises concerns about tax evasion responses, since monitoring from the tax administration is missing, and cash payments are frequent among individual firms. The Italian tax authority is aware of the risk of easing tax evasion responses. For instance, the annual government report on tax evasion (see [Ministero dell'Economia e delle Finanze 2022](#)) documented that the tax gap from self-employment income was nearly 30 million euros per year, corresponding to nearly 70 percent of the potential revenue from self-employment income.¹⁵

3 Bunching Responses to Preferential Tax Regimes

This section provides evidence of bunching responses from individual firms at the eligibility cutoff for preferential tax regimes. It also shows how the size of the tax notch significantly impacts the extent of bunching. We then study the nature of this response, showing that bunching responses are consistent with revenue manipulation.

3.1 Bunching Responses

Bunching methodology. The eligibility cutoff for preferential regimes creates a *notch*, leading to discontinuities in firms' average payoffs. Crossing this cutoff results in a discontinuity in the tax rate, tax base, bookkeeping compliance costs, and tax evasion detection probability. We use the bunching methodology to identify behavioral responses at the cutoff ([Saez 2010](#); [Chetty et al. 2011](#); [Kleven and Waseem 2013](#)).¹⁶ Since the eligibility cutoff varies over time and, in some years, across industries, we first normalize each cutoff point. We then group firms into j bins of revenue and calculate the number of firms in each bin, n_j , centered at the eligibility cutoff. The following regression is then run:

$$n_j = \sum_{k=0}^7 \alpha_k (z_j)^k + \sum_{i=z_l}^{z_u} \gamma_i \cdot \mathbf{1}(z_j = i) + u_j. \quad (1)$$

The first term is a 7-th-degree polynomial (as in [Chetty et al. 2011](#)) that accounts for potential curvature in the counterfactual revenue density. The second term is an indicator function for bins located in the excluded range, $[z_l, z_h]$ where bunching occurs. We calculate counterfactual bin counts as the predicted values from equation (1), omitting the contribution of dummies in the excluded range: $\hat{n}_j = \sum_{k=0}^7 \alpha_k (z_j)^k$. To determine the excluded range, we follow the convergence method proposed by [Kleven and Waseem \(2013\)](#): the lower bound is determined by visual inspections as the point where excess

([Pomeranz 2015](#); [Liu et al. 2021](#)).

¹⁵Tax authorities in other countries implementing comparable preferential tax schemes for self-employees have faced similar issues. For instance, the French tax authority carried out an audit program in 2011 on 1,162 randomly selected taxpayers who benefited from a generous preferential tax regime ([Aghion et al. 2024](#)). They found that 30 percent of taxpayers were under-reporting income and extrapolated that around 400 million euros could be recovered if all the self-employed had been audited.

¹⁶Appendix B describes the theory behind bunching responses to tax notches.

bunching starts to emerge; the upper bound is computed such that excess bunching below the notch equals the missing mass above. The excess mass of firms bunching at the cutoff is calculated as $\hat{B} = \sum_{i=z_l}^0 (n_j - \hat{n}_j)$.¹⁷

Overall bunching response. We start presenting evidence that individual firms systematically report revenue just below the cutoff for preferential tax eligibility. In panel A of [Figure 3](#), we pool all individual firms in our data, grouping them in 200-euro bins of (normalized) revenue. The graph compares the empirical distribution (blue dots) with the counterfactual distribution (red solid line) and reports estimates of the total excess number of firms (B), and the excess mass of firms relative to the average density in the bunching region (b). The figure provides clear evidence of bunching: relative to the counterfactual distribution, there is an excess mass of firms reporting revenue just below the cutoff. We estimate excess bunching of 1.975 times the height of the counterfactual distribution, implying that the density of firms just below the threshold is nearly twice as large as it would be in the absence of the policy.

Reported revenue adjustment and elasticity estimate. Our z_u estimate suggests that, in the absence of the notch, the marginal buncher would have reported approximately 15 thousand euros more in revenue. This indicates that firms reduce reported revenue by about 51 percent to remain within the preferential tax regime. Following [Kleven and Waseem \(2013\)](#), we use these estimates to approximate the reported revenue elasticity by relating the revenue response Δz^* to the change in the implicit marginal tax rate τ^* created by the notch. The elasticity of reported revenue to the implicit net-of-tax rate is given by:¹⁸

$$\epsilon = \frac{\Delta z^*/z^*}{\Delta \tau^*/(1 - \tau^*)} \approx \frac{(\Delta z^*/z^*)^2}{\Delta \tau/(1 - \tau)} \quad (2)$$

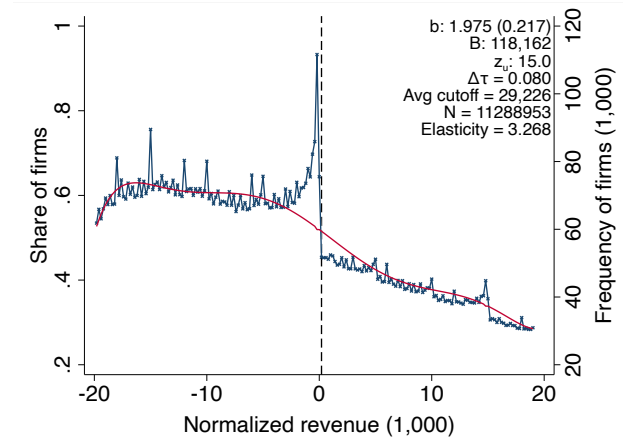
In the graph, we report the average tax rate jump at the notch ($\Delta \tau$), which is about 8 percent, the average cutoff (29,226 euros), and the average revenue response (15,000 euros). Our estimates yield a reported revenue elasticity of about 3.3. This large elasticity is difficult to reconcile with standard estimates that capture “real” responses ([Saez et al. 2012](#)). To put this estimate in perspective, note that, in a relatively comparable setting, [Lobel et al. \(2024\)](#) find reported revenue elasticity to tax notches between 0.35 and 1, and

¹⁷Following [Chetty et al. \(2011\)](#), we compute the standard error of \hat{B} by using a parametric bootstrap procedure in which a large number of gross income distributions (200 in our case) are generated by random resampling the error term u_j . This procedure generates a new set of counts that can be used to calculate new \hat{B} estimates. We can then define the standard error of \hat{B} as the standard deviation of the distribution of \hat{B} that we obtain through this iterative procedure.

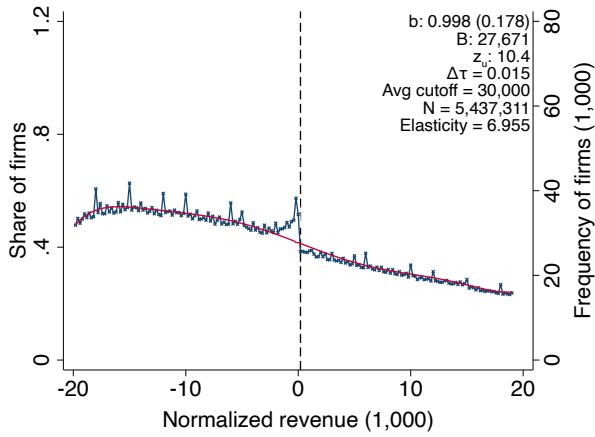
¹⁸This formula treats the notch as a hypothetical kink that generates a jump in the marginal tax rate. Under the assumption of homogeneous elasticity across taxpayers, the marginal buncher’s response provides an estimate of the structural elasticity. However, if elasticities are heterogeneous, this method reflects the response of the most elastic taxpayers, making our estimate an upper bound on the true structural elasticity.

Figure 3: Bunching Responses to Preferential Tax Schemes

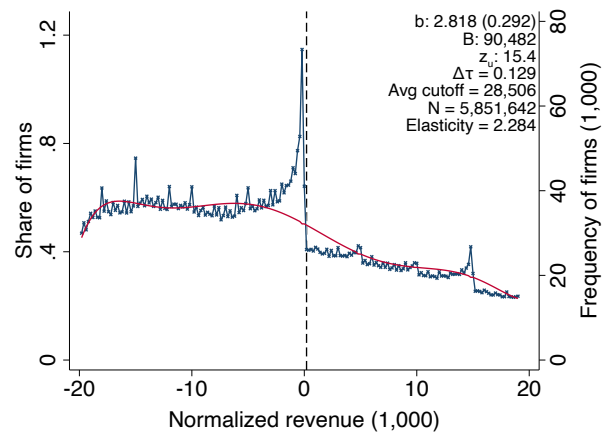
A. Pooled sample



B. Tax notch below average



C. Tax notch above average



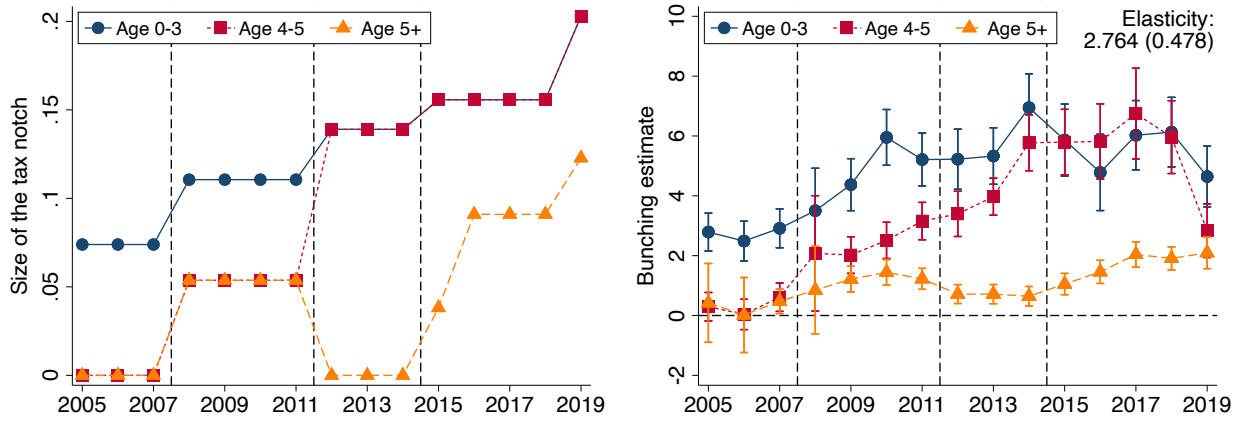
Notes: Each figure shows the empirical distribution of revenue (blue dots) and the counterfactual distribution (red curve). Panel A focuses on the pooled data for the period 2005-2019; panel B on the sample with the tax notch below average; panel C on the sample with the tax notch above average. The horizontal axes report normalized revenues: the distance from the revenue cutoff determining eligibility for preferential tax schemes. The bins are €200 wide. We also report estimates of the total excess number of firms (B), the excess mass of firms as a share of average density in the bunching region and its associated bootstrapped standard error (b), and the upper bound estimate (Δz^*), calculated as described in Section 3.1. In each graph, we also display the average jump in the tax rate ($\Delta\tau$), the average cutoff, the number of observations, and the estimated elasticity from equation (2).

suggest that the observed responses are likely driven by misreporting rather than real economic adjustments.

Bunching responses to variation in the size of the tax notch. The bunching and implied reported revenue estimates capture responses to notches in tax rates, enforcement, tax base, and compliance costs. However, only the *tax rate notch* varies over time, allowing us to isolate the role of tax incentives in driving bunching, while controlling for time-invariant factors. To assess this, we compare bunching responses to policy-induced

changes in the size of the tax notch. These comparisons also serve as a test for the relevance of the instrument we introduce later. As an initial test, we split the sample based on whether the tax notch is above or below the average. Panels B and C of Figure 3 show that the bunching mass is nearly three times greater (2.818 versus 0.998) when the tax notch is larger (12.9 percent versus 1.5 percent). This suggests that tax incentives play a key role in bunching behavior, beyond other benefits of the preferential regime.

Figure 4: Tax Notch Size and Bunching Responses Across Firm Age Groups



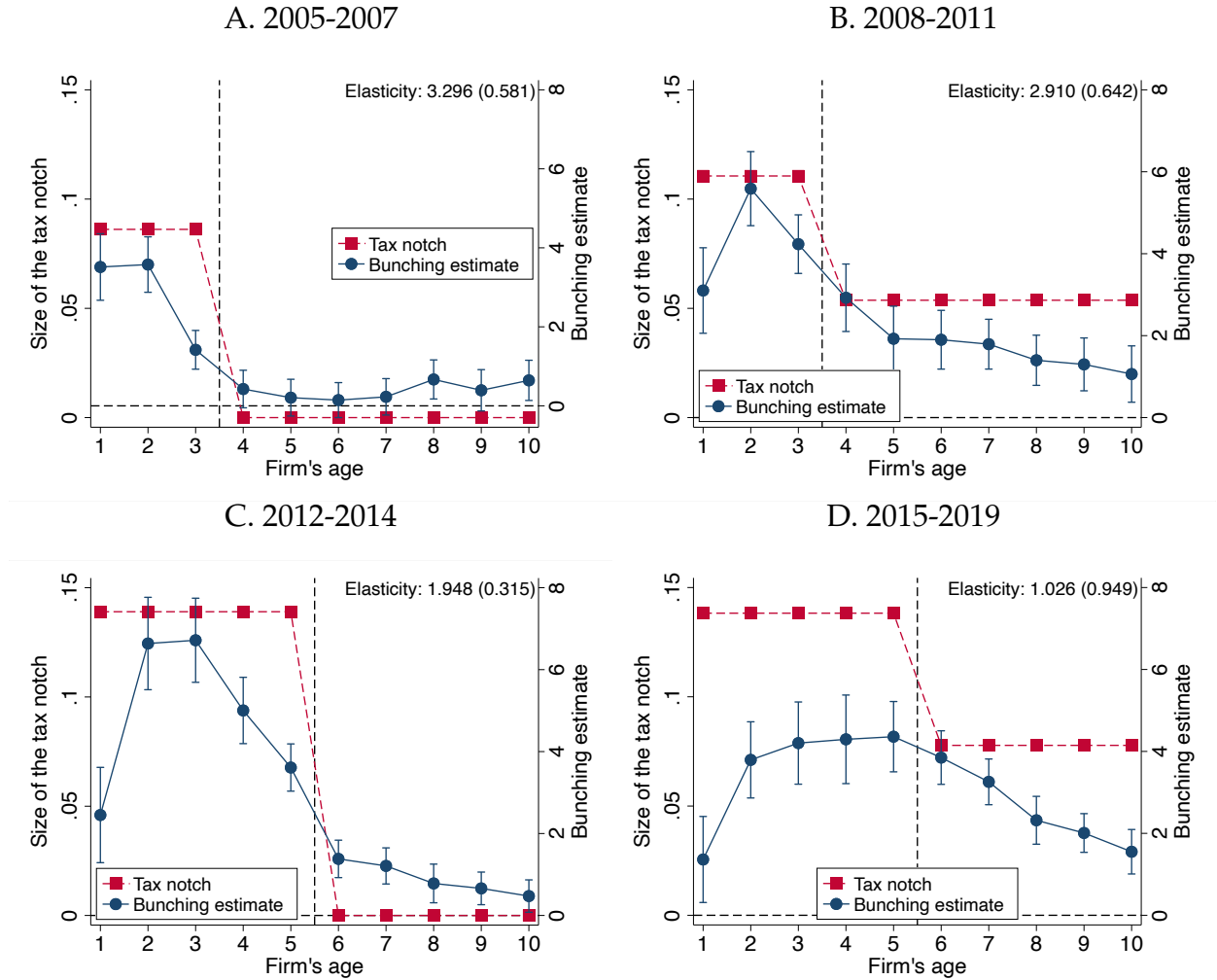
Note: This figure compares the size of the tax notch (the average tax rate differential between the ordinary and preferential regime at the eligibility cutoff; left-hand side graph) with the bunching response (right-hand side graph) over time within each firm's age group. Bunching estimates and 95 percent confidence intervals are calculated as described in Section 3.1. We present trends for the three groups of firms that might face a different tax rate under the preferential tax regimes: firms created from less than 3 years; between 3 and 5 years; and from more than 5 years. The black vertical lines denote the preferential regime's change, which creates variation over time and across firms in the size of the tax notch. The figure also reports the elasticity of bunching with respect to the tax rate differential and its associated standard error.

To further examine the role of tax incentives, we exploit temporal variation in the size of the tax notch across different firm age groups. The underlying assumption is that tax-related incentives to bunch vary over time, while other factors remain constant. Figure 4 compares the tax notch size with bunching estimates (and 95 percent confidence intervals) across firm age groups. Vertical black lines indicate policy reforms that altered the tax notch. The figure shows that bunching behavior strongly relates to the tax notch size. For example, between 2008 and 2011, when the tax notch was, on average, 7.5 percentage points higher for firms younger than three years, their bunching response was approximately three times larger. Over time, changes in the tax notch consistently align with variations in the bunching response. Before 2007, firms older than five years did not benefit from preferential tax treatment, and no bunching was observed. However, as the preferential regime was extended to them, these firms began exhibiting bunching behavior, with responses intensifying after 2015 due to stronger tax incentives.¹⁹ Relating

¹⁹Each graph reports the size of the tax notch averaged across industries. As previously described, heterogeneity in the profitability coefficient creates variation in the tax notch across industries. Figure A2 consistently shows a positive correlation between the bunching estimate and the profitability coefficient.

changes in the bunching estimate with changes in the size of the tax notch, we estimate an elasticity of about 2.8, mirroring the estimate derived from equation (2).

Figure 5: Bunching Responses and Tax Notch Discontinuities by Age



Note: This figure examines whether bunching behavior exhibits discontinuities based on firm age. Each panel compares the tax notch size (red squares) by years since firm creation with the corresponding bunching response (blue circles) and refers to a specific preferential tax regime, which varies in both the location and magnitude of the notch. Bunching estimates and 95 percent confidence intervals are calculated as described in Section 3.1. The black vertical lines denote the discontinuous change in the size of the tax notch. The figure also reports the elasticity of bunching with respect to the tax rate differential and its associated standard error.

To further refine this analysis, Figure 5 examines whether bunching behavior exhibits discontinuities based on firm age. Each panel compares the tax notch size (red squares) by years since firm creation with the corresponding bunching response (blue circles) and refers to a specific preferential tax regime, which varies in both the location and magnitude of the notch. The results provide clear graphical evidence linking the extent of bunching behavior to the size of the tax notch. Periods characterized by large changes in the notch (e.g., 2005-2007, 2012-2014) display sharp differences in bunching magnitude. For instance, during 2005-2007, when firms under three years faced a sizable notch, young firms exhibited a statistically significant bunching response, while older firms did

not. By contrast, during periods with smaller notch changes (2008-2011, 2015-2019), the bunching difference was more gradual. The implied elasticity estimates range from 1 to 3.3, substantially larger than standard estimates that reflect “real” responses.

3.2 Misreporting or Real Response?

Previous research has documented that bunching responses are more pronounced when misreporting is easier. For instance, [Saez \(2010\)](#) and [Kleven et al. \(2011\)](#) show that bunching responses are much larger when income is self-reported (i.e., among self-employees) than when it is third-party reported. [Aghion et al. \(2024\)](#) show that bunching responses to preferential regimes for the self-employed in France indicate a significant evasion elasticity, with minimal real income elasticity. Similar responses have been observed in other contexts as well ([Best et al. 2015](#); [Almunia and Lopez-Rodriguez 2018](#); [Bachas and Soto 2021](#); [Lobel et al. 2024](#)). In our context, a crucial factor facilitating revenue manipulation is the exemption of firms eligible for preferential tax regimes from the obligation to maintain accounting books. This exemption hampers the effectiveness of tax audits. We present multiple pieces of evidence supporting the notion that revenue underreporting is likely the primary driver of the bunching response.

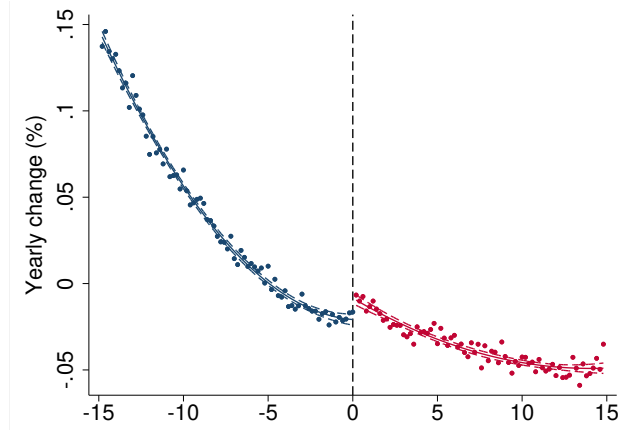
Comparing revenue and variable inputs’ costs. Our first test compares firm-level revenue growth with the growth in variable input costs around the (normalized) eligibility cutoff. This analysis offers suggestive evidence of the underlying mechanisms behind the bunching response. If labor supply responses are the main factor, we would expect revenue growth to correlate with the growth in variable input costs. In this case, the cutoff would constrain certain market transactions, distorting both revenue and input costs for firms just below the cutoff. By contrast, if bunching is driven by revenue underreporting, we would observe distortions in reported revenue growth without corresponding changes in input costs.

We conduct this analysis over two periods: 2016–2018, when the eligibility threshold remained unchanged, and 2018–2019, when the threshold was raised. In the first period, we expect firms just below the eligibility threshold to exhibit an abnormally low growth rate compared to firms just above it. In the second period, the increase in the threshold allows us to assess whether firms previously constrained by the cutoff significantly grow. [Figure 6](#) illustrates changes in average reported revenue (left-hand side graphs) and variable input costs (right-hand side graphs) around the normalized eligibility threshold. Each figure includes a quadratic fit with confidence intervals around average growth rates within 200-euro bins. The results indicate that during the stable threshold period, firms just below the cutoff exhibit significantly lower revenue growth, with no comparable discontinuity in input costs. After the threshold increase, firms that previously bunched at the cutoff display abnormally high revenue growth compared to non-bunching firms. Again, we find no significant differences in input cost growth

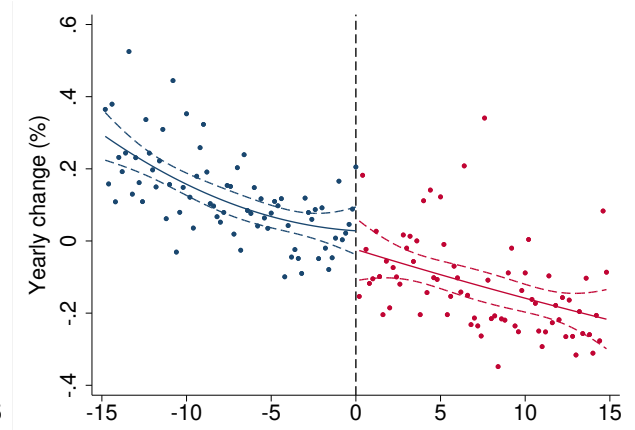
between the two groups. The absence of changes in variable input costs supports the interpretation that revenue manipulation, rather than real responses, is the primary driver of the bunching behavior.

Figure 6: Revenue and Inputs' Cost Growth Around the Eligibility Cutoff

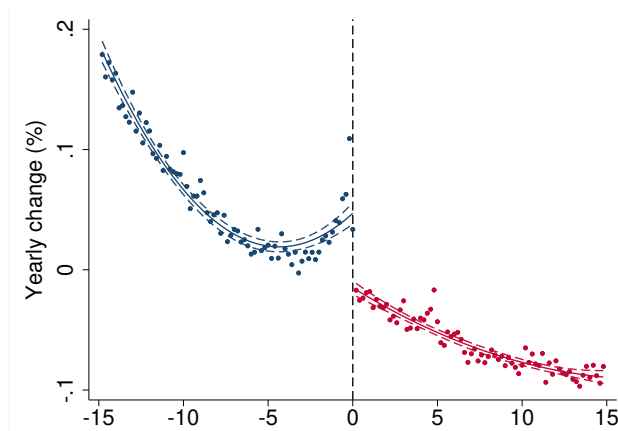
A. *Outcome: revenue growth*
Period: no cutoff change (2016-2018)



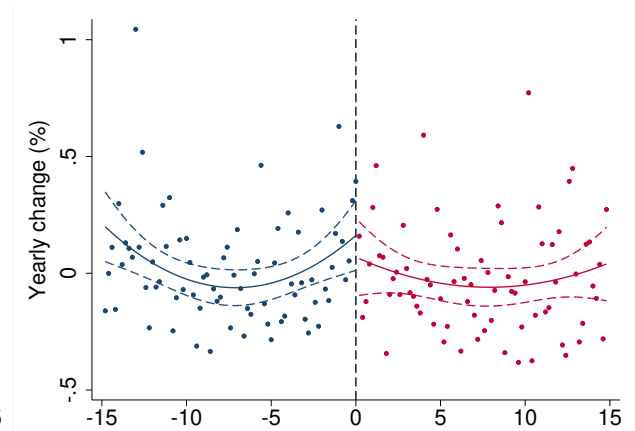
B. *Outcome: inputs cost growth*
Period: no cutoff change (2016-2018)



C. *Outcome: revenue growth*
Period: cutoff increases (2018-2019)



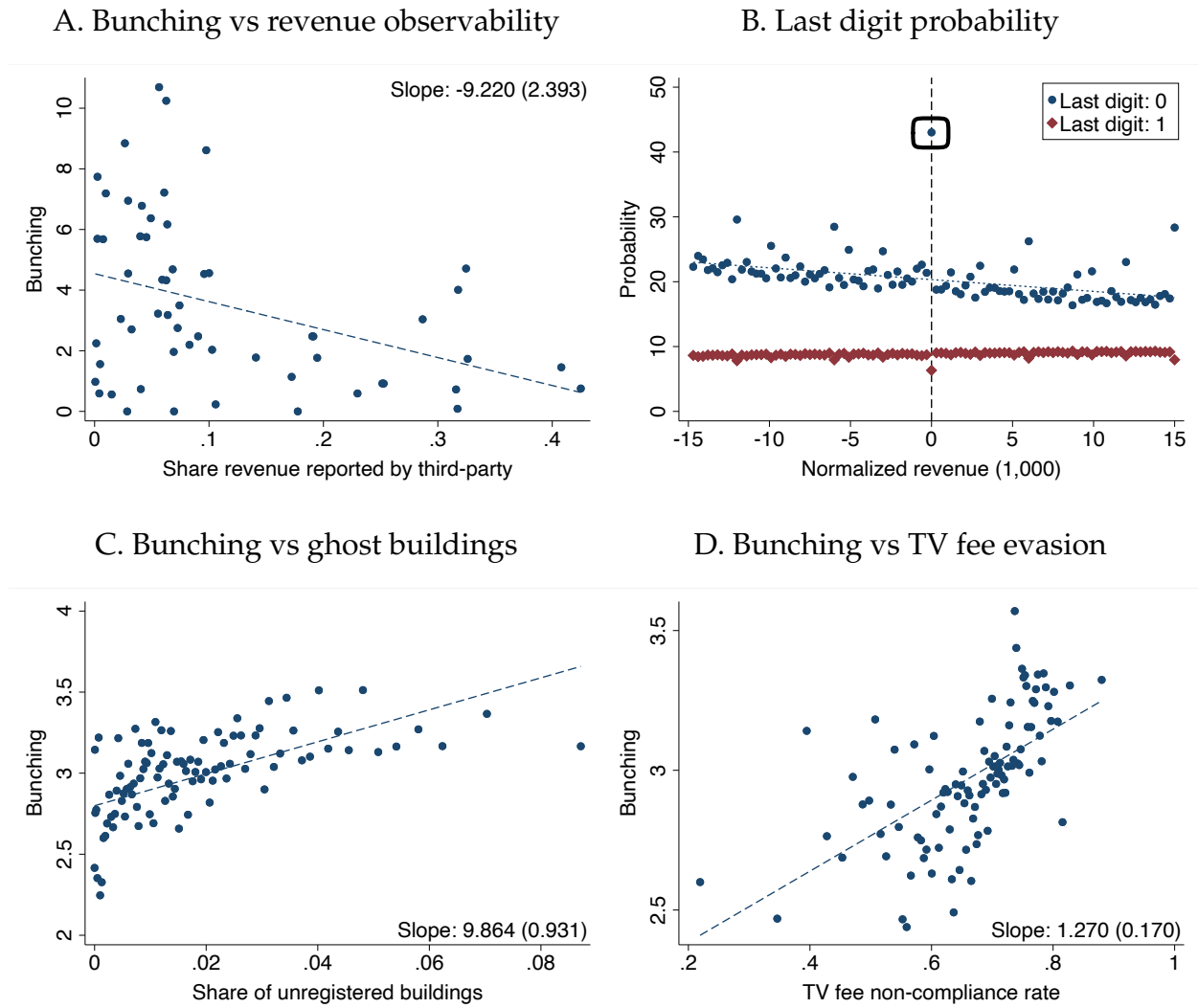
D. *Outcome: inputs cost growth*
Period: cutoff increase (2018-2019)



Note: The figure plots the bin-average growth rates of revenue (left-hand side graphs) and variable input costs (right-hand side graphs) across the normalized revenue distribution. We plot these outcomes over two periods: i) 2016-2018, when the cutoff did not vary; ii) 2018-2019, when the cutoff increased. We also report quadratic fits and confidence intervals around the bin average.

Bunching and revenue observability. Next, we examine whether the extent of bunching is influenced by the availability of third-party information on firms' revenues. Building on previous research linking misreporting to third-party reporting (e.g., [Kleven et al. 2011](#); [Lobel et al. 2024](#)), we leverage the fact that certain transactions, such as government sales or exports, are independently reported to the tax authority. To capture this relationship, we use industry-level data from the Italian Institute of Statistics (Istat) on "revenue

Figure 7: Correlates of the Bunching Rate



Notes: Panel A compares the estimated bunching rate with the share of third-party reported revenue across 64 industries. Panel B shows the fraction of individual firms reporting zero (blue circles) and one (red diamonds) as the last digit across the normalized revenue distribution. Panel C compares the bunching rate (vertical axis) with the share of (taxable) unregistered buildings (horizontal axis) across municipalities. Panel D relates the bunching rate (vertical axis) with the national TV fee non-compliance rate (horizontal axis) across municipalities. In panels A, C, and D, the variables are depicted in equal-sized bins, along with the line of best fit, the estimated slope, and the associated standard error.

observability”, defined as the proportion of self-declared revenue that is independently verified by the tax authority.²⁰ To assess the link between revenue observability and bunching behavior, panel A of Figure 7 plots bunching estimates against the share of third-party reported revenue across 64 industries. The figure reveals a strong negative correlation: industries with a higher proportion of revenue directly observed by tax authorities (e.g., manufacturing) exhibit a weaker bunching response, whereas those more reliant on direct sales to final consumers (e.g., retail) display stronger bunching. While other factors could contribute to this correlation, we interpret this as further evidence

²⁰Specifically, we use the input-output matrix provided by Istat to compute the share of output in each sector directed to the public sector or export, which is more likely to be invoiced.

that revenue misreporting plays a key role in driving the observed bunching behavior.

Bunching at specific digits. Following [Aghion et al. \(2024\)](#), we investigate anomalies in the last digit of reported revenues. This analysis is based on Benford’s Law, which states that in many real-world numerical datasets, the distribution of first digits follows a logarithmic pattern, with smaller digits appearing more frequently. However, this pattern weakens for subsequent digits, and the last digit is expected to follow a uniform distribution. In the absence of manipulation, each digit in the set 0, 1, ..., 9 should occur with equal probability, and this uniformity should hold consistently across the entire revenue distribution, including the bunching area. Panel B of [Figure 7](#) presents the probability distribution of firms reporting 0 (blue circles) and 1 (red diamonds) as the last digit across the normalized revenue distribution. The data reveal a general tendency for firms to report zero more frequently than other digits, regardless of their revenue level. However, firms just below the eligibility threshold are more than twice as likely to report 0 as the last digit. While descriptive, this sharp increase at the threshold provides further evidence of strategic reporting behavior consistent with tax evasion.

Bunching and other tax evasion indicators. Finally, we compare the share of individual firms reporting revenue just below the eligibility cutoff in a municipality with two existing proxies of tax evasion: the share of unregistered (taxable) buildings, and the national TV fee non-compliance rate. Both indicators capture individual non-compliance behavior rather than overall market-level tax evasion, which might be driven by large corporations. [Figure 7](#) shows that both the two indicators exhibit a strong correlation with the bunching rate (panels C and D). This relationship remains robust even when examining variation within provinces (see Appendix [Figure A3](#)).

4 Market Externalities of Tax Evasion

In this section, we examine whether and how revenue misreporting by individual firms affects their competitors. We first outline the channels through which firms that engage in tax evasion could gain a competitive advantage. Then, we introduce the identification strategy used to assess this impact and present our main findings.

4.1 Conceptual Framework and Market Definition

The competitive advantage of tax non-compliant firms. Our estimates suggest that the marginal buncher would have reported approximately 15 thousand euros more in revenue, which is roughly half of its reported revenue. If this response reflects real effects (e.g., firms reducing production or working less intensely to remain below the threshold), their competitors might benefit from the reduced labor supply of bunching firms.

By contrast, if revenue misreporting is at least part of the response, bunching firms

could gain a competitive edge. By enjoying a zero tax rate on a substantial portion of their revenue, non-compliant firms can gain market power by offering per-unit prices below competitive levels.²¹ In settings with increasing marginal costs, taxes act as a wedge that reduces optimal output levels, leading compliant firms to produce less than they would in the absence of taxation. In contrast, non-compliant firms may sustain higher production levels and/or lower prices, enabling them to capture a greater market share. Under some circumstances, compliant firms may also choose to evade taxes themselves.²² Across all scenarios, the observable consequence is a decline in the revenue of non-compliant firms' competitors. This motivates our main focus on whether the competitors of bunching firms experience revenue losses. In Appendix C, we present a stylized model illustrating the mechanisms through which tax non-compliance distorts competitive outcomes, what we refer to as "market externalities".

Defining competitors. Identifying the relevant set of competitor firms for individual bunching firms presents two main challenges. The first is to define the relevant market in which firms compete. We adopt the European Commission's definition of a market for competition law purposes, a strategy widely used in the literature (see [Bresnahan and Reiss 1991](#); [Syverson 2004](#)). This approach relies on two criteria:

- i. *Product market definition:* firms are considered competitors if they produce goods or services that are close substitutes. To approximate this condition, we use the standard NACE industry classification at the two-digit level, assuming that firms within the same industry are more likely to produce substitutable products.
- ii. *Geographical market definition:* firms are assumed to compete more directly when they operate in the same geographic area. Given the presence of transportation costs and other distance-related frictions, competition is typically more localized, especially for smaller firms that lack the organizational complexity to operate across multiple areas.²³

²¹The extent to which tax non-compliance provides a competitive advantage depends on the pass-through of taxes to prices or production decisions. In standard tax incidence models ([Harberger 1962](#); [Kotlikoff and Summers 1987](#)), the degree of pass-through depends on the relative elasticities of supply and demand. Under perfect competition, taxes are largely passed onto consumers. In this case, tax-compliant firms face a direct disadvantage compared to non-compliant firms, which can offer lower prices and capture greater market share. However, in imperfectly competitive markets, firms with some degree of pricing power may absorb part of the tax burden by reducing profit margins, thereby limiting the pass-through to consumers ([Weyl and Fabinger 2013](#)). In such cases, the competitive advantage of tax evasion is smaller but still present, as non-compliant firms can sustain higher profit margins or undercut prices more selectively.

²²Non-compliance of individual firms might also generate cascading effects through the production chain ([de Paula and Scheinkman 2010](#), [Best et al. 2015](#)). For example, a plumber might purchase plumbing equipment and supplies from wholesalers or retailers while offering services to households and construction firms. If the plumber does not issue invoices to evade tax, their suppliers and customers may also underreport their revenue. The value chain of the plumber (and of any other individual firm) is reasonably local, and the introduction of municipality-year fixed effects accounts for the cascading effects of the plumber's tax evasion.

²³A survey conducted by the Italian Institute of Statistics on a representative sample of firms with more

Based on these criteria, we define a market at the municipality-industry level. To ensure robustness, we conduct sensitivity analyses by expanding the geographical scope (using local labor markets, defined as clusters of contiguous municipalities linked by commuting patterns) and by refining the industry classification (using the NACE three-digit level). The results remain consistent across these alternative definitions of market boundaries.

The second challenge is selecting comparable firms that are less likely (or able), at least partially, to evade taxes. We focus on firms that are not eligible for preferential tax schemes due to their ex ante-determined legal form.²⁴ These firms are required to maintain formal accounting records and are subject to stricter tax authority monitoring, which significantly increases their costs of tax evasion compared to individual firms. Consistently, the tax gap from self-employment income is nearly 70 percent of the potential revenue, whereas the gap is about 18 percent for income from firms of other legal forms ([Ministero dell'Economia e delle Finanze 2022](#)).

4.2 Identification Strategy

Our goal is to estimate how the prevalence of individual bunching firms in a market, our proxy for firms' tax non-compliance, affects the outcomes of their competitors. Focusing on each competitor firm i , operating in market m in year t , we estimate the following equation:

$$y_{i,t} = \beta \cdot B_{m(i),t} + \gamma_i + \delta_t + u_{i,t}, \quad (3)$$

where $y_{i,t}$ represents a firm-level outcome, and the key independent variable, $B_{m(i),t}$, measures the share of individual bunching firms observed in market m . This is computed as the share of individual firms reporting revenue just below the eligibility cutoff for preferential tax regimes, relative to the total number of firms in the market. To ensure comparability across markets, we define the "excess bunching" region as the (normalized) revenue range $[-5,000; 0]$.²⁵ On average, individual bunching firms represent 9.6 percent of all individual firms, 18.2 percent of non-individual firms, and 7.5 percent of all firms (see Appendix [Figure B3](#) for its distribution).

Firm fixed effects, γ_i , account for time-invariant factors, including persistent market characteristics and systematic differences in tax rates between firms eligible and ineligi-

than 10 employees finds that, on average, 71 percent of these firms consider their primary competitors to be businesses within the same municipality (see [Istat, Censimento Industrie e Servizi](#)). This figure is likely a lower bound, as the relevant market is expected to be even more localized when focusing on individual firms.

²⁴By focusing on non-individual firms as competitors, we exclude another potential group of competitors: individual firms that do not bunch. However, these firms represent an endogenously selected sample of the eligible firms, making them less suitable for comparison.

²⁵We compute $B_{m(i),t}$ in this way to ensure cross-market comparability and to avoid issues related to using an estimated bunching measure as a covariate ([Wooldridge 2010](#)). However, [Figure B2](#) shows that our simplified measure is strongly correlated with the standard bunching estimate across markets, municipalities, and industries.

ble for preferential regimes. Year fixed effects, δ_t , control for macroeconomic shocks and policy changes affecting all firms. Finally, $u_{i,t}$ captures idiosyncratic firm-level shocks. Because the effect of tax non-compliance is likely to be correlated within a market over time, we account for any dependence between observations within a market by clustering all regression results at the market level.

The coefficient of interest, β , computes how variations in the prevalence of individual bunching firms affect competitors' outcomes. The key identifying assumption is that changes in revenue manipulation from individual firms reflect efforts to remain eligible for preferential schemes, rather than responses to other time-varying market factors. Demand fluctuations are a critical example of such unobserved market shock, since they could simultaneously influence both individual firms and their competitors, generating bias in ordinary least squares estimates.

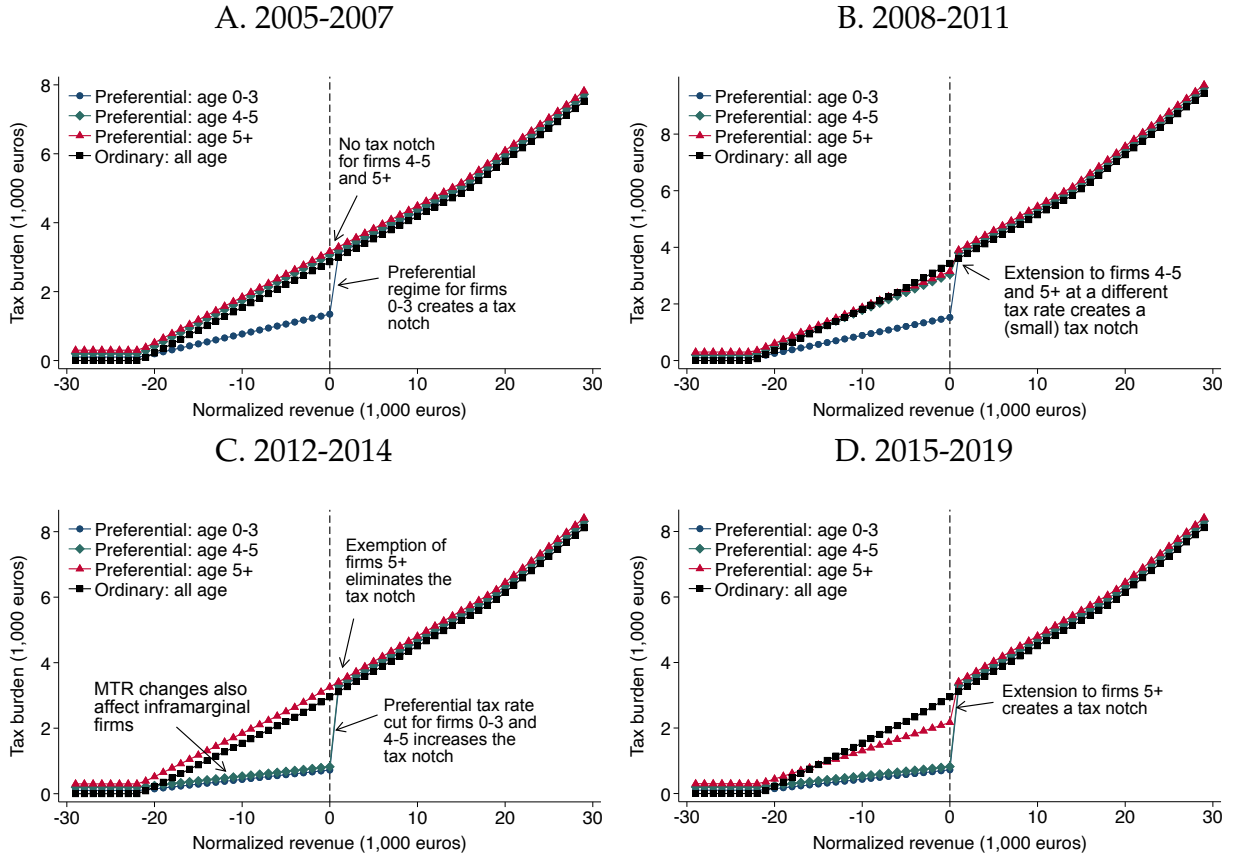
Policy changes. To estimate β , we require variation in $B_{m,t}$ that is uncorrelated with $u_{i,t}$. As outlined in Appendix C, a firm's optimal evasion decision equates the marginal cost and marginal return of evasion. Holding evasion costs constant, the tax savings from evasion determine the firm's non-compliance behavior. For the marginal (bunching) firm, these savings equal the difference in the tax burden under the ordinary and preferential regimes. Therefore, the probability of bunching increases with the size of this differential.²⁶ This theoretical prediction aligns with the empirical evidence presented in Section 3.1 (see Figure 4 and Figure 5), which shows that the share of bunching firms increases when the size of the tax notch – the jump in tax burden at the eligibility cutoff – is larger.

Our approach exploits policy-induced variation in the size of the tax notch across the firm age cohorts (0-3, 4-5, and 5+) exposed to different preferential tax rates. Figure 8 illustrates these policy changes, plotting the tax burden (vertical axes) against normalized revenue bins (horizontal axes), under both tax regimes for a representative firm. The main sources of identifying variation are the following:

- i. *2005-2007*: Firms aged 0–3 faced a substantial tax notch, while older firms (4–5 and 5+) faced no notch.
- ii. *2008-2011*: The 2008 reform extended the preferential regime to firms older than 3, lowering their tax rate by 2.5 percentage points. This created a small tax notch for the 4-5 and 5+ cohorts.
- iii. *2012-2014*: The age limit for preferential treatment was raised to 5, and the preferential marginal tax rate was cut from 10 to 5 percent. This increased the notch for younger firms (0–3 and 4–5) and eliminated it for firms 5+.

²⁶The Allingham and Sandmo (1972)'s model recognizes additional determinants of tax evasion, such as detection probabilities and penalties. We will account for these factors by allowing compliance costs (and also tax morale) to flexibly vary across places and industries (through municipality-year and industry-year fixed effects).

Figure 8: Tax Burden by Firm Age Over the Revenue Distribution



Note: This figure summarizes the main sources of policy changes that create variation in the size of the tax notch. The figure plots the tax burden (vertical axes) by revenue bins, normalized to the eligibility cutoff for preferential regimes (horizontal axes). We plot the tax burden for the representative firm under the preferential and ordinary tax regimes for firms in the age cohorts 0-3, 4-5, and 5+.

- iv. 2015-2019: Eligibility was extended to firms aged 5+, with a new preferential rate of 15 percent.

These temporal and cohort-specific policy changes also vary across industries. As shown in Appendix [subsection B4](#), changes in the size of the tax notch tend to be attenuated in industries with a small profitability coefficient (i.e., a larger tax base), compared to industries with higher profitability coefficients. Industry-specific eligibility cut-offs (2015–2018) and their adjustment in 2019 introduced further variation in notch size, though this was modest relative to changes in tax rates and age eligibility.

2SLS model and identifying assumptions. This variation in the size of the tax notch across firm age groups, industry, and over time underpins an exposure research design: markets differ in exposure to policy changes depending on their age and industrial composition. We operationalize these policy-induced changes by creating a shift-share instrument:

$$Z_{m,t} = \sum_{a=1}^3 \underbrace{\omega_{a(m)}}_{\text{market age share}} \times \underbrace{\tau_{a(m),s(m),t}}_{\text{tax rate differential}}. \quad (4)$$

$\omega_{a(m)}$ is the share of individual firms in age group $a = [0-3; 4-5; 5+]$ in market m . Following convention (Goldsmith-Pinkham et al. 2020), the age share is fixed at the initial period (2005). $\tau_{a(m),s(m),t}$ is the size of the tax notch (the average tax rate differential under the ordinary and preferential tax regimes) for firms of age a in industry s , and year t .

We implement a two-stage least-squares (2SLS) analysis, using $Z_{m,t}$ as an instrument for $B_{m,t}$. The significant relationship between the size of the tax notch and bunching, documented in Section 3.1, supports the relevance of the instrument, and we will present more test below suggesting a strong first-stage relationship.

The exclusion restriction requires that $\text{cov}(Z_{m(f),t}, u_{f,t}) = 0$: $Z_{m,t}$ should affect competitor firms solely via policy-induced changes in bunching. Two potential threats to this assumption merit discussion. First, more generous preferential regimes could prompt inframarginal firms to expand output or cut prices. Second, favorable tax treatment might encourage new firm entry, thereby intensifying competition. Both effects could plausibly arise following reforms such as the one in 2012, which reduced the marginal preferential rate by 5 percentage points.

However, inframarginal firms generally face low tax burdens, so the gains from further tax reductions are modest compared to the substantial tax savings experienced by marginal firms that remain just below the threshold. For instance, after the 2012 reform, a 0–3 year old firm with normalized revenue of –€10,000 would see its annual tax bill fall by €336, equivalent to a 2.9 percentage point cut in its average tax rate. For firms with normalized revenue of –€20,000, the tax savings shrink to €48, reflecting an average tax rate cut of 0.8 percentage points. By contrast, crossing the threshold results in a sharp increase in tax liability of €2,334 more per year, corresponding to a 13.4 percentage point jump in the average tax rate. Regarding the second concern, trends in the number of individual firms (see panel A of Figure 1) offer little evidence of a surge in entry, possibly because the tax advantage for new firms has remained relatively stable over time.

To inspect potential violations of the exclusion restriction, we examine whether the instrument predicts outcomes such as revenue for inframarginal firms or firm entry. We also assess first-stage effects outside the bunching region. If the instrument impacts firms beyond bunching incentives, these effects should appear more broadly in the revenue distribution. Reassuringly, these tests suggest any such channels are minor.

Event-study approach. Our empirical approach can be viewed as pooling together multiple difference-in-differences designs leveraging heterogeneous shock exposure to common policy changes. Goldsmith-Pinkham et al. (2020) show that, if a parallel trends condition holds with respect to market exposure share, a shift-share instrument will be a valid instrument. As discussed previously, there are several policy changes that generate

variation in the size of the tax notch. We focus on the 2015 reform, which provides a compelling case since it created a tax notch for firms older than 5 years, but kept the notch for other firms unaffected. Therefore, it creates a differential exposure across markets depending on the fraction of individual firms older than 5 years.

We pool firms in two groups: i. *high exposure*: competitor firms operating in markets where the share of individual firms older than 5 years is in the top tercile of the distribution; ii. *low exposure*: competitor firms operating in markets where the share of individual firms older than 5 years is in the bottom tercile of the distribution. The differential exposure to the policy change is sizable between the two groups: the average share of individual firms older than 5 years in the bottom tercile is just about 5 percent, while it is over 60 percent in the top tercile. We then run regressions as follows:

$$y_{i,t} = \sum_{k \neq 2014; k=2012}^{2017} \beta_k \cdot \mathbf{1}(K_t = k) \cdot \mathbf{1}(m(i) = \text{High Exposure}) + \gamma_i + \delta_t + u_{i,t}, \quad (5)$$

where $y_{i,t}$ is a firm-level outcome observed in years from 2012 to 2017. We focus on this time window to avoid confounding effects stemming from other reforms that took place in the years before and after. γ_i and δ_t are firm and year fixed effects, respectively. The coefficients of main interest are β_k : the impact of stricter exposure to the 2015 reform on the firm-level outcome variable of interest (relative to the year before the policy implementation). To ensure shares' exogeneity, we can test the parallel trend condition: we expect to see similar trends in the outcome variable of interest across markets that were differently exposed by the reform (i.e., $\beta_k = 0 \forall k < 2014$). In addition to analyzing pre-trends, the event-study also allows us to get a sense of whether the exclusion restriction is violated by examining whether trends in the revenue of inframarginal firms and the entry rate of individual firms vary in accordance with the differential reform exposure across markets.

4.3 Main Results

This section examines how policy-induced changes in the proportion of individual bunching firms affect the outcomes of their competitors. We begin by presenting the 2SLS and event-study estimates. Next, we assess the robustness of our findings and explore potential mechanisms. Finally, we analyze the implications for allocative efficiency.

2SLS results. We begin by examining how the effect of tax non-compliance by individual bunching firms varies with the size of their competitors. Since bunching firms are relatively small, we expect their most direct competitors to be firms of comparable size operating in the same market. By contrast, larger firms are less likely to face head-to-head competition from bunchers, either because they serve multiple markets or benefit from scale and organizational advantages that insulate them from the competitive pressure of individual bunching firms.

Table 2 presents 2SLS estimates of the impact of the market share of bunching firms on the log revenue of their competitors. Column (1) includes competitor firms with average revenue below €100,000; column (2) includes those with revenue between €100,000 and €250,000; column (3) covers firms reporting between €250,000 and €500,000; column (4) includes those between €500,000 and €1,000,000; and column (5) focuses on firms with revenue exceeding €1,000,000. All specifications include firm and year fixed effects.

Table 2: 2SLS Effects of Bunching Firms' Market Share on Competitors' Revenue by Size

| | Outcome: log(revenue) | | | | |
|------------------------------|---------------------------------------|----------------------|----------------------|-------------------|-------------------|
| | Sample: competitor firms with revenue | | | | |
| | <100k (1) | 100-250k (2) | 250-500k (3) | 500-1,000k (4) | >1,000k (5) |
| $B_{m,t}$ | -0.045*** (0.004) | -0.033*** (0.003) | -0.012*** (0.003) | 0.001 (0.004) | -0.001 (0.010) |
| Observations | 8,751,859 | 5,485,722 | 3,273,322 | 2,320,568 | 3,880,411 |
| Firm FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| Mean N of firms | 541,962 | 344,876 | 217,843 | 157,614 | 235,612 |
| Mean revenue (€) | 45,637 | 162,950 | 355,040 | 706,114 | 1,041,516 |
| Competitors' revenue effect: | | | -€3.913 billion | | |
| Bunchers' misreporting: | | | €3.462 billion | | |
| Implied spillover effect: | | | -€1.130 | | |

Note: This table reports 2SLS estimates of the effect of the market share of individual bunching firms on the log revenue of their competitors, disaggregated by size. Column (1) includes competitor firms with average revenue below €100,000; column (2) includes those with revenue between €100,000 and €250,000; column (3) covers firms reporting between €250,000 and €500,000; column (4) includes those between €500,000 and €1,000,000; and column (5) focuses on firms with revenue exceeding €1,000,000. All specifications control for firm and year fixed effects. The endogenous variable is instrumented using the shift-share strategy described in equation (4), which leverages policy-induced variation in eligibility rules and the fixed demographic composition of markets. Markets are defined at the municipality–industry–year level. Individual bunching firms are defined as those reporting revenue within €5,000 below the eligibility threshold for preferential tax regimes. Competitors are non-individual firms operating in the same local market. We also report the implied aggregate revenue loss for competitors, calculated as the product of the estimated effect, the average revenue, and the average number of firms in each revenue bracket group. To benchmark the magnitude of this loss, we calculate the total presumed revenue misreporting by bunching firms as the product of the number of bunchers and the assumed average misreported amount of €15,000. The implied spillover multiplier is obtained by dividing the aggregate competitor revenue loss by the aggregate bunchers' misreporting, providing a summary measure of the indirect revenue effect of tax evasion. Standard errors, clustered at the market level, are reported in parentheses.

The results reveal a clear pattern of heterogeneity. For the smallest competitors, a one percentage point increase in the market share of bunching firms reduces revenue by about 4.5 percent. The effect remains economically and statistically significant for firms in the €100,000–€250,000 and €250,000–€500,000 revenue brackets, with declines in revenue of nearly 3.3 and 1.2 percent, respectively. In contrast, for larger firms (revenue above €500,000), the effect is economically negligible and statistically indistinguishable

from zero, indicating that these firms are largely shielded from the competitive pressure exerted by bunching firms. These results support the interpretation that the mechanism operates through horizontal competition across firms of similar size, rather than more diffuse general equilibrium effects.²⁷ To our knowledge, this is the first direct evidence of market externalities resulting from the likely revenue misreporting from individual bunching firms.

The implied aggregate revenue loss across all competitor firms in the sample is substantial: estimated at €3.913 billion. This is calculated by multiplying the estimated effect in each size group by the group's average revenue and number of firms, then summing across groups. To contextualize this loss, we compute the total misreporting by bunching firms as €3.462 billion, assuming an average underreporting of €15,000 per bunching firm. The ratio of these two quantities yields a spillover multiplier of -1.13 , indicating that each euro of underreported revenue from bunching firms leads to €1.13 in lost revenue for their competitors. This sizeable indirect effect suggests that the distortion from tax evasion extends well beyond the evading firms themselves, undermining their competitors through reduced market share.

Given that effects are concentrated among smaller firms, the remainder of the analysis focuses on competitor firms with annual revenue below €500,000. This subset includes the firms most directly exposed to the competitive pressure exerted by bunching firms and captures the segment where tax evasion generates the most significant distortions.

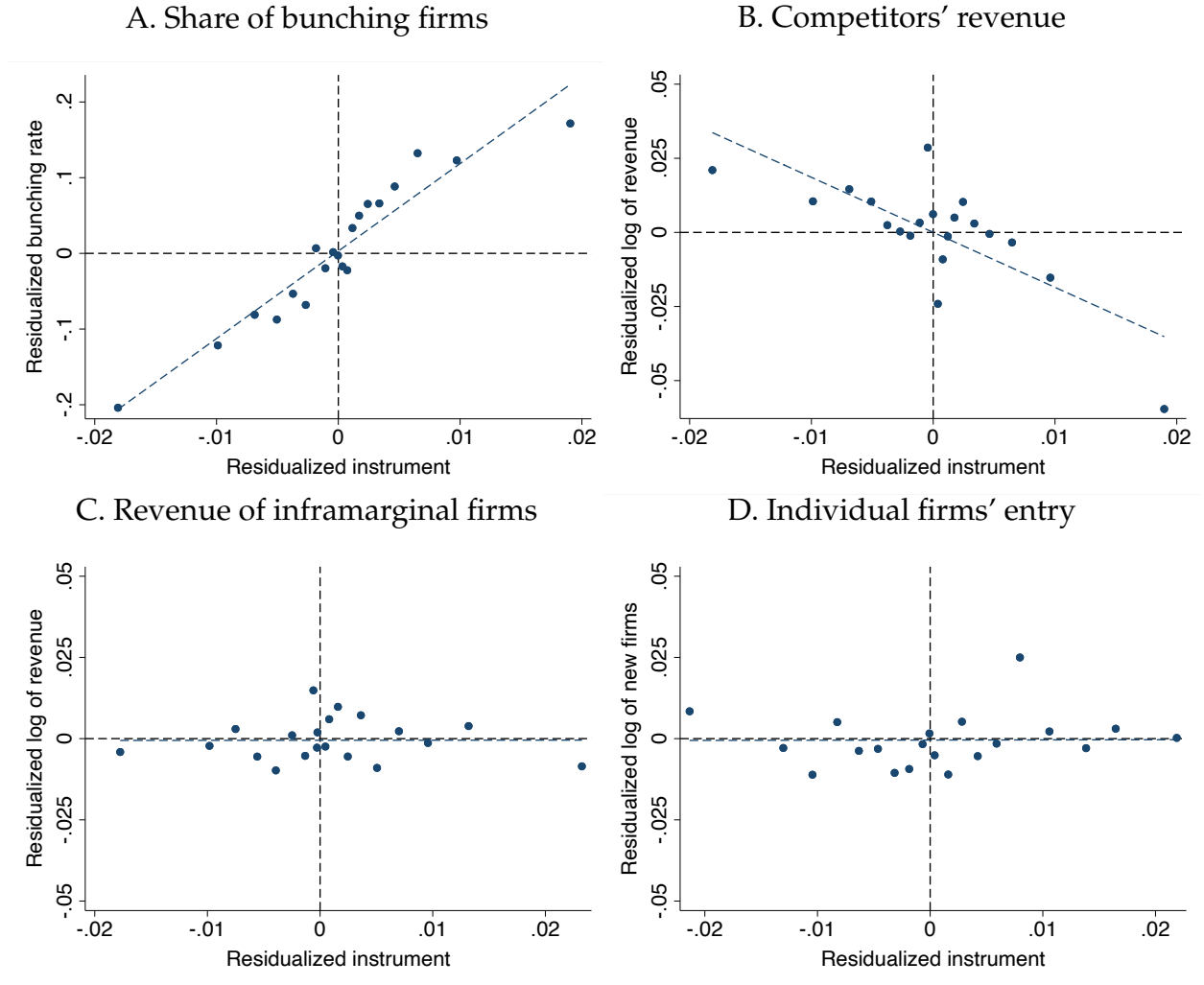
To provide a transparent visualization of the identifying variation, we complement the regression analysis with binscatter plots that depict both the first-stage and reduced-form relationships. These graphs serve two purposes. First, they offer a graphical validation of the instrument's relevance by illustrating how the shift-share instrument predicts the market share of bunching firms. Second, they visualize the reduced-form link between the instrument and competitor revenue, allowing readers to assess the raw correlation driving the 2SLS estimates.

Panel A of [Figure 9](#) depicts the relationship between the share of individual bunching firms and the instrumental variable defined in equation (4). Panel B illustrates the association between the log revenue of competitors and the instrumental variable. Each plotted point represents average residuals from firm and year fixed effects regressions, grouped into 20 equal-sized bins. The slope of the least squares regression line fitted through these points corresponds to the first-stage relationship in panel A and the reduced-form relationship in panel B.

The figure consistently shows that markets experiencing larger increases in the size of the tax notch also exhibit stronger bunching responses. This suggests a positive relationship between bunching and the size of the tax notch, aligning with the findings presented

²⁷In Appendix [Table D1](#), we report the OLS coefficients, whose point estimates are essentially equal to zero. The OLS estimates likely suffer from attenuation bias due to measurement error in market-level bunching rates, as well as omitted variables that could create a positive bias. For example, a negative market-wide demand shock that simultaneously reduces bunching and competitors' revenue. Reverse causality may also be a concern if competitor revenue gains push more individual firms to bunch.

Figure 9: Binscatter Plots



Notes: The top panel of this figure provides a graphical representation of the first-stage (panel A) and the reduced-form relationship (panel B). It compares the share of individual bunching firms (panel A; vertical axis) and the log of competitors' revenue (panel B; vertical axis) with the instrumental variable (horizontal axes) presented in equation (4). The bottom panel compares the log of revenue of inframarginal firms (panel C; vertical axis), defined as non-bunching individual firms benefiting from preferential tax regimes, and the entry rate of individual firms (panel D; vertical axis) with the instrumental variable (horizontal axes). In panels A-C, we depict the residuals obtained by regressing each variable on firm and year fixed effects; in panel D, we regress each variable on market and year fixed effects. We plot the residuals in 20 equal-sized bins and show the line of best fit. The sample includes competitor firms with annual revenue below €500,000.

in Section 3.1. This linear relationship also seems to satisfy the monotonicity assumption of the 2SLS, which implies that individual firms become weakly more likely to bunch as the size of the tax notch increases. Competitor firms experience larger revenue losses when the tax notch is larger, suggesting that tax-induced bunching behavior generates significant market externalities.

To test for potential violations of the exclusion restriction, we analyze two alternative outcomes. First, we examine the log revenue of inframarginal firms, defined as non-bunching individual firms benefiting from preferential tax regimes (Panel C). If policy-

induced change in the size of the tax notch influenced market competition by widening the wedge in net-of-tax marginal costs between eligible and non-eligible firms, inframarginal firms would be expected to gain market share, leading to an increase in their revenue. However, the results provide no evidence of such an effect, supporting the assumption that the reform did not distort competitive dynamics in this way. The absence of an effect on inframarginal firms' revenue can be attributed to the relatively small policy-induced variation in their tax burden.

Another potential concern is whether policy changes altered market dynamism, such as by stimulating firm entry or encouraging firms to relabel or split.²⁸ To investigate this, panel D focuses on the number of newly created firms at the market level, using market fixed effects instead of firm fixed effects. The results indicate no significant impact on firm entry. Taken together, these findings reinforce the validity of the instrument.

Event-study evidence. We complement the 2SLS approach with an event-study analysis based on the 2015 reform. This reform provides a clean and compelling case for identification: it introduced a tax notch for firms older than 5 years, while leaving the notch of other firms unchanged. As a result, markets differ in their exposure to the reform based on the ex ante share of individual firms above the five-year threshold. Using the model outlined in equation (5), [Figure 10](#) presents the event-study coefficients along with 95 percent confidence intervals, based on market-level standard errors. Panel A shows the policy impact on the share of individual bunching firms, while Panel B reports its effect on the log revenue of their competitors.

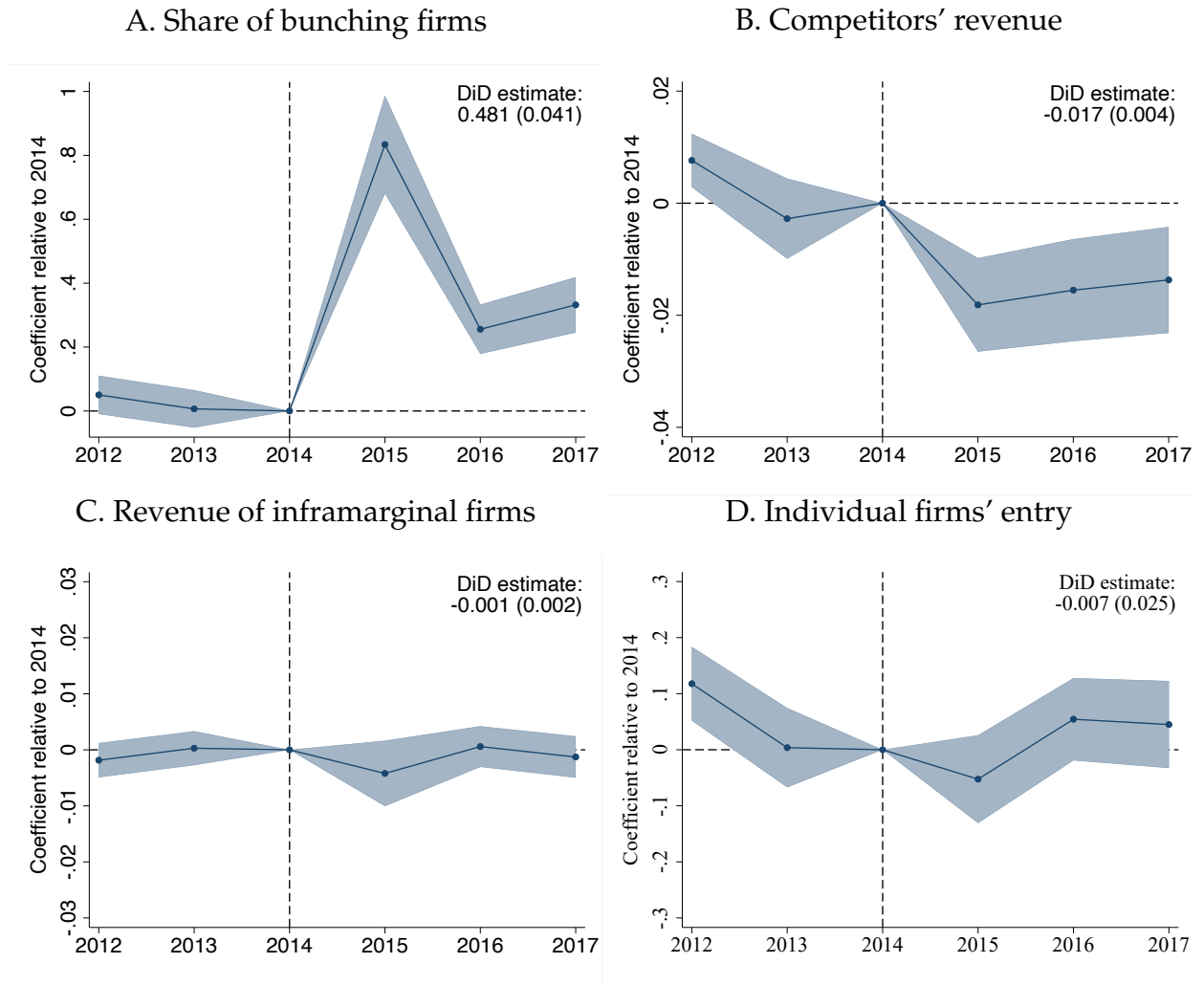
Three key findings emerge from this analysis. First, the estimates of β_k for the years preceding the reform are close to zero, indicating no pre-existing trends that could confound the causal effect. This supports the validity of the shift-share instrument ([Goldsmith-Pinkham et al. 2020](#)). Second, following the reform, markets with higher exposure experience an immediate increase in the share of individual bunching firms compared to less exposed markets, confirming a strong first-stage relationship. Third, this increase in bunching among individual firms is associated with an immediate and persistent decline in the revenue of their competitors, providing robust evidence of a reduced-form relationship.²⁹

Each graph also reports coefficient estimates and corresponding standard errors from a specification that interacts a post-2015 dummy with an indicator for highly exposed markets. The results show that, following the reform, the share of individual bunching firms rose by approximately 0.5 percentage points in more exposed markets rela-

²⁸This also includes the possibility that compliant firms changed their legal form ([Smith and Miller 2021](#)) or the incentives for a large firm to “masquerade” as many small firms by separately incorporating business segments ([Onji 2009](#)). Note that if firms' creation reflects *fake* business creation, our bunching estimate captures these responses as long as the new business reports revenue in the excess bunching region. In that case, the bunching estimate is a combination of “intensive” margin responses (i.e., existing firms adjusting their reported revenue to locate below the eligibility cutoff) and “extensive” margin responses.

²⁹Appendix [Figure D1](#) consistently shows no effect on larger-size competitor firms.

Figure 10: Event-Study Evidence



Note: Each graph depicts the event-study coefficient estimates and 95 percent confidence intervals from market-level standard errors obtained from equation (5). We depict the impact on the share of individual bunching firms (panel A), the log of the revenue of their competitors (panel B), the log of revenue of inframarginal firms (panel C), defined as non-bunching individual firms benefited from preferential tax regimes, and the entry rate of individual firms (panel D). The event-study is based on the 2015 reform, which created a tax notch for firms older than 5 years, but kept the notch for other firms unaffected. Therefore, it creates a differential exposure across markets depending on the fraction of individual firms older than 5 years. We classify markets as more (less) exposed if in the top (bottom) tercile of the market share of individual firms older than 5 years. In panels A–C, each specification includes firm and year fixed effects; in panel D (where the outcome is aggregated at the market level), the specification includes market and year fixed effects. Each graph also reports the coefficient estimate and its associated standard error from a specification of the outcome of interest on the interaction between a dummy for more exposed markets and the post-2015 dummy. The sample includes competitor firms with annual revenue below €500,000.

tive to less exposed ones. In response, competitors experienced an average revenue decline of about 1.7 percent. Scaling this reduced-form estimate by the first-stage estimate yields a coefficient of 0.035, which is fairly similar to our 2SLS estimates based on the full 2005–2019 period.

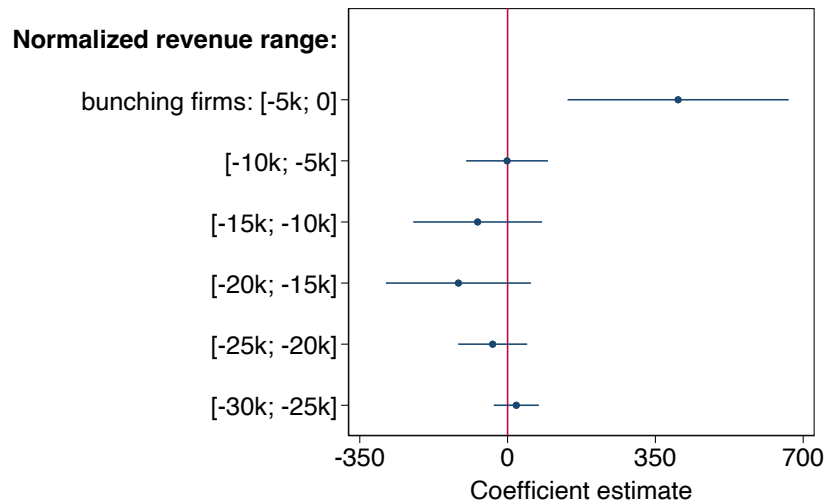
Panels C and D attempt to assess the exclusion restriction assumption, testing whether the reform influences other market dynamics. The results show no systematic relation-

ship between the reform and either the revenue of inframarginal firms or the entry rate of individual firms. This supports the validity of our instrument, indicating that its effects on competitor firms operate primarily through policy-induced changes in bunching behavior.

4.4 Robustness Checks

Additional tests for instrument validity and exogeneity. Our 2SLS estimates rely on the exclusion restriction: the instrument affects competitors' outcomes only through its impact on bunching. One might be worried that changes in the generosity of the preferential regime affected competitors via channels unrelated to bunching. We previously ruled out two such channels – changes in inframarginal firms' revenue and firm entry – as meaningful sources of bias (see [Figure 9](#) and [Figure 10](#)). To further assess other potential channels, we test for first-stage effects in other segments of the revenue distribution. If the instrument influences eligible firms beyond bunching incentives, we should observe first-stage effects outside the bunching region. [Figure 11](#) shows coefficient estimates and 95 percent confidence intervals from regressions of the number of individual firms in 5,000-unit bins of normalized revenue on the instrument. Only the bunching group shows a statistically significant response, reinforcing the instrument's validity.

Figure 11: First-Stage Relationship Over the Normalized Revenue Range



Note: This figure presents the “first-stage” relationship between the number of individual firms and the instrument, detailed in equation (4), for each revenue range normalized by the distance from the cutoff determining eligibility for preferential tax regimes. We report coefficient estimates and 95 percent confidence intervals from standard errors clustered at the market level.

As usual, exogeneity can also be assuaged by including control variables. Following the logic of [Altonji et al. \(2005\)](#), movements in point estimates when conditioning on observable confounders suggest the potential importance of unobserved confounders. On top of our baseline fixed effects, we also control for time-varying market characteristics

(e.g., market size and firm composition by legal form). Appendix [Figure D2](#) confirms that the results remain stable.

An additional test starts from the observation that the share defined in equation (4) adds up to a number weakly smaller than one (since the denominator includes both individual and non-individual firms). In such “incomplete shift-share” settings with panel data, [Borusyak et al. \(2025\)](#) recommend controlling for the share and allowing the coefficient to change with time.³⁰ While cross-market heterogeneity in the shares is already absorbed by the firm (market) fixed effects, we follow this recommendation by including up to 20 groups of age shares interacted with year effects. Appendix [Figure D3](#) shows that the results are qualitatively unchanged.

Alternative specifications. Appendix [Figure D4](#) tests the robustness of our baseline estimates to the inclusion of more granular fixed effects. Starting from our baseline model with firm and year fixed effects, we introduce industry-year fixed effects, which control for industry-level shocks, and municipality-year fixed effects to account for local shocks affecting all firms within the same municipality. Finally, we include both municipality-year and industry-year fixed effects, offering the most stringent specification. The estimates remain fairly consistent across specifications, suggesting that unobservable factors are unlikely to drive the main effect.

Age share exogeneity. [Goldsmith-Pinkham et al. \(2020\)](#) argue that the validity of shift-share instruments depends on the specific thought experiment underlying the analysis and appropriate asymptotics. In our case, the relevant experiment is differential exposure across markets to a common “shock” – variation in the tax notch – mediated by market age composition. Regarding asymptotics, the empirical framework aligns with a setting where the number of markets approaches infinity, while the number of periods and share categories remain fixed (123,846 markets, 15 periods, 3 age categories). Identification thus requires that age shares are exogenous to *changes* in the error term.³¹ We assess this by testing whether correlates of share levels predict changes in firm growth. Appendix [Figure D5](#) shows no predictive relationship, supporting exogeneity.

Sensitivity to definitions of markets and bunching. It is instructive to verify that our estimates are not overly sensitive to the baseline choices and definitions we adopted. Two key choices warrant scrutiny. First, the definition of the market. We assess robustness by altering both the geographical unit of analysis (from municipalities to clusters of contiguous municipalities) and the industry classification (from 2-digit to 3-digit NACE).

³⁰The shares have to add up to one to interpret the shift-share instrument as a share-weighted *average* of shifts rather than a share-weighted *sum*. If this is not the case, the instrument can vary across units through the sum of shares.

³¹Since we always include firm (market) fixed effects, the strategy remains valid even if the *levels* of the shares are correlated with outcome levels.

Results remain qualitatively similar (Appendix [Table D2](#)). Our findings also remain remarkably consistent when focusing on highly localized markets, where market boundaries are more naturally delineated.³² Second, we test robustness to different measures of bunching: using the number (rather than share) of bunching firms, log transformations, and the classical bunching estimate. The results remain qualitatively consistent (Appendix [Table D3](#)).³³

4.5 Mechanisms and Other Firm-Level Distortions

Our main result is that revenue under-reporting by individual bunching firms generates a substantial negative spillover: for every euro of under-reported revenue by bunching firms, the rest of the economy loses €1.13 in revenue. This effect arises because bunching firms, by underreporting income, face no tax burden on a significant portion of their revenue and can use this advantage to undercut prices and poach price-sensitive consumers. This generates a crowding-out effect, as competitor firms lose customers and market share to evading firms. However, the impact might not stop at lost customers, but ripple across multiple dimensions of firm behavior and performance. This section explores potential channels that could have amplified the competitive distortion.

Price competition and markup compression. The most immediate strategic response to intensified competition from competitor firms is to adjust pricing. As bunching firms can undercut the market, their competitors face pressure to reduce their markups to retain customers. Column 1 of [Table 3](#) shows that a 1 percentage point increase in the prevalence of bunching firms leads to a 0.035 point reduction (i.e., about 1.7 percent of the average) in their competitors' markup, measured as revenue over operating costs. This effect is consistent with intensified price competition driven by asymmetric tax liabilities.

Productivity losses. As competitors lose revenue, they may be forced to scale down operations, cut investment, or operate below efficient capacity. These responses can generate productivity losses. For example, they may spread fixed costs over a smaller output base, or delay upgrading equipment and processes. Columns 2 and 3 of [Table 3](#) show that a 1 percentage point increase in the market share of bunching firms is associated with a 5 percent drop in value-added per worker, which partly reflects a reduction in their total value added. These effects indicate that revenue losses among competitor firms are not solely absorbed through pricing or margins, but also reflect declining productivity. Taking into account the contribution of these firms to aggregate productivity, it can be shown that fully eliminating bunching would increase aggregate productivity by approximately

³²Highly localized markets are identified as those with a high prevalence of firms identifying competitors within the same municipality, based on data from [Istat, Censimento Industrie e Servizi](#).

³³In this exercise, note that the magnitude of the coefficients is not directly comparable since the base is different (e.g., level versus absolute values).

Table 3: Markup Compression and Productivity Loss for Competitors

| | markup (1) | log productivity (2) | log value added (3) |
|--------------|----------------------|-------------------------|------------------------|
| $B_{m,t}$ | -0.035*** (0.008) | -0.050*** (0.004) | -0.113*** (0.008) |
| Observations | 17,510,903 | 17,510,903 | 17,510,903 |
| Firm FE | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |

Note: This table reports 2SLS estimates of how the market share of individual bunching firms influences various outcomes for their competitors: markup (column 1), defined as the ratio of revenue to operating costs, log value added per worker (column 2), and log value added (column 3). All specifications include firm and year fixed effects. The instrumental variable, described in equation (4), leverages policy changes and the fixed demographic composition of each market. Markets are defined at the municipality-industry-year level. Individual bunching firms are those with reported revenue between –€5,000 and 0 relative to the eligibility threshold for preferential regimes; competitors are non-individual firms operating in the same market and reporting less than €500,000 revenue. Standard errors, clustered at the market level, are reported in parentheses.

2.5 percent.³⁴

Labor cost adjustments. To manage shrinking output and margins, competitor firms can also adjust their labor costs. Column 1 of Table 4 shows that a 1 percentage point increase in the share of bunching firms leads to a 14 percent decrease in the total wage bill of their competitors. This is a large and economically meaningful effect: a back-of-the-envelope calculation suggests that about 40 percent of the lost revenue is passed on to workers. This figure broadly aligns with empirical estimates of labor’s incidence in corporate taxation (e.g., Fuest et al. 2018). These labor cost reductions reflect both extensive and intensive margin adjustments. Column 2 shows a 6 percent decline in the number of workers, while column 3 shows a 5.8 percent decline in average wages. Columns 4 and 5 show that firms shed employees more aggressively than self-employed workers, suggesting that wage workers – often more skilled or costly – are more likely to exit. This workforce composition change may further depress productivity, reinforcing the mechanism discussed above.

Reciprocity in tax evasion. If tax enforcement is perceived as weak, the incentive to comply might erode in the whole market. Revenue losses among competitors could thus reflect both real adjustments (lower prices or output) and increased evasion in response. Despite both scenarios implying a market externality, the nature of the response has dif-

³⁴The population average effect is derived using basic algebra, taking into account that aggregate productivity is a weighted average of firm-level productivity across size classes, with employment shares as weights. This estimate is, of course, purely indicative, as it is extrapolated from locally identified coefficients and does not account for general equilibrium effects.

Table 4: Labor Costs Adjustments

| | log labor costs (1) | log N workers (2) | log wage rate (3) | log N dependent employed (4) | log N self- workers (5) |
|-----------|---------------------------|-------------------------|-------------------------|------------------------------------|-------------------------------|
| $B_{m,t}$ | -0.140*** (0.009) | -0.060*** (0.004) | -0.058*** (0.005) | -0.146*** (0.009) | -0.026*** (0.002) |
| Obs | 17,510,903 | 17,510,903 | 17,510,903 | 17,510,903 | 17,510,903 |
| Firm FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Note: This table presents 2SLS estimates of how the market share of individual bunching firms affects their competitors' log total wage bill (column 1), log employment (column 2), log wage rate (column 3), log dependent workers (column 4), and log self-employed workers (column 5). Each specification includes firm and year fixed effects. The instrument, detailed in equation (4), is constructed using policy changes and a market's fixed demographic composition. Markets are defined at the municipality-industry-year level. Individual bunching firms are those reporting revenue between -5,000 and 0 relative to the eligibility cutoff for preferential regimes, while competitors are non-individual firms operating in the same market and reporting less than €500,000 revenue. Standard errors, clustered at the market level, in parentheses.

ferent normative implications (Chetty 2009). To assess this, we examine whether revenue losses are larger in areas with weaker tax compliance norms, proxied by TV fee evasion and the presence of unregistered taxable buildings. Table 5 shows minimal variation in the estimates, suggesting that the revenue loss is likely due to real effects rather than further evasion. This result aligns with the idea that competitors face stricter enforcement and higher marginal costs of evasion, making under-reporting riskier and less feasible. This interpretation is supported by the nature of the firm-level adjustments we observe. Competitor firms reduce their labor costs along both the intensive and extensive margins. These responses are difficult to reconcile with a narrative of reciprocal evasion, which would typically leave labor inputs relatively unchanged.

4.6 Allocative Efficiency

This section presents evidence on the impact of tax evasion on aggregate productivity. We then disentangle the components of productivity variation, following the approach of Melitz and Polanec (2015).

We assess allocative efficiency at the aggregate level to determine whether resources are misallocated due to tax evasion. Specifically, we examine how changes in the share of individual bunching firms affect market-level productivity. Using the decomposition method proposed by Melitz and Polanec (2015), we separate aggregate productivity changes into contributions from three firm groups: incumbents, entrants, and exits.³⁵ Among incumbents, it is possible to further distinguish the contribution of two more

³⁵This extends the decomposition by Olley and Pakes (1996). See Appendix E for details.

Table 5: Heterogeneity by Tax Compliance Attitudes

| | Outcome: log(revenue) | |
|--|--|--------------------------------|
| | (1) | (2) |
| | <i>Proxy for tax compliance attitudes:</i> | |
| | TV fee evasion | Unregistered taxable buildings |
| $B_{m,t}$ | -0.060*** (0.005) | -0.061*** (0.007) |
| $\times 1(\text{Value} > \text{median})$ | 0.004 (0.005) | 0.006 (0.006) |
| Observations | 17,510,903 | 17,510,903 |
| Firm FE | Yes | Yes |
| Year FE | Yes | Yes |

Notes: This table examines whether the 2SLS estimate of the effect of individual bunching firms' market share on their competitors' revenue varies by proxies for tax compliance attitudes. We use two municipality-level proxies: the national TV fee non-compliance rate (column 1) and the share of taxable unregistered buildings (column 2). Each specification includes firm and year fixed effects. The instrument, described in equation (4), is based on policy changes and the fixed demographic composition of each market. Markets are defined at the municipality-industry-year level. Individual bunching firms are those reporting revenue between -5,000 and 0 relative to the eligibility threshold for preferential regimes; competitors are non-individual firms operating in the same market and reporting less than €500,000 revenue. Standard errors clustered at the market level are reported in parentheses.

components: (i) the *within* margin: the variation in the efficiency of firms; and (ii) the *between* margin: the reallocation of resources among firms characterized by different productivity levels.

Therefore, for each market and year, we decompose productivity changes into four components: (i) productivity growth of incumbents, (ii) reallocation (measured by the covariance between productivity and employment shares), (iii) entry, and (iv) exit. We estimate the following regression at the market-year level:

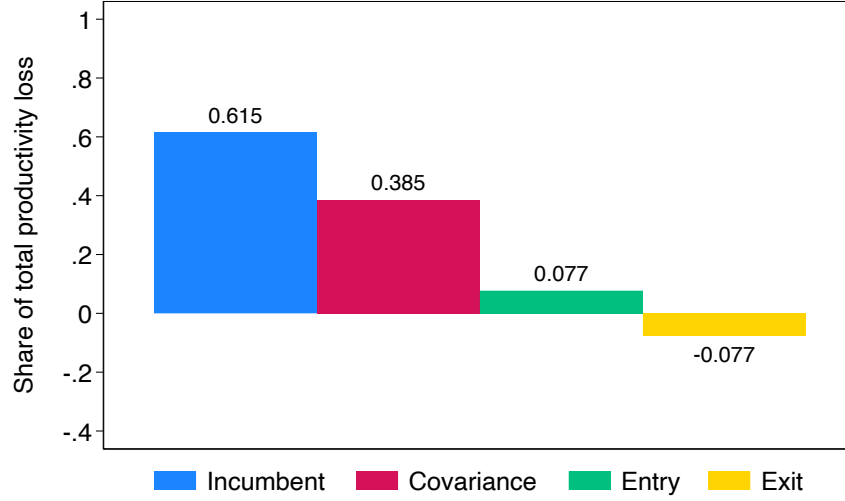
$$\Delta y_{m,t} = \beta \cdot \Delta B_{m,t} + \gamma_m + \delta_t + u_{m,t}, \quad (6)$$

where $\Delta y_{m,t}$ represents the variation in labor productivity or one of its components, $\Delta B_{m,t}$ is the change in the (instrumented) share of individual bunching firms, and γ_m and δ_t are market and year fixed effects, respectively. The coefficient of interest is β , which captures the impact of changes in the share of individual bunching firms on labor productivity.

According to our preferred specification, β is equal to 0.013 (with a standard error equal to 0.005).³⁶ Figure 12 shows that the main impact stems from the incumbents: higher tax evasion is linked to lower productivity growth among existing firms. Reallo-

³⁶Note that this estimate is not properly comparable with that discussed above as it is based on regressions at the market level (instead of the firm level).

Figure 12: Productivity Loss Decomposition



Notes: This figure shows the fraction of the total productivity loss in a market that stems from different factors, using a decomposition approach à la [Melitz and Polanec \(2015\)](#). The first (blue) bar represents incumbent firms; the second (red) bar indicates the portion of productivity loss stemming from the covariance between firm productivity and size; the third (green) bar shows the fraction of productivity loss from firm entry; the fourth (yellow) bar displays productivity losses from firm exiting the market.

cation is also impaired, as shown by a decline in the covariance between firm productivity and size, indicating that tax evasion reduces the movement of labor toward more productive firms.³⁷ This may reflect reduced incentives to grow, both for firms benefiting from preferential tax regimes and for their competitors facing unfair competition. The effects through entry and exit are smaller.

5 Conclusions

This paper presents the first empirical evidence of market externalities of tax evasion: firms' tax non-compliance distorts the outcomes of their competitors. Using administrative data on the universe of firms in Italy, we compute a tax evasion proxy as the fraction of individual firms manipulating their revenue to meet eligibility criteria for several preferential tax regimes. We show that a significant portion of individual firms under-report their revenue to gain eligibility for these generous preferential tax schemes. The extent of revenue manipulation strongly responds to variations in the size and location of the notch determining eligibility for these preferential schemes. These responses generate considerable heterogeneity in the extent of revenue manipulation across places, industries, and over time within municipality-industry cells, our granular definition of a

³⁷A growing literature has examined the interplay between firm-level productivity, the business environment, and overall economic performance (see [Restuccia and Rogerson \(2008\)](#) and [Hsieh and Klenow \(2009\)](#) for seminal contributions; [Restuccia and Rogerson \(2017\)](#) for a review). The key finding of this literature is that distortions preventing the equalization of the marginal value of inputs across firms can potentially generate large losses in aggregate productivity.

market.

Using policy-induced changes in the size of the notch to predict the market-level share of individual firms that engage in tax evasion, we establish a causal link between market-level tax evasion and the revenue of their competitors. The latter is defined as firms that are non-eligible for preferential tax regimes (because of their pre-determined legal form) and operate in the same market.

According to our findings, the increasing power of non-compliant firms taking over market share from competitors creates a lopsided playing field, where compliant firms find it hard to keep up. Reduced revenue and productivity losses lead firms to cut workers' salaries and reduce their workforce. This unfair competition also has negative effects on aggregate productivity, partly owing to worsening allocative efficiency.

In terms of policy implications, our results highlight the inefficiencies created by preferential tax regimes for individual firms, a policy applied by most countries (OECD 2023). We show that this public policy contributes to revenue manipulation and negative market externalities. This channel may explain the strong association evident both across and within countries (Kleven et al. 2016, Jensen 2021) on self-employment rates, tax evasion, and productivity. Moreover, fighting tax evasion not only increases tax revenue and promotes tax fairness (see, e.g., Alstadsæter et al. 2019, Guyton et al. 2021, Alstadsæter et al. 2022), but can also enhance market efficiency by leveling the playing field.

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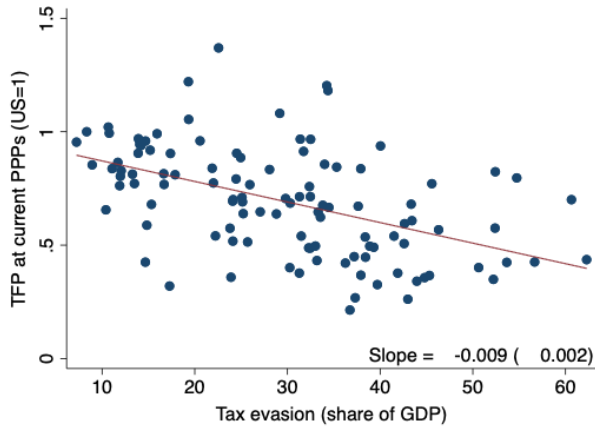
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A Additional Tables and Figures

Figure A1: Self-Employment Share, Tax Evasion, and Productivity

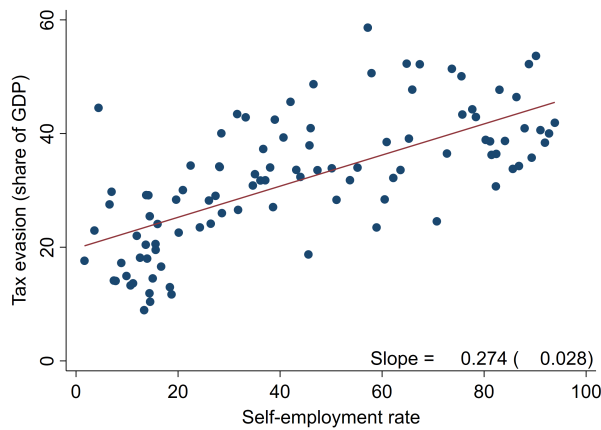
A. Productivity and tax evasion:
cross-country correlation



B. Productivity and tax evasion:
cross-Italian LLM correlation



C. Tax evasion and self-employment:
cross-country correlation



D. Tax evasion and self-employment:
cross-Italian LLM correlation



Notes: The top panel presents the relationship between productivity and tax evasion. The left-hand side graph provides a cross-country comparison between total factor productivity at current power purchasing prices (from the Penn World Table) and a proxy for the size of the shadow economy (from [Medina and Schneider 2018](#)). The right-hand side graph plots the relationship between the log of the value added per worker (from the Italian Institute of Statistics) and the share of unregistered buildings (from the Italian Internal Revenue Agency) across Italian local labor markets. The bottom panel depicts the association between tax evasion and the share of self-employed taxpayers. The left-hand side graph provides a cross-country comparison between a proxy for the size of the shadow economy (from [Medina and Schneider 2018](#)) and the self-employment rate (World Bank data). The right-hand side graph plots the relationship between the share of unregistered buildings (from the Italian Internal Revenue Agency) and the self-employment rate across Italian local labor markets.

Table A1: Preferential Tax Regimes for Individual Firms

| Regime | Period | Revenue cutoff | Age cutoff | Tax rate (%) | Tax rate by age? | Tax base by industry? | Cutoff by industry? | VAT duties? |
|---|-----------|-------------------|------------|--------------|------------------|-----------------------|---------------------|-------------|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| <i>Agevolato:</i> Law 388/2000 | 2000-2011 | 30,000 | 3 years | 10% | No | Yes | No | No |
| <i>Minimi:</i> Law 244/2007 | 2008-2011 | 30,000 | No | 20% | No | Yes | No | No |
| <i>Minimi agevolato:</i> Law 98/2011 | 2012-2014 | 30,000 | 5 years | 5% | No | Yes | No | No |
| <i>Forfettario I:</i> Law 140/2014 | 2015-2018 | 15,000 -40,000 | No | 5%-15% | Yes | Yes | Yes | No |
| <i>Forfettario II:</i> Law 145/2018 | 2019- | 65,000 | No | 5%-15% | Yes | Yes | No | No |

Note: This table presents the main features of the preferential tax scheme for individual firms in Italy. For each preferential tax regime for individual firms, the table provides the following information: *column 1:* the regime's denomination and the relevant law; *column 2:* the period when the regime applies; *column 3:* the revenue cutoff (in euros) determining eligibility (with minimum and maximum values in case of different cutoffs by industries); *column 4:* the firm's age cutoff determining a change in the preferential tax rate; *column 5:* the preferential tax rate (or the tax rate below and above the age cutoff in case the tax rate varies by age); *column 6:* whether the tax rate varies by firm's age; *column 7:* whether the tax base varies by industry; *column 8:* whether the revenue cutoff determining eligibility varies by industry; *column 9:* whether the regime grants exemption from value-added tax fulfillment.

Table A2: Industry-Level Information on Preferential Tax Regimes for Individual Firms

| Industry | NACE-2007 | Revenue cutoff (euros) | | | | Profitability coefficient (%) |
|-----------------------------------|--------------------------------|------------------------|-------------|------------------|-------------|-------------------------------|
| | | 2005-2014 (1) | 2015 (2) | 2016-2018 (3) | 2019 (4) | |
| Food & beverage | 10-11 | 30,000 | 35,000 | 45,000 | 65,000 | 0.4 |
| Wholesale and retail trade | 45; 46.2-46.9; 47.1-47.7; 47.9 | 30,000 | 40,000 | 50,000 | 65,000 | 0.4 |
| Street vendors of food and drinks | 47.81 | 30,000 | 30,000 | 40,000 | 65,000 | 0.4 |
| Street vendors of other products | 47.82-47.89 | 30,000 | 20,000 | 30,000 | 65,000 | 0.54 |
| Construction and real estates | 41-43; 68 | 30,000 | 15,000 | 25,000 | 65,000 | 0.86 |
| Trade intermediaries | 46.1 | 30,000 | 15,000 | 25,000 | 65,000 | 0.62 |
| Accommodation and catering | 55-56 | 30,000 | 40,000 | 50,000 | 65,000 | 0.40 |
| Professional activities | 64-66; 69-74; 85; 86-88 | 30,000 | 15,000 | 30,000 | 65,000 | 0.78 |
| Other industries | | 30,000 | 20,000 | 30,000 | 65,000 | 0.67 |

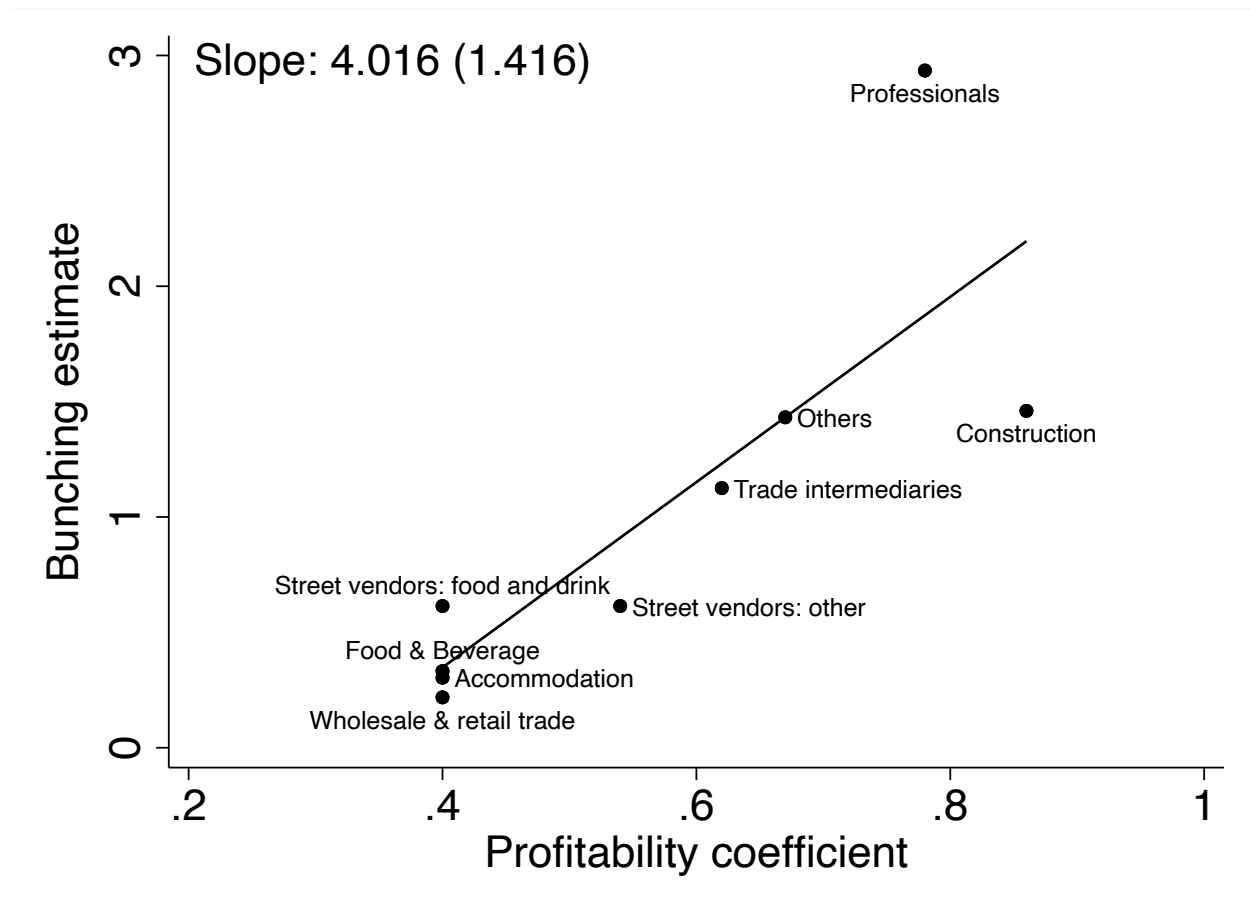
Note: For each industry and regime, the table presents information on the revenue cutoff determining eligibility for the preferential tax regime (columns 1-4), and the profitability coefficient, which is the portion of the tax base subject to the preferential tax rate (column 5).

Table A3: Personal Income Tax Schedule

| Taxable income (euros per-year) | Marginal tax rate (%) |
|---------------------------------|-----------------------|
| A. Period 2005-2006 | |
| <4,500 | 0 |
| 4,501-26,000 | 23 |
| 26,001-33,500 | 33 |
| 33,501-100,000 | 39 |
| > 100,000 | 45 |
| B. Period 2007-2019 | |
| < 4,500 | 0 |
| 4,501-15,000 | 23 |
| 15,001-28,000 | 27 |
| 28,001-55,000 | 38 |
| 55,001-75,000 | 41 |
| > 75,000 | 43 |

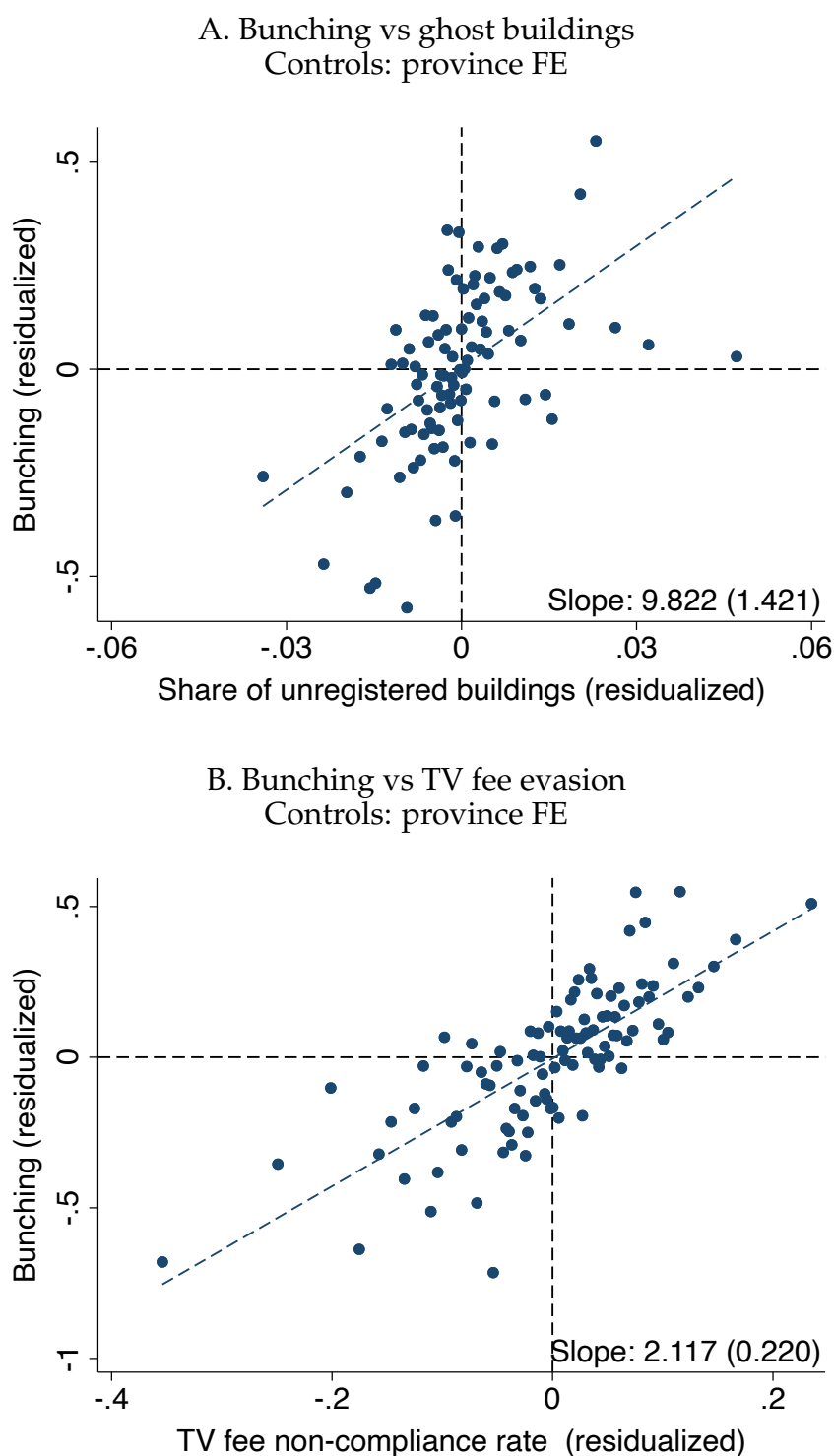
Note: This table displays information on the Italian personal income tax (IRPEF) over the 2005-2006 period (top panel) and 2007-2019 period (bottom panel). The tax base is defined as net of deductible expenses, such as social security and welfare contributions or donations to non-profit organizations.

Figure A2: Bunching Response and Profitability Coefficient



Notes: This figure relates the bunching estimate to the industry-specific profitability coefficient. Bunching estimates are calculated as described in Section 3.1. The profitability coefficient follows the classification of the Italian government (see Section 2.2 for details): it varies from a minimum of 40 percent for street vendors, the food and beverage industry, and the accommodation and catering industry, to a maximum of 86 percent for the construction and real estate industry. The graph also reports the estimated slope and the associated standard error.

Figure A3: Correlating the Bunching Rate with Other Tax Evasion Indicators - Further Specifications



Notes: Each panel compares the bunching rate (vertical axes) with the share of unregistered buildings (horizontal axis; right-hand side graph) and the national TV fee non-compliance rate (horizontal axis; left-hand side graph), controlling for province fixed effects. These variables are depicted in 100 equal-sized bins and show the line of best fit. Each graph also reports the estimated slope and the associated standard error.

B Bunching Responses to Tax Notches

B1 Bunching Theory

To provide an example of how these notches affect firm behavior, let us consider the case of self-employed individuals' responses to the tax rate notch. Assume that each self-employed individual, indexed by i , sells her output at a price p , and makes two choices: tax evasion (e_i) and labor supply (l_i). Each self-employed individual reports taxable income (i.e., the individual firm's revenue) $\bar{y}_i = y_i - e_i$, where y_i is her true revenue ($y_i = pl_i$). The preferential tax regime provides a (flat) tax rate, τ^p , that is lower than the basic (regular) tax rate, τ^b , when a self-employed individual reports revenue below a certain cutoff K . Therefore, self-employees reporting $\bar{y}_i > K$ face the tax rate τ^b , while those reporting $\bar{y}_i \leq K$ are eligible for the preferential tax scheme and pay τ^p . The preferential tax scheme creates a notch in the budget constraint of the self-employed: a discontinuity in the choice set of taxable versus net income. This notch induces self-employed individuals, who would otherwise report more revenue, to instead bunch right at the tax notch.

Figure B1 provides a simple illustration of how self-employed individuals would respond to the preferential tax scheme notch. Panel A presents a budget set diagram; panel B the density distributions. Before the introduction of the preferential tax scheme, self-employees report taxable income, y , that maximizes their own utility subject to their budget constraint. Income is distributed according to a smooth density distribution $h(y)$ and any heterogeneity is due to preferences or idiosyncratic shocks. With the introduction of the preferential tax scheme, self-employees will face a tax notch at income level y^* . The notch generates a region of strictly dominated choice in the income interval $(y^*, y^* + \Delta y^D]$, where it is possible to increase both leisure and consumption (net income) by moving to the notch point y^* . At this income level, a self-employee can maximize net income by paying the preferential tax rate τ^p instead of the basic tax rate τ^b . All self-employees located in the income interval $(y^*, y^* + \Delta y^*]$, where the bunching region is larger than the area of strictly dominated choice, $\Delta y^* > \Delta y^D$, will respond to the preferential tax scheme notch by bunching.

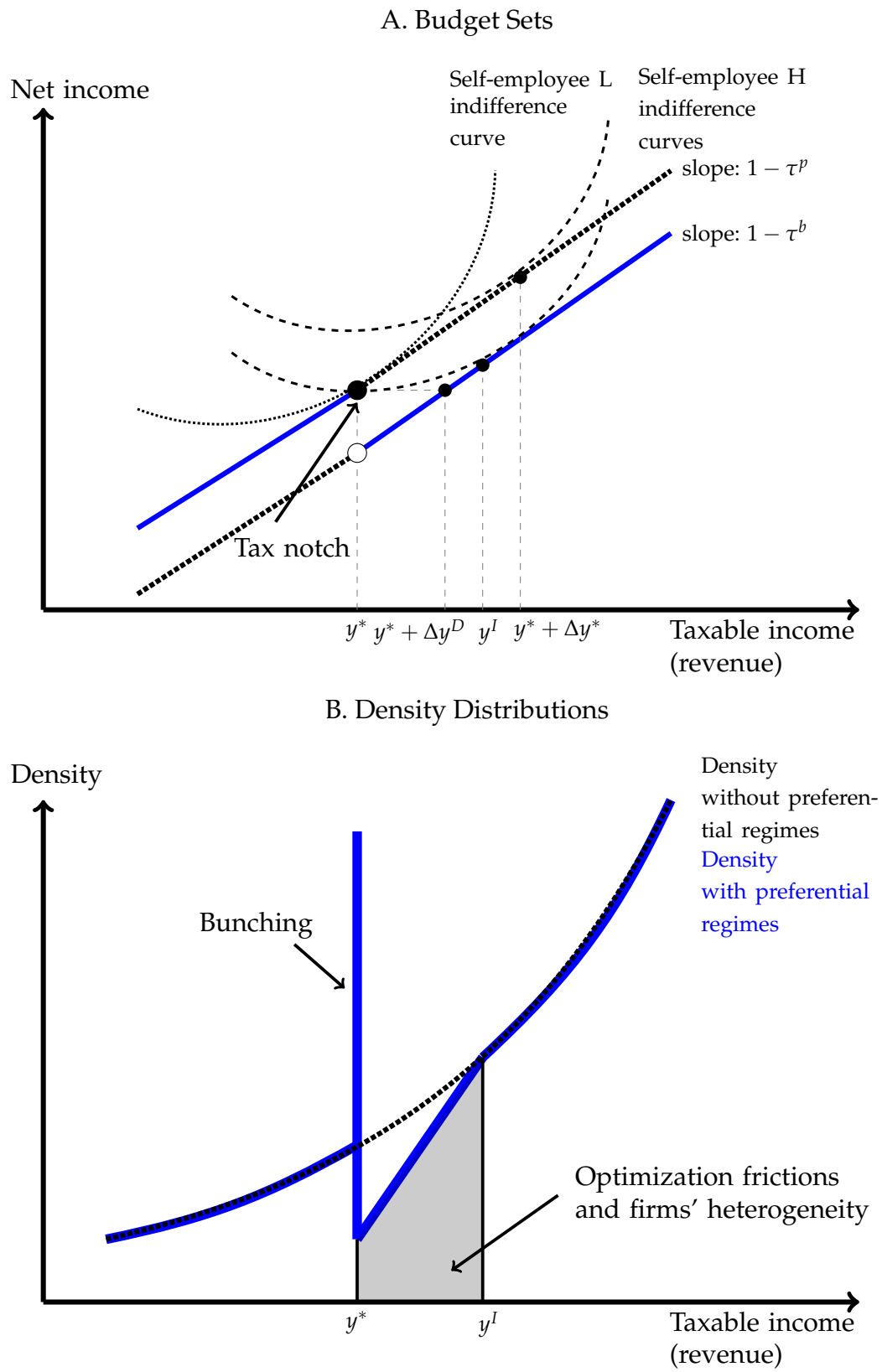
In this example, we illustrate responses from two types of "bunchers". We define self-employed L as the one with the lowest income before the introduction of the preferential tax scheme, y^* ; self-employed H as the one with the highest income, $y^* + \Delta y^*$. The preferential tax scheme leads self-employed L to continue to choose income y^* and benefit from an increase in net income. Self-employee H will also bunch at the tax notch because is exactly indifferent between the notch point y^* and the interior point y^I . Self-employed L and H represent the two extreme cases: each self-employed between L and H will bunch at the preferential tax scheme notch. Therefore, because no one is willing to locate between the tax notch y^* and the interior point y^I , this model would predict a density hole in the segment $(y^*, y^I]$ and excess bunching at the notch y^* .

In practice, the predictions of this benchmark model can be questioned due to optimization frictions, such as adjustment costs or inattention, and heterogeneity in the advantages of the preferential regime across firms. For instance, since revenue-based taxation is advantageous to taxpayers with high-profit margins, the standard regime might be convenient for self-employees with large (deductible) costs, such as those with many employees, significant investments, and high operating expenses. Changes in the location of the eligibility cutoff, which varies across industries and over time, and in the size of the preferential tax rate, also introduce heterogeneities in the size of the tax notch across industries, by firm's age, and over time. These heterogeneity and optimization frictions might prevent some self-employed individuals from bunching, creating a significant density mass in the (otherwise empty) strictly dominated region.

Assuming that the counterfactual density $h_0(y)$ is roughly constant on the bunching segment $(y^* + \Delta y^*)$, we can express excess bunching at the tax notch as a function of the counterfactual density and the marginal buncher:

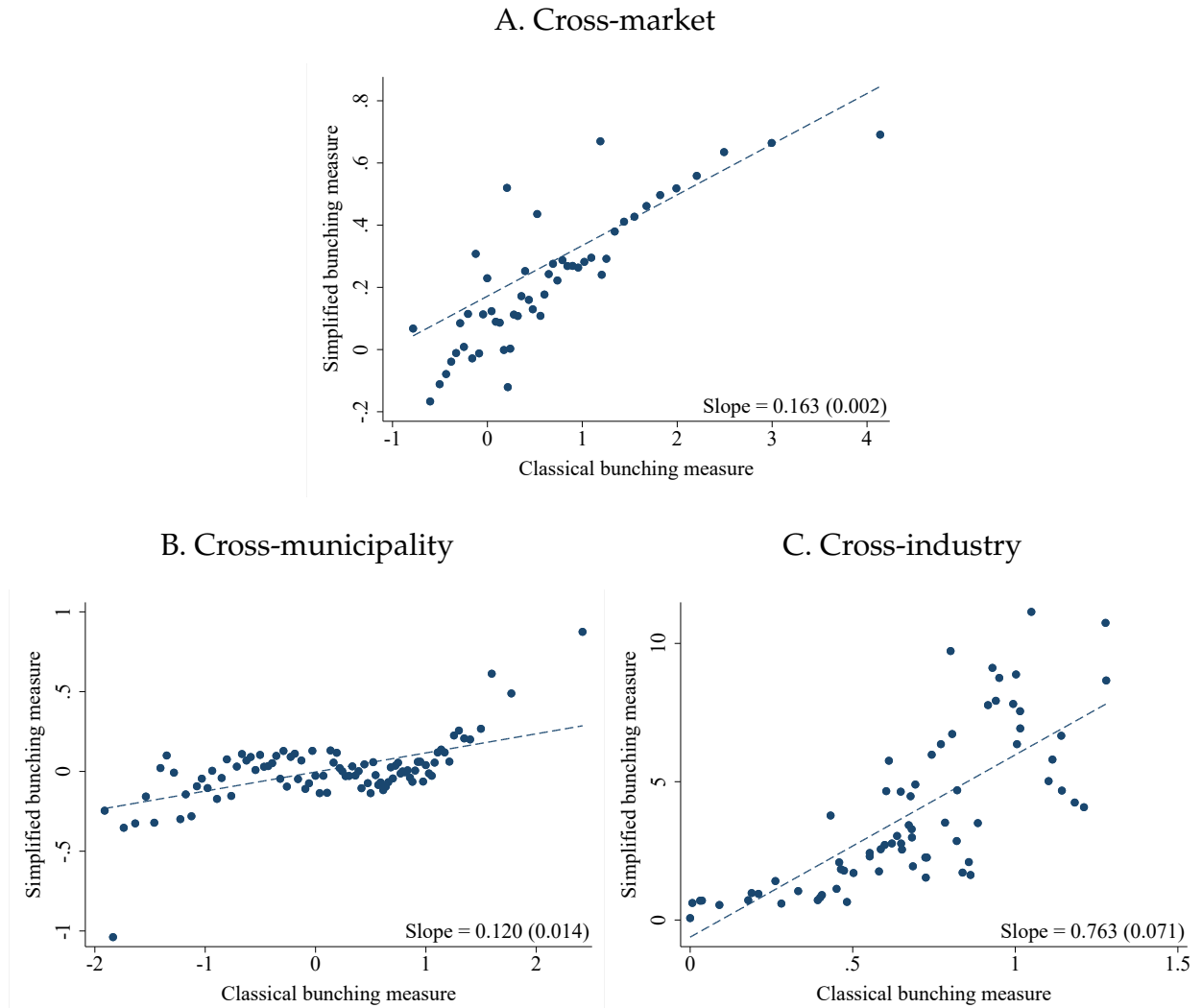
$$B = \int_{y^*}^{y^* + \Delta y^*} h_0(y) dy \approx h_0(y^*) \Delta y^*. \quad (7)$$

Figure B1: Bunching Responses to the Tax Notch



B2 Correlating “Simplified” and “Classical” Bunching Measures

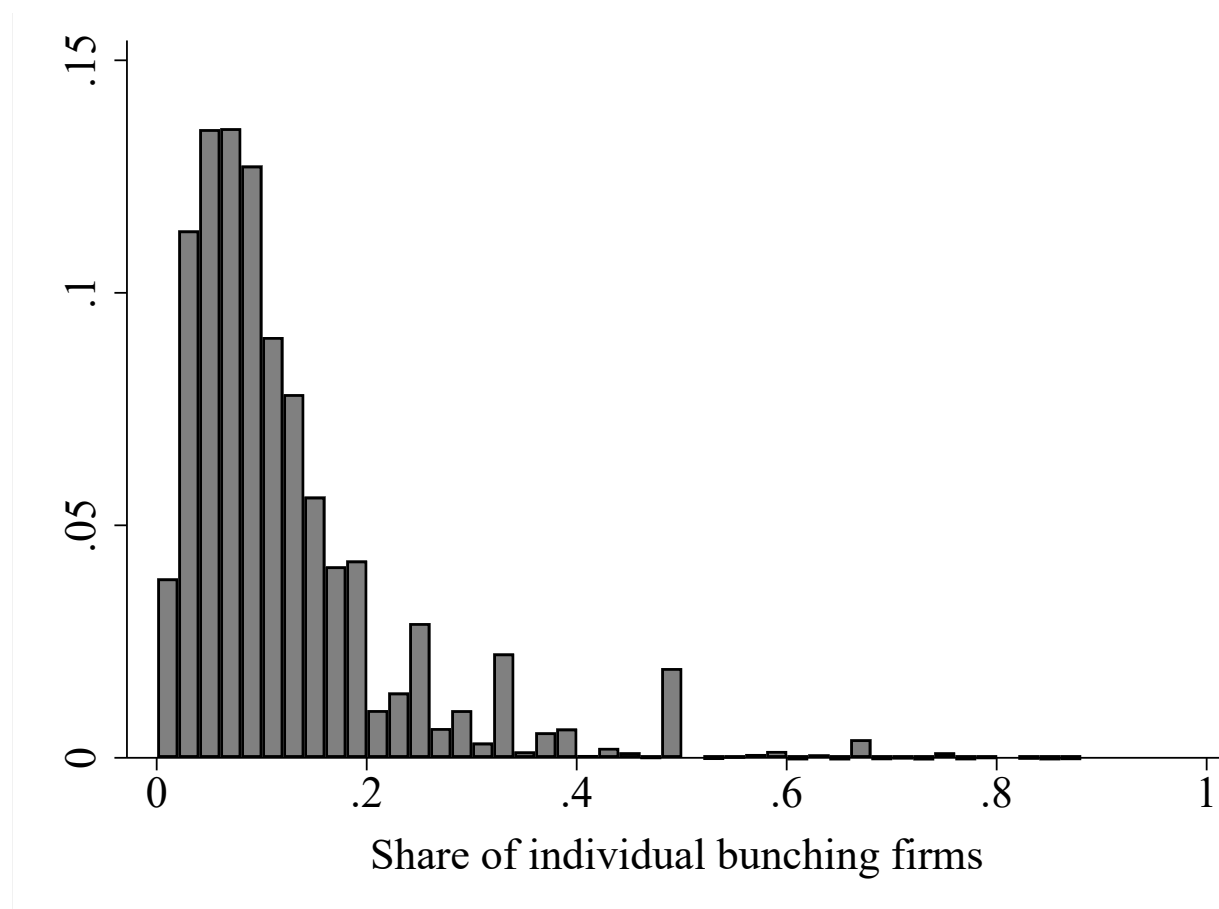
Figure B2: Correlating “Simplified” and “Classical” Bunching Measures



Notes: This figure compares the “simplified” bunching measure (vertical axes) with the “traditional” bunching measure (horizontal axes). We depict the cross-market correlation in panel A; the cross-municipality correlation in panel B; and the cross-industry correlation in panel C. Each graph depicts the two variables in 100 equal-sized bins and shows the line of best fit. The two measures are standardized to have mean 0 and standard deviation equal to 1. Each graph also reports the estimated slope and the associated standard error.

B3 The Distribution of the Bunching Rate

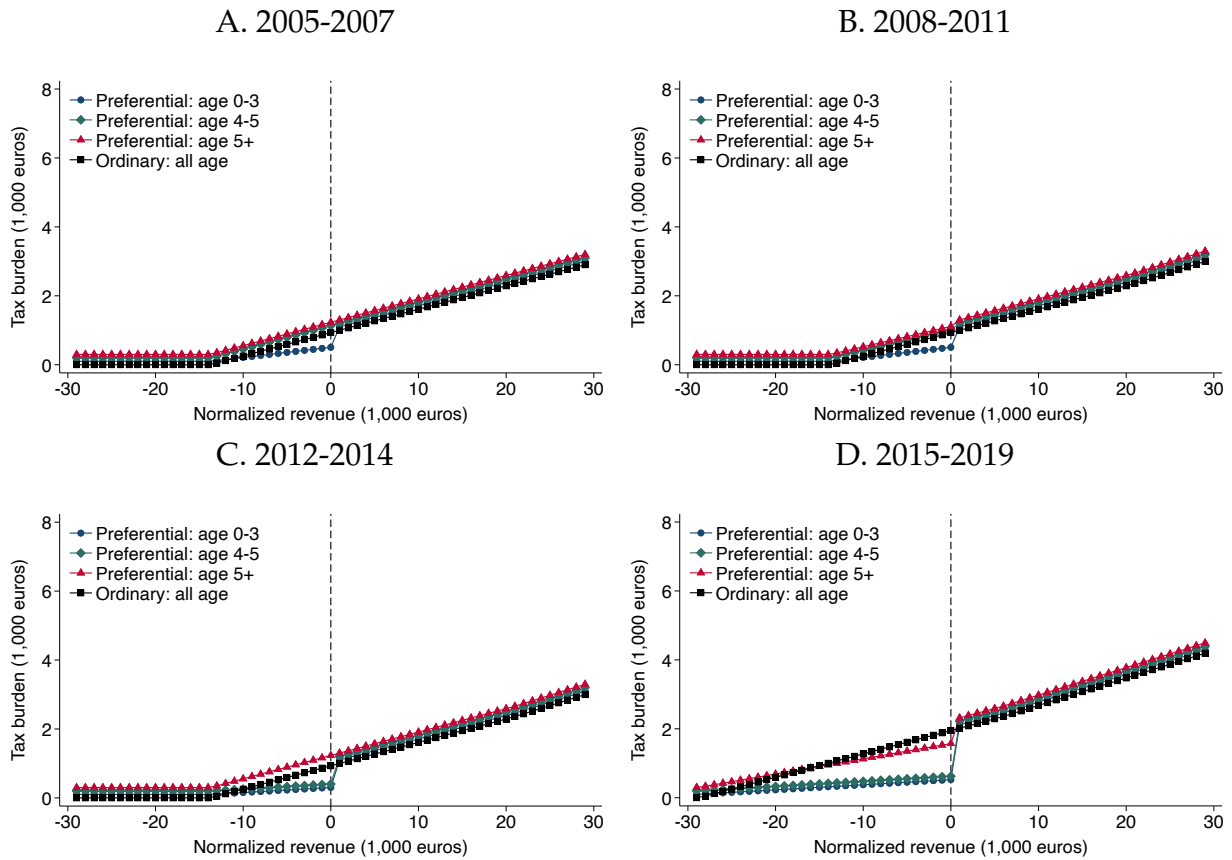
Figure B3: The Distribution of the Bunching Rate



Note: The histograms show the distribution of the bunching rate, the share of individual bunching firms reporting revenue of at least 5,000 euros below the eligibility cutoff for preferential tax regimes. The bars' width is 2 percentage points.

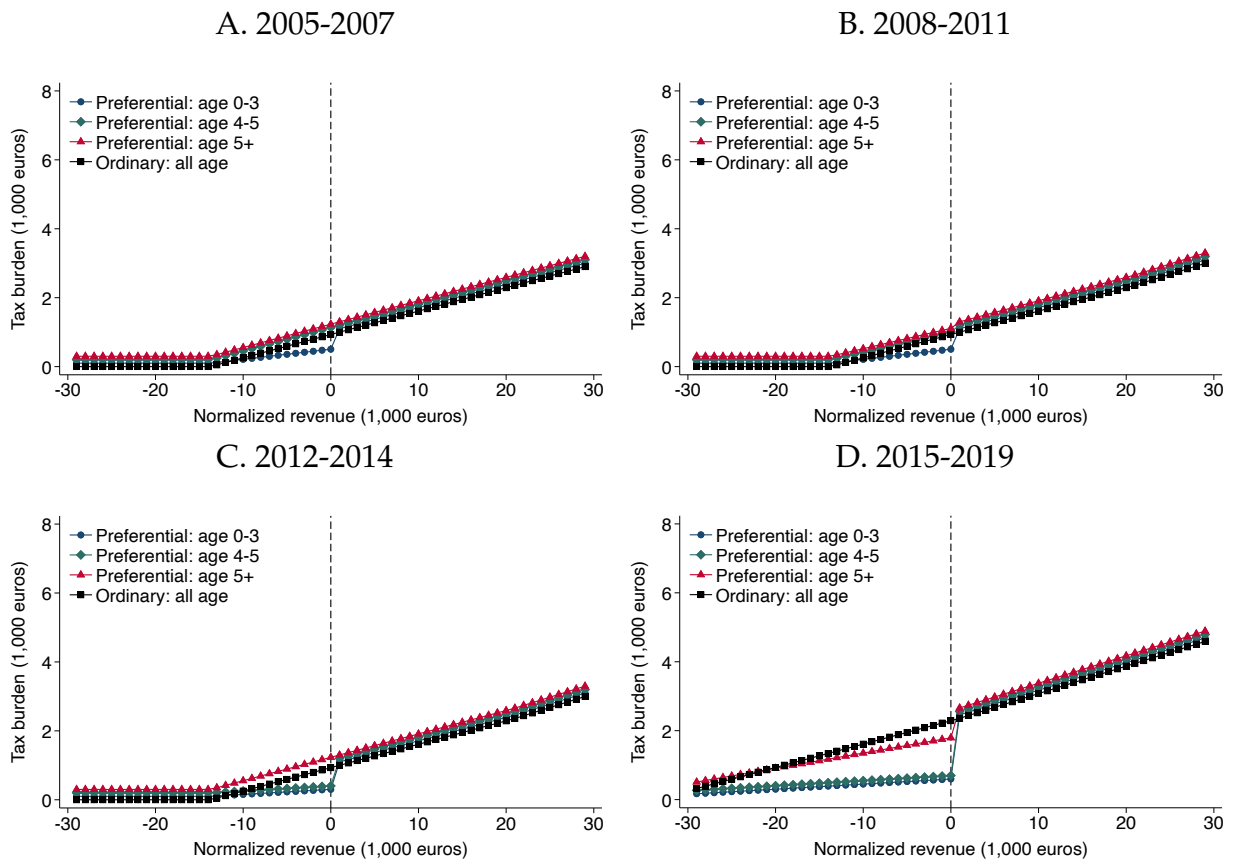
B4 Heterogeneity in the Size of the Tax Notch by Industry

Figure B4: Food and Beverage Industry



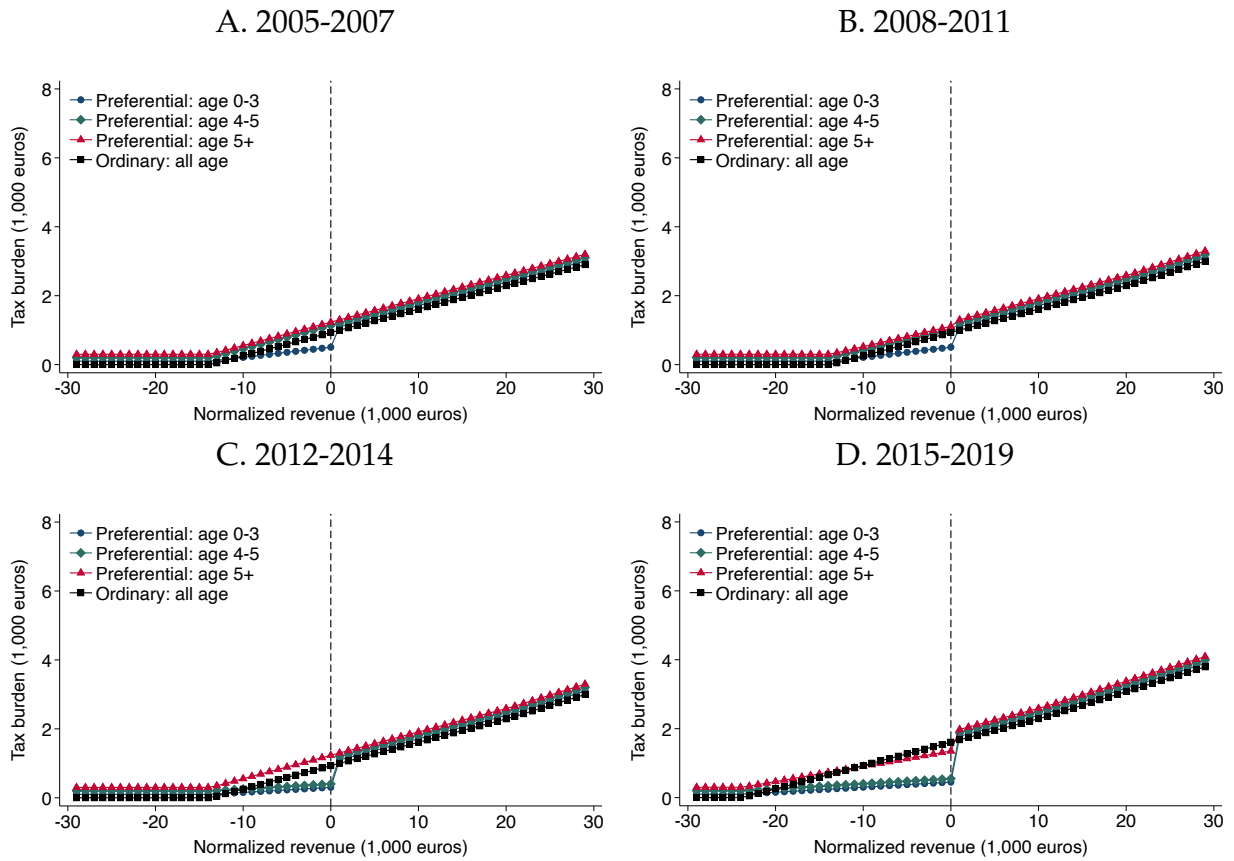
Note: This figure summarizes the main sources of policy changes that create variation in the size of the tax notch for a firm operating in the food and beverage industry. The figure plots the tax burden (vertical axes) by revenue bins, normalized to the eligibility cutoff for preferential regimes (horizontal axes). We plot the tax burden for a representative firm under the preferential and ordinary tax regimes for firms in the age cohorts 0-3, 4-5, and 5+.

Figure B5: Retail Trade Industry



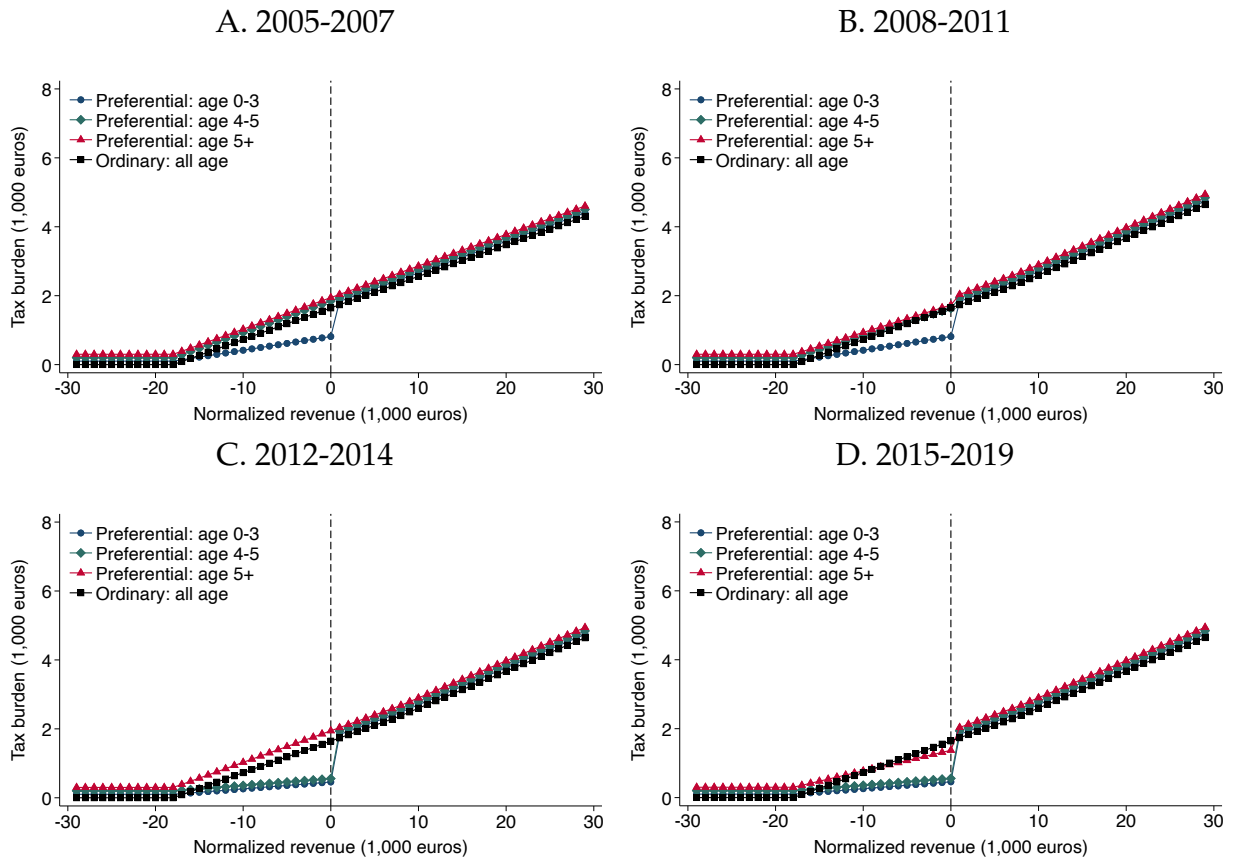
Note: This figure summarizes the main sources of policy changes that create variation in the size of the tax notch for a firm operating in the retail trade industry. The figure plots the tax burden (vertical axes) by revenue bins, normalized to the eligibility cutoff for preferential regimes (horizontal axes). We plot the tax burden for a representative firm under the preferential and ordinary tax regimes for firms in the age cohorts 0-3, 4-5, and 5+.

Figure B6: Street Vendors in Food and Beverage Industry



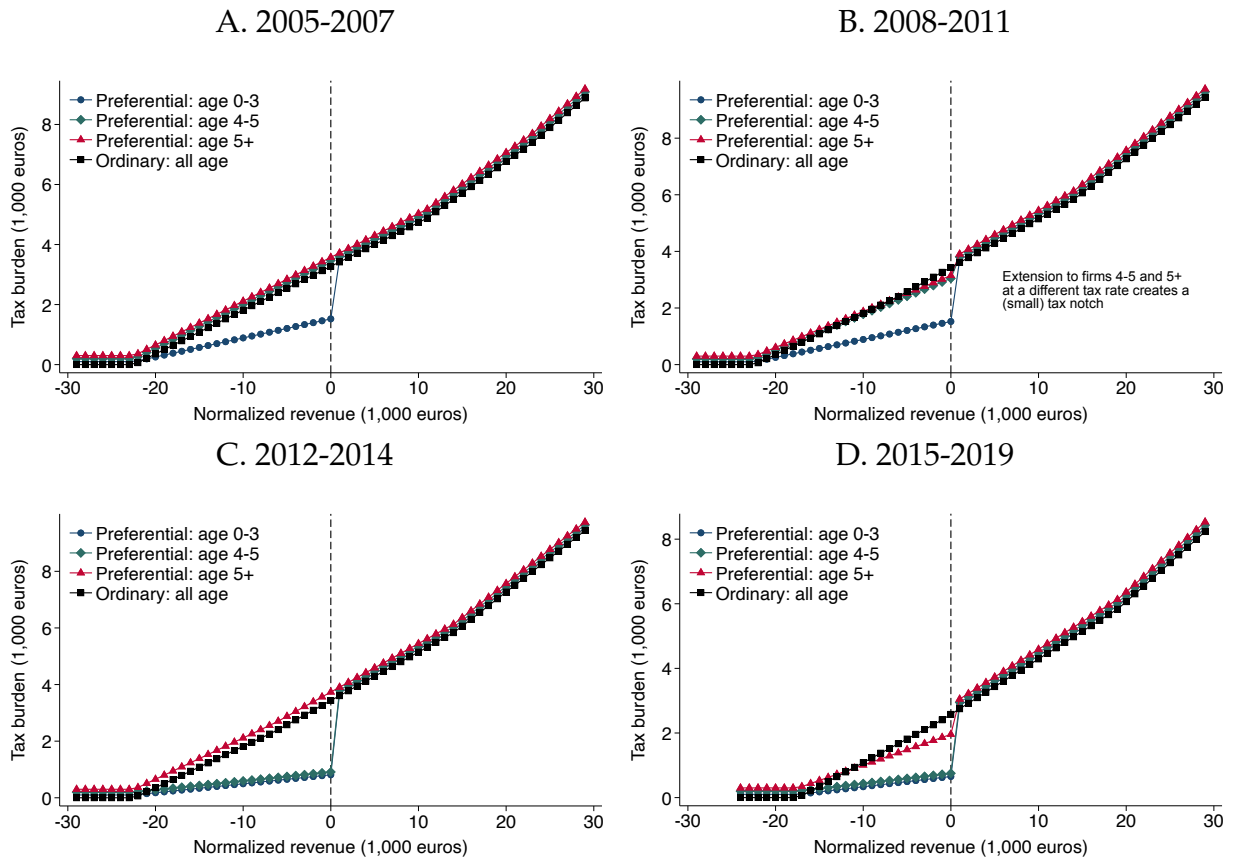
Note: This figure summarizes the main sources of policy changes that create variation in the size of the tax notch for a firm operating in the street vendors of the food and beverage industry. The figure plots the tax burden (vertical axes) by revenue bins, normalized to the eligibility cutoff for preferential regimes (horizontal axes). We plot the tax burden for a representative firm under the preferential and ordinary tax regimes for firms in the age cohorts 0-3, 4-5, and 5+.

Figure B7: Street Vendors in Other Industries



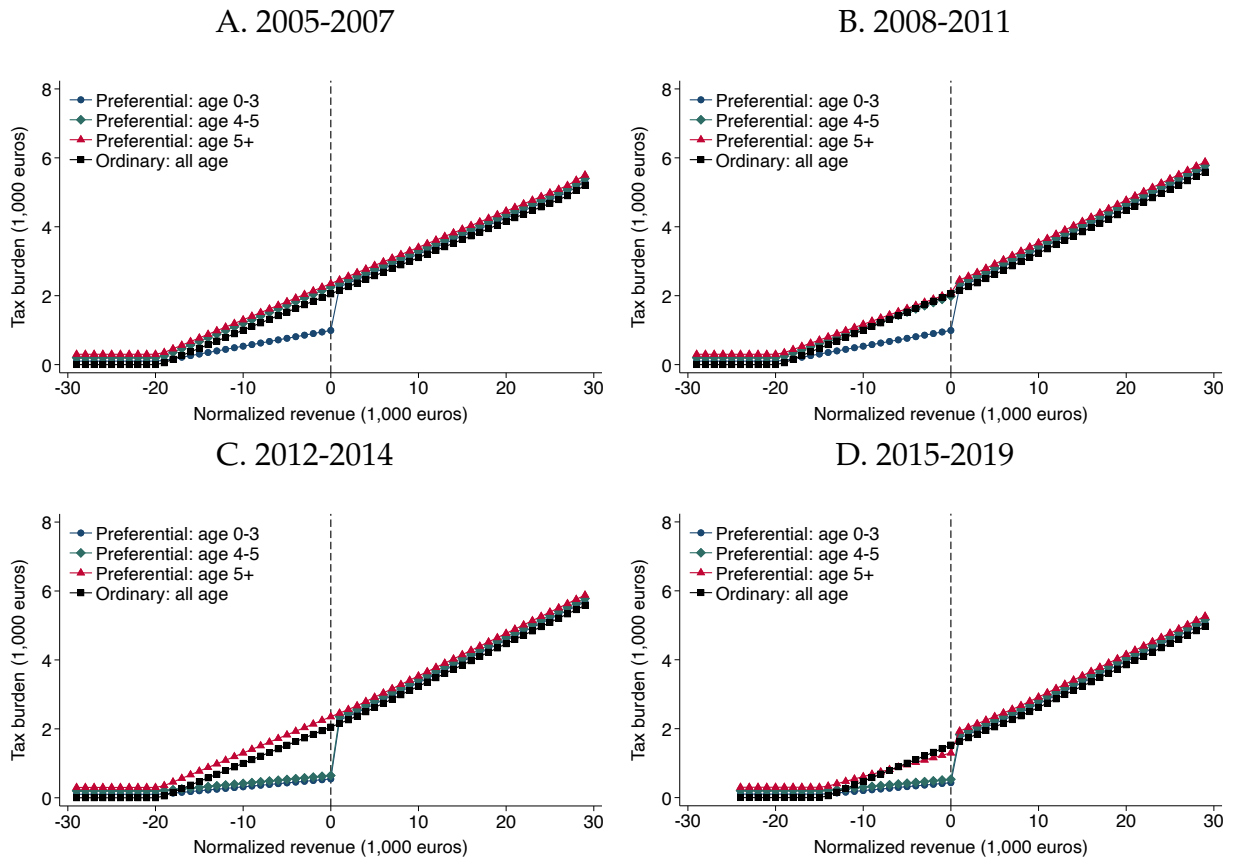
Note: This figure summarizes the main sources of policy changes that create variation in the size of the tax notch for a firm operating in the street vendors of other industries. The figure plots the tax burden (vertical axes) by revenue bins, normalized to the eligibility cutoff for preferential regimes (horizontal axes). We plot the tax burden for a representative firm under the preferential and ordinary tax regimes for firms in the age cohorts 0-3, 4-5, and 5+.

Figure B8: Construction Industry



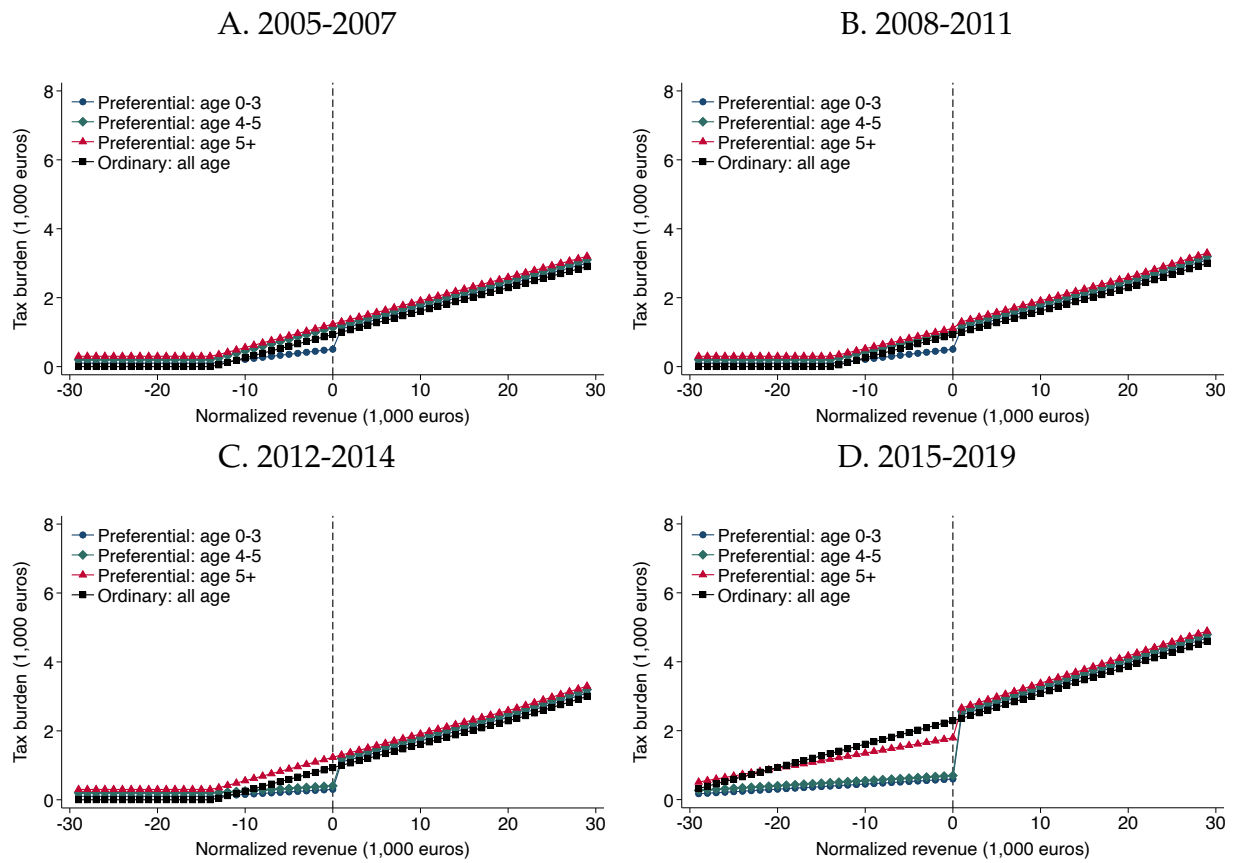
Note: This figure summarizes the main sources of policy changes that create variation in the size of the tax notch for a firm operating in the construction industry. The figure plots the tax burden (vertical axes) by revenue bins, normalized to the eligibility cutoff for preferential regimes (horizontal axes). We plot the tax burden for a representative firm under the preferential and ordinary tax regimes for firms in the age cohorts 0-3, 4-5, and 5+.

Figure B9: Trade Intermediaries Industry



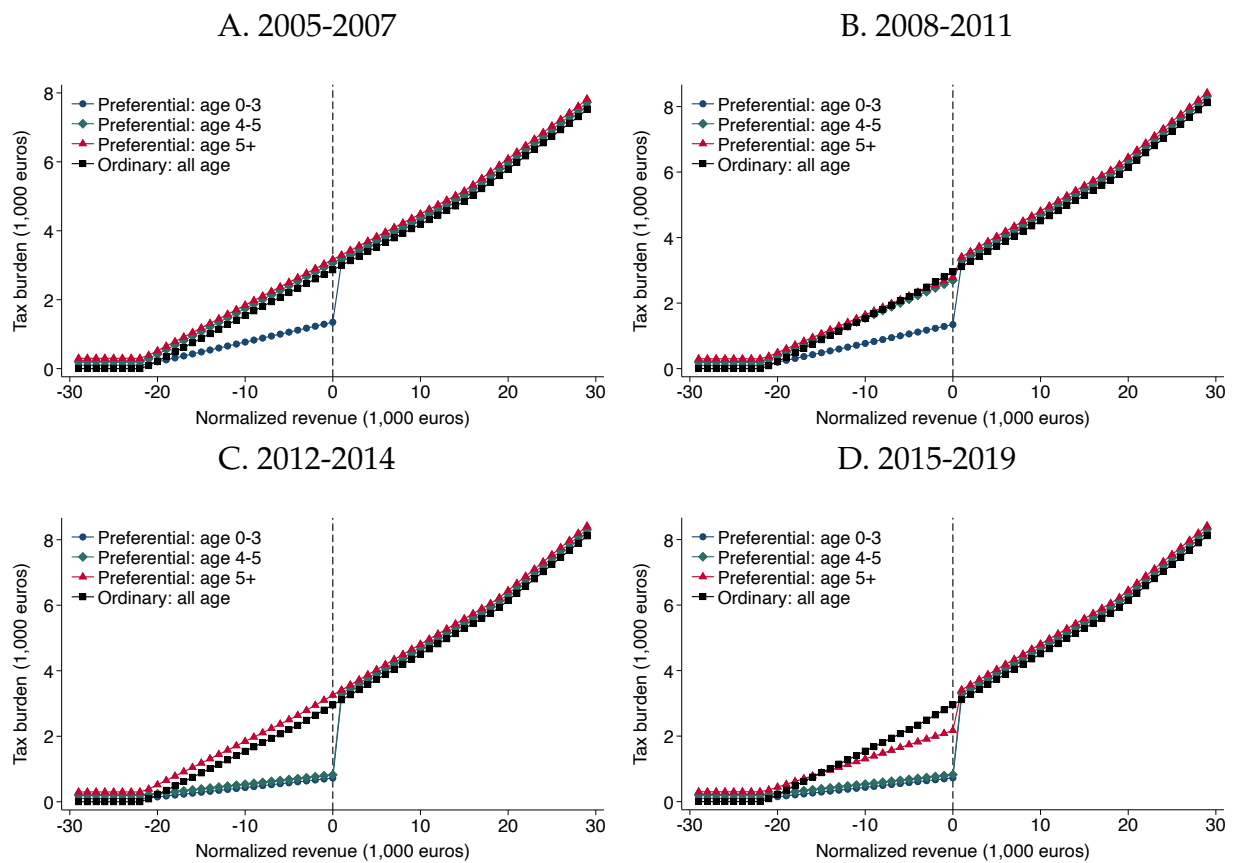
Note: This figure summarizes the main sources of policy changes that create variation in the size of the tax notch for a firm operating in the trade intermediaries industry. The figure plots the tax burden (vertical axes) by revenue bins, normalized to the eligibility cutoff for preferential regimes (horizontal axes). We plot the tax burden for a representative firm under the preferential and ordinary tax regimes for firms in the age cohorts 0-3, 4-5, and 5+.

Figure B10: Accommodation and Catering Industry



Note: This figure summarizes the main sources of policy changes that create variation in the size of the tax notch for a firm operating in the accommodation and catering industry. The figure plots the tax burden (vertical axes) by revenue bins, normalized to the eligibility cutoff for preferential regimes (horizontal axes). We plot the tax burden for a representative firm under the preferential and ordinary tax regimes for firms in the age cohorts 0-3, 4-5, and 5+.

Figure B11: Professional Activities Industry



Note: This figure summarizes the main sources of policy changes that create variation in the size of the tax notch for a firm operating in the professional activities industry. The figure plots the tax burden (vertical axes) by revenue bins, normalized to the eligibility cutoff for preferential regimes (horizontal axes). We plot the tax burden for a representative firm under the preferential and ordinary tax regimes for firms in the age cohorts 0-3, 4-5, and 5+.

C Conceptual Framework

This section provides a highly stylized model of the market externalities of tax evasion. We assume that each firm decides how much to produce and what to report for tax purposes. We first consider the firm optimal choice of production and evasion. We then discuss how firm tax non-compliance can affect equilibrium prices and distort compliant firm outcomes.

D1 Firm Output and Tax Evasion Choices

Suppose that an economy is composed of several small markets where a set of firms operates. Each firm i chooses the amount of output, y_i , to produce based on a cost function, $c_i(y_i)$, that is strictly convex and differentiable. Revenue is just price, p_i , times the firm's output. Firms can under-report their revenue by an amount $\epsilon = y - \bar{y} \geq 0$, where \bar{y} is reported revenue. The resource costs of under-reporting are captured by $k_i(\epsilon_i)$, which is an increasing and convex function of concealed revenue with $k_i(0) = 0$.¹ The government sets a tax rate τ and a profitability coefficient, μ , which determines the share of firm revenue subject to the tax rate. The choices of two tax instruments help us to connect more closely the framework to the policy experiment that we analyze in the paper. The firm tax liability is then $T_i = \tau(\mu \cdot p\bar{y}_i)$, depending on its declared revenue and the profitability coefficient.

Firms choose y and ϵ to maximize their after-tax profits:

$$\Pi_i(y_i, \epsilon_i) = (1 - \tau)\mu p_i y_i - c_i(y_i) + \tau \mu \epsilon_i - k_i(\epsilon_i). \quad (8)$$

The first-order condition is that each firm chooses an output level such that the marginal revenue equals the marginal cost:

$$c'(y_i) = p_i \cdot (1 - \tau) \cdot \mu. \quad (9)$$

An optimum for ϵ_i satisfies:

$$k'_i(\epsilon_i) = \tau \mu. \quad (10)$$

The right-hand side of this condition is the marginal benefit of an extra euro of evasion, which is increasing in the statutory tax rate, τ , and the profitability coefficient, μ . The left-hand side is the marginal cost of an extra euro of evasion.² A key implication of this result is that the tax capacity of the government determines the cost of evading taxes ([Best et al.](#)

¹Firms invest in concealment strategies (e.g., seeking specialist advice, reorganizing transaction patterns) to hide their revenue, incurring in a real resource cost. This cost may vary across firms, with larger and more visible firms incurring higher costs.

²This result is derived from the assumption that $k(\epsilon)$ depends on the difference between reported and under-reported revenue, rather than on the difference between reported and true tax liability ([Allingham and Sandmo 1972](#); [Yitzhaki 1974](#)).

2015; Keen and Slemrod 2017). When the cost of evading taxes is sufficiently high (i.e., $k'_i(0) > \tau\mu$), the firm reports its true revenue, and the after-tax profits correspond to the true after-tax profits.

D2 The Competitive Advantage for Non-Compliant Firms

The market distortions created by tax evasion stem from the difference between the firm marginal cost and the (net-of-effective tax) price. In general, firms pay a tax rate based on their reported, rather than actual, tax base. The effective tax rate paid by a firm, τ_e , differs from the statutory tax rate depending on the extent of revenue under-reporting. If the firm does not under-report revenue ($\epsilon = 0$), then $\tau = \tau_e$. The equilibrium price for a firm is then:

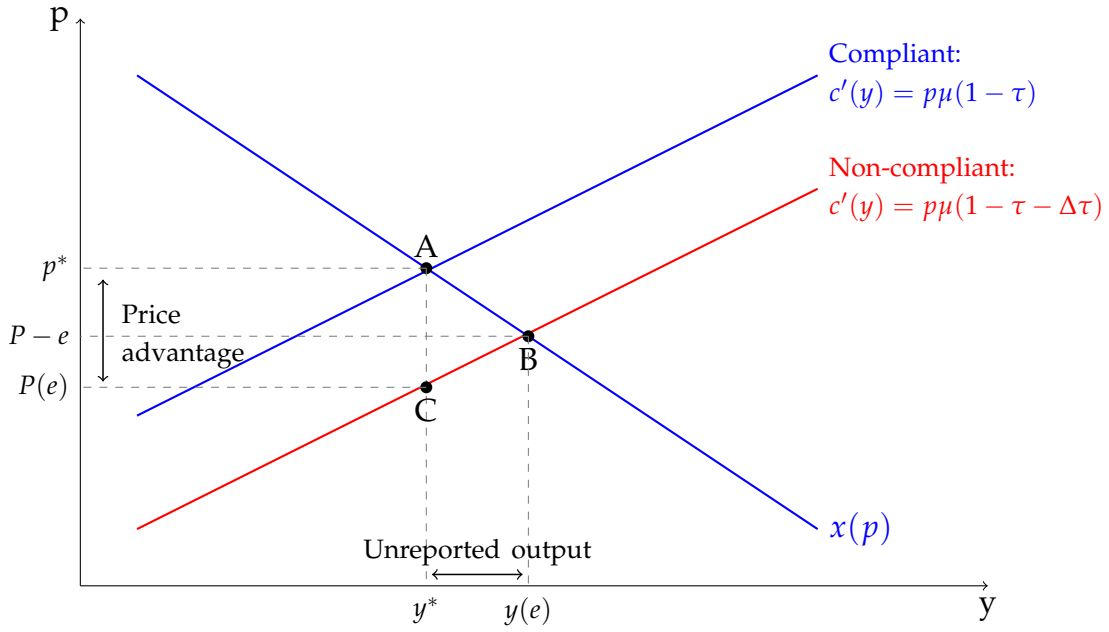
$$p_i = \frac{c'_i(y_i)}{\mu(1 - \tau_e)}. \quad (11)$$

The equilibrium price increases with the effective marginal tax rate, $\partial p_i / \partial \tau_e > 0$. This implies that tax evasion yields a competitive advantage in setting prices: firms with a larger extent of revenue under-reporting can afford to set lower prices on their products. Non-compliant firms can thus gain market power thanks to their ability to alter prices away from competitive levels.

To study the implications of tax evasion on equilibrium prices, consider a setting with just a non-compliant and a compliant firm competing in a market whose demand function is given by $x(p)$. The demand function is continuous and strictly decreasing at all p such that $x(p) > 0$ and that there exists a $\bar{p} < \infty$ such that $x(p) = 0$ for all $p \leq \bar{p}$. The two firms face the same constant returns to scale technology $c(y)$ and maximize their profits as in equation (8). The non-compliant firm faces low costs of tax evasion and always chooses $\epsilon_i > 0$ based on equation (10). The compliant firm faces an infinite cost of under-reporting revenue and hence sets $\epsilon_i = 0$. The non-compliant firm faces an effective tax rate that is lower than the statutory tax rate, $\tau_e < \tau$, while the complaint firm faces the statutory tax rate τ . This difference in effective tax rates implies that, ceteris paribus, the non-compliant firm can set a price that is lower than the price set by the compliant firms.

Figure C1 provides an illustration of the competitive advantage for non-compliant firms. In the absence of tax evasion, the equilibrium price and output are p^* and y^* , which corresponds to point A in the graph, where demand equals supply. The non-compliant firm evades taxes by not reporting an amount equal to $y(\epsilon) - y^*$. This implies under-reporting revenue by $p^*(y(\epsilon) - y^*)$, a lower effective tax rate, and a lower equilibrium price. The loss in government revenue due to under-reporting is equal to the lower tax liability faced by the non-compliant firm: $\Delta T_i = -\tau(\mu \cdot p^*(y(\epsilon) - y^*))$, which is the amount of taxes that the non-compliant firm would have paid at equilibrium price p^* if it had reported the output $y(\epsilon) - y^*$.

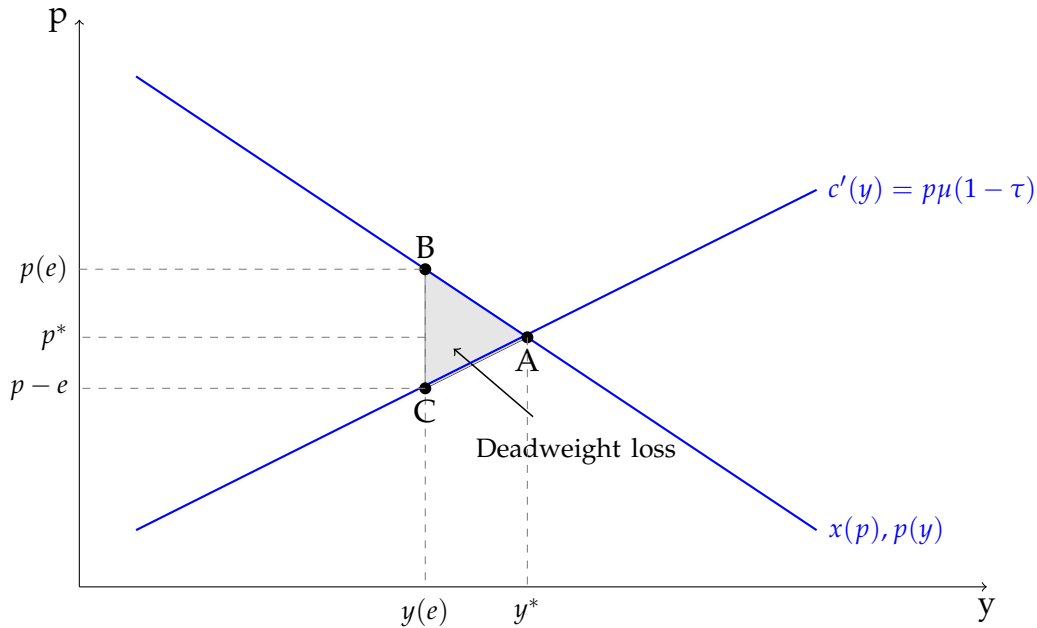
Figure C1: The Competitive Advantage of Non-Compliant Firms



D3 The Distortion to Compliant Firms

Competition among compliant and non-compliant firms would inherently lead to a setting of strategic interaction. The non-compliant firm can undercut the compliant firm by reducing its price by a small amount $e > 0$. The revenue for the compliant firm will then decrease if it keeps the equilibrium price p^* . To remain competitive, the compliant firm is thus forced to reduce its price by $e > 0$ and consequently adjust its production.

Figure C2: The Deadweight Welfare Loss for Compliant Firms



Formally, the welfare loss occurring to the compliant firm can be measured by the change in the Marshallian surplus. Assuming that consumption equals production and

denoting by $S(y)$ the surplus at the production level y , the Marshallian surplus is the integral of the difference between the inverse demand function and the marginal cost function of the compliant firm. The change in the compliant firm's surplus resulting from cutting prices by e is then:

$$S(\epsilon) - S(0) = \int_{y^*}^{y(e)} [p(y) - c'(y)] dy. \quad (12)$$

This expression is negative because $y(e) < y^*$ and $p(y) \geq c'(y)$ for all $y \leq y^*$. The social welfare is optimized when prices are p^* , the output is y^* , and $e = 0$. To see this, note that since $S'(e) = [p(y(e)) - c'(y(e))]y'(e)$, we have $S'(y^*) = 0$. Starting from a welfare optimum, then a small displacement from the optimum has a first-order effect on welfare.

The reduction in social welfare is equal to the shaded area in [Figure C2](#). This “dead-weight loss” corresponds to the revenue loss of the compliant firm due to lowering the equilibrium price and output. The associated reduction in government revenue is equal to $\Delta T_i = -\tau(\mu \cdot p^*(y(e) - y^*))$, which is the amount of taxes that the compliant firm would have paid on the revenue sold at equilibrium price p^* for the output $y(e) - y^*$. Identifying the revenue loss of the compliant firm is thus the key parameter to measuring the extent of the compliant firm's welfare loss due to tax evasion.

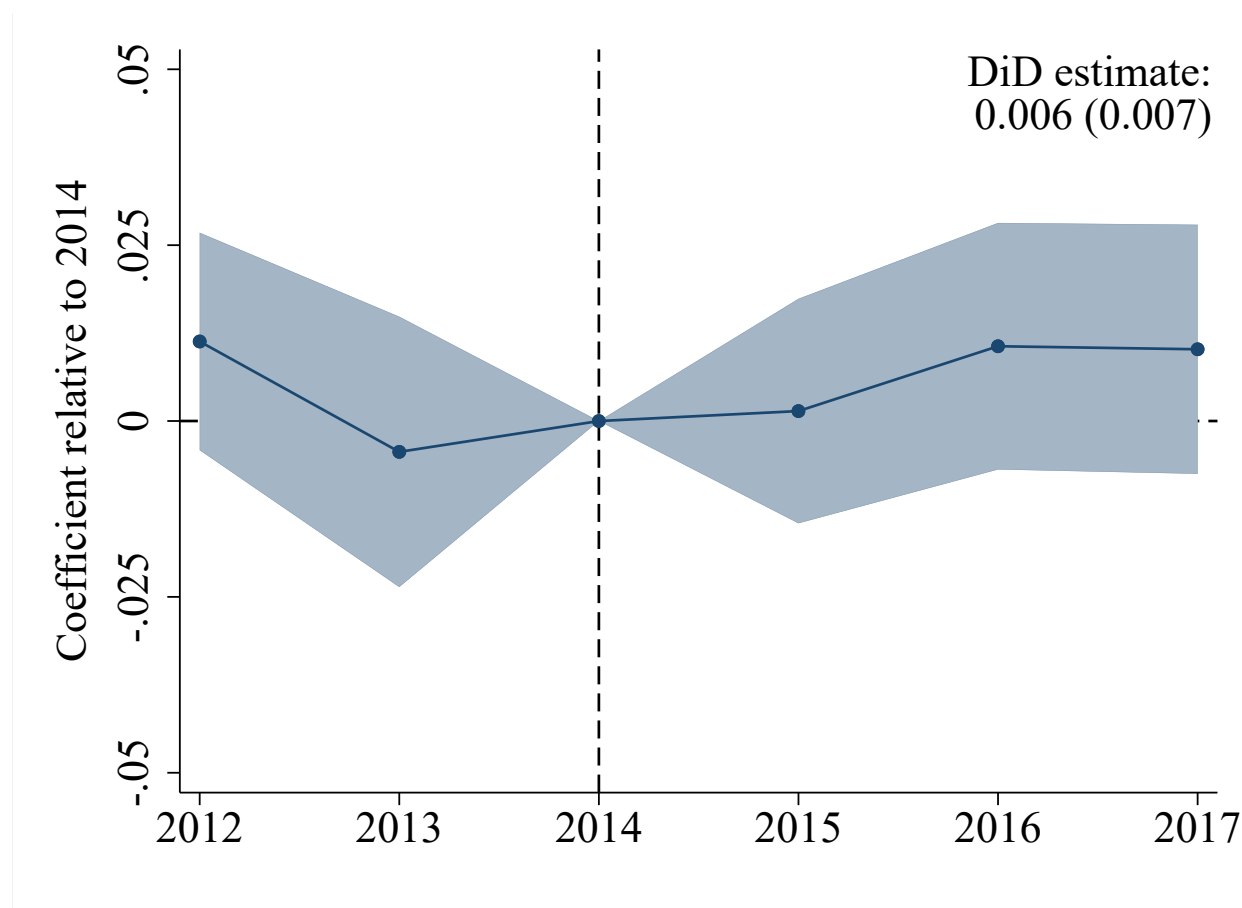
This competitive pressure can affect compliant firms in several ways. For instance, compliant firms could reduce prices to try to maintain their competitiveness or reduce the level of activity, as their market share is partly absorbed by non-compliant firms. Compliant firms could also subsequently become non-compliant themselves. In all cases, what would be observed is a reduction in the revenue of compliant firms. Since the nature of the revenue response has different normative implications ([Chetty 2009](#)), we will explore below whether it reflects reciprocity in tax evasion. Reduced revenue can also lead compliant firms to adjust their production function, reducing costs such as employee wages or downsizing the workforce. In this scenario, some of the costs of tax evasion would be passed on to workers.

Non-compliance of individual firms might also have cascading effects through the production chain ([de Paula and Scheinkman 2010](#), [Best et al. 2015](#)). For example, a plumber might buy plumbing equipment and supplies in the wholesale or retail trade and offer services to a household as well as to a construction firm. If the plumber does not issue invoices to evade tax, then his/her suppliers and customers also likely under-report their revenue. We do not investigate these market externalities for two main reasons. First, we are interested in the effects of tax evasion on market competition. Second, effects along the production chain, such as in the plumber example, are implicitly captured by our set of granular fixed effects. Indeed, the value chain of the plumber – and of any other individual firm – is reasonably local, and the introduction of municipality-year fixed effects accounts for the cascading effects of the plumber's tax evasion.

D Robustness Checks and Alternative Specifications

D1 Event-Study Evidence on Larger-Size Competitor Firms

Figure D1: Event-Study Evidence on Larger-Size Competitor Firms



Note: The figure depicts the event-study coefficient estimates and 95 percent confidence intervals from market-level standard errors obtained from equation (5). The outcome variable is the log of the revenue of competitor firms that are larger in size compared to our baseline group. The event-study is based on the 2015 reform, which created a tax notch for firms older than 5 years, but kept the notch for other firms unaffected. Therefore, it creates a differential exposure across markets depending on the fraction of individual firms older than 5 years. We classify markets as more (less) exposed if in the top (bottom) tercile of the market share of individual firms older than 5 years. Each specification includes firm and year fixed effects. The figure also reports the coefficient estimate and its associated standard error from a specification of the outcome of interest on the interaction between a dummy for more exposed markets and the post-2015 dummy.

D2 OLS estimate

Table D1: OLS Effects of Bunching Firms' Market Share on Competitors' Revenue by Size

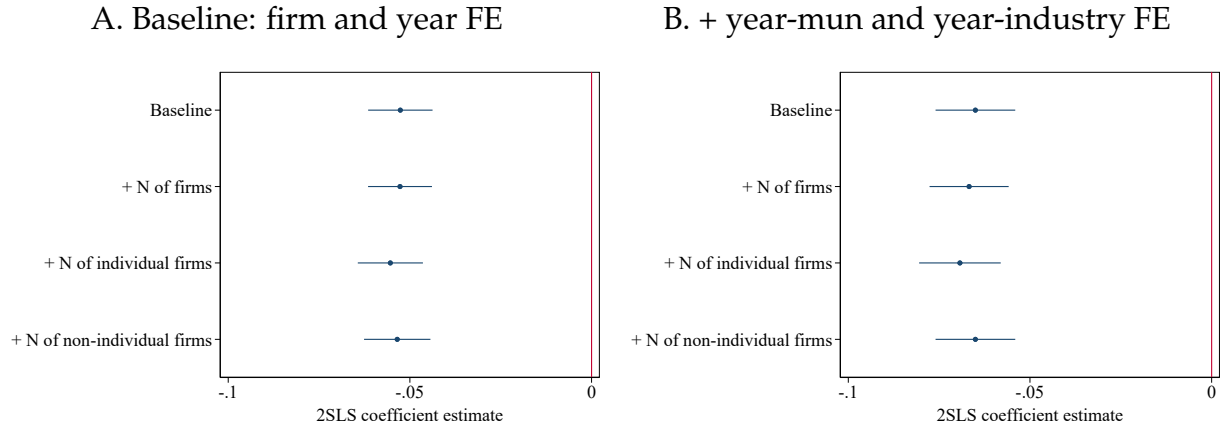
| | Outcome: log(revenue) Sample: firms with revenue | | | | |
|--------------|---|-----------------------|-----------------------|-----------------------|--------------------|
| | <100k (1) | 100-250k (2) | 250-500k (3) | 500-1,000k (4) | >1,000k (5) |
| $B_{m,t}$ | 0.00034** (0.000) | 0.00081*** (0.000) | 0.00132*** (0.000) | 0.00077*** (0.000) | 0.00030 (0.000) |
| Observations | 8,751,859 | 5,485,722 | 3,273,322 | 2,320,568 | 3,880,411 |
| Firm FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |

Note: This table reports OLS estimates of the effect of the market share of individual bunching firms on the log revenue of their competitors, disaggregated by competitor firm size. Column (1) includes competitor firms with average revenue below €100,000; column (2) includes those with revenue between €100,000 and €250,000; column (3) covers firms reporting between €250,000 and €500,000; column (4) includes those between €500,000 and €1,000,000; and column (5) focuses on firms with revenue exceeding €1,000,000. All specifications control for firm and year fixed effects. Markets are defined at the municipality–industry–year level. Individual bunching firms are defined as those reporting revenue within €5,000 below the eligibility threshold for preferential tax regimes. Competitors are non-individual firms operating in the same market and reporting less than €500,000 revenue. Standard errors, clustered at the market level, are reported in parentheses.

D3 Sensitivity to Additional Controls

In this section, we test the sensitivity of our estimates to additional time-varying factors. Although our baseline model relies on a very demanding set of fixed effects - firm, industry-year, and municipality-year fixed effects - the exclusion restriction of our 2SLS model might be threatened by omitted changes in competitors' firm outcomes due to market-specific time-varying channels unrelated to individual firms' revenue manipulation. For instance, changes in the generosity of the preferential tax schemes might stimulate business creation. If this is the case, then competitor firms' outcomes would be influenced by tougher (fair) competition, rather than through (unfair) competition driven by tax evasion. To show that this is not the source of our findings, we check for significant changes in our coefficient estimate when conditioning on the number of firms operating in a market in any given year. As suggested in [Altonji et al. \(2005\)](#) and [Oster \(2019\)](#), significant changes in coefficient estimates imply the potential importance of unobserved confounders. In [Figure D2](#), we provide reassuring evidence that our coefficient estimate remains remarkably stable when controlling for time-varying market-specific changes in i) the number of firms; ii) the number of individual firms; iii) the number of non-individual firms. Similar results are obtained when we replicate the analysis on other firm outcomes (results available upon request).

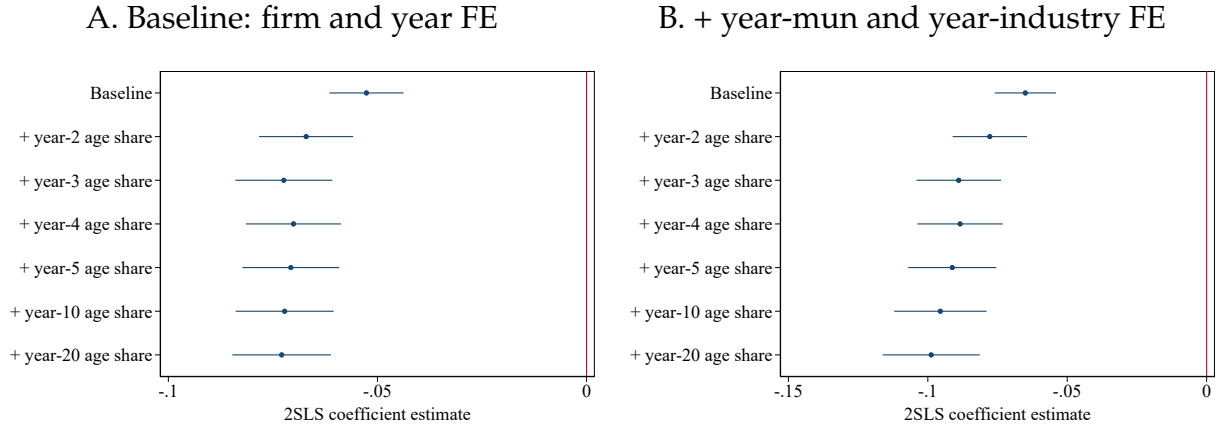
Figure D2: Sensitivity to Additional Controls



Notes: This figure tests the robustness of our baseline 2SLS estimates on the log of firm revenue, computed from a model with firm fixed effects and year fixed effects (“Baseline” in the left-hand side graph); and with firm, year-municipality, and year-industry fixed effects (“Baseline” in the right-hand side graph). Each figure reports the 2SLS coefficient estimate and 95 percent confidence intervals from market-level clustered standard errors. On top of the baseline controls, we add the following controls: i. number of firms in the market (second row); ii. number of individual firms in the market (third row); number of non-individual firms in the market (fourth row). Market-level bunching rate is calculated as the fraction of individual firms that report revenue just below the cutoff determining eligibility for preferential tax schemes. Individual bunching firms are those reporting revenue between -€5,000 and 0 relative to the eligibility cutoff for preferential regimes, while competitors are non-individual firms operating in the same market and reporting less than and reporting less than €500,000 revenue. The instrument, described in equation (4), is based on policy changes and a market’s (fixed) demographic composition. Each market is defined at the municipality-industry-year level.

D4 Robustness for “Incomplete” Shift-Share Design

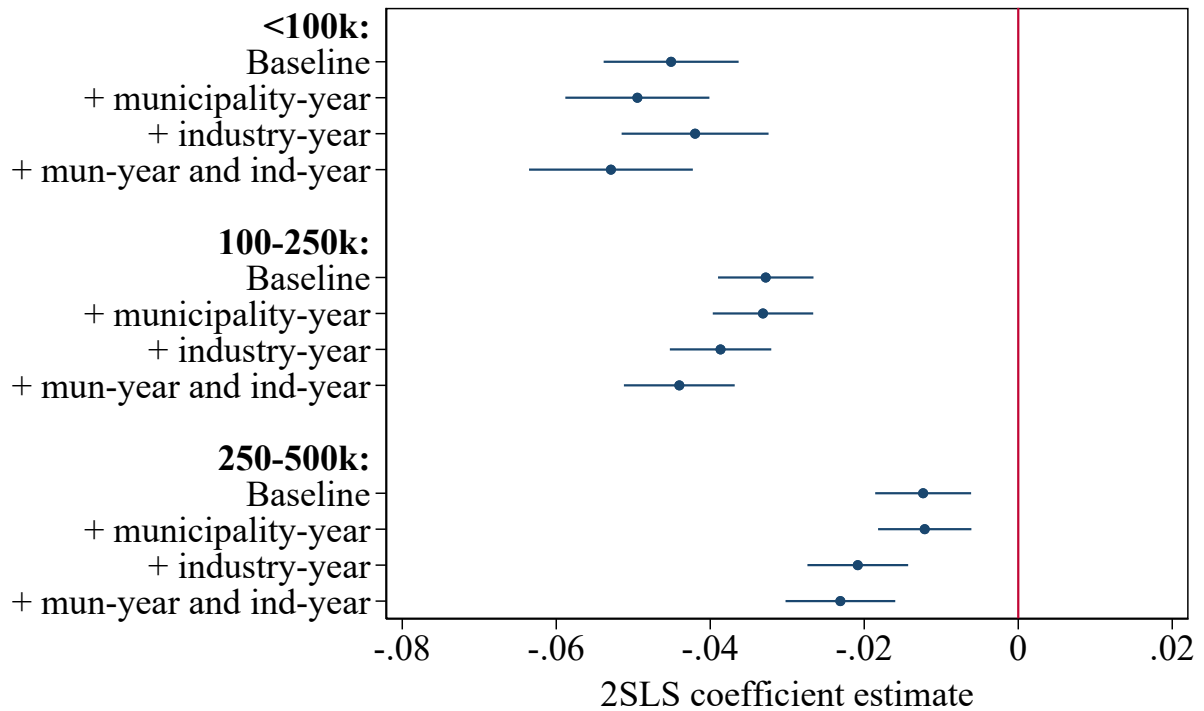
Figure D3: Robustness for “Incomplete” Shift-Share Designs



Notes: This figure tests the robustness of our baseline 2SLS estimates on the log of firm revenue, computed from a model with firm fixed effects and year fixed effects (“Baseline” in the left-hand side graph); and with firm, year-municipality, and year-industry fixed effects (“Baseline” in the right-hand side graph). Each figure reports the 2SLS coefficient estimate and 95 percent confidence intervals from market-level clustered standard errors. On top of the baseline controls, we control for groups (2, 3, 4, 5, 10, or 20) of market shares interacted with year fixed effects. The market-level bunching rate is calculated as the fraction of individual firms that report revenue just below the cutoff determining eligibility for preferential tax schemes. Individual bunching firms are those reporting revenue between -€5,000 and 0 relative to the eligibility cutoff for preferential regimes, while competitors are non-individual firms operating in the same market and reporting less than €500,000 revenue. The instrument, described in equation (4), is based on policy changes and a market’s (fixed) demographic composition. Each market is defined at the municipality-industry-year level.

D5 Alternative Specifications

Figure D4: Alternative Specifications



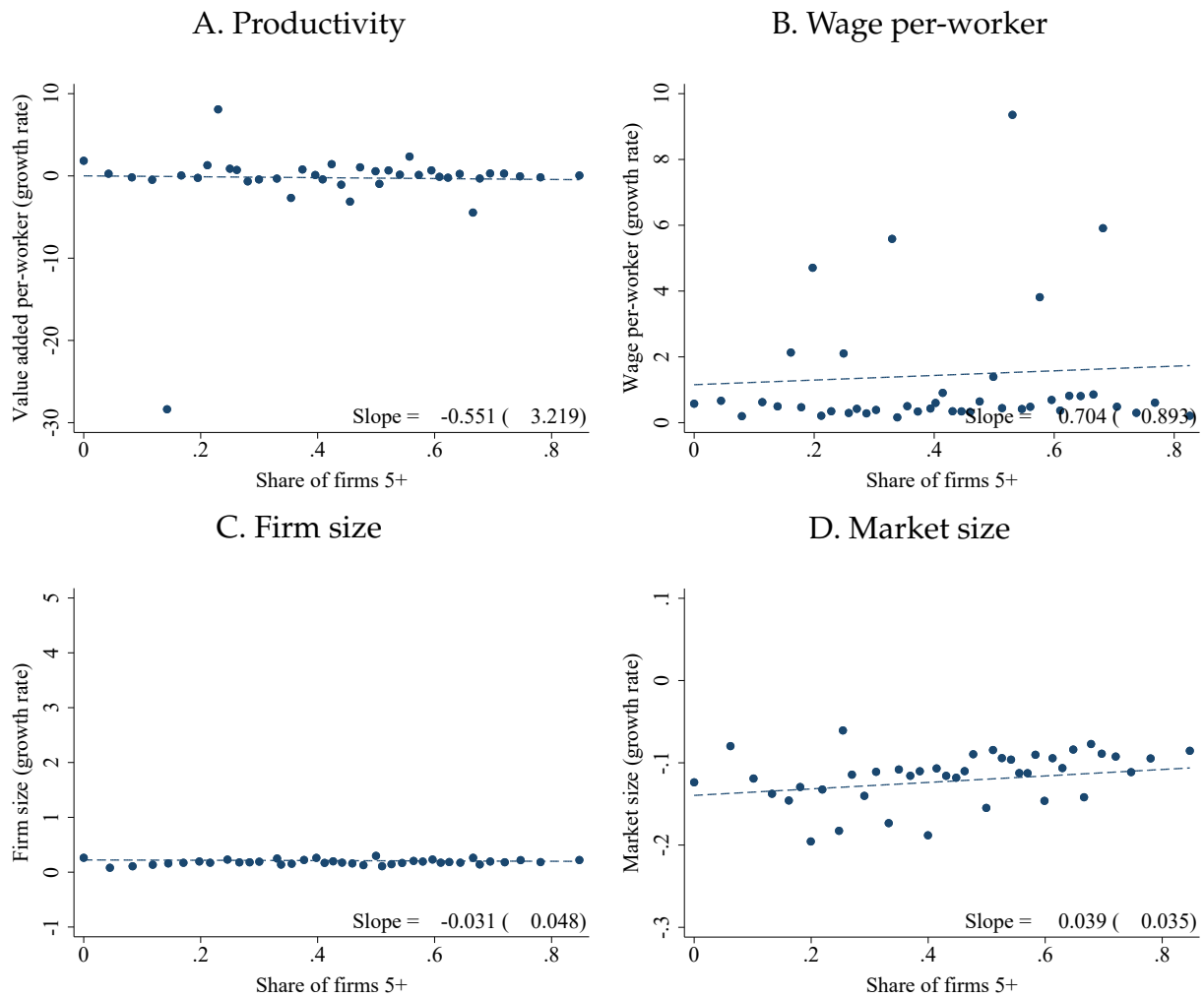
Notes: This figure presents 2SLS estimates and 95 percent confidence intervals of how the market share of individual bunching firms affects their competitors' log revenue by firm size group. In each group, the first row reports estimates from the baseline model with firm and year fixed effects; the second row includes firm and year-industry fixed effects; the third row incorporates firm and year-municipality fixed effects; and the fourth row accounts for firm, industry-year, and municipality-year fixed effects. The instrument, detailed in equation (4), is constructed using policy changes and a market's fixed demographic composition. Markets are defined at the municipality-industry-year level. Individual bunching firms are those reporting revenue between -€5,000 and 0 relative to the eligibility cutoff for preferential regimes, while competitors are non-individual firms operating in the same market.

D6 The Correlates of Market Shares

Our research design reflects differential exogenous exposure, due to the (fixed) market demographic composition, to common policy shocks. It rests on the assumption that *changes* (rather than *levels*) of firms' revenue are similar across markets with a different share of young (or old) firms.³ The central identification concern is thus that the market shares predict firm outcomes through channels other than those due to policy changes in the incentive to bunch. For example, markets with high versus low exposure may have features that predict change in the outcome through channels other than the bunching rate, violating the exclusion restriction. As recommended by [Goldsmith-Pinkham et al. \(2020\)](#), one way to assess this possibility is to look at the correlates of the shares. If these correlates suggest other channels through which the shares affect outcomes, then we might be skeptical of the identifying assumption. Guided by both theoretical and empirical evidence on firm growth predictors (see, e.g., [Kumar et al. 1999](#); [Luttmer 2011](#)), [Figure D5](#) plots the relationship between the share of firms older than 5 in a market and four predictors of firm growth: firm productivity (value added per worker); wage per worker; firm size; market size (total number of firms). We find no significant association, validating our identifying assumption.

³As emphasized in [Goldsmith-Pinkham et al. \(2020\)](#), "In particular, the key question researchers should have in mind is whether the correlates of the levels of the shares predict *changes* in the outcome. For the empirical strategy to be valid, it is fine if the level of the correlates is related to the level of the outcome." (p. 2605).

Figure D5: The Correlates of Market Age Shares



Notes: This figure shows scatter-plots comparing various predictors of firm growth (vertical axes) on the market share of firms created from more than 5 years (horizontal axes). Panel A focuses on firm productivity (value added per worker); panel B on the wage per worker; panel C on firm size; panel D on market size (total number of firms). Each graph compares the growth rate in each predictor (over the 2005-2019 period) versus the market share observed in 2005. We plot 50 equal-sized bins and show the line of best fit. Each graph also reports the estimated slope and the associated market-level clustered standard error from regressions on the first-difference of each predictor variable on the market share of firms created from more than 5 years.

D7 Sensitivity to Alternative Market Definitions

Our empirical strategy depends on the market definition. In this section, we verify the robustness of our results after perturbation of the boundaries of the market. We modify our baseline market definition along two dimensions. First, we use a finer industry classification: the NACE 3-digit level. Second, we move to a wider geographical unit of analysis: from municipality to the local labor market (LLM). Finally, we focus on a sample of firms operating in markets with a high level of localism. In this case, market boundaries are more naturally delineated, and our estimates should be less sensitive to attenuation bias due to measurement errors in market definition. Highly localized markets are defined as those where the share of firms identifying competitors within the same municipality is above the median, based on data from [Istat, Censimento Industrie e Servizi](#). [Table D2](#) shows that our baseline estimates remain substantially similar.

Table D2: Sensitivity to Alternative Market Definitions

| | <i>Outcome: log(revenue)</i> | | | |
|--|------------------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) |
| <i>A. Market definition: municipality-NACE 3-digit</i> | | | | |
| $B_{m,t}$ | -0.019*** (0.003) | -0.016*** (0.003) | -0.020*** (0.003) | -0.019*** (0.004) |
| <i>B. Market definition: LLM-NACE 2-digit</i> | | | | |
| $B_{m,t}$ | -0.059*** (0.004) | -0.065*** (0.005) | -0.065*** (0.005) | -0.076*** (0.005) |
| <i>C. Market definition: LLM-NACE 3-digit</i> | | | | |
| $B_{m,t}$ | -0.027*** (0.003) | -0.027*** (0.003) | -0.028*** (0.003) | -0.030*** (0.003) |
| <i>D. Market definition: Highly local markets</i> | | | | |
| $B_{m,t}$ | -0.067*** (0.003) | -0.081*** (0.003) | -0.069*** (0.003) | -0.096*** (0.003) |
| Observations (panels A-C) | | | 17,510,903 | |
| Observations (panel D) | | | 12,462,841 | |
| Firm FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Year-industry FE | No | Yes | No | Yes |
| Year-municipality FE | No | No | Yes | Yes |

Note: This table presents 2SLS estimates of how the market share of individual bunching firms affects their competitors' log revenue. We test the sensitivity to different market definitions: i. municipality and 3-digit industry code (panel A); ii. local labor market and 2-digit industry code (panel B); iii. local labor market and 3-digit industry code (panel C); iv. markets with a high level of localism (panel D), defined as those where the share of firms identifying competitors within the same municipality is above the median. Column 1 reports estimates from a model with firm and year fixed effects; column 2 includes firm and year-industry fixed effects; column 3 incorporates firm and year-municipality fixed effects; and column 4 accounts for firm, industry-year, and municipality-year fixed effects. The instrument, detailed in equation (4), is constructed using policy changes and a market's fixed demographic composition. Individual bunching firms are those reporting revenue between -€5,000 and 0 relative to the eligibility cutoff for preferential regimes, while competitors are non-individual firms operating in the same market and reporting less than €500,000 revenue. Standard errors, clustered at the market level, are shown in parentheses.

D8 Alternative Measures of the Bunching Rate

Table D3 shows that our estimates remain consistent when we use alternative measures of the bunching rate. We employ four alternative definitions: i. the log of the share of bunching firms +1 (panel A); ii. the number of bunching firms (panel B); iii. the log of the number of bunching firms +1 (panel C); iv. the ratio between the number of firms below the cutoff $[-€5,000;0]$ and those above $[0; €10,000]$ (panel D). The latter is a variable more closely related to the “classical” measure of bunching. Although the interpretation of the first-stage effect varies depending on the measure used to quantify the baseline bunching rate, we observe that regardless of the method used to measure bunching, it has a negative impact on the outcome variables of interest.

Table D3: Sensitivity to Alternative Bunching Definitions

| | Outcome: log(revenue) | | | |
|--|-----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) |
| <i>A. Bunching measure: log of share of bunching firms</i> | | | | |
| $B_{m,t}$ | -0.681*** (0.090) | -0.526*** (0.055) | -0.680*** (0.080) | -0.610*** (0.058) |
| <i>B. Bunching measure: N of bunching firms</i> | | | | |
| $B_{m,t}$ | -0.003*** (0.001) | -0.002** (0.001) | -0.002*** (0.001) | -0.002*** (0.001) |
| <i>C. Bunching measure: log of N of bunching firms</i> | | | | |
| $B_{m,t}$ | -0.859*** (0.205) | -0.455*** (0.049) | -0.542*** (0.071) | -0.383*** (0.035) |
| <i>D. Bunching measure: classical bunching estimate</i> | | | | |
| $B_{m,t}$ | -0.646*** (0.149) | -1.243*** (0.339) | -0.709*** (0.122) | -1.699*** (0.450) |
| Observations | 17,510,903 | | | |
| Firm FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Year-industry FE | No | Yes | No | Yes |
| Year-municipality FE | No | No | Yes | Yes |

Note: This table tests the robustness of our estimates to different bunching measures. We employ four alternative definitions: i. the log of the share of bunching firms +1 (panel A); ii. the number of bunching firms (panel B); iii. the log of the number of bunching firms +1 (panel C); iv. the ratio between the number of firms below the cutoff [-€5,000;0] and those just above [0; €5,000] (panel D). Column 1 reports estimates from a model with firm and year fixed effects; column 2 includes firm and year-industry fixed effects; column 3 incorporates firm and year-municipality fixed effects; and column 4 accounts for firm, industry-year, and municipality-year fixed effects. The instrument, detailed in equation (4), is constructed using policy changes and a market's fixed demographic composition. Competitors are non-individual firms operating in the same market and reporting less than €500,000 revenue. Standard errors, clustered at the market level, are shown in parentheses.

E Dynamic Olley-Pakes Productivity Decomposition

We examine the effects of a variation of the bunching rate on variation of the productivity at the market level employing the decomposition approach proposed by [Melitz and Polanec \(2015\)](#). This approach allows us to assess, for any period, the relative contribution of three groups of firms: the ones that survive (i.e., incumbents), entrants, and exiting firms. For incumbents, it is possible to further distinguish the contribution of two more components: (i) the variation in the efficiency of individual firms (i.e., within margin); and (ii) the reallocation of resources to firms characterized by different productivity levels (i.e., between margin). Therefore, for each market and any year, we decompose the productivity growth into four main components: the productivity growth of incumbent firms, the covariance between employment shares and productivity (which measures the extent of reallocation), the contribution of entering firms, and the contribution of exiting firms.

Formally, we split firms into entrants (E), exiters (X), and incumbents (S), and we define Φ_{gt} and w_{gt} as the aggregate productivity and the share of employment in the group $g \in \{E, X, S\}$ at time t . Then:

$$\Phi_1 = \Phi_{S1}\omega_{S1} + \Phi_{X1}\omega_{X1}; \quad (13)$$

$$\Phi_2 = \Phi_{S2}\omega_{S2} + \Phi_{E2}\omega_{E2}, \quad (14)$$

and the difference between Φ_1 and Φ_2 is:

$$\Phi_2 - \Phi_1 = (\Phi_{S2} - \Phi_{S1}) + \omega_{E2}(\Phi_{E2} - \Phi_{S2}) + \omega_{X1}(\Phi_{S1} - \Phi_{X1}) \quad (15)$$

We can rewrite the former equation as:

$$\underbrace{\Delta\Phi}_{\text{productivity change}} = \underbrace{\Delta\varphi_S}_{\text{prod incumbents}} + \underbrace{\Delta Cov_S}_{\text{cov prod and size}} + \underbrace{\omega_{E2}(\Phi_{E2} - \Phi_{S2})}_{\text{entry gain/loss}} + \underbrace{\omega_{X1}(\Phi_{S1} - \Phi_{X1})}_{\text{exit gain/loss}} \quad (16)$$

where $\Delta\varphi_S$ measures the gain deriving from average productivity changes, ΔCov_S the increase due to reallocation of workers toward more productive firms, $\omega_{E2}(\Phi_{E2} - \Phi_{S2})$ the gain from new firm entering the market and $\omega_{X1}(\Phi_{S1} - \Phi_{X1})$ the contribution of firm exiting the market.

Note that the contribution of the selection margin at the productivity decomposition depends on the reference productivity level for entrants and exiters. Namely, entrants generate positive productivity growth if (and only if) they have higher productivity than the remaining (surviving) firms in the same time period when entry occurs. Exiters, in turn, generate positive productivity growth if (and only if) they have lower productivity than the remaining (surviving) firms in the same time period when the exit occurs.