Corporate Taxation and Evasion Responses: Evidence from a Minimum Tax in Honduras

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Abstract

We use administrative data on the universe of corporate taxpayers in Honduras to study the impact of a minimum tax implemented between 2014 and 2017. While minimum taxes are widely used tools in lower income countries to ensure tax payment from large corporations, evidence on the response of taxpayers and implications for tax collection are still scarce. We document substantial tax evasion when costs are deductible: large corporations significantly increase their reported profit margins when incentives to over-report costs disappear, implying evasion rates of up to 17% of profits. We also use the reaction of taxpayers to a revenue-dependent exemption threshold to estimate the elasticity of reported revenue, a key behavioral parameter to assess the impact of taxing output. Our estimates suggest large elasticities in the range of [0.35,1]. Importantly, these responses are attenuated when revenue is independently observed by the tax authority, suggesting that revenue misreporting plays an important role. Our results inform the trade-offs involved when considering broadening the tax base to curb evasion and highlight the importance of tax administration capacity to the design of tax policy.

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1 Introduction

The landscape of corporate taxation has changed significantly in the last few decades. Average statutory corporate tax rates have fallen from over 40% in the 1990s to 30% in low-income countries, and by even more in middle- and high-income countries (International Monetary Fund, 2019b). At the same time, technological changes such as the rise of digital companies and the emergence of tax heavens mean that governments face increasing challenges to assure compliance in corporate tax payments (Zucman, 2014). These trends pose particularly stark threats to the tax base in lower-income countries, which often do not have the institutional capacity to fight tax evasion.

One tool already deployed by several governments to assure tax payments by corporations are minimum taxes (Best, Brockmeyer, Kleven, Spinnewijn, & Waseem, 2015; Mosberger, 2016; Alejos, 2018). These are taxes assessed on a broader base when reported profits are very low. The International Monetary Fund (IMF) recommends the use of minimum taxes as part of "simple measures protecting against base erosion" (International Monetary Fund, 2019a). Some form of minimum taxation on corporations is also at the core of recent international tax cooperation initiatives, such as the G20/OECD Inclusive Framework on Base Erosion and Profit Shifting (BEPS)[1]. Despite the prominence of minimum taxes in economic debates, evidence is scarce on their impact on the behavior of firms. Therefore, the very desirability of this type of tax as a response to tax base erosion remains in doubt.

In this paper we study corporate responses to the introduction of a minimum tax in Honduras between 2014-2017. Before the introduction of the minimum tax, corporations in Honduras faced a flat 25% tax on reported taxable income (profits), defined as gross revenues minus total claimed deductions. Starting in FY2014, the country introduced a minimum tax provision mandating that taxpayers declaring yearly gross revenue above L10 million (approximately USD 400,000) pay the maximum between their liability under profit taxation and 1.5% of declared gross revenue. The policy effectively introduced a floor on the amount of taxes paid by large corporations even when reported profits are low. The minimum tax provision was widely debated: it potentially affected the 20% largest corporations in the country, faced strong opposition from the private sector, and was disputed in courts and eventually upheld as constitutional by the Supreme Court.

Using the universe of corporate tax declarations between 2011 and 2018, we start by documenting that taxpayers responded strongly to the incentives created by the minimum

[1]The 2017 US Tax Cuts and Job Act (TCJA) also includes a provision for multinational firms to pay the maximum between corporate profit taxes and taxes on a broader base which does not allow for certain costs usually linked to profit shifting to be deducted. This so called BEAT (base erosion anti-abuse) provision effectively replaced the alternative minimum tax (AMT) for corporations, which was repealed. In the context of the ongoing debate about large corporations not paying federal taxes, President-elect Joe Biden has proposed a minimum tax on corporations with book profits above USD 100 million (Li, Watson, & LaJoie, 2020)

tax. Since firms reporting gross revenue below L10 million are exempt from the minimum tax, its introduction created a threshold where tax liability might change discontinuously in response to small changes in declared revenue. As an illustration, a firm declaring L9.99 million in gross revenue and close to zero profits will pay virtually no taxes, but declaring L10 million would create a tax liability of L150,000 (1.5%*L10 million) under the minimum tax. This *notch* (discontinuous change in tax liability) generates strong incentives for firms to strategically locate below the exemption threshold. We show that the distribution of firms declaring gross revenue in the vicinity of the exemption threshold was smooth between 2011 and 2013, but presents a clear and increasing excess mass immediately below the threshold when the minimum tax went into effect in 2014. When the exemption threshold was increased to L300 million in 2018, the excess mass around the previous notch immediately disappeared.

We use tools from the bunching literature (Kleven, 2016; Kleven & Waseem, 2013), adapted to our context, to recover bounds on the elasticity of reported revenue with respect to one-minus the tax rate. Our estimates suggest that the marginal buncher reduces their reported revenue by 15-30% to avoid being subject to the minimum tax and facing higher tax liability. We estimate revenue elasticities in the range of [0.35,1], considerably higher than previous estimates for similar contexts[2].

The large estimated elasticity highlights the limits faced by the tax authority in broadening the tax base: increasing tax rates will lead to a substantially smaller tax base. While the revenue response could be entirely driven by real production decisions (firms decreasing sales in order to be exempt) we offer evidence that misreporting revenue is part of the explanation. We construct firm-level measures of *revenue observability*, which we define as the share of self-declared revenue that is independently observed by the tax authority through third-party reporting (VAT withholdings of suppliers being the main source of information). We show that taxpayers are more likely to locate immediately below the exemption threshold when the tax authority has limited ability to independently assess declared revenue: the excess mass below the exemption threshold is 65% larger for firms with below median revenue observability. We also explore different levels of revenue observability across industries and document the same pattern of behavior: firms in high-observability industries are much less likely to bunch below the threshold, implying a lower elasticity of reported revenues. Taken together, we interpret these as evidence that at least part of the observed response of declaring revenue below the exemption threshold is explained by misreporting and thus potentially responsive to the enforcement environment.

While firms that would have declared gross revenue slightly above the exemption threshold might report lower revenue to escape the minimum tax, larger firms will not

[2] Bachas & Soto (2018), for example, estimate elasticities of reported revenue in the range [0.08 - 0.33] for corporations in Costa Rica.

be exempt. We document that taxpayers with revenues significantly above the threshold reduce their reported costs and increase their reported profit margins, consistent with the fact that under revenue taxation firms cannot decrease their tax liability by inflating costs. We interpret this as *prima facie* evidence of evasion under the profit taxation regime. In order to quantify these evasion responses, we explore the fact that a minimum tax creates a *kink* in the tax schedule faced by taxpayers (Best et al., 2015): both the tax rate and the tax base change discontinuously at the profit margin level that separates the two regimes, while the tax liability changes continuously.

We show that corporations in Honduras, when faced with the minimum tax, respond as predicted and bunch at the profit margin kink: the marginal buncher increases their reported profit margin by 0.9 - 1.1 percentage points. Decomposing the profit margin change between real production and cost misreporting components, and using the revenue elasticity obtained using the notch[3], we estimate that under profit taxation corporations increase their reported costs by 13 - 17% of their profits in order to reduce their tax liability. We also explore the rich administrative data to show that not all deduction categories respond in the same manner. We provide both non-parametric evidence and estimate "donut-hole" discontinuity regressions suggesting that, under profit taxation, firms systematically over-report hard-to-trace deductions, like costs linked to the purchase of goods and materials, while no over-reporting is observed in categories that generate paper trail that is easier to verify, like labor or financial costs. This is similar to findings from Mosberger (2016) in Hungary and strongly suggest a focus for tax authorities efforts in assessing the veracity of claimed deductions under profit taxation.

The previous results document strong behavioral responses to the minimum tax and illustrate the main trade-off induced by deviating from profit taxation: a broader tax base reduces tax evasion (Best et al., 2015), at the cost of efficiency loss (Diamond & Mirrlees, 1971). It also exemplifies the distortions introduced by tax notches: by taxing marginal revenue well above 100% when crossing an arbitrary threshold, notches induce large responses (Kleven & Waseem, 2013; Slemrod, 2013; Sallee & Slemrod, 2012)[4].

In order to quantify the impacts of the minimum tax on government revenue collection and profit of firms, as well as compare these with alternative tax policies, we impose more structure on the profit maximization problem of firms and calibrate a model using behavioral parameters estimated above. We present three main exercises. First, under our parametric assumptions, we quantify the impact of the specific minimum tax policy

[3] In the minimum tax policy studied in Pakistan, Best et al. (2015) do not have variation that allows them to estimate the elasticity of reported revenue, but show that cost adjustment estimates are robust to a wide range of elasticity values since real production incentives are very small around the kink. We can explore the fact that the exemption threshold for the minimum tax in Honduras introduces a notch in the tax schedule that allows us to estimate the elasticity of revenue and use that to pin down an evasion response.

[4] Slemrod (2013) discusses in detail the use of notches and their implications for welfare. Kanbur & Keen (2014); Keen & Mintz (2004); Bigio & Zilberman (2011) discuss optimal enforcement thresholds.

introduced in Honduras, considering that previously firms were taxed on profits. We estimate that the reform increased tax revenues by up to 30%, but at the cost of reducing aggregate corporate profits by 10% due to larger tax liability and production distortions. We also show the very stark incentives created by the tax notch: firms bunching below the L10 million threshold are able to reduce their tax liabilities by 80%, even though in aggregate the revenue loss from their behavior is less than 1%. We additionally present different scenarios in which the minimum tax rate and/or the revenue eligibility threshold change and assess their impacts on tax revenue and profits.

Our second scenario considers a potentially simpler policy change to increase tax revenue from large taxpayers: an increase in the *average* profit tax rate faced by corporations declaring gross revenue above the L10 million threshold[5]. This policy also creates a notch and incentivizes some firms to bunch below the exemption threshold. Contrary to revenue taxation under a minimum tax, however, here the incentives to misreport are exacerbated: firms will over-report costs even more to reduce taxable income, although production efficiency is preserved. We show that to collect the same amount of revenue as in the minimum tax regime would require an average tax rate of 40%, 15 p.p. higher than the tax rate below the threshold. While production is not distorted under the increased profit tax rate, aggregate profits fall by 20% in this scenario driven by increased evasion related losses.

Given the stark losses faced by owners of capital in the previous scenarios, our third exercise consists in simulating tax systems in which the government varies the share of costs that can be deducted and the tax rate applied to the resulting taxable income base (Bachas & Soto, 2018; Best et al., 2015). Our results highlight the intuition that, starting from a non-distortionary system where only pure profits are taxed, allowing some degree of production distortion might generate welfare gains by decreasing evasion costs incurred by firms[6]. We show that for any deduction level smaller than 85% the tax authority can increase tax revenue between 8-10% without losses in aggregate profits.

Two caveats about our results should be taken into account. First, we do not attempt to estimate who bears the incidence of corporate taxes (Auerbach, 2005; Bastani & Waldenström, 2020). While the classic result of Harberger (1962) is that capital owners economy-wide bear the full incidence of corporate taxation in a closed economy, recent empirical evidence suggests that a substantial share of the tax burden is also borne by workers (Suárez Serrato & Zidar, 2016; Fuest et al., 2018). For those reasons we also do not discuss any possible redistribution motives from the minimum tax reform, since such

[5]Tax schedules with increasing average rates across the size distribution are not uncommon in the developing world, as exemplified by Bachas & Soto (2018) in Costa Rica and Kleven & Waseem (2013) in Pakistan.

[6]As Bachas & Soto (2018) and Best et al. (2015), we refer to welfare gains considering scenarios in which aggregate profits do not fall but government revenues increase. The assumption that evasion costs are true social costs is crucial to our results (Chetty, 2009).

exercises would require attributing incidence. Second, our model of firm optimization and our simulations do not consider general equilibrium effects of a broader tax base. Limiting cost deduction not only distorts firm size directly, but also cascades down production networks and distorts input prices and the size of downstream firms. Best et al. (2015) develop a general equilibrium model and show that introducing some degree of production inefficiency is still optimal when enforcement is imperfect.

This paper provides several contributions to the public finance and development literatures. First, it provides new evidence that complements previous findings about minimum taxes in Pakistan (Best et al., 2015), Hungary (Mosberger, 2016) and Guatemala (Alejos, 2018). Unlike previous studies, the specific design of the minimum tax in Honduras, including a revenue-based exemption threshold, allows us to estimate the elasticity of reported revenue for corporations, a key behavioral parameter to understand the impact of minimum taxes. We also credibly document and quantify tax evasion for large corporations under the profit taxation regime, driven by over-reporting deductions. Estimates of tax evasion for registered taxpayers are particularly absent for lower-income countries where broad, randomized tax audits are rare[7].

Second, our work provides new evidence on tax evasion in developing countries using administrative data. Londoño-Vélez & Ávila Mahecha (2019) document substantial evasion of a wealth tax in Colombia, highlighting the use of offshore accounts and of harder-to-observe wealth components as a relevant mechanism. We construct a measure of revenue observability for each firm, using third-party information available to the tax authority, and show that firms bunch less below the exemption threshold when revenue is more readily observable. Our rich administrative data allows to build on the work of Almunia & Lopez-Rodriguez (2018), which perform a similar exercise using input-output tables at the sectoral level. By documenting that availability of third-party information reduces bunching below the exemption threshold, our paper reinforces the idea that evasion responses are not fundamental primitives that govern firms' behavior, but are to some degree sensitive to the enforcement context (Fack & Landais, 2016; Slemrod & Kopczuk, 2002; Basri et al., 2019). This is consistent with other recent evidence that investment in tax authorities' capacity might generate large gains in revenue by curbing evasion (Congressional Budget Office, 2020; Sarin & Summers, 2020; Johannesen et al., 2020; International Monetary Fund, 2015).

Finally, we contribute to the growing literature on bunching methodologies that use discontinuities in the tax design to identify structural parameters (see Kleven (2016) for a recent review). While there exists extensive research on how individuals react to discontinuities in the tax schedule (Saez, 2010; Bastani & Selin, 2014; Kleven & Waseem,

[7] Trigueros, Longinotti, & Vecorena (2012) document that only nine out of eighteen surveyed countries in Latin America have any estimate of evasion available, for any kind of tax. Our estimates for Honduras refer to tax evasion by large corporations filing income tax and do not consider other margins such as non-registration or non-declaration.

2013), we contribute to the more limited literature on how corporations respond to these incentives, similarly to the work of Bachas & Soto (2018) in Costa Rica and Devereux, Liu, & Loretz (2014) in the United Kingdom.

The rest of the paper is organized as follows. In Section 2 we present the context of corporate taxation in Honduras, discuss in detail the minimum tax provisions and describe our sample. In section 3 we present a model of profit maximization by firms that illustrates how we can expect corporations to react when faced with the introduction of a minimum tax. In Section 4 we first present non-parametric evidence of corporate behavior under the minimum tax and then show how this evidence can be used to recover structural parameters of interest. We provide robustness exercises that strengthen our argument that we identify responses to the minimum tax in section 5. In section 6 we present a calibrated model of the decision of firms and simulate the impact of alternative tax systems. We conclude in section 7.

2 Institutional Context and Data

We study a reform that introduced a minimum tax on corporations in Honduras, a lower middle-income country in Central America with a population of 9 million and per capita GDP of $5,800 PPP in 2018. The level and composition of government tax revenues in Honduras is comparable to other countries with similar per capita income. First, total tax revenues represent around 18% of GDP, significantly below the average of 25% observed in high income OECD countries[8]. Second, the country is much more reliant on goods and services taxes, representing over 50% of total tax revenue, than on income taxes, which amount to one-third of total tax revenue. Finally, corporate income taxes are equivalent to 4% of GDP, almost twice as much as personal income taxes (International Monetary Fund, 2018). These last two facts are broadly consistent with the perception that lower income countries face significant informational constraints in assessing more complex tax liabilities and therefore rely more on broader sales taxes and/or taxing large corporations (Gordon & Li, 2009)[9]. Recent years have witnessed significant efforts to improve tax collection capacity in the country, including a broad overhaul of the tax authority agency

[8]These numbers refer exclusively to taxes and exclude important revenue components such as social security contributions. Considering total revenue, the OECD average revenue-to-GDP ratio is 35% while in Honduras it stays close to 20%, making the gap even starker.

[9]Figure A1 illustrate how Honduras compares to other countries in terms of overall and corporate income tax collection. While total tax collection as share of GDP is very much in line with the average value for countries with similar per capita income, Honduras is more reliant on corporate income taxes.

in 2015[10]. Since then the number of income tax filers has doubled (from 74,000 to almost 150,000) and the share of electronic declarations has increased by 16 percentage points to 81%.

Non-incorporated taxpayers (*Personas Naturales*) are approximately 80% of the total number of income tax filers and face a progressive tax schedule on labor income[11]. Corporations (*Personas Jurídicas*), on the other hand, face a 25% flat tax rate on taxable income, defined as gross revenues minus standard deductions such as wages, raw materials, depreciation of capital, interests paid and carryover losses[12]. Fiscal years in Honduras run according to the calendar year and taxpayers must file the income tax declaration by April 30th.

The minimum tax studied in this paper was introduced in 2014 as part of the broader "Public Finance Management, Exemptions' Control and Anti-Evasion Measures" tax law[13]. The two main features of the minimum tax are as follows. First, it exempts taxpayers reporting gross revenue below L10 million[14], which are still liable for a 25% rate on declared taxable income. Second, taxpayers reporting gross revenue above L10 million are liable for a minimum of 1.5% of their reported revenue. When filing the yearly income tax declaration, corporations must compute their tax liability under the usual profit regime and the 1.5% regime, and are liable for the largest of the two. Since profits are taxed at 25%, a taxpayer declaring 6% profit margin (reported profits divided by gross revenue) will face a tax liability equivalent to 25%*6% = 1.5% of gross revenues and will be located exactly at the edge between the two regimes.

The immediate objective of the minimum tax was to create a floor to the effective tax rate (tax liability divided by gross revenue) faced by large taxpayers: regardless of declared profits, corporations with revenue above L10 million should pay no less than 1.5% of their declared gross revenues in taxes. In Figure 1, panel A, we present evidence

[10]Starting in 2013, the government of Honduras restructured several public institutions under the oversight of the "Centralized and Decentralized Public Administration Reform Commission". The reform of the tax authority (formerly known as DEI, *Dirección Ejecutiva de Impuestos*) was led by the Interamerican Development Bank (IDB). The diagnostic before the reform was that "most administrative and technical staff do not have the basic profiles or training levels required for managing tax administration properly." (Interamerican Development Bank, 2015). Other shortcomings described were similar to what International Monetary Fund (2015) identifies as key challenges to tax administration in many countries: high turnover of senior staff, lack of IT personnel and infrastructure, and lack of professional development. Over 1,500 workers were dismissed and new hires were performed by an international, independent human resources firm.

[11]The progressive tax schedule is updated yearly to account for inflation and includes four brackets with increasing marginal tax rates. In FY2019, income below L158,995 (approximately USD 6,400) was exempt and amounts above that face increasing marginal rates of 15%, 20% and 25%. Income from other sources such as dividends, interest and capital gains are taxed at a 10% flat rate.

[12]Throughout the paper we use the terms "taxable income" and "profits" interchangeably, always referring to the base taxed at 25%.

[13]The 2014 tax law also increased VAT rates from 12% to 15%, made permanent a surcharge of 5% on taxable income above L1 million and introduced a 10% tax on dividends received by residents.

[14]Approximately USD 400,000 using the average market exchange rate in 2018 (USD 1 = L24.5). This is the exchange rate used throughout the paper when mentioning US dollar amounts.

that the policy substantially raised the effective rate faced by large corporations.

In the period 2011-2013, before the minimum tax was in place, the median effective rate faced by firms with gross revenue around L10 million was approximately 0.5%. Between 2014 and 2017, when the minimum tax is in place for firms declaring revenue above L10 million, the median effective rate substantially changes around the threshold. Firms declaring gross revenues below that level still face an effective rate close to 0.5%. Corporations with revenue above L10 million, however, are now subject to the minimum tax and the median firm faces an effective rate of exactly 1.5%[15]. The figure also illustrates the *notch* generated by the minimum tax: by declaring gross revenue marginally above L10 million firms face a discontinuous increase in their tax liability. While in panel A we focus on corporations around the exemption threshold, in panel B we document that the policy was effective in increasing the median effective rate for all firms declaring gross revenue well above the threshold.

The increase in effective tax rate for firms above the exemption threshold is driven by firms that declare low profit margins but no longer pay very small tax liabilities. We illustrate that fact in Figure 2, where we plot effective tax rates for firms declaring different profit margins[16]. In the period 2011-2013, before the introduction of the minimum tax, the relationship between declared profit margin and tax liability is approximately linear for all profit margin levels. With the introduction of the minimum tax, however, the relationship between profitability and tax liability changes for firms with profit margins below 6%, which face a minimum tax liability equivalent to 1.5% of their gross revenue. For those firms, the incentive to declare lower profits in order to reduce their tax liability disappears. The figure also illustrates that the policy introduces a *kink* in the budget set of taxpayers exactly at the 6% threshold, with a change in the slope of the tax schedule.

Three special provisions of the minimum tax law are worth discussing in more detail. First, taxpayers in certain sectors (cement, state enterprises, pharmaceuticals and bakery) face a 0.75% rate instead of 1.5%. Firms in those sectors are less than 2% of taxpayers, so we exclude them from our main analysis and present separate results showing their behavior is also consistent with predictions from theory. Second, we also exclude from our main analyses firms operating in petroleum-related sectors and those in their first two years of operations, which are exempt from the minimum tax[17]. As discussed below, the number of corporations filing taxes is rapidly increasing in the period of study and "young" firms represent up to 25% of taxpayers in some years. Nonetheless, they are predominantly small, with declared gross revenue well below the exemption threshold.

[15] Figure A3 shows a similar pattern when plotting the average instead of median effective rate.

[16] The sample is restricted to firms declaring gross revenue above L13 million and therefore inframarginal to the bunching behavior below L10 million

[17] Both exemptions in the first years of operation and lower rate for sectors such as pharmaceuticals are common features of minimum tax regimes across the world. We provide a summary of minimum tax provisions in several countries in Appendix G.

Finally, firms declaring losses are also exempt from the minimum tax. This feature is potentially relevant to our empirical exercises, since that might create strong incentives for low profit firms to report negative results. In practice, however, this behavior is very limited due to the existence of a net asset tax that also applies to firms reporting losses. In Appendix F, we discuss the net asset tax in more detail and show that the introduction of the minimum tax seems to overwhelmingly affect firms that otherwise would be paying taxes on profit, not on their net assets.

Despite being part of a larger tax reform, the minimum tax provision was highly salient and widely debated in the public sphere. A previous attempt to institute a 1% minimum tax in 2011 was ruled unconstitutional by the Supreme Court and never went into effect. The 2014 reform was again challenged in the courts but eventually upheld as constitutional in 2015, and stayed in place until FY2017. In the aftermath of highly contested elections in that year, the government approved a series of policy reforms that included the gradual phasing out of the minimum tax provision. For FY2018, the exemption threshold was raised from L10 million to L300 million. While approximately 20% of corporations declared gross revenue above L10 million before the introduction of the minimum tax, only 1.3% declared revenues above L300 in 2017. The law additionally established further increases in the exemption threshold to L600 million in FY2019 and L1 billion in FY2020, meaning that very few corporations would be affected by the minimum tax at the end of this period (International Monetary Fund, 2018).

2.1 Data and descriptive statistics

The main analyses in this paper are based on administrative data comprising the universe of income tax declarations from corporations in the 2011-2018 period. We supplement this data, in additional exercises, with monthly VAT declarations and third-party information on taxpayers' transactions. Electronic filing by corporations has steadily increased in the period, from less than 60% of total declarations in 2011 to almost 85% in 2018[18]. Throughout the paper, we exclude taxpayers in special regimes that exonerate them from paying any income taxes[19]. The resulting dataset is an unbalanced panel of over 180,000 firm-year observations and approximately 41,000 unique firms.

We present basic descriptive statistics of our sample in Table 1 for years 2013-2018, highlighting the following facts. First, the number of corporations filing income tax has steadily increased throughout the period, from less than 20,000 in 2013 to approximately 30,000 in 2018. While in our main estimates we use an unbalanced panel of taxpayers,

[18]Our dataset encompasses declarations using three type of forms: DEI-350 was an electronic form discontinued in 2015, when the more detailed SAR-357 was introduced. Throughout the period, taxpayers could also use a paper form (SAR-352) which provides less detailed information on both revenues and deductions.

[19]Approximately 3-5% of corporations in each period, mostly export-oriented manufacturing firms.

we show that firm's responses to the minimum tax are qualitatively similar in a balanced panel of corporations that file every year. Second, average reported gross revenue was around L30 million (USD 1.2 million) but with wide dispersion: the median corporation in the sample had yearly gross revenues of L1.2 million (USD 48,000) and over 80% reported revenues below L10 million. Third, average pre-tax profit margins steadily increase throughout the period, from less than 2% in 2013 to almost 5% in 2018. As discussed below, part of this increase is likely explained by the introduction of the minimum tax, which induced a decrease in claimed deductions and consequent increase in reported profits for large corporations. Despite that, average profit margins are always well below 6%, meaning that the average tax liability under profit taxation is less than 1.5% of gross revenues. Fourth, even though the minimum tax is not directly aimed at multinational corporations (MNC) operating in the country, these are disproportionately large and thus potentially affected by the policy: even though MNCs represent only 2-4% of corporate filers, they pay approximately 60% of taxes[20]. Finally, even though only a small fraction of firms end up liable for minimum taxes (between 6-8% in 2014-2017), they contribute 20-30% of total corporate tax revenues. Indeed, despite the number of firms liable for minimum taxes falling by an order of magnitude in 2018, when the exemption threshold increased, their contribution to total corporate tax revenues was still close to 15%.

In order to illustrate the relevance of the largest corporations to tax collection, we present in Table 2 the share of total revenue and taxes declared by the largest taxpayers. In 2013, before the introduction of the minimum tax provision, the largest twenty corporations in terms of gross declared revenue (top 0.1%) declared almost 30% of total revenues and accounted for 32% of total corporate taxes. Almost 70% of taxes were generated by the top 1% corporations and the top 10% (approximately 2,000 firms) paid more than 90% of taxes[21]. This skewness in the distribution of firm size highlights the potential of the minimum tax to significantly increase revenue collection despite exempting approximately 80% of firms.

[20]Multinational corporations are defined as firms filing transfer price declarations at some point in the period 2014-2017. The potential for the minimum tax to increase tax collection from MNCs depend not only on their gross revenues but also on their profit margin in the absence of minimum taxation. In Figure A2 we show that large MNCs declare higher profit margins than domestic firms in 2013, but still only 30% declare margins above 6%, implying an effective tax rate above 1.5%.

[21]This is similar to what Devereux et al. (2014) report for corporations in the United Kingdom (top 1% account for 80% of corporate income taxes) and Almunia & Lopez-Rodriguez (2018) report for Spain (top 2% report 80% taxable profits.). In the United States, Auerbach (2005) mentions that the largest 0.04% corporations in terms of assets account for 62% of all corporate income tax in 2001. In a more similar context, Bachas & Soto (2018) document that the largest 20% corporations account for 87% of corporate taxes, which is a substantially smaller share than in Honduras.

3 Conceptual framework

3.1 Model of firm optimization

In this section we present a stylized model of profit maximization by firms in line with the classical approach of Allingham & Sandmo (1972) and adapted by Best et al. (2015) to illustrate the incentives introduced by a minimum tax and motivate the empirical exercises that follow. Firms choose a production level y and the level of costs $\hat{c}$ reported to the tax authority, which might be higher than true costs of production given by an increasing and convex function $c(y)$[22]. Firms face an increasing and convex loss in the amount of cost misreported given by $g\Big(\hat{c} - c(y)\Big)$, with $g(0) = 0$[23]. Since a regime with a minimum tax allows for both profit and revenue taxation, we model the possibility that only a share $\mu \in [0, 1]$ of costs can be deducted to obtain the taxable income, taxed at rate τ. Firms then choose the vector $(\hat{c}, y)$ to maximize after-tax profits:

$$\underset{(\hat{c},y)}{Max} \quad \Pi(\hat{c}, y) = y - c(y) - \tau\Big(y - \mu\hat{c}\Big) - g\Big(\hat{c} - c(y)\Big) \tag{1}$$

Under a linear tax schedule, first-order conditions are:

$$g'\Big(\hat{c} - c(y)\Big) = \tau\mu \tag{2}$$

$$c'(y) = \frac{1-\tau}{1-\tau\mu} = 1 - \tau\frac{1-\mu}{1-\tau\mu} = 1 - \tau_E \tag{3}$$

When choosing how much costs/deductions to report, firms equalize the marginal cost of misreporting deductions to the marginal benefit $\tau\mu$ (not paying tax rate τ on share μ of marginal reported cost). Similarly, the level of production is obtained by equalizing the marginal benefit of producing one extra unit of output $1 - \tau$ to the marginal cost $c'(y)(1 - \tau\mu)$, which crucially depends on how much of costs can be deducted to obtain taxable income. We re-write Equation 3 so that firms equalize the marginal cost of production to $1 - \tau_E$, the net-of-tax benefit of marginally increasing production.

Under a pure profit taxation regime, when all production costs can be deducted ($\mu = 1$), we have that $\tau_E = 0$ and $c'(y^*) = 1$: taxes on pure profits are non-distortionary and firms choose the efficient level of production. In the other extreme, when $\mu = 0$ firms pay taxes on their gross revenue and $\tau_E = \tau$ and $c'(y_r) = 1 - \tau \implies y_r \leq y^*$. That is, firms are sub-optimally small since the marginal benefit of an extra unit of revenue is $1 - \tau$. For any interior value of $\mu \in (0, 1)$, production levels will be below optimal.

While taxing a broader base than profits induce distortions in productions levels, the opposite is true for evasion levels: under revenue taxation Equation 2 becomes $g'\Big(\hat{c} -$

[22] We assume output prices are fixed and equal to p = 1, so we can express revenue equal to production.

[23] In our stylized model we consider that firms can only misreport costs and not revenues. This is a simplifying assumption we make to illustrate the idea that it is easier to misreport costs than revenue.

$c(y)\Big) = 0$ and then $\hat{c} = c(y)$. When costs are not deductible, firms have no incentive to misreport and so report truthfully. Increases in costs deductibility μ induce firms to increase their reported costs in order to reduce tax liability, but also produce misreporting losses[24].

3.2 Incentives under the minimum tax

Informed by the model, we now discuss the change in incentives faced by firms that were initially subject to a 25% flat rate on profit and see the introduction of a minimum tax. We can write the tax liability faced by firms as

$$T(y, \hat{c}) = \begin{cases} 0.25 * \Big(y - \hat{c}\Big), & \text{if } y < 10,000,000 \\ Max\{0.25 * \Big(y - \hat{c}\Big), 0.015 * y\}, & \text{if } y \geq 10,000,000 \end{cases} \tag{4}$$

Consider first firms with gross revenue significantly above L10 million and therefore not exempt from the minimum tax. From the expression above, the tax liability under profit and revenue taxation will be the same whenever the declared profit margin $(y-\hat{c})/y$ is equal to $0.015/0.25 = 6\%$. Corporations which in the absence of the minimum tax would have reported profit margins above 6% have no incentive to change their behavior: their liability under profit taxation is still larger than 1.5% of their revenues, so they effectively do not face a different regime. Firms which declare positive profit margins below 6%, on the other hand, now face a tax of 1.5% on their gross revenues instead of 25% on declared taxable income. According to the model discussed, this induces changes in two dimensions. First, production decisions are now distorted (since $\tau_E = 0.015$) and firms will reduce production/revenues. Under the assumption of decreasing returns to scale, that effect will lead to an increase in firms' profit margins (Best et al., 2015). Second, under revenue taxation firms will not over-report costs, since misreporting entails losses but no longer provides the benefit of reducing tax liability. Both effects will cause the pre-tax profit margin distribution to shift right. Since taxpayers reporting profit margins above 6% are not affected, only the distribution below 6% is shifted and we should observe an excess mass around that threshold.

Consider now the incentives faced by firms that, absent the minimum tax, would have declared gross revenue slightly above the L10 million exemption threshold. Just as discussed above, firms that would have declared profit margins above 6% face no change in incentives and will still choose the same revenue and declared cost levels as they would under pure profit taxation. Low profit firms, however, now face a different decision. They

[24] Importantly for welfare evaluation, we interpret these evasion losses as social losses, such as the costs of keeping parallel accounting systems or avoiding entering certain economic transactions that might reveal true costs. As discussed by Chetty (2009), implications for welfare analysis differ if evasion costs are actually seen as transfer between agents (fines paid to the government, for example) or if perceived costs are different from actual costs.

might declare gross revenue above L10 million and adjust their production and evasion decisions in response to the 1.5% minimum tax liability. But they might also decide to decrease revenue to slightly below L10 million so that they are exempt from the minimum tax and pay the profit tax. Unlike notches generated by wealth (Londoño-Vélez & Ávila Mahecha, 2019) or gross income taxes (Kleven & Waseem, 2013), where all taxpayers above the notch see their liability discontinuously increase, in our setting only a subset of taxpayers are affected by the notch (Bachas & Soto, 2018). The benefit of declaring revenue below the exemption threshold, i.e., of bunching, is inversely proportional to the profit margin that would be declared in the absence of the minimum tax.

To see that, consider the profits of a hypothetical taxpayer that must decide between choosing a production level marginally below the exemption threshold (bunching) y^T and reporting cost $\hat{c}$, or producing y_0 above the threshold, reporting true costs $\hat{c}_0 = c(y_0)$ and paying the minimum tax:

$$\Pi(y^T, \hat{c}|Bunch) = y^T - \tau_\pi\Big(y^T - \hat{c}\Big) - c(y^T) - g\Big(\hat{c} - c(y^T)\Big) \tag{5}$$

$$\Pi(y_0, \hat{c}_0|NotBunch) = y_0 - \tau_y y_0 - c(y_0) - \underbrace{g\Big(\hat{c}_0 - c(y_0)\Big)}_{=0} \tag{6}$$

in which the term of cost misreporting will be zero since staying above the threshold means being taxed on revenue, so there is no incentive to overreport costs.

The gains from deciding to bunch can therefore be written as

$$Bunching\ Gains \approx \underbrace{(y^T - y_0)}_{\leq 0} - \underbrace{\Big(c(y^T) - c(y_0)\Big)}_{\leq 0} - \underbrace{(\tau_\pi y^T - \tau_y y_0)}_{\geq 0} + \tau_\pi \hat{c} - g\Big(\hat{c} - c(y)\Big) \tag{7}$$

The expression above breaks down the change in profits when deciding to bunch. The first two terms capture the fact that, when bunching, firms will reduce real output, therefore losing revenue, but also reducing costs. The third term captures the fact that bunching means paying a much larger tax rate on gross reported revenues (25% vs. 1.5%), while the fourth term captures the main benefit of bunching: the opportunity to deduct 25% of all reported costs when being taxed on profits instead of revenue. This highlights the fact that the incentive to bunch is directly proportional to costs: for any given level of revenues, firms with higher costs have a stronger incentive to bunch since they will be able to deduct those costs from their tax base when bunching[25]. The fifth term captures the negative effects for the firm in misreporting costs, which is increasing in the distance between true and reported costs.

[25]As discussed in section 2, firms reporting negative profits are not liable for the minimum tax. Incentives to bunch are therefore largest for firms with high costs but positive profits, and turn to zero when firms incur losses.

4 Empirical results

We start this section providing non-parametric evidence that taxpayers responded to the introduction of the minimum tax in a manner consistent with the model described above. We then proceed to explore these behavioral responses in order to recover structural parameters of interest.

4.1 Evidence of behavioral responses

We start presenting evidence that, consistent with the simple model outlined previously, taxpayers responded to the existence of the exemption threshold by reporting gross revenue immediately below L10 million. In Figure 3, we present the empirical densities of reported gross revenues separately for three periods: 2011-2013, before the introduction of the minimum tax; 2014-2017, when the policy was in place with a L10 million exemption threshold; and 2018, when the exemption threshold was increased to L300 million. It is clear that, in the absence of the notch created by the minimum tax, the distribution of reported revenue is smooth throughout the interval. In the period when the minimum schedule creates a notch at L10 million, however, corporations respond by adjusting their reported revenue to slightly below the threshold: there is a clear excess mass of firms in that region, and a more diffuse absence of mass slightly above. Consistent with the theory presented previously, there is no "hole" in the distribution immediately above the L10 million notch, since the minimum 1.5% effective rate is not binding for firms with high enough profit margin[26]. Furthermore, we highlight that the bunching in reported gross revenue might be driven by real production responses, by under reporting real revenue or by a mix of the two. We return to this issue below and provide evidence that at least part of this behavior is driven by misreporting.

While firms immediately to the right of the notch have a strong incentive to bunch at the L10 million threshold, firms that would have reported much larger revenue are infra-marginal to this bunching behavior. As discussed above, the introduction of the minimum tax leads affected firms to decrease evasion through misreporting and decrease scale, increasing reported profit margins. Since only firms otherwise declaring profit margins below 6% are affected we should observe an excess mass of firms exactly at the kink. In practice we often observe a diffuse mass in the vicinity of the kink (Saez, 2010). In Figure 4, Panel A, we present the empirical density of reported profit margin for firms declaring revenue above L13 million, and therefore infra-marginal to the bunching behavior at the notch, separately for 2011-2013 and 2014-2017. In the period before

[26]As discussed by Kleven & Waseem (2013) and Gelber, Jones, & Sacks (2020), among others, some firms might not respond to the incentives to bunch due to inattention, high adjustment costs or some combination of other frictions. We discuss below how we interpret the existence of such taxpayers in our elasticity estimates.

the introduction of the minimum tax, we observe a steep negative slope in the density of profits, smoothly distributed around the 6% kink. With the introduction of the minimum taxation in 2014, the distribution becomes starkly different as predicted by theory: there is much less mass around positive but close to zero profit margins and firms bunch around the 6% kink.

While in Panel A of Figure 4 we illustrate the change in profit margin density before and after the introduction of the minimum tax, in panel B we present empirical densities for the period 2014-2017, while the minimum tax was in place, separately for firms with reported revenue significantly below and above the L10 million exemption threshold. The pattern is remarkably similar to Panel A: firms declaring revenue below the exemption threshold, and therefore unaffected by the minimum tax, are much more likely to declare low profit margins, while those under the minimum tax regime declare higher profit margins and bunch at the 6% kink. We interpret these differences in reported profit margin as evidence that corporations over-report costs under profit taxation to evade taxes, and adjust their behavior when taxed on revenues.

The previous set of figures are strong evidence that the minimum tax was a highly salient policy change that induced taxpayer behavioral responses. In the remaining of this section we explore how these responses can be used to identify parameters of interest.

4.2 Revenue elasticity at the L10 million notch

In order to translate the observed behavioral responses presented above into estimates of parameters underlying firms' behavior we use tools from the bunching literature. The core insight developed by Saez (2010) is that non-linearities in the tax schedule faced by taxpayers will generate bunching, the amount of which is proportional to the elasticities governing taxpayers' behavior. Our first step is then estimating the counterfactual distribution that would have prevailed in the absence of these discontinuities, so that we can obtain an estimate of the excess bunching and relate that to underlying behavior.

We first discuss how the bunching in response to the L10 million threshold can be used to estimate the elasticity of reported revenue. As previously shown, the exemption threshold generates a notch, where tax liability discontinuously changes for some taxpayers. According to our model, firms deciding to locate exactly at the notch (bunchers) come from a continuous region $[y^T, y^T + \Delta Y]$, where $y^T = L10$ million.

To recover the counterfactual gross revenue density, we fit a polynomial regression to the empirical density of revenue, including dummies for the "excluded region" - the area around the notch affected by the policy (Saez, 2010; Chetty, Friedman, Olsen, & Pistaferri, 2011). We then predict the counterfactual density for the entire distribution ignoring the dummies, extrapolating the polynomial prediction to the bunching area and assuring a smooth counterfactual distribution around the notch[27].

We first collapse the data in bins of L100,000 (USD 4,080) of revenue and estimate[28]:

$$n_j = \sum_{k=0}^{5} \beta_k y_j^k + \sum_{b=y_L}^{y_H} \gamma_b \mathbb{1}\{y_j = b\} + \epsilon_j \tag{8}$$

where n_j is the number of observations in bin j, y_j are the revenue midpoint of bin j, $[y_L, y_H]$ is the excluded region affected by the notch and $\mathbb{1}\{y_j = b\}$ are dummies indicating that bin j belongs to the excluded region.

The predicted counterfactual density is defined as $\hat{n}_j = \sum_{k=0}^{5} \hat{\beta}_k y_j^k$. We can then obtain the excess mass of taxpayers below the threshold as the difference between the empirical and predicted densities $\hat{B} = \sum_{b=y_L}^{y_N} (n_j - \hat{n}_j)$, where y_N is the bin with upper bound equal to the notch.

The credible estimation of the counterfactual density requires the excluded region to be correctly determined - all those bins affected by the existence of the notch/kink in the tax schedule should not be used to estimate the counterfactual density. We follow the method pioneered by Kleven & Waseem (2013) when taxpayers face notches: while the lower bound of bunching is visually determined, we use the convergence method to obtain an upper bound for the affected region. We exploit the fact that, according to our model, the excess mass observed immediately below the notch ($\hat{B}$) must be equal to the missing mass above $\left(\hat{M} = \sum_{b=y_N}^{y_u} (n_j - \hat{n}_j)\right)$, so we recursively estimate Equation 8 increasing the upper bound y_H until $\hat{B} \approx \hat{M}$[29], at which point we determine that to be the upper bound.

Empirical revenue densities for each year and estimated counterfactual densities are presented in Figure 5. In each figure we provide estimates of the total excess number of firms (B), the excess mass of firms as a share of average density in the bunching region (b), the upper bound of the bunching region estimated using the convergence method (y_u) and the number of underlying observations used in each graph (N)[30]. At each year between 2014 - 2017, we estimate an excess between 80 and 150 taxpayers around the cutoff - between four and six times as many firms as the average counterfactual density in the bunching region. The estimated upper bound using the convergence method varies

[27] The assumption of a smooth distribution is not a trivial one, as pointed by Blomquist & Newey (2017) and Bertanha et al. (2018). In particular, they show that kinks cannot identify the elasticity of taxable income if we allow for unrestricted heterogeneity of preferences. In our setting, we can partially alleviate concerns about the counterfactual density by showing, as we do in Figure 3, that the density was indeed smooth around the threshold before and after the existence of the notch.

[28] Our baseline specification uses a fifth-order polynomial on revenue. We present robustness exercises to that choice in the appendix.

[29] Since we estimate the regression using discrete bins, we determine $\hat{B} \approx \hat{M}$ to mean that $|(\hat{B} - \hat{M})/\hat{B}| \leq 0.03$.

[30] Standard errors are obtained by bootstrapping the entire estimating procedure, resampling errors from Equation 8 500 times.

from L11.4 million in 2016/2017 to L13 million in 2015. In Figure 6 we provide estimates pooling all corporate filings in the 2014-2017 period, providing us with a larger sample. Our estimates indicate that the excess mass below the notch is equivalent to 5.5 times the predicted counterfactual density and that the marginal buncher would have reported gross revenue of L11.8 million in the absence of the notch, effectively reducing their declared revenue by over 15% in order to avoid the minimum tax. The results for each year and for the pooled sample are presented in columns (1) - (4) of Table 3.

In order to recover the elasticity of reported revenue from the behavioral responses estimated above, we adapt the reduced-form approximation developed by Kleven & Waseem (2013). We can show that, for a given revenue response ΔY by the marginal buncher, the elasticity of reported revenue is given by[31]:

$$\epsilon_{y,(1-t)} = \left(\frac{1}{\tau_y \left(2 + \frac{\Delta Y}{Y^T}\right) - 2\tau_\pi \frac{(Y^T - \hat{c})}{Y^T}} \right) \left(\frac{\Delta Y}{Y^T} \right)^2 \tag{9}$$

Importantly, the estimated elasticity depends not only on the change in reported revenue, but also on the cost that would have been reported when bunching, since the tax base changes from gross revenue above the notch to reported profits below it.

We will compute lower and upper bounds on the true structure elasticity. The convergence method used to obtain the upper bound of the bunching region provides an estimate of the counterfactual revenue of the marginal buncher. Under the assumption of homogeneous elasticity across all taxpayers, the response of the marginal buncher allows us to recover the structural revenue elasticity. If elasticities are heterogeneous, however, the convergence method recovers the response of the taxpayer with higher elasticity (Kleven & Waseem, 2013; Londoño-Vélez & Ávila Mahecha, 2019). For that reason, we consider our estimate using that method as an upper bound on the true structural elasticity.

While the convergence method provides the revenue response of the marginal buncher, we still need the counterfactual cost to estimate the elasticity. Our model indicates the answer: since the marginal buncher is the taxpayer with strongest incentive to bunch and incentives are inversely proportional to the profit margin, the marginal buncher has close to zero profits. That allows us to set $Y^T - \hat{c} = 0$ in Equation 9 and write the reported revenue elasticity as a function of known policy parameters and the estimated revenue response of the marginal buncher:

$$\epsilon_{y,(1-\tau)} \approx \left(\frac{1}{\tau_y} \right) \left(\frac{1}{2 + \frac{\Delta Y}{Y^T}} \right) \left(\frac{\Delta Y}{Y^T} \right)^2 \tag{10}$$

We present results of the estimated upper bound of the elasticities in column (5)

[31] This approximation relies on the implicit marginal tax rate between the notch and the counterfactual revenue of the marginal buncher. We present the derivation of the formula in Appendix B.

of Table 3. The key quantity needed to obtain the upper bound estimate is the revenue response of the marginal buncher, estimated using the convergence method and presented in column (4). These estimates yield upper-bound revenue elasticities in the interval of $[0.6, 2.6]$. Estimates are particularly large in 2014 (1.3) and 2015 (2.6), when the upper bound of the bunching region is estimated to be above L12 million. Estimates for 2016 and 2017 are very similar (0.61) and smaller than our preferred estimate using the pooled sample ($\epsilon_y = 0.99$). We also note estimates are noisy, with very large standard errors[32].

We now turn to the estimation of the lower bound of the revenue elasticity. Our approach is similar to the "bunching-hole" method proposed by Kleven & Waseem (2013), but adapted to take into account the fact that bunching incentives depend on firms' profit margins (Bachas & Soto, 2018). We provide a brief description here and save details for Appendix C. Since the decision to bunch depends both on counterfactual revenue and costs, we can rewrite Equation 9 to find the counterfactual cost that would make a taxpayer indifferent between bunching or not, given a distance ΔY from the threshold and elasticity ϵ_y:

$$\hat{c}^* = Y^T\left(1 - \frac{\tau_y}{\tau_\pi}\right) - \frac{\tau_y}{\tau_\pi}\frac{\Delta Y}{2} + \frac{(\Delta Y)^2}{2\epsilon_y \tau_\pi Y^T} \tag{11}$$

Since the incentives to bunch are inversely related to profit margins, we know that if a taxpayer with revenue $Y^T + \Delta Y$ and cost $\hat{c}^*$ is indifferent to bunching, all taxpayers with lower profit margins should also bunch since they face even stronger incentives. If we knew the counterfactual profit margin distribution, we could compute the share of taxpayers bunching for each revenue bin, for a given elasticity, and compare the total amount of predicted bunching to our estimated excess mass below the notch. In order to implement that strategy, we need to make an assumption about the unobserved counterfactual profit margin distribution above the threshold. We assume the profit margin distribution for firms reporting revenue in the interval L6 - 8 million, significantly below the notch, is a good approximation for the unobserved distribution (Bachas & Soto, 2018)[33]. We then compute the estimated elasticity as the one generating a predicted amount of bunching equal to the excess mass observed below the notch, among a range of elasticity values[34].

One important caveat of the lower bound methodology is that we consider that all taxpayers that have an incentive to bunch will do so. There is ample evidence, nonetheless, that even when facing strictly dominated regions some taxpayers do not bunch (Kleven

[32]Standard errors are estimated by bootstrap and the empirical distribution of estimated elasticities is highly non-symmetrical: for the pooled sample where the point estimate is 0.99 the empirical 95% confidence interval is $[0.7, 5.7]$, meaning there is significant uncertainty on the upper bound of the estimate, but little on the lower bound. We present the histogram of our bootstrap estimates for the pooled sample in Figure A16.

[33]We show in Figure A17 that the profit margin distribution is similar for the L6 - 8 million and L10-12 million range in the period before the introduction of the minimum tax.

[34]We illustrate this procedure in Figure A18 for the pooled sample of taxpayers in 2014-2017.

& Waseem, 2013; Gelber et al., 2020). While notches often give rise to strictly dominated regions for all taxpayer and allow researchers to estimate optimization frictions, we show in Appendix D that is not the case with the exemption notch in Honduras. Since the size of the discontinuous change in tax liability depends on counterfactual profit margin, the existence and extent of dominated region also depends on the counterfactual profitability. While it is possible to make stronger assumptions, ruling out extreme preferences in order to estimate optimization frictions (Best, Cloyne, Ilzetzki, & Kleven, 2020), we abstain from doing so and consider our estimates to be lower bounds for the true reported revenue elasticity: the existence of optimization frictions require, all else equal, a larger elasticity to obtain the same amount of predicted bunching mass.

We present lower bound estimates for ϵ_y in column (6) of Table 3. Here estimated elasticities are both much lower and more stable across years, and likewise much more precise and statistically different from zero in every period. While the elasticity is lower (0.2) in 2014, when we observe significantly less bunching, for the period 2015-2017 and the pooled sample estimates lie tightly between 0.35 - 0.4.

We take results for the pooled sample as our preferred estimates, where we obtain a range for the reported revenue elasticity of $[0.35, 0.99]$[35]. These are substantially larger than the estimates obtained by Bachas & Soto (2018) for corporations in Costa Rica, for example, where the similar range using lower and upper bound estimates is $[0.08, 0.33]$. They are also much larger than estimates of individual earnings elasticities in Pakistan obtained by Kleven (2018), which mostly fall in the range $[0.05, 0.3]$[36]. Overall, our results suggest that, under the existing enforcement environment while the minimum tax was in place, the reported gross revenue of corporations was highly elastic, limiting to some extent the ability of the tax authority to increase revenues through higher tax rates.

4.3 Real or misreporting response at L10 million notch?

The observed response in declared gross revenues under the minimum tax could be due to real production decisions, to under reporting of realized revenues or to a mix of both. In this section we explore the evidence related to these possibilities.

We investigate whether the amount of bunching is related to the availability of third-party information (TPI) about the sales of taxpayers. Previous studies have documented much less bunching in response to change in marginal tax rates among wage-earners

[35]We perform robustness exercises for the estimated elasticity of reported revenue in Table A3, using different polynomial orders. For the lower bound elasticity, the estimate is unchanged using a higher order polynomial but somewhat larger (0.5 - 0.6) when using a lower order polynomial. Consistent with noisy estimates in our preferred specification, however, estimates for the upper bound vary significantly when using different polynomials, ranging from 1.6 to 6.

[36]The estimates in Kleven (2016) are also noisy when using the convergence method, and for one of the notch points the upper-bound elasticity is above unit. In the different context of wealth taxation, Londoño-Vélez & Ávila Mahecha (2019) reports wealth elasticities as large as 4 using the convergence method. We summarize these findings from the literature in Figure A4.

than among the self-employed (Saez, 2010) and also less evasion (measured by audits) for income with third-party information (Kleven, Knudsen, Kreiner, Pedersen, & Saez, 2011; Londoño-Vélez & Ávila Mahecha, 2019). We hypothesize that observing less bunching among taxpayers with high "revenue observability" is evidence in favor of misreporting as opposed to real production decisions.

Several transactions in which firms engage, such as selling to the government or exporting, generate third-party information: these sales are directly reported to the tax authority, allowing them to independently assess part of the revenue declared by taxpayers[37]. The availability of this information, nonetheless, is limited: overall less than 60% of corporations have any third-party information available, and even among larger firms declaring revenue above L5 million more than 15% are not covered at all. We use these reports to create a firm-level measure of revenue observability, defined as the share of self-declared revenue that is independently observed by the tax authority. Conditional on having any third-party information available, the median ratio between third-party informed and self-declared revenue is 25%[38].

In Figure 7, panel A, we plot the empirical density of revenue for the period 2015-2017 around the L10 million threshold separately for two groups: corporations for which some third-party information is available and those for which it is not. We observe bunching in both distributions, although there is slightly more mass below the threshold among those firms with no third-party information available. Since for a significant number of taxpayers the amount reported by third-parties is very small, we also repeat the exercise in panel B, now separating the sample in those above and below the (unconditional) median of revenue observability (15%). Here we observe a much sharper bunching behavior for firms with lower revenue observability, although excess mass is still clearly present for firms with higher degree of third-party coverage. We quantify these differences in panel A of Table 4. Whereas we estimate the excess mass at the notch for firms with above median revenue observability as four times the counterfactual density, for firms with below median observability we estimate seven times as much mass, and this difference is precisely estimated.

We provide additional evidence that bunching below the exemption threshold is driven by revenue misreporting by evaluating heterogeneity across industries. The availability of TPI varies systematically across industries given the nature of their economic activities.

[37]The tax authority has access to five sources of information on taxpayers' revenues. The most important one are sales to some large companies, which are mandated to report individual purchases as part of the credit system used for VAT. Credit and debit card operators also provide reports on sales as they are VAT withholding agents. All sales to the government and exports are also directly accessible to the tax authority. Finally, some other withholding activities by very large companies also generate information on sales of their suppliers. Data on third-party information is only consistently available since 2015 so we restrict our analysis to the period 2015-2017.

[38]One clear limitation for the availability of third-party information is the rule that determines which firms must provide detailed purchase reports on suppliers as part of the VAT credit system. We discuss that in the conclusion section.

Since the main source of third-party information is withholding through the VAT credit systems, revenues from firms in upstream sectors are more likely to be reported to the tax authority. On one extreme, the median corporation operating in construction or retail sees less than 15% of their total self-declared revenue being reported directly to the tax authority by third-parties. On the other, for the median firm in manufacturing or transportation sectors the revenue reported by third-parties amount to approximately 40% of their self-reported revenue. We then evaluate whether bunching at the sectoral level is systematically correlated with the degree of revenue observability in each industry, in the spirit of the analysis in Almunia & Lopez-Rodriguez (2018) but using firm-level data on revenue observability, allowing for a direct measure of the information set available for the tax authority on the revenue of taxpayers[39].

In panel B of Table 4 we present estimates of excess bunching at the notch, normalized by the predicted density at the threshold (column 2). First, we estimate large and precisely estimated excess bunching for firms in all industries. The amount of bunching, however, vary significantly across sectors: the excess mass ranges from 3.5 times the counterfactual density in manufacturing to approximately 8 times in agriculture and construction. To assess whether the amount of bunching is correlated with the availability of TPI, in Figure 8 we plot the estimated excess mass below the notch and the median revenue observability in each industry. We observe a strong negative correlation between the two measures: in industries where third-party reporting covers a larger share of firm's revenue much less bunching is observed immediately below the L10 million notch. Consider retail, where the majority of sales are to final customers and a low penetration of debit and credit cards means that only a small fraction of corporations' revenues are reported to the tax authority. The excess mass observed below the notch is seven times the predicted density, indicating a large amount of response to the incentives provided by the minimum tax. Manufacturing firms, on the other extreme, mostly supply to other firms and see a much larger share of their total sales directly informed to the tax authority. Here the excess mass at the notch is only half that observed among retail firms. While other factors might contribute to the observed negative correlation, we interpret this as further evidence that misreporting revenues plays a role in explaining the observed bunching below the exemption threshold[40].

[39] Almunia & Lopez-Rodriguez (2018) rely on input-output tables to compute the share of sales from each sector to final consumers.

[40] An alternative mechanism through which firms might report revenue exactly below the notch is re-timing the realization of revenues (Bachas & Soto, 2018). We do not find evidence in favor of that. In Figure A5 we use monthly VAT sales data and show that potential buncher, defined as firms reporting revenue between L9-10 million in 2014-2017, do not seem to systematically report lower sales at the end of the year when compared to firms reporting higher or lower revenue (panel A) nor when compare with firms reporting revenue in the same range in 2018.

4.4 Estimating evasion under profit taxation

We now turn to firms with gross revenue significantly above L10 million and therefore inframarginal to the bunching behavior below the notch. As documented above, the introduction of the minimum tax led to an increase in the reported profit margins and bunching around the 6% threshold, which separates the profit and revenue taxation regimes.

Let B be the excess mass of taxpayers locating around the threshold. These bunchers are coming from a continuous segment $[\Pi^T - \Delta\Pi, \Pi^T]$ below the kink: these are taxpayers that otherwise would have reported lower profit margins, but under revenue taxation increase their reported profit. The area where these bunchers come from is not empty, however, since the entire distribution shifts to the right as taxpayers declare higher profit margins.

Following a very similar approach as the one used above, our goal is again to estimate the counterfactual distribution and use it to obtain an estimate of excess bunching at the kink. We estimate a counterfactual distribution of profits using a polynomial regression akin to Equation 8 and obtain estimates of the excess mass of taxpayers located around the kink[41].

In Figure 9 we present the empirical and estimated counterfactual profit margin densities for each year in the period 2014-2017. Between 90 and 210 firms are estimated to bunch around the 6% profit kink each year, an excess mass equivalent to 3-6 times the average density in the interval. In Figure 10 we present results for the pooled sample, where we estimate a similar excess mass equivalent to 5.4 times the average counterfactual density around the kink. We present the same results in the first two columns of Table 5.

Starting from the estimated excess mass around the kink, we can recover the change in reported profit margin by the marginal buncher noting that the bunching mass B around the threshold can be expressed as:

$$B = \int_{\Pi^T - \Delta\Pi}^{\Pi^T} f_0(\Pi) d\Pi \approx \Delta\Pi f_0\left(\Pi^T\right) \implies \Delta\Pi \approx \frac{B}{f_0\left(\Pi^T\right)} \tag{12}$$

where $f_0(.)$ is the counterfactual profit margin density and the approximation assumes the density is constant on the bunching segment. Empirically, we estimate $f_0(\Pi^T)$ as the average predicted density in the bunching region, and use the estimated excess mass at the kink to obtain $\Delta\hat{\Pi} \approx \frac{\hat{B}}{\hat{f}_0(\Pi^T)}$.

We present results for the estimated change in profit margins in column (3) of Table 5. With the exception of 2014, when we observe less bunching, estimates for 2015-2017 and for the pooled sample are very similar: the marginal buncher increased declared

[41] We compute the number of taxpayers in bins 0.2 p.p. wide. Following the literature, we determine visually the lower and upper bounds of the bunching region.

profit margin between 0.9 - 1.1 percentage points, a narrow range of precisely estimated responses. To put it differently, the marginal buncher would have declared a profit margin of approximately 5% under profit taxation, when incentives to misreport are strong and production decisions are undistorted.

In order to interpret the magnitude of these changes in reported profit and separate the total effect between cost evasion and production decisions, we use the decomposition of reported profit margin response developed by Best et al. (2015). Totally differentiating the reported profit margin and considering the incentives of a taxpayer around the kink yields:

$$\Delta\hat{\Pi} = \frac{\tau_y^2}{\tau_\pi}\epsilon_{y,(1-\tau)} - \frac{d(\hat{c} - c(y))}{y} \tag{13}$$

The main insight provided by the decomposition is that, since the tax rate on revenues is often very small (0.015 in the case of Honduras), even large revenue elasticities will only generate second-order effects on the change in reported profit margins. If we observe large increases in reported profit margin from the marginal buncher, therefore, changes in reported cost due to evasion incentives must be playing a large role. We illustrate that point in column (4) of Table 5, where we consider the implied revenue elasticity in a model where there is no cost evasion[42]. For all years and for the pooled sample, the implied elasticities under no cost evasion are implausibly high: with the exception of 2014 when the estimate is 6.7, the remaining elasticities of 10-12 are four times larger than our largest estimate in Table 3 and an order of magnitude higher than our preferred estimates, suggesting that cost evasion must be playing a significant role in explaining the observed response.

We present our estimates of cost misreporting in column (6). We use the upper bound elasticity $\epsilon_y = 0.99$ obtained for the pooled sample, so evasion estimates are a lower bound of the true evasion, and express evasion as a share of reported profits[43]. With the exception of 2014, where bunching is smaller, in the period 2015-2017 and using the pooled data we estimate that cost misreporting is in the range of 13-17% of reported profits[44].

These estimates are very similar to evasion documented by Best et al. (2015) for most corporations in Pakistan, which also fall in the range of $[0.13, 0.17]$, and by Alejos (2018) for corporations in Guatemala that fail to claim an exemption to the local minimum tax. Our results reinforce these previous findings that evasion through cost misreporting

[42]That is, we set $d(\hat{c} - c(y)) = 0$ and compute the implied revenue elasticity $\epsilon_y = \frac{\tau_\pi}{\tau_y^2}\Delta\hat{\Pi}$.

[43]We can rewrite Equation 13 as $\frac{d(\hat{c}-c(y))}{\pi} = \tau_y\epsilon_y - \frac{\tau_\pi}{\tau_y}\Delta\hat{\Pi}$, where $\pi = y - \hat{c}$ and using the fact that around the 6% profit margin kink $\frac{(y-\hat{c})}{y} = \frac{\tau_y}{\tau_\pi}$.

[44]We present estimates using alternative polynomial orders in Table A2. Results are practically unchanged, with evasions estimates falling between 16-19% for the pooled sample.

in lower income countries is significant even for large corporations, making the use of taxation of broader bases a potential tool to increase tax revenues.

4.5 The composition of cost adjustments

In the previous section we document that corporations evade a substantial amount of taxes by over reporting costs under a profit regime, and immediately change their reporting behavior when evasion incentives disappear under the minimum tax. One relevant policy question arising from these evasion responses, that might inform tax authorities' efforts, is whether firms adjust all cost categories similarly between these regimes, or if some cost items seem particularly prone to evasion.

We first present non-parametric evidence, in Figure 11, that deduction levels change discontinuously at the L10 million revenue threshold, consistent with the fact that, under the minimum tax, firms above the threshold increase their reported profits[45]. Reassuringly, we observe no discontinuity in claimed costs in the period 2011-2013, before the minimum tax was in place. In order to assess whether specific cost categories are more responsive to the change in incentives, we use detailed cost items claimed in corporate income tax filings to construct five broad cost categories: Labor, Goods and Materials, Operations, Financial and Losses & others[46]. In Figure 12, Panel A, we present costs as share of gross revenue for each bin of declared revenue. The figure suggests that costs related to the purchase of goods and materials are the only ones that significantly change at the L10 million threshold. While for firms declaring revenue below L10 million the participation of goods and materials steadily increases, the average share of those costs falls discontinuously by over 5 p.p. at the threshold and remains at a lower level for firms declaring up to L15 million in revenue. We do not observe a similar discontinuous fall in claimed deductions for other categories that generate more paper trail, such as financial or labor costs[47]. In Panel B of the same figure we focus on the goods and materials category, showing that the discontinuous change observed at the notch is not observed in 2018, when the exemption threshold increase to L300 million.

We present a more formal test of whether these discontinuities can be attributed to the minimum tax in Table 6. Since we previously presented strong evidence that taxpayers strategically locate below the revenue threshold in order to avoid the minimum tax, we cannot simply estimate a regression discontinuity at the notch. Instead we esti-

[45] In Figure A6 we show that the discontinuous change in deductions claims around the notch implies an increase in reported profit margins.

[46] The detailed breakdown of cost categories only exists for firms declaring using the electronic SAR-357 form introduced in 2015. In all exercises using detailed cost data, we restrict our sample to the period 2015-2018 and to taxpayers filing electronically (70 - 80% of all corporations).

[47] While firms do not provide information on the number of employees in their income tax filings, we use data on withholding of taxes on wages to approximate the number of wage workers across the revenue distribution. In Figure A7 we show that the average number of wage workers is smooth across the L10 million notch, suggesting no change in labor inputs across the notch.

mate a linear "donut-hole" discontinuity regression, evaluating whether the level of costs change at the threshold but extrapolating from revenue levels not affected by bunching behavior[48].

In Column (1) we present results from a specification using median deductions by bin as dependent variable. We estimate that the amount of claimed deductions fall by approximately L260,000 at the threshold, consistent with the non-parametric evidence presented. Since the median deduction at the threshold is L9.8 million, the estimated effect implies that the median firm above the threshold decrease deduction claims by 2.7% and doubles the reported profit margin. In Columns (2) through (5) we repeat the same exercise but use the ratio of deductions to revenue as dependent variable. The only estimate statistically different from zero and meaningful in magnitude is goods and material costs: they fall by almost 5 p.p. from an average of 37% below the notch. Mosberger (2016), using a different empirical strategy, also documents a significant change in goods and materials costs by firms facing a minimum tax in Hungary, suggesting this seems to be a deduction category particularly over reported by firms trying to reduce profit tax liabilities and therefore a potential focus for tax authorities.

5 Robustness and additional exercises

In this section we provide additional evidence that the empirical patterns discussed previously are indeed the result of corporate responses to the minimum tax.

Our main sample consists of an unbalanced panel of corporations. Since the number of firms filing income tax increases significantly during the period, one might worry that results are purely driven by sample composition. We show that this is not the case by restricting the sample to a subset of firms observed in every year between 2013 and 2018[49]. In panel A of Figure A8 we present empirical revenue densities and in panel B we present profit margin densities for each year. The same pattern observed in the full sample is present in the balanced panel: an excess of firms reporting revenue slightly below L10 million and larger firms bunching around 6% profit margin in 2014-2017, but not before or after the exemption threshold was substantially increased.

We also previously documented that the bunching behavior below the L10 million exemption threshold was observed across industries. We present that evidence graphically in panel A of Figure A9. In panel B we show that the right-shift in the profit margin

[48]Unlike Bachas & Soto (2018), who perform a similar exercise, we cannot use these regressions to recover an estimate of cost elasticity. The reason is that, unlike in their setting where all firms in the bracket above the notch face an incentive to change costs due to a higher average tax rate, in our setting only low-profit firms will have an incentive to change costs, while firms with profit margins above 6% do not change their behavior. The observed change in average costs at the threshold will conflate both behaviors.

[49]There are 12,172 corporations that filed income tax declarations in every year between 2013 and 2018.

distribution, accompanied by an excess mass around the 6% kink, is also observed in almost all industries. In Table A1 we present estimates of excess bunching at the 6% profit margin kink and cost evasion for corporations in different industries. With the exception of the small number of firms with undeclared economic sector, we estimate large and significant cost evasion for all sectors, ranging from 10% of reported profit in retail to over 25% in manufacturing, automotive and transportation. These results show that the evasion behavior observed in the full sample is not driven by a few industries, but widespread across corporations in the economy.

We perform two additional exercises that strengthen our case that the shift observed in declared profit margins by firms above the revenue exemption threshold was a response to the specific features of the minimum tax. First, as mentioned in section 2, a small number of industries were subject to a reduced minimum tax rate of 0.75% instead of 1.5%. Corporations in those industries therefore face a kink in the tax schedule not at 6% rate of profit margin but at $\frac{0.0075}{0.25} = 3\%$, and according to our model we should observe excess mass around that threshold. In Figure A10 we show that is precisely what happens: between 2014-2017, the distribution of profit margins for firms in these industries is shifted to the left when compared to corporations facing the 1.5% minimum tax and the peak of the distribution is exactly around 3%.

Second, we also investigate whether the increase in declared profit margins is induced by "lazy cost reporting" (Best et al., 2015). If there are fixed-costs in filing different cost line items, taxpayers might respond to revenue taxation by reducing the number of items filed and therefore generating an increase in profit margins, even if they were reporting truthfully under a profit taxation regime. We investigate whether there are significant changes in the share of cost line items reported in Figure A11. Panel A presents the share across the 6% profit margin kink, for firms reporting revenue above L13 million, while panel B reports shares across the L10 million notch. If the observed changes in deductions/profit were being driven by filing costs, we should expect an increase in the share of items reported when firms report profit margins above 6% (Panel A) and a decrease for firms reporting above the exemption threshold (Panel B). Instead, shares are mostly smooth across the thresholds, and no different from the behavior of firms in 2018, when the exemption threshold was much higher and fewer firms are subject to the minimum tax. These results suggest it is unlikely that costly filing drive our results, at least on the extensive margin, and point to the importance of evasion under profit taxation.

6 Assessing the impact of counterfactual policies

In order to make progress in quantifying the impacts of the minimum tax and alternative tax policies, we make stronger parametric assumptions about the profit function of firms and calibrate a model. We consider firms with isoelastic production costs and cost misreporting loss functions so we can rewrite Equation 1 as follows:

$$\hat{\Pi}(y,\hat{c}) = y - \alpha_i - \frac{\theta_i}{1+1/e}\left(\frac{y}{\theta_i}\right)^{(1+1/e)} - \tau(y-\mu\hat{c}) - \frac{B_i}{1+1/\gamma}\Big(\hat{c}-c(y)\Big)^{(1+1/\gamma)} \tag{14}$$

Taxpayer are heterogeneous in three dimensions, characterized by the vector $(\theta_i, \alpha_i, B_i)$ that define productivity, production fixed cost and evasion ability, respectively. Heterogeneity in productivity allows firms to have different optimal production levels, while varying fixed costs generates a distribution of profit margins. We consider the maximization problem of firms under a simple profit taxation regime and calibrate the model using the parameters previously estimated and data from 2013, before the introduction of the minimum tax. We set $e = 0.99$, the upper bound revenue elasticity from our pooled sample, and use the estimates from Best et al. (2015) for evasion cost elasticity $\gamma = 1.5$. We then calibrate the remaining parameters to match the distributions of reported revenue and reported costs, considering that firms evade 17% of profits through cost over-reporting[50].

We perform three main exercises. First, we simulate the actual minimum tax system implemented in Honduras in 2014, with an exemption threshold for firms reporting gross revenue below L10 million and minimum effective tax of 1.5% for larger firms. Second, we consider an alternative to the minimum tax regime where the tax authority increases the average tax rate that large firms pay on profits. Finally, we simulate an alternative tax system in which all firms are taxed not on pure profits but on a broader base, only allowing partial cost deduction.

We present results for our first exercise in Table 7. First, consider the actual minimum tax implemented, in which firms reporting gross revenue below L10 million are exempt and those above face a minimum tax liability of 1.5% of gross revenue (first line)[51]. We estimate that over 60% of corporations declaring revenue above the exemption threshold are liable for the minimum tax and that total government revenues increase by over 30% when compared to a flat profit tax rate of 25%[52]. This is attained by a 120% increase in the aggregate tax liability of firms paying the minimum tax and a decrease of 10% in aggregate profit for all firms in the economy. The fall in aggregate profits shows that, under the parameters of the actual policy implemented, the potential gains for firms when moving from profit to revenue taxation (decrease in losses from misreporting cost) is dwarfed by the losses from higher tax liability and production distortions.

Our calibrated model also allows us to quantify the strong incentives introduced by

[50]Details are presented in Appendix E.

[51]In Figure A12 and Figure A13 we present simulated revenue and profit margin distributions under the minimum tax regime.

[52]In these simulations we exclude taxpayers that were liable for Net Asset tax in 2013, since we do not model firms' asset accumulation and reporting decisions.

the exemption notch: the total tax liability of bunching firms is less than 25% what they would have payed had they stayed above the threshold and paid the minimum tax. Despite that strong reaction at the margin, the increase in taxes paid by infra marginal firms dwarfs this loss: reduction in taxes from bunching firms is only 1% of total revenue from the minimum tax. While in our model bunching below the exemption threshold is exclusively driven by real production decisions, we provided evidence that at least part of this behavior seems to be explained by revenue misreporting. That finding highlights that, despite generating relatively small aggregate losses, notches can generate large horizontal inequities: firms otherwise similar might be liable for vastly different tax burdens simply due to willingness to misreport revenue.

We also assess the impact of alternative minimum tax specifications, in which we vary both the exemption threshold and the minimum tax rate. We highlight two features of our simulations. First, holding constant the minimum tax rate on gross revenues, increasing the exemption threshold only slowly decreases total revenue gains due to the long right tail of firm size. Doubling the exemption threshold from L10 to L20 million, for example, still leads to 28% revenue gain, and a L50 million exemption threshold still increases tax revenue by 23%. For the same reasons, aggregate profits still fall substantially when considering exemption thresholds at L20 million (-9%) and L50 million (-7.6%). Second, small changes in the minimum tax rate generate large impacts in aggregate tax revenue and firms' profit, given the very broad base (gross revenue). Using the same L10 million exemption threshold and considering a minimum tax rate of 0.5% (implying a minimum profit margin of 2% under profit taxation), for example, generates a tax revenue increase of less than 4% and aggregate profit loss of 0.5%. When comparing these magnitudes with the actual policy implemented, the decrease in tax revenue gain is driven by two forces. First, the minimum "allowable" profit margin is now lower: corporations with a 5% profit margin, for example, are allowed to pay an effective tax rate of 25%*5% = 1.25% when the minimum tax is 0.5%, while they would be liable for the 1.5% minimum tax under the previous regime. Second, firms with very low profit margins now only pay 0.5% in effective tax rate instead of 1.5%. This logic extends to increases in the minimum tax rate: increasing it from 1.5% to 2% leads to a 50% increase in tax revenue but at the cost of a 17% fall in aggregate firms' profits.

Our second exercise considers a progressive tax schedule in which firms declaring gross revenue above L10 million face an increase in *average* tax rates, without a change in the tax base (reported profits). We consider that the average tax rate is still 25% for firms below the exemption threshold, so firms also face a discontinuous change in tax liability when reporting revenue above L10 million and will have a strong incentive to bunch below the threshold. Unlike in our setting where firms with low profits benefit the most from bunching, here firms with high profit margins face the strongest incentives to locate below the notch, since they have the most to lose from higher tax rates. We present results for scenarios that consider an average profit tax rate between 30% and 50% in Table 8. Increasing the average tax rate by 5 p.p. to 30%, for example, would increase tax revenues by 12% and reduce aggregate corporate profits by 7%. In order to generate the same amount of tax revenue gains as the minimum tax, average taxes have to increase by 15 p.p. to 40%. While production efficiency is preserved under high tax rate profit taxation, evasion costs are exacerbated in this scenario and lead to large losses in aggregate profits, which fall by 20%.

These simulations suggest that the owners of corporations had strong reasons to oppose the introduction of a minimum tax scheme, at least in the format it was implemented. Following Best et al. (2015) and Bachas & Soto (2018), we consider alternative scenarios that could be more attractive to corporate shareholders. Instead of pure profit taxation and an additional minimum tax on gross revenue, we consider systems that allow only partial deduction for all firms, under the constraint that aggregate firm profit is not reduced when compared to the baseline of pure profit taxation under a 25% rate. Here we explicitly explore the production vs. revenue efficiency trade-off at the heart of the minimum tax discussion of Best et al. (2015): it is only possible to increase both aggregate profits and government revenue because corporations incur in non-deductible misreporting costs under profit taxation. By introducing some production distortion in the form of partial cost deductibility, we can reduce losses from cost misreporting.

Figure 13 presents the main results of our simulation. For each level of deduction rate μ, we compute the revenue maximizing tax rate (under the constraint of constant profit) and how aggregate revenues change. For a wide range of deduction levels, we show that aggregate revenues could be increased by 8-10%. Among all possible pairs of (τ, μ), we estimate that allowing 45% of costs to be deducted and taxing the remaining net revenues under a 2.3% rate would increase government corporate tax collection by 9.4%, without reducing aggregate profits. But it is noteworthy that there is little gain to be obtained once we consider deduction rates below 85%: we obtain large revenue increases by introducing small distortions in production starting from firms' optimal production level, but after these initial distortions the government can do little more to raise revenue without decreasing aggregate profits. In particular, it's noteworthy that under a pure revenue tax system ($\mu = 0$), we estimate the optimal tax rate to be 1.3% - not far from the current 1.5% applied under the minimum tax.

7 Conclusion

Minimum taxes are seen as effective tools for tax authorities to curb tax evasion in low-income countries and are at the heart of recent debates on global tax cooperation. In this paper we provide new evidence on corporate reaction to minimum taxes in Honduras. The specific design of the minimum tax provision in the country, including an exemption threshold based on declared gross revenues, allow us not only to quantify evasion under profit taxation but also to provide bounds on the elasticity of declared revenue - a key behavioral parameter when considering taxation under less than full deductibility of production costs.

We document meaningful evasion under profit taxation. Corporations liable for a minimum tax declare much larger profit margins when the incentives to over report costs disappears. We quantify that response and estimate that inflated costs allowed these firms to reduce tax liabilities by up to 17%. Curbing evasion through excessive reporting of deductions is costly to tax authorities (Carrillo, Pomeranz, & Singhal, 2017) since it requires time-intensive verification of receipts. The case of Honduras illustrates these limits: in 2018 approximately 150,000 taxpayers filed an income tax declaration, but there were only 45 full and 138 partial audits[53]. We provide evidence that taxpayers exploit these limitations and use hard-to-verify cost categories to reduce tax liability. The introduction of the minimum tax does not lead to changes in the amount of labor or financial deductions claimed - categories that often generate paper trail and are therefore easier to verify - but leads to substantial changes in the amount of costs related to purchase of goods and materials. Improving oversight of claimed deductions of goods and materials seems to be a natural focal point for the efforts of tax authorities.

Using the response of taxpayers to the notch created by the exemption threshold, we bound the elasticity of reported revenue with respect to the net-of-tax rate at [0.35, 1]. These estimates are substantially higher than previous results for corporate taxpayers in similar settings and illustrate the limits faced by authorities in imposing high tax rates on broader bases. Whereas the elasticity of reported revenue summarizes responses both through real production and reporting decisions, we provide evidence that at least part of the observed response is due to revenue under-reporting. Firms with high revenue observability are less likely to strategically locate below the exemption threshold. The same result holds across industries: firms in upstream industries, for which third-party information is more readily available due to VAT withholding, also present less excess bunching and therefore a lower implied revenue elasticity.

These results highlight the fact that taxpayers' behavioral responses are endogenous to the enforcement environment (Fack & Landais, 2016; Slemrod & Kopczuk, 2002). Building state capacity and properly designing rules to enforce tax compliance, therefore, might substantially change the trade-offs between available instruments. In the case of minimum taxes, improving the ability to assert the veracity of claimed deductions should decrease evasion through cost misreporting, making profit taxation more attractive. Improvements in independent verification of taxpayers' declared revenue, conversely, make

[53]Full audits are in-site visits that review all tax liabilities of a taxpayer, while partial audits are requests for taxpayers to provide more information, such as receipts supporting claimed deductions, focused on specific tax liabilities.

broadening the tax base more attractive by reducing the elasticity of reported revenue.

Honduras provides a sharp example of how administrative reporting rules can affect the enforcement environment. The main source of third-party information on taxpayers' revenues are VAT withholdings. All firms can use VAT paid on their purchases as credit for their own liabilities, but only a subset of firms defined as "medium and large" have the obligation to provide individualized information on the identity of their suppliers, generating independent information on their revenues. While there are good reasons not to require all firms to provide such detailed information, the definition of "medium and large" firms is constantly updated based on revenue or profit, but has been fixed since 2011. In Figure A15 we plot the share of taxpayers in each group that are defined as "medium and large" and therefore required to provide detailed VAT information. Among the top 1% of corporations in terms of revenue, over 90% had to file detailed VAT information in 2011. That share steadily decreased since 2014, reaching less than 80% in 2018. A similar scenario is observed if we focus on the top 0.1% or top 10% of firms: an increasing number of very large firms are not required to file detailed VAT data since the requirements have not been updated since 2011. This example illustrates how seemingly innocuous administrative rules on reporting by taxpayers can have important impacts on tax compliance behavior.

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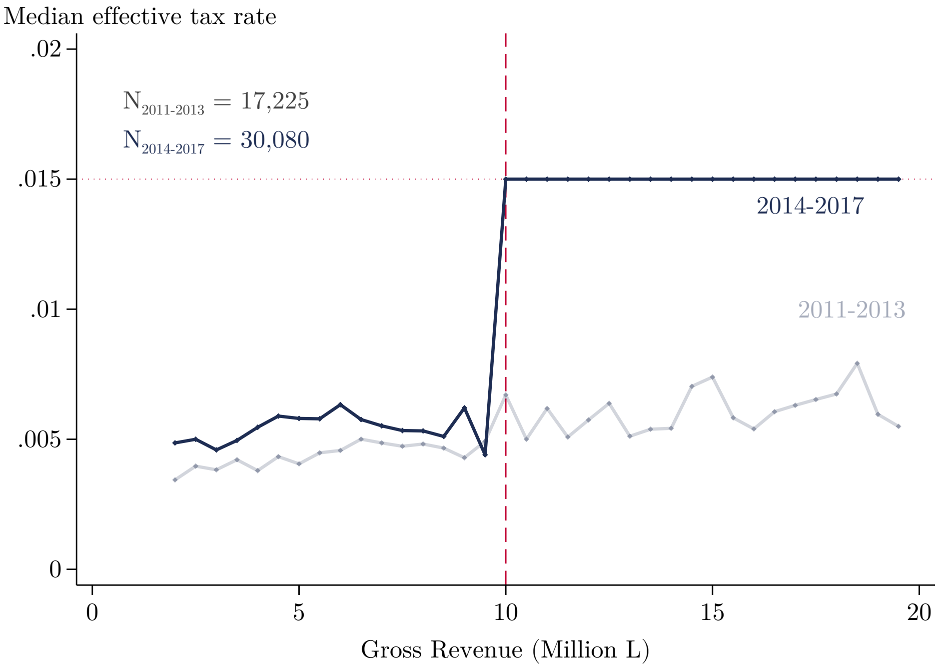
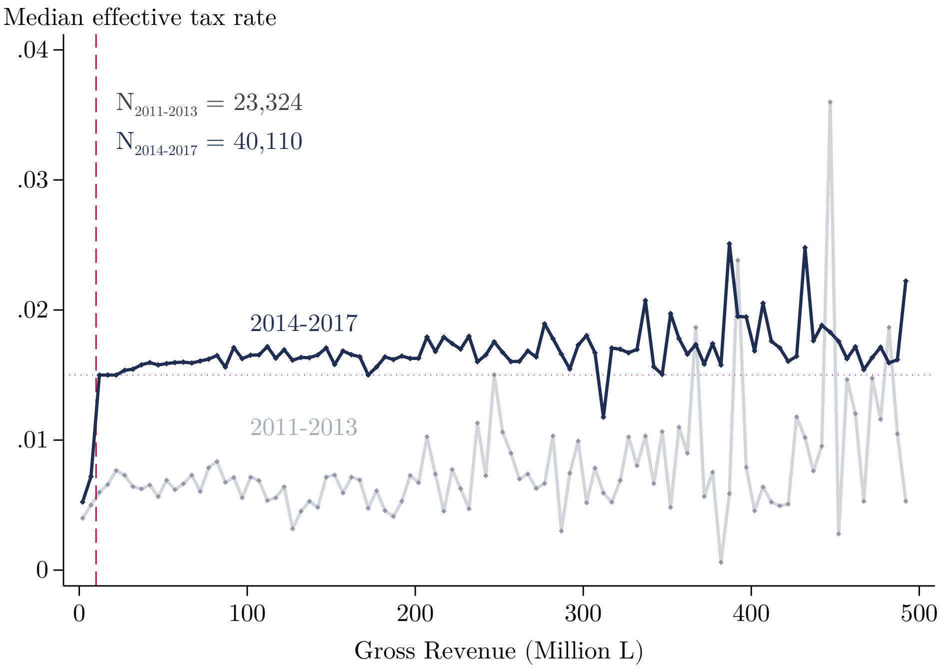
Figure 1: Median effective tax rate across declared revenue distribution



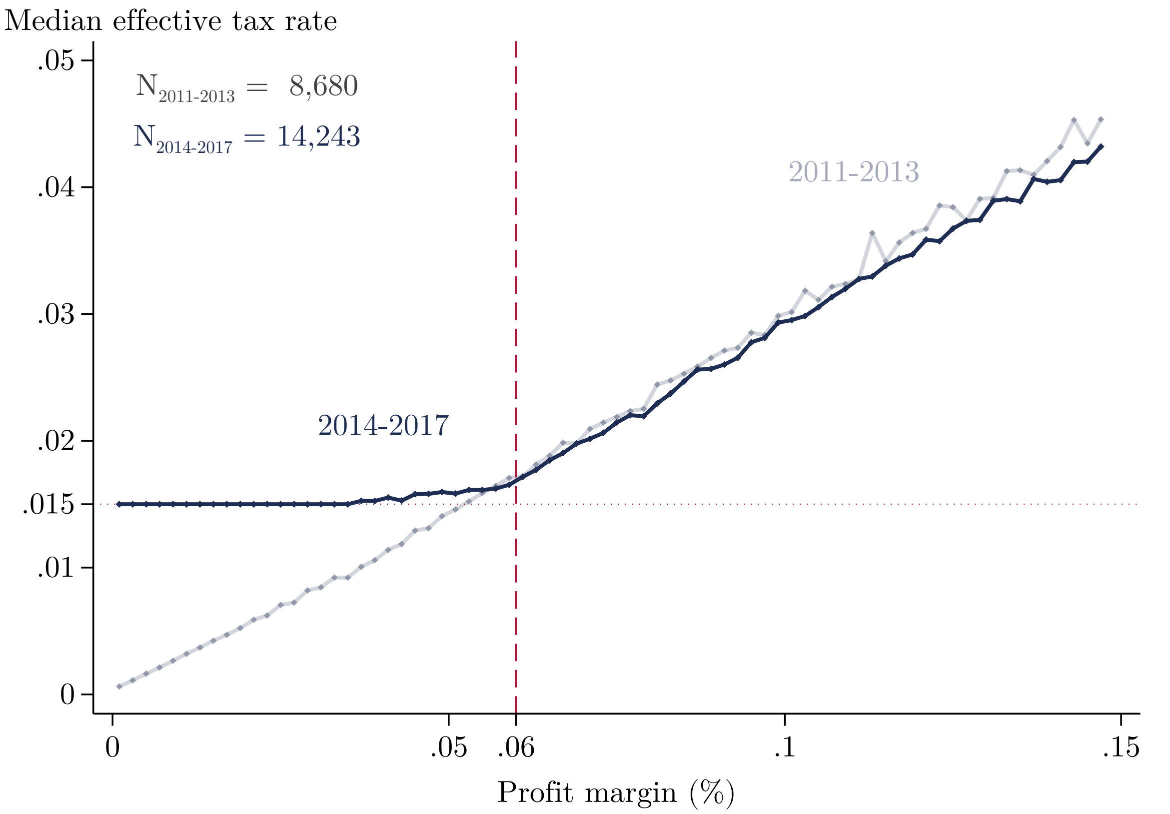
(a) Around L10 million exemption threshold



(b) Across gross revenue distribution

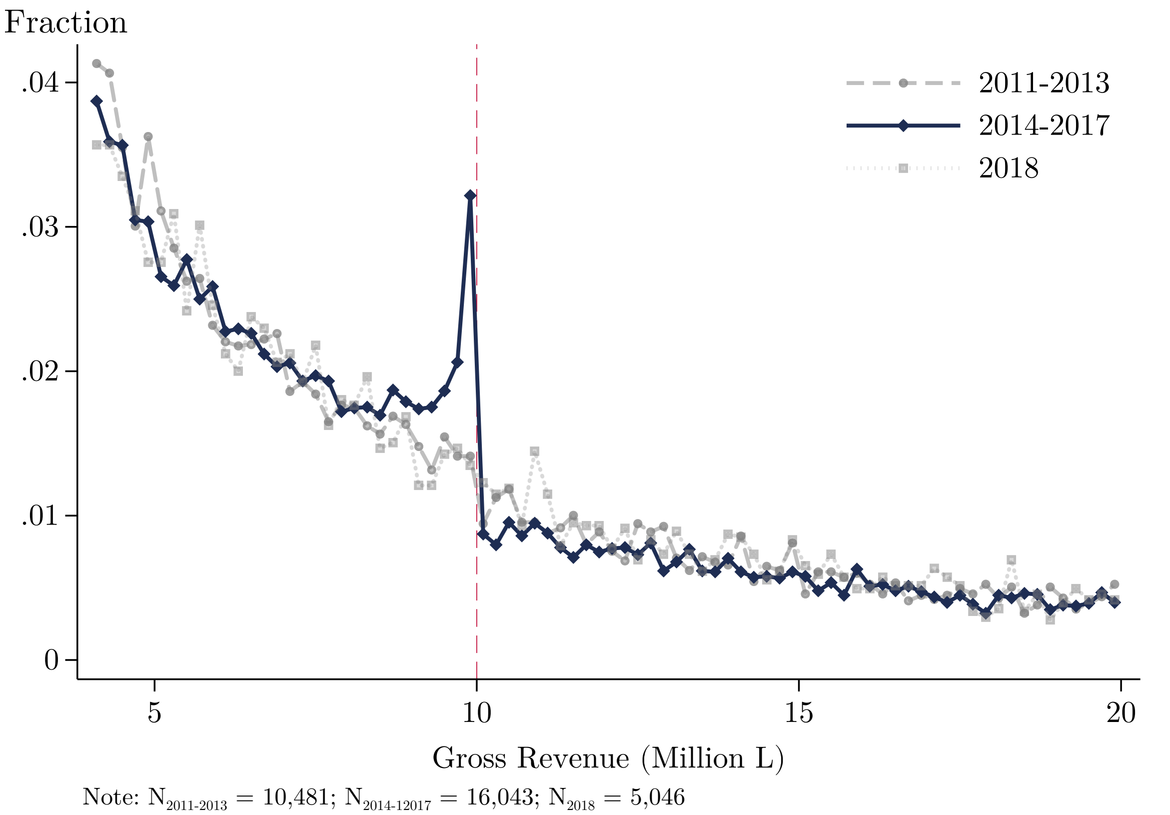
Note: This figure presents median effective tax rates, defined as the ratio between tax liability and gross revenue, for each bin of declared gross revenue. Panel A restricts the sample to taxpayers declaring gross revenue between L2-20 million, while panel B includes taxpayers with gross revenue between L2 - 500 million. It documents that the minimum tax increased effective tax rates for corporations declaring more the L10 million: the median effective rate increases by approximately 1 p.p. around the threshold in 2014-2017, with no equivalent variation in 2011-2013, before the policy was introduced. Bins are L500,000 wide in Panel A and L5 million in Panel B.

Figure 2: Median effective tax rate across declared profit margin distribution



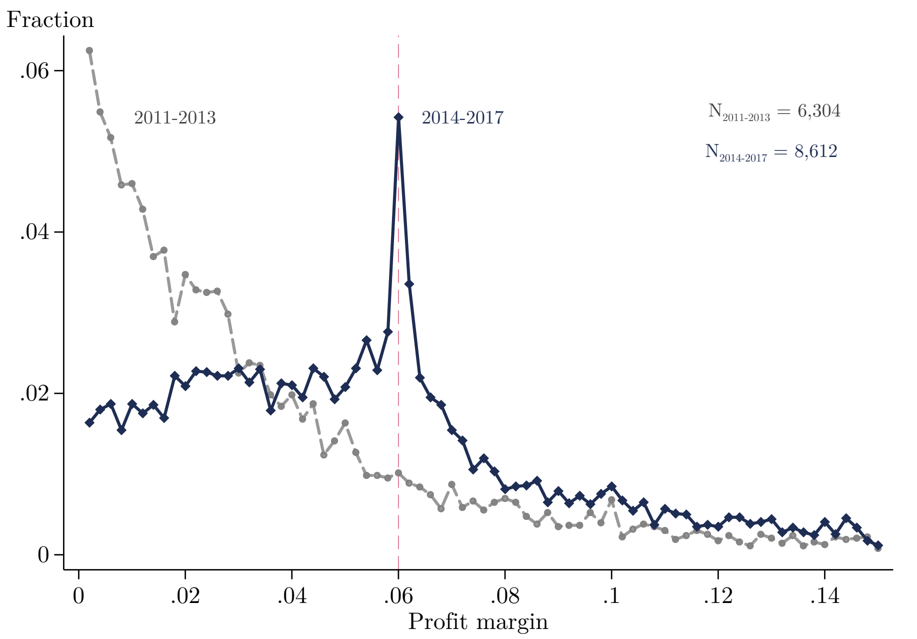
Note: This figure presents median effective tax rates, defined as the ratio between tax liability and gross revenue, for each bin of declared profit margin. The sample is restricted to firms declaring gross revenue above L13 million, and therefore inframarginal to bunching at the L10 million threshold. It documents that the introduction of the minimum tax creates a kink (change in slope of tax schedule) at the 6% threshold. Firms declaring profit margins below that level cannot decrease their tax liability by declaring lower margins, since their liability is at least 1.5% of gross revenues. Bins are 0.2 p.p. wide.

Figure 3: Empirical Density of Gross Revenue around L10 MM threshold

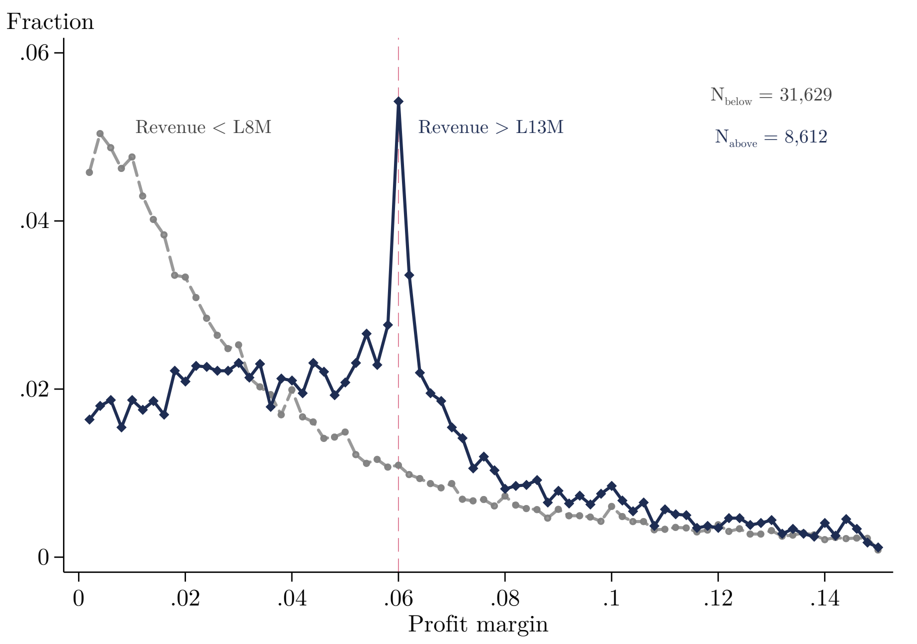


Note: This figure presents the empirical density of gross revenues from firms pooled for three periods: 2011-2013 (before the minimum tax introduction); 2014-2017 (when the exemption threshold was L10 million); and 2018 (after the threshold for eligibility increased to L300 million). It documents that, consistent with theoretical predictions, taxpayers respond to the notch created by the L10 million exemption threshold by bunching below the threshold. Bins are L200,000 wide. The sample is restricted to taxpayers declaring gross revenue between L4-20 million and excludes taxpayers exempt from the minimum tax.

Figure 4: Empirical density of profit margins



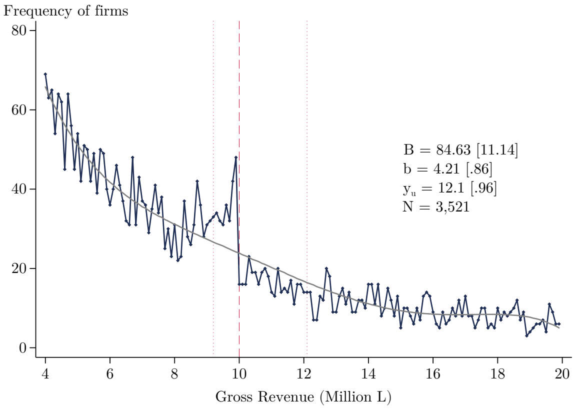
(a) Empirical density of profit margins above L13 million - Pre and Post Minimum Tax



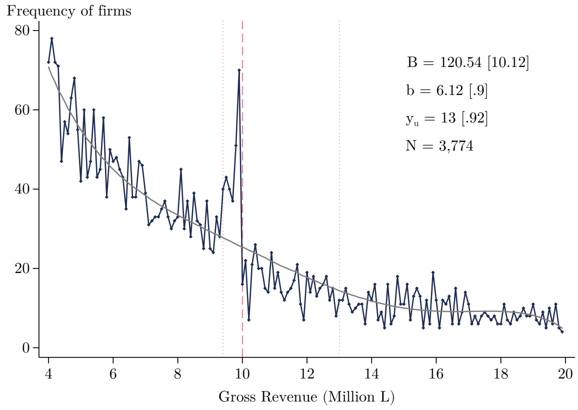
(b) Empirical density of profit margins in 2014-2017 - Below and above L10 million threshold

Note: These figures present the empirical density of positive reported profit margins. Panel A presents densities for firms with gross revenue above L13 million, before (2011-2013) and during (2014-2017) the existence of the minimum tax. Panel B present densities for the period of 2014-2017 of two groups of firms: those reporting gross revenue below L8 million (exempt from minimum tax) and those above L13 million (potentially liable for the minimum tax and infra-marginal to the bunching behavior at L10 million in revenue). It documents that firms affected by the minimum tax increase their reported profit margin and bunch around the 6% kink. Bins are 0.2 percentage points wide and the first bin starts at 0.1%, such that the 6% kink is the midpoint of a bin.

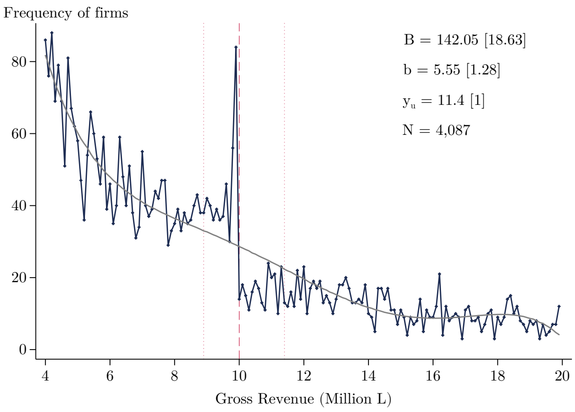
Figure 5: Empirical Density of Gross Revenue around L10 million threshold



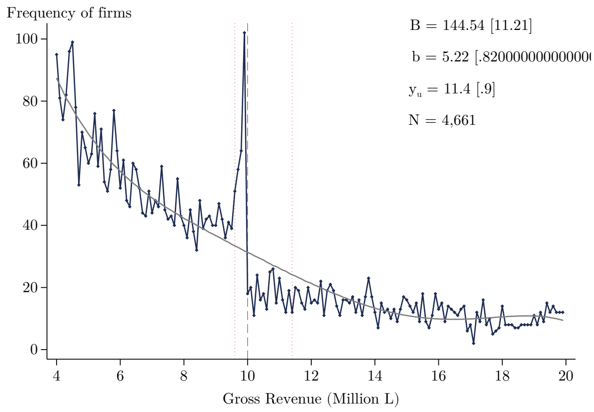
(a) 2014



(b) 2015



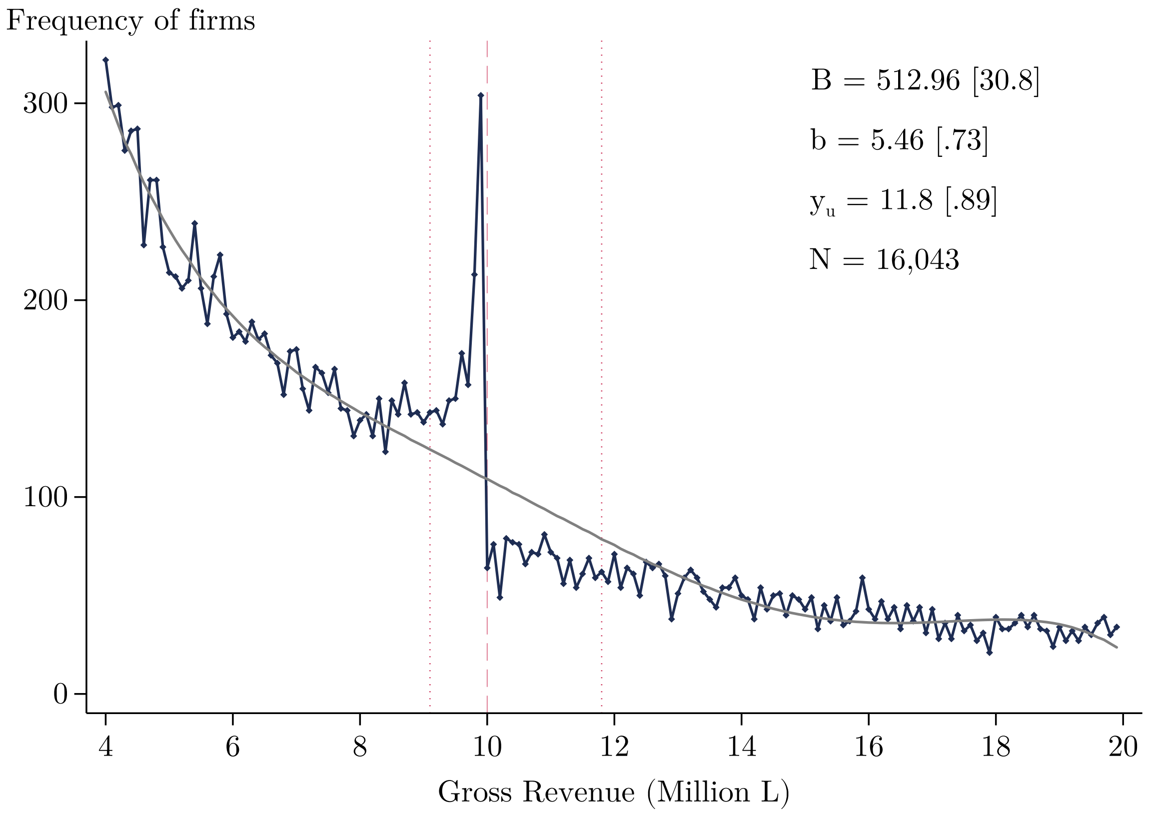
(c) 2016



(d) 2017

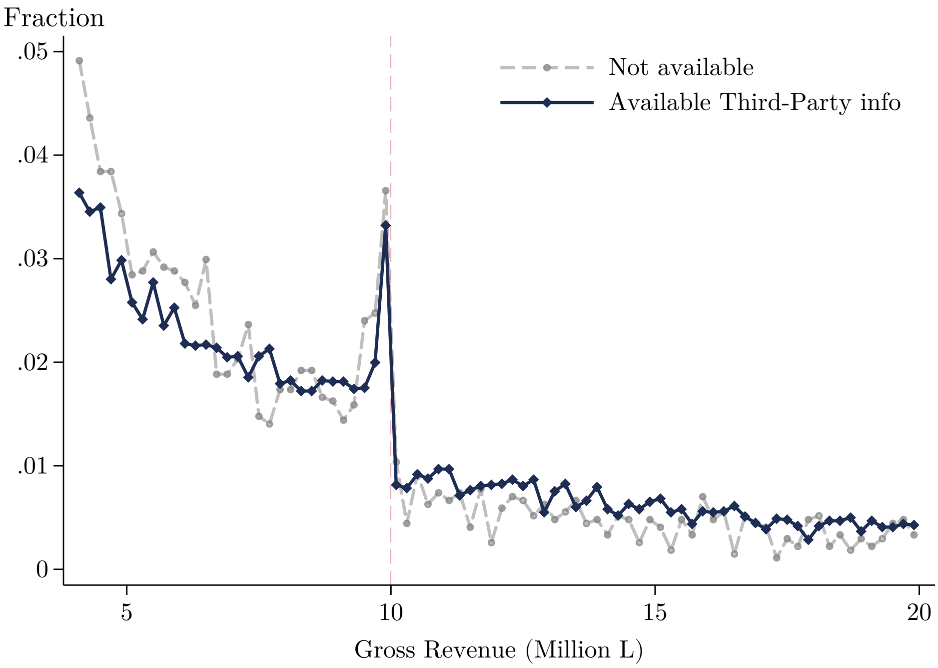
Note: These figures present empirical and counterfactual densities of declared gross revenue for each year in the period 2014-2017. The lower bound of the bunching region is chosen visually while the upper bound is obtained using the convergence method discussed in Section 4.3. The dashed line marks the L10 million notch while the dotted lines mark the lower and upper bounds of the bunching region. For each year we present the excess mass below the notch (B), the excess mass as a share of the predicted mass in the bunching region (b), the upper bound obtained from the convergence method (y_u) and the underlying number of taxpayers in each figure (N). Standard errors in brackets are obtained through bootstrapping. Bins are L100,000 wide.

Figure 6: Empirical Density of Gross Revenue around L10 million threshold - Pooled Years (2014-2017)

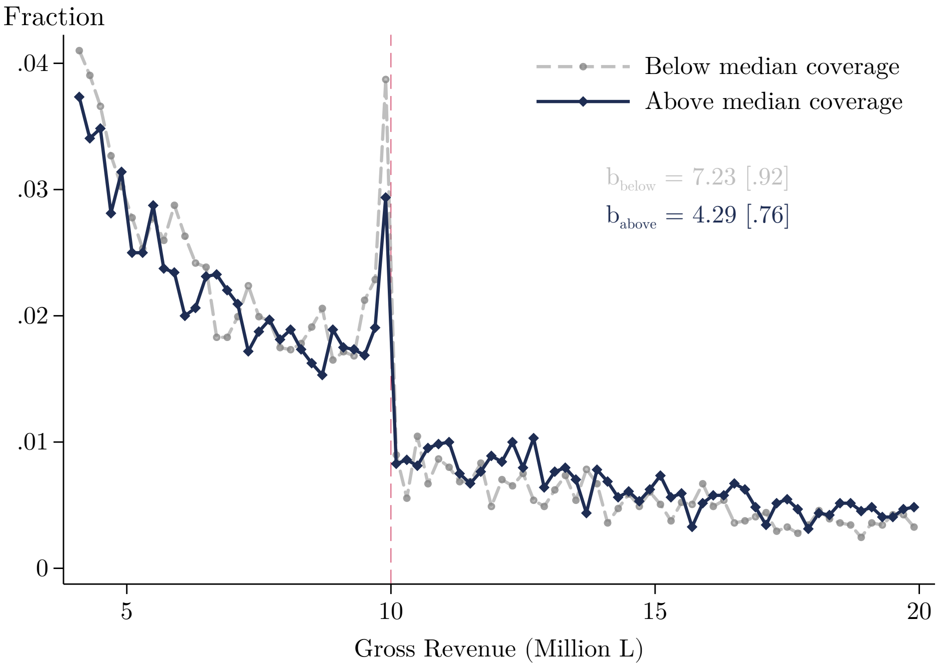


Note: This figure presents empirical and counterfactual densities of declared gross revenue for a pooled sample of firms in the period 2014-2017. The lower bound of the bunching region is chosen visually while the upper bound is obtained using the convergence method discussed in Section 4.3. The dashed line marks the L10 million notch while the dotted lines mark the lower and upper bounds of the bunching region. We present the excess mass below the notch (B), the excess mass as a share of the predicted mass in the bunching region (b), the upper bound obtained from the convergence method (y_u) and the underlying number of taxpayers in each figure (N). Standard errors in brackets are obtained through bootstrapping. Bins are L100,000 wide.

Figure 7: Empirical gross revenue density by third-party status - pooled 2015-2017



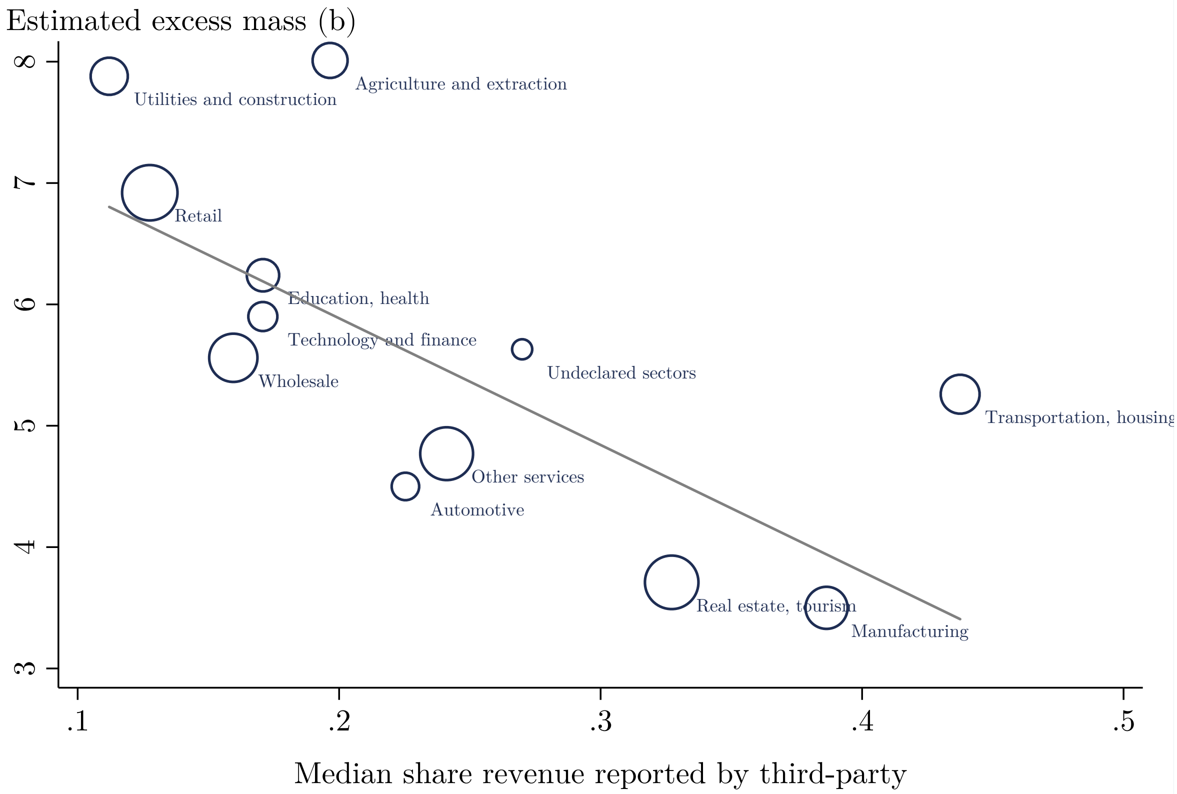
(a) Extensive margin



(b) Intensive margin

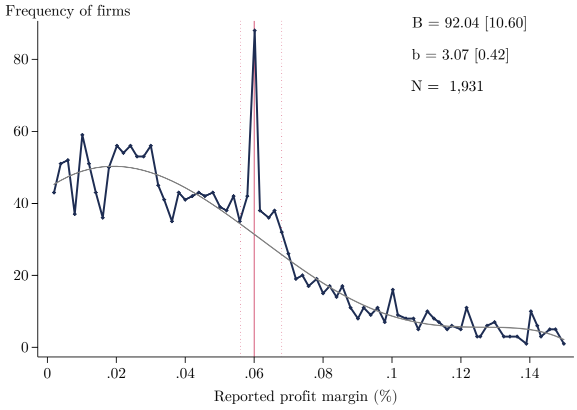
Note: These figure presents the empirical densities of declared gross revenue, pooled for the 2015-2017 period, exploring heterogeneity according to availability of third-party information on revenue. Panel A compares corporations for which no third-party information is available (gray line) with those for which some information is available (blue line). Panel B explores differences in the intensive margin of third-party information: it compares firms with below median (15%) share of declared revenue reported by third parties (gray line) with those above median (blue line). Bins are L200,000 wide.

Figure 8: Scatter plot of amount of bunching vs. revenue observability across industries

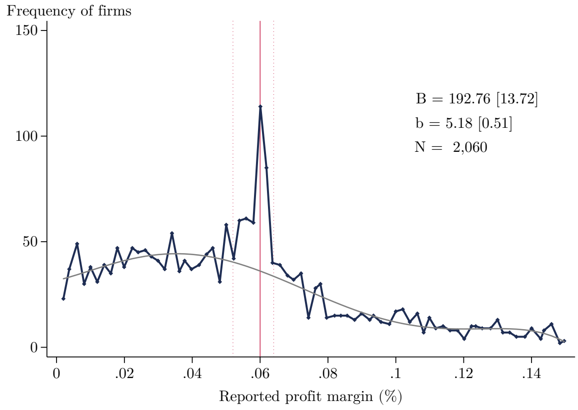


Note: This figure presents a scatter plot of estimated excess mass at the L10 million threshold and the median share of self-reported revenue also informed by third parties in each industry. Results show that in industries with higher third-party reporting we observe less bunching. Excess mass is defined as the excess number of firms bunching at the L10 million notch as a ratio of the predicted mass at the notch. The share of reported revenues is calculated in 2018, for firms declaring gross revenues in the interval L5-15 million. The size of markers is proportional to the reported sales in 2018 by industries.

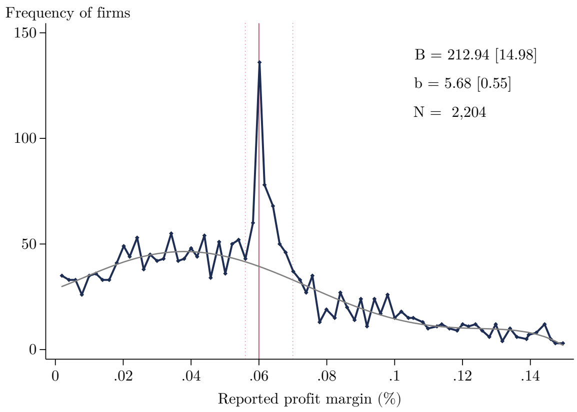
Figure 9: Empirical Density of profits around 6% threshold



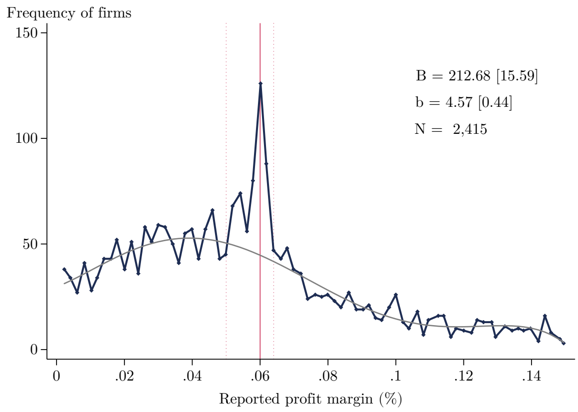
(a) 2014



(b) 2015



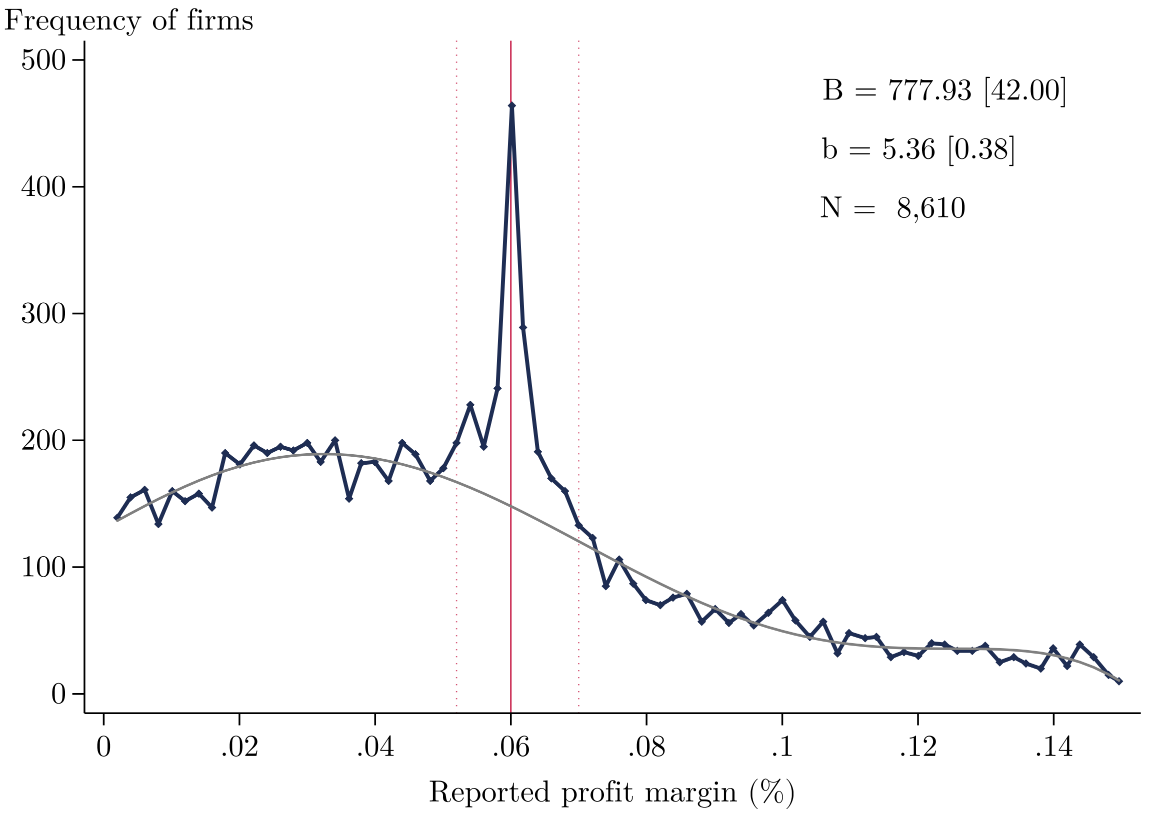
(c) 2016



(d) 2017

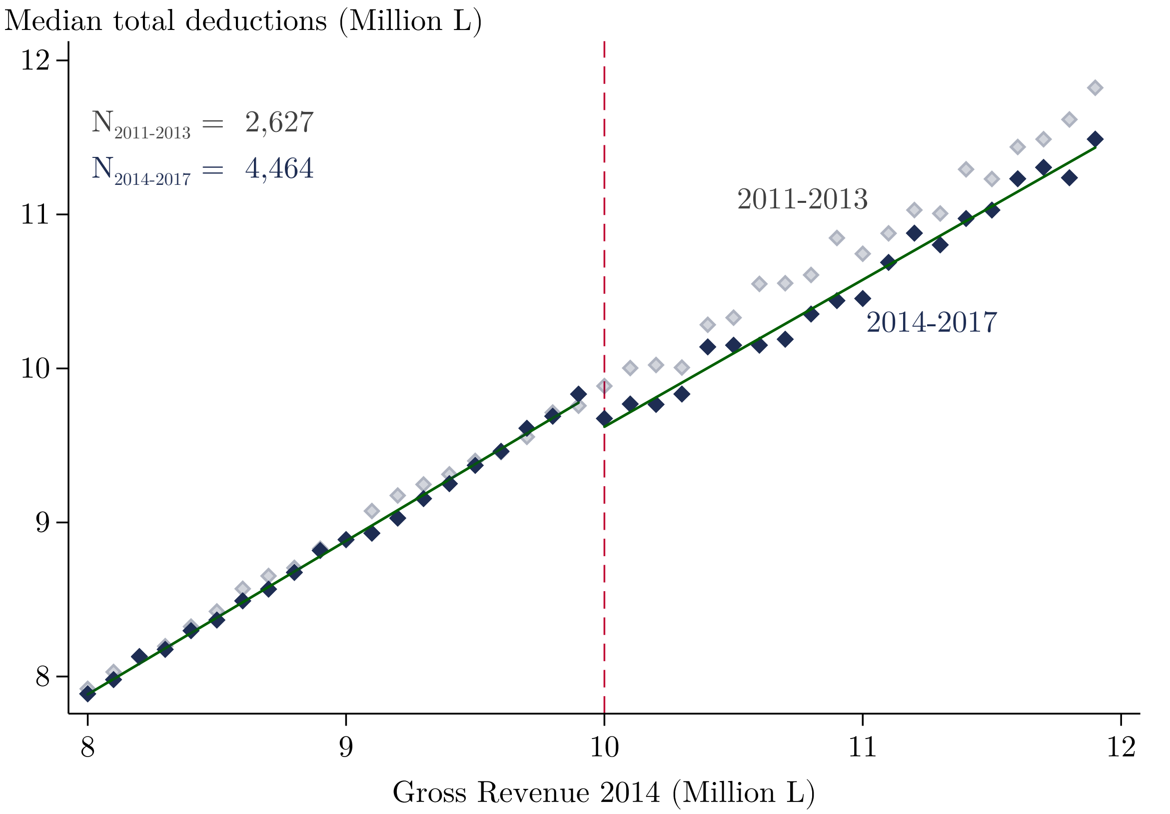
Note: These figures present the empirical and estimated counterfactual distributions of profit margins for each year in the period 2014-2017. The lower and upper bounds of the bunching region are determined visually. The solid red line marks the 6% kink while the dotted lines present the lower and upper bounds of the bunching region. For each year we present the excess mass around the kink (B), the excess mass as a share of predicted density around the kink (b) and the underlying number of taxpayers in each figure (N). Standard errors in brackets are obtained through bootstrapping. Bins are 0.2 percentage points wide and the first bin starts at 0.1%, such that the 6% kink is the midpoint of a bin.

Figure 10: Empirical Density around 6% profit margin threshold - Pooled Years (2014-2017)



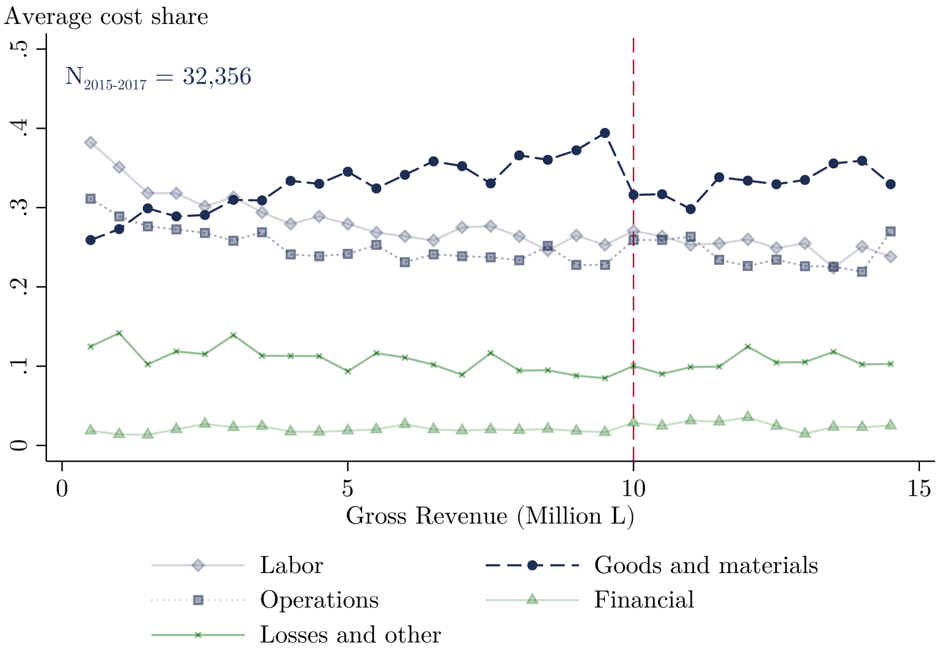
Note: These figures present the empirical and estimated counterfactual distributions of profit margins for a pooled sample of firms in the period period 2014-2017. The lower and upper bounds of the bunching region are determined visually. The solid red line marks the 6% kink while the dotted lines present the lower and upper bounds of the bunching region. We present the excess mass around the kink (B), the excess mass as a share of predicted density around the kink (b) and the underlying number of taxpayers in each figure (N). Standard errors in brackets are obtained through bootstrapping. Bins are 0.2 percentage points wide and the first bin starts at 0.1%, such that the 6% kink is the midpoint of a bin.

Figure 11: Median total deductions by gross revenue

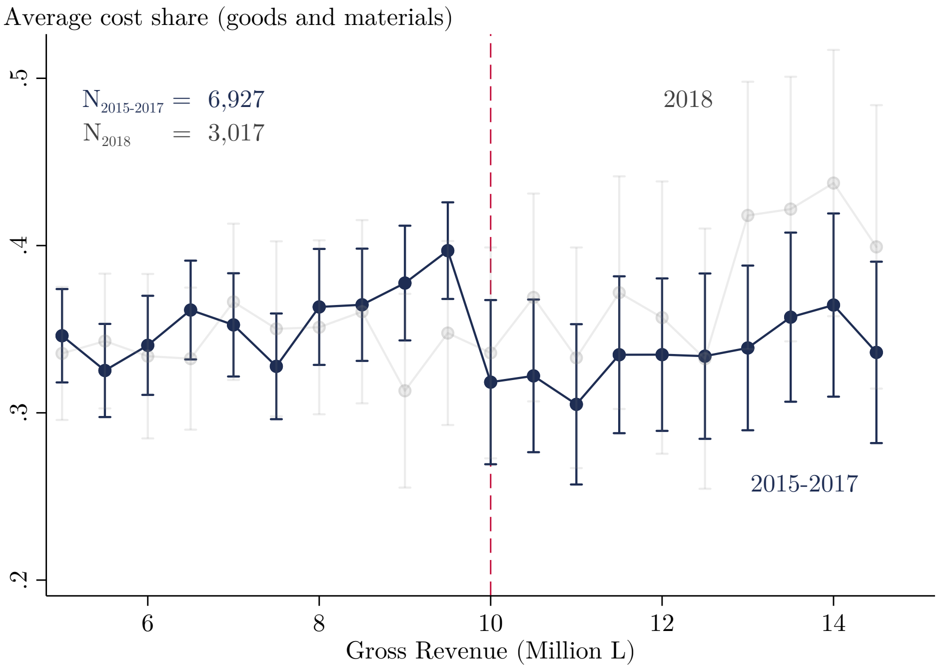


Note: This figure presents median reported total deductions by revenue bin for two groups: taxpayers in 2011-2013, before the introduction of the minimum tax, and 2014-2017, while the minimum tax was in place with a L10 million exemption threshold. The figure documents that claimed deductions fall discontinuously at the exemption threshold during the 2014-2017 period, consistent with the right-shift of the profit distribution observed for taxpayers subject to the minimum tax. No similar discontinuous change is observed in the period before the introduction of the minimum tax. Bins are L100,000 wide.

Figure 12: Cost line items as share of revenue



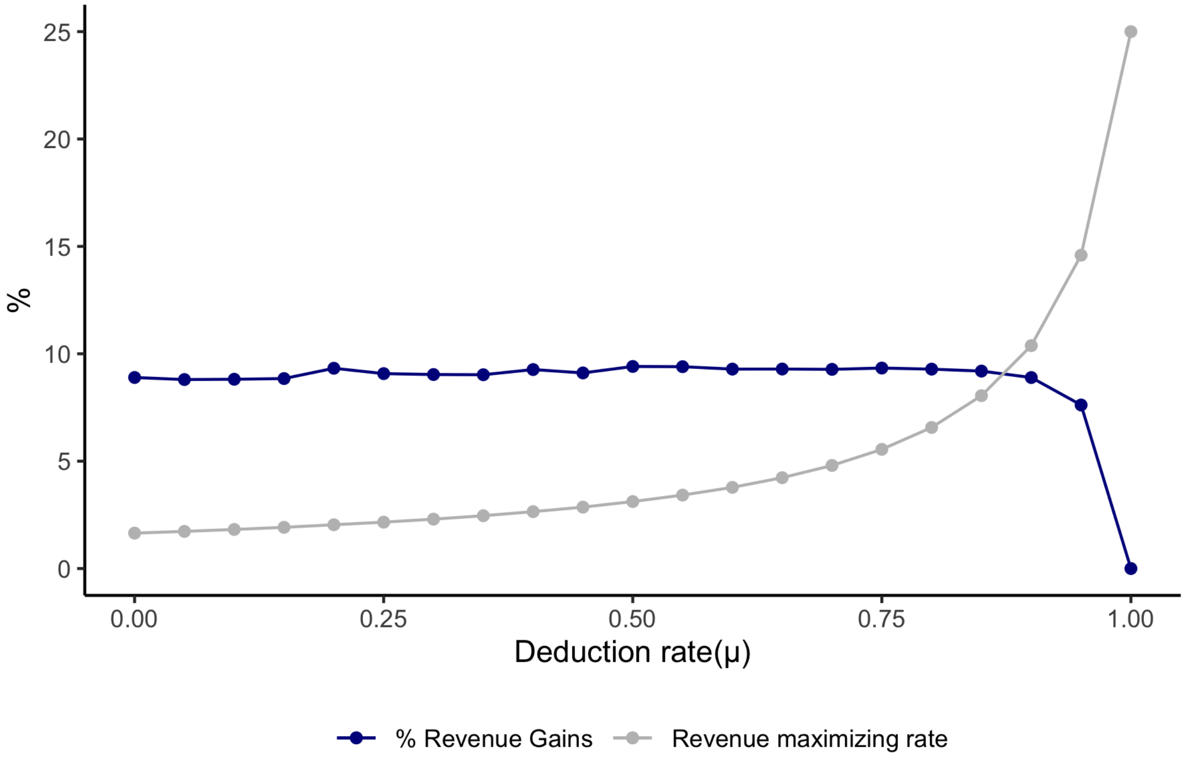
(a) All categories (2015-2017)



(b) Goods and materials (2015-2017 & 2018)

Note: These figures present cost line items as share of revenues in each bin. Panel A presents average shares in 2015-2017 for five cost categories: Labor, Goods and Materials, Operations, Financial, and Losses and other. Panel B focuses on Goods and Materials cost shares, separately for 2015-2017 and 2018. Bins are L500,000 wide in both panels. This sample only includes taxpayers using electronic declaration, for which we have detailed breakdown of cost items (approximately 80% of taxpayers per year) and excludes taxpayers with profit margins above the 99th and below 1st percentile of profit margin distribution.

Figure 13: Revenue maximizing tax rate



Note: This figure presents the results of simulations of taxes systems using different sets of tax and deduction rates. The x-axis present different values of μ, the share of costs that can be deducted. The grey line presents, for every level of deduction, the tax rate that maximizes revenue conditional on aggregate profits being no smaller than in baseline, while the blue line presents the revenue gains for each deduction and tax rate pair.

Table 1: Descriptive statistics

	2013	2014	2015	2016	2017	2018
Overall firms' characteristics						
Revenue (Million L)	31.35	30.81	27.99	26.49	28.31	27.47
	(336.33)	(329.80)	(293.49)	(257.53)	(317.50)	(314.64)
Deduction (Million L)	30.54	30.00	26.59	24.85	26.92	26.33
	(347.37)	(342.83)	(281.04)	(235.07)	(311.61)	(299.31)
Pre-tax profits (Million L)	0.83	0.87	1.44	1.68	1.48	1.22
	(63.59)	(65.57)	(40.91)	(33.25)	(54.17)	(57.37)
Pre-tax profit margin (%)	1.94	2.36	3.13	4.19	4.14	4.89
	(20.18)	(21.38)	(22.43)	(22.33)	(22.44)	(24.87)
Tax liability (Million L)	0.54	0.67	0.69	0.68	0.72	0.68
	(10.90)	(10.80)	(11.09)	(9.86)	(11.89)	(12.24)
Exempt from Minimum Tax (%)	.	17.8	24.6	26.3	22.2	21.1
Revenue above L10 Million (%)	18.0	17.4	16.7	17.1	17.1	17.9
Not exempt and above L10 million (%)	.	16.2	14.7	14.1	14.2	16.1
Paid Minimum Tax (%)	.	8.1	6.6	6.1	6.4	0.5
Share taxes from Minimum Tax (%)	.	29.5	21.6	19.5	19.8	14.6
Share of MNC (%)	3.5	3.6	3.2	3.0	2.8	2.6
Share taxes from MNC (%)	66.4	65.4	62.0	60.0	58.7	60.7
N	19,223	20,464	23,658	25,729	27,825	29,944

Note: This table reports descriptive statistics for the sample of corporations filing income taxes in Honduras in the period 2013-2018. Profit margins are defined as the ratio between tax liability and gross revenue and are trimmed below -100% when calculating yearly averages in this table. Exemption from the minimum taxes is defined for taxpayers in first two years of operation and/or by economic sector, and does not include taxpayers declaring revenue below the exemption threshold. Multinational corporations (MNC) are identified as firms presenting a transfer price declaration in the period 2014-2018.

Table 2: Share of revenue and taxes across gross revenue distribution

	2013		**2017**	
	(1)	(2)	(3)	(4)
	Revenue	Taxes	Revenue	Taxes
Top 0.1%	28.1	32.2	28.5	34.3
Top 1%	63.0	68.6	63.4	67.2
Top 10%	91.0	91.9	90.8	93.2
Top 20%	95.8	96.2	95.6	97.1
Bottom 50%	0.6	0.9	0.5	0.7

Note: This table presents the share of total revenue and total taxes for corporations at the top 0.1%, top 1%, top 10%, top 20% and the bottom 50% of declared yearly gross revenues. Columns (1) and (2) refer to statistics in 2013, while columns (3) and (4) refer to 2017. Corporations exempt from all income taxes are excluded from the sample. The results illustrate the skewness of the size distribution and the importance of the very largest firms for aggregate tax collection: in 2013, 20 firms (top 0.1%) declared 28% of total revenue and were liable for 32% of total taxes.

Table 3: Estimates by year for L10 million notch

Year	(1) Excess # Firms (B)	(2) Firms % counterfactual (b)	(3) $\mathrm{y_u}$ (upper bound)	(4) Δ Revenue (upper bound)	(5) ϵ_{y} (upper)	(6) ϵ_{y} (lower)
2014	84.63	4.21	12.10	2.10	1.33	0.20
	(11.14)	*(0.86)*	*(0.96)*	*(0.96)*	*(1.53)*	*(0.06)*
2015	120.54	6.12	13.00	3.00	2.61	0.40
	(10.12)	*(0.90)*	*(0.92)*	*(0.92)*	*(1.53)*	*(0.08)*
2016	142.05	5.55	11.40	1.40	0.61	0.40
	(18.63)	*(1.28)*	*(1.00)*	*(1.00)*	*(1.44)*	*(0.13)*
2017	144.54	5.22	11.40	1.40	0.61	0.35
	(11.21)	*(0.82)*	*(0.90)*	*(0.90)*	*(1.30)*	*(0.06)*
Pooled	512.96	5.46	11.80	1.80	0.99	0.35
	(30.80)	*(0.73)*	*(0.89)*	*(0.89)*	*(1.40)*	*(0.05)*

Note: This table presents estimates of change in reported revenue and elasticities for each year in the period 2014-2017 and also for all years pooled. The first column reports the estimated excess number of firms, defined above as $\sum_{b=y_L}^{y_N}(n_j - \hat{n}_j)$, while column 2 reports the ratio between excess mass and average counterfactual density in the bunching region. Column (3) presents the upper bound estimated using the convergence method and column (4) the change in revenue. Column (5) presents the upper bound estimates of reported revenue elasticity, defined in Equation 10, while column (6) presents the lower bound estimates using the methodology presented in section 4.3.

Table 4: Bunching at L10 million notch - by TPI and industries

	(1) Excess # Firms (B)	(2) Firms % counterfactual (b)	(3) Number Observations
Third-party information			
Below median TPI	253.33	7.23	6,121
	(20.77)	*(0.92)*	
Above median TPI	166.76	4.29	6,401
	(14.16)	*(0.76)*	
Industries			
Agriculture and extraction	45.75	8.01	865
	(3.62)	*(0.97)*	
Manufacturing	38.09	3.50	1,516
	(7.48)	*(1.29)*	
Utilities and construction	52.20	7.88	1,038
	(6.46)	*(1.90)*	
Automotive	16.70	4.50	650
	(6.08)	*(2.07)*	
Wholesale	65.11	5.56	1,880
	(8.93)	*(0.91)*	
Retail	71.64	6.92	1,884
	(13.01)	*(1.69)*	
Transportation, housing	31.65	5.26	1,174
	(10.09)	*(2.31)*	
Technology and finance	23.70	5.90	757
	(5.39)	*(1.49)*	
Real estate, tourism,other	48.30	3.71	2,530
	(9.40)	*(0.67)*	
Education, health, entertainment	37.00	6.24	1,050
	(10.72)	*(2.15)*	
Other services	62.23	4.77	2,298
	(10.74)	*(1.51)*	
Undeclared sectors	16.33	5.63	401
	(5.20)	*(2.06)*	

Note: This table presents estimates of bunching below the L10 million notch for firms with different levels of third-party information (TPI) (panel A) and in different industries (panel B). Column (1) presents the estimated excess mass of firms while column (2) presents the ratio between excess mass and average counterfactual density in the bunching region. Column (3) presents the number of firms for each exercise. Panel A documents that excess mass is much larger for firms with below median availability of TPI. Panel B shows that, while excess mass is large and precisely estimated across all industries, it is particularly large for sectors such as retail, construction and agriculture, and much less pronounced in manufacturing.

Table 5: Estimated responses at the kink

Year	(1) Excess Mass (B)	(2) Bunching (b)	(3) Delta Profit ($\Delta\Pi$)	(4) Implied ϵ_y (no evasion)	(5) Estimated evasion ($\epsilon_y = 0.99$)
2014	92.04	3.07	0.60	6.67	-8.52
	(10.60)	*(0.42)*	*(0.10)*	*(0.99)*	*(1.48)*
2015	192.76	5.18	1.00	11.11	-15.18
	(13.72)	*(0.51)*	*(0.10)*	*(1.18)*	*(1.77)*
2016	212.94	5.68	1.10	12.22	-16.85
	(14.98)	*(0.55)*	*(0.10)*	*(1.24)*	*(1.85)*
2017	212.68	4.57	0.90	10.00	-13.52
	(15.59)	*(0.44)*	*(0.10)*	*(1.04)*	*(1.55)*
Pooled	777.93	5.36	1.10	12.22	-16.85
	(42.00)	*(0.38)*	*(0.10)*	*(0.91)*	*(1.36)*

Note: This table presents estimates of change in reported profit margins and evasion estimates for each year in the period 2014-2017 and also for all years pooled. Column (1) reports the estimated excess number of firms while column (2) reports the ratio between excess mass and average counterfactual density in the bunching region. Column (3) presents estimated change in profit margins. Column (4) presents the implied revenue elasticity using the decomposition in Equation 13 and considering no cost evasion. Column (5) computes the estimated cost evasion using the same decomposition and $\epsilon_y = 0.99$, our preferred estimate for the revenue elasticity upper bound.

Table 6: Deductions discontinuity at the notch

		Deductions components (% of revenue)				
	(1) Total deductions	(2) Labor	(3) Materials	(4) Operation	(5) Financial	(6) Other
Jump in cost	-0.265***	0.0108	-0.0483**	-0.00268	0.00419	0.0120
	(0.06)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
Slope below threshold	0.983***	-0.00573**	0.00793**	-0.00133	0.000893	-0.00281
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Slope change above threshold	-0.0283**	0.00207	-0.00200	0.00162	-0.00137	0.00339
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Intercept	9.764***	0.250***	0.373***	0.233***	0.0205***	0.0931***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
Observations	160	160	160	160	160	160
R-Squared	0.999	0.214	0.225	0.149	0.266	0.165

Note: This table reports results of "donut-hole" discontinuity regressions using binned data for firms declaring between L4 and L20 million in revenue. The dependent variable is median claimed deductions in column (1) and mean cost as a share of declared revenue, for each cost item, in columns (2) through (6). The sample is restricted to firms with electronic declarations between 2015-2017 and exclude approximately 3% of firms for which the sum of claimed deductions computed from individual cost lines does not match total claimed deductions. We also trim the sample at the first and 99th percentile of declared profit margin distributions. Robust standard errors are presented in parenthesis.

Table 7: Simulated impact of counterfactual minimum tax policies

Exemption Threshold (L million)	Minimum tax rate (%)	Share taxpayers owing MT (%)	Tax revenue increase (%)	Tax liability change for MT firms (%)	Change aggregate profits (%)	% tax paid by bunchers	Tax loss from bunchers (%)
10	1.5	62.4	30.3	122.5	-10.0	23.8	1.0
10	0.5	28.0	3.6	94.5	-0.5	17.4	0.5
10	2.0	70.6	49.2	146.8	-17.4	24.0	1.3
20	0.5	16.5	3.3	92.9	-0.5	23.6	0.3
20	1.5	36.4	27.7	120.7	-9.1	30.1	1.2
20	2.0	40.6	45.1	144.8	-16.0	23.7	1.5
50	0.5	7.4	2.6	88.7	-0.4	22.7	1.5
50	1.5	17.1	22.8	117.3	-7.6	30.0	2.4
50	2.0	18.5	36.9	141.2	-13.2	25.6	3.3

Note: This table presents results of counterfactual minimum tax policies using the calibrated model. Columns (1) and (2) present the counterfactual notch above which the firms are subject to the minimum tax and the tax rate applied on gross revenue, respectively. Column (3) presents the share of taxpayers with revenue above the exemption threshold paying minimum taxes; column (4) presents the increase in collected tax revenue; column (5) presents the aggregate increase in tax liability faced by firms paying the minimum tax; column (6) presents the change in aggregate corporate profit; column (7) presents the ratio between total tax liability below and above the exemption threshold for bunchers; and column (8) presents the share of total potential revenue collected under minimum tax that is lost from bunching taxpayers.

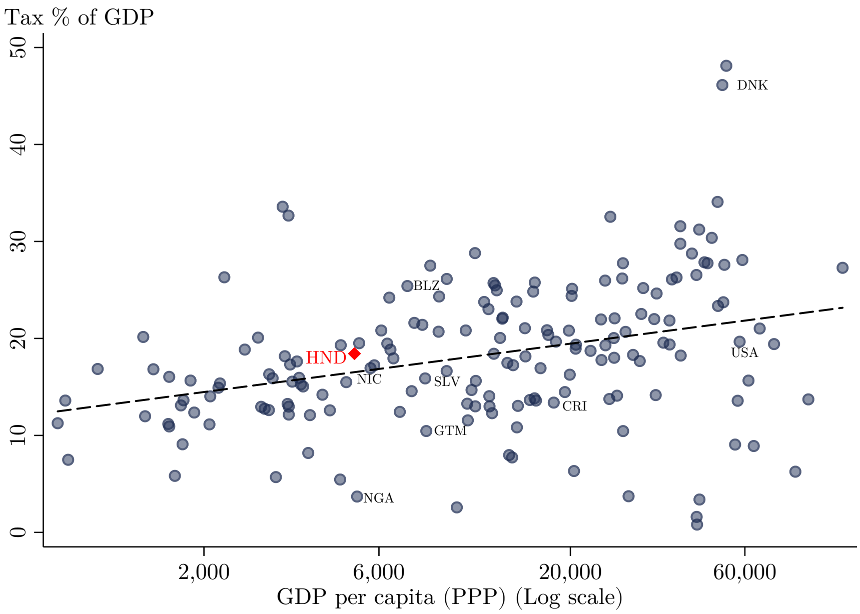
Table 8: Simulated impact of counterfactual increase in average profit tax

Average profit tax rate (%)	Tax revenue increase (%)	Change aggregate profits (%)
30	12.2	-6.9
35	22.2	-13.5
40	29.9	-20.0
45	35.9	-26.3
50	39.3	-32.5

Note: This table presents results of counterfactual policies where the average profit tax rate is increased for firms declaring gross revenue above L10 million, using the calibrated model. Columns (1) presents the average profit tax rate simulated in each scenario. Column (2) presents the total % increase in tax collection while column (3) presents aggregate profit losses.

A Appendix Graphs and Table

Figure A1: Taxes as percentage of GDP across countries

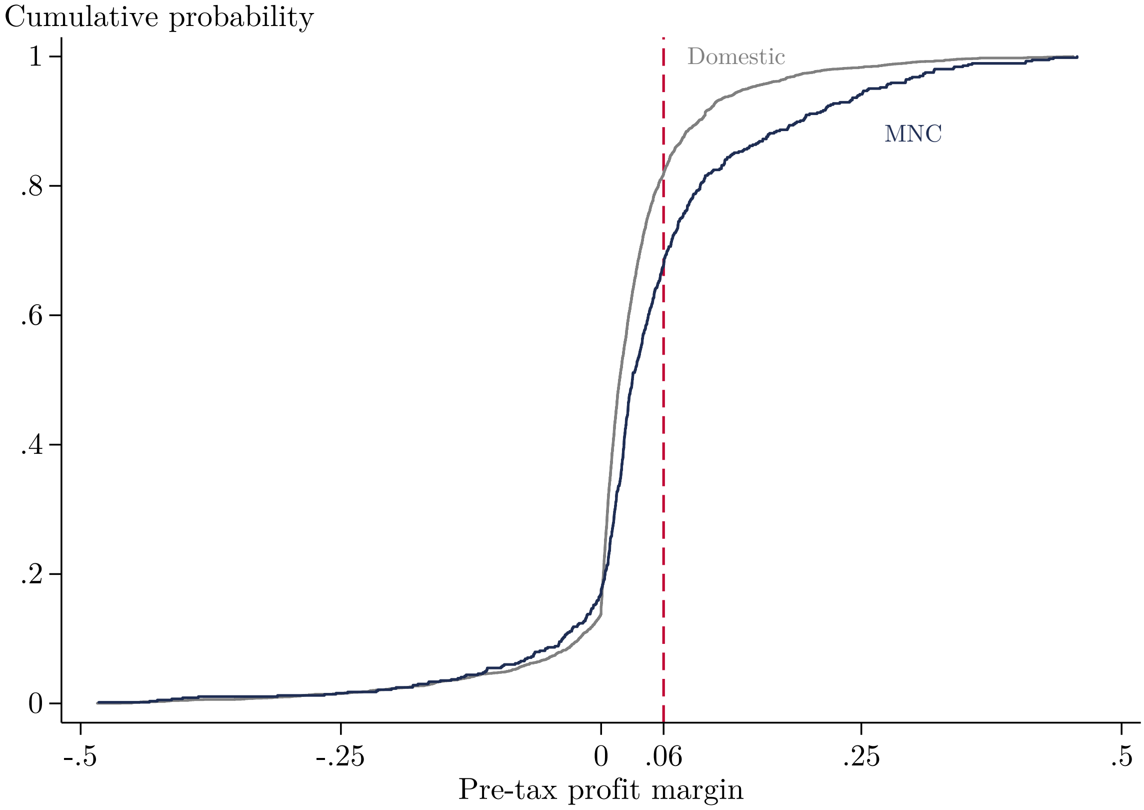


(a) Tax revenue

(b) Corporate income tax revenue

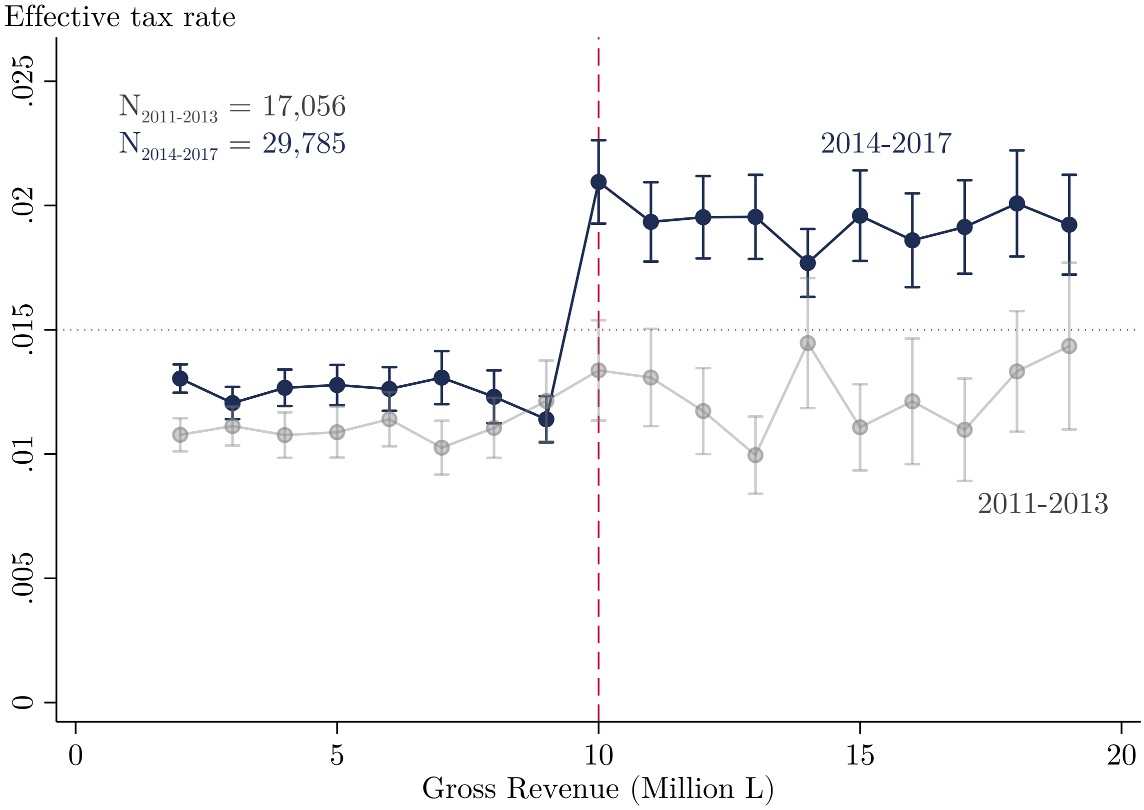
Note: These figures plot countries' tax revenue (Panel A) and corporate income tax revenue (Panel B) as percentage of GDP vs. (log) per capita GDP in 2016. Per capita GDP is expressed in PPP current dollars. Source: World Bank and International Monetary Fund (IMF) World Revenue Longitudinal Data.

Figure A2: Pre-tax profit margin CDF - Domestic vs. Multinational corporations



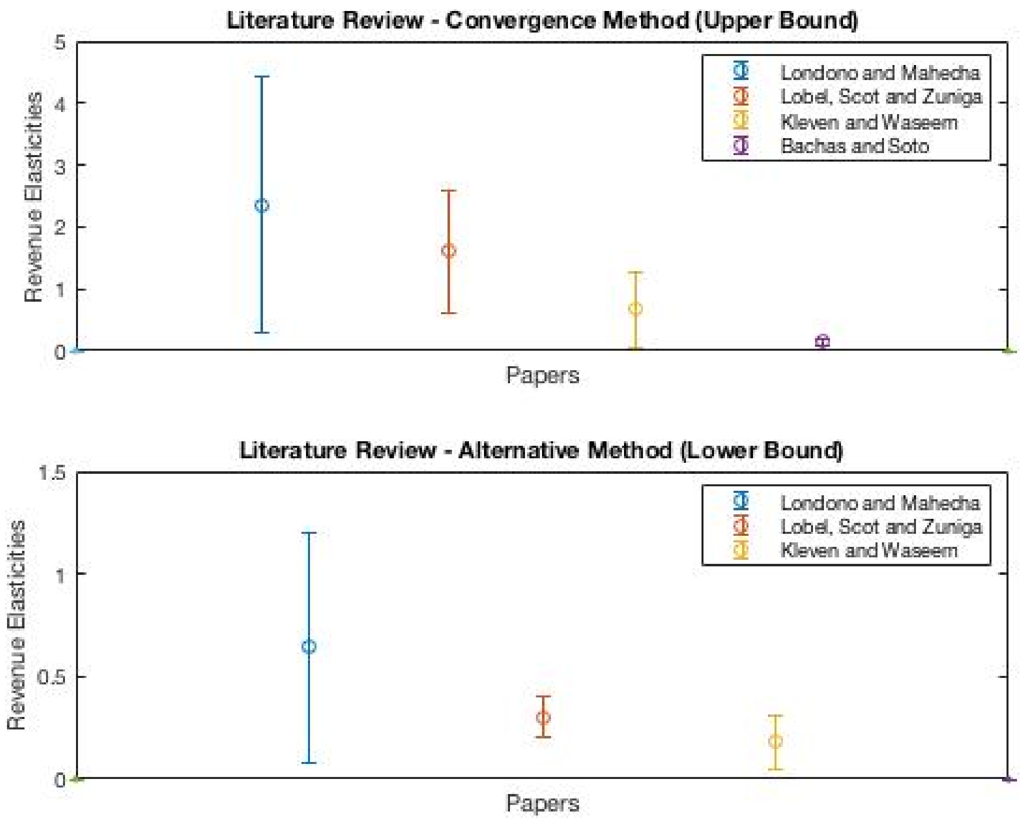
Note: This figure presents the cumulative distribution functions (CDF) of pre-tax profit margins by domestic and multinational firms in 2013, before the introduction of the minimum tax. The CDF of MNCs is shifted to the right (for positive values), indicating higher declared profit margin across the distribution. In particular, approximately 30% of MNC declared profit margins above the 6% threshold that separates the minimum tax and profit regimes in 2014-2017, while this number is less than 20% for domestic corporations. MNCs are defined as taxpayers that present transfer pricing declarations at some point in 2014-2018. The sample is restricted to taxpayers declaring at least L8 million in gross revenue and the distribution is trimmed at the 1st and 99th percentiles.

Figure A3: Average effective tax rate across declared revenue distribution



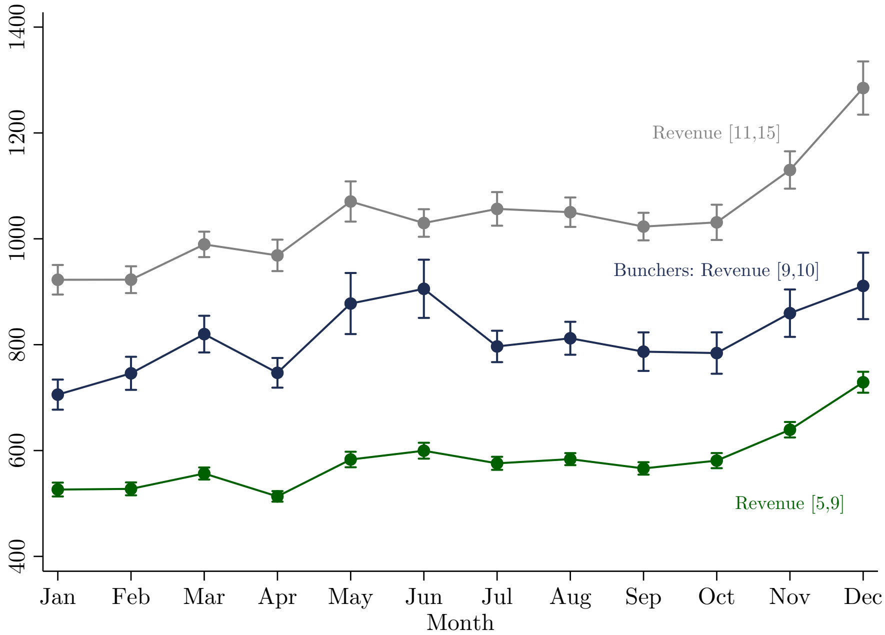
Note: This figure presents mean and 95% confidence intervals of the effective tax rate, defined as the ratio between taxes due and gross revenue, for each bin of declared gross revenue. It documents that the minimum tax increased effective tax rates for corporations declaring more the L10 million: the average effective rate increases by approximately 1 p.p. around the threshold in 2014-2017, with no equivalent variation in 2011-2013, before the policy was introduced. Bins are L1 million wide. Sample is restricted to taxpayers declaring between L2-20 million and effective rate is trimmed at 99th percentile. The blue line refers to the pooled sample of taxpayers in 2014-2017, when the minimum tax was in place, while the gray line refers to the pooled sample of 2011-2013, before the introduction of the policy.

Figure A4: Literature Review

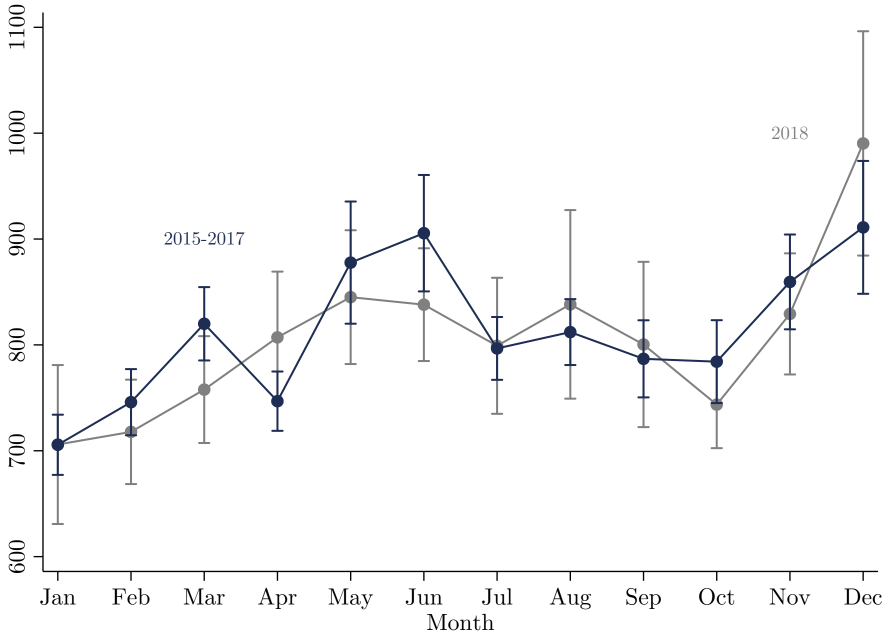


Note: These figures present elasticities estimate using two different methods discussed in the literature. Important to note that (Londoño-Vélez & Ávila Mahecha, 2019) report wealth elasticity. All other papers report revenue elasticity. For each of those papers, estimates are presented in a range. The figure illustrate those ranges, with a dot mark at the range median.

Figure A5: Monthly sales for firms with different yearly gross revenue



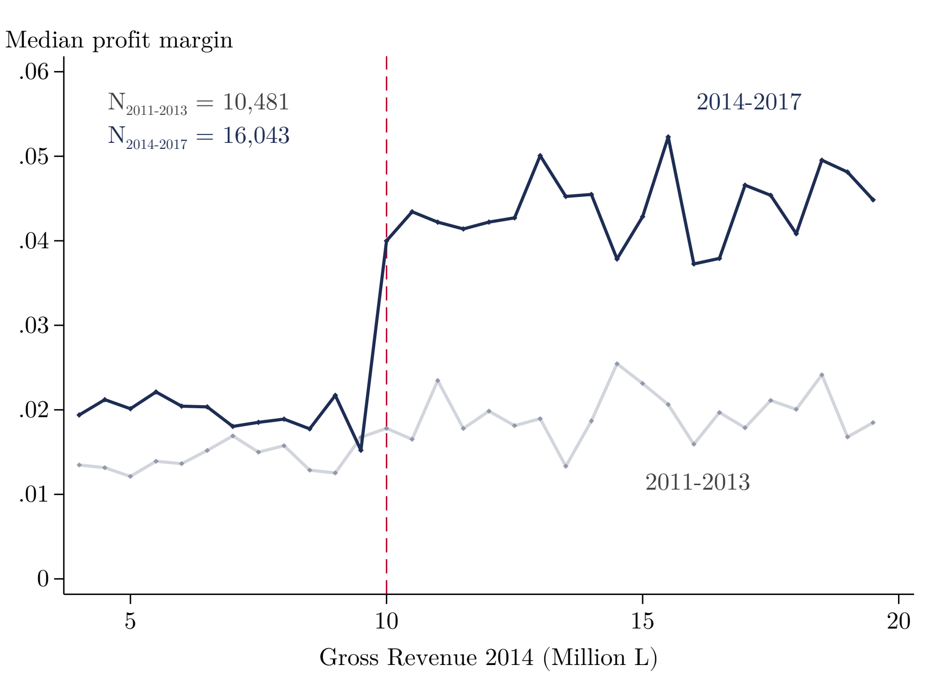
(a) 2015-2017 - Around L10 million notch



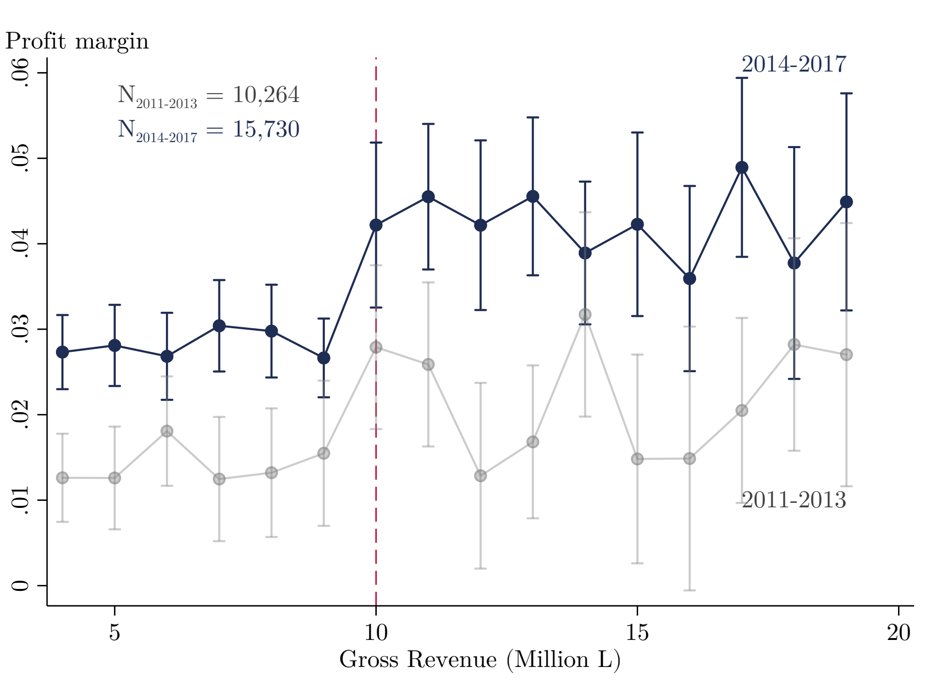
(b) 2015-2017 vs. 2018 - Below notch

Note: This figure presents average and 95% CI monthly sales separately for firms declaring gross revenue in L5-9 million, L9-10 million and L11-15 million bins on period 2015-2017 (Panel A), and for firms declaring gross revenue between L9-10 million in 2015-2017 and 2018. The sample is restricted to firms filing both monthly sales taxes and yearly income taxes and only include firm-year observations for which the total amount of monthly revenue falls within 5% of the total revenue declared in the yearly Income Tax Declaration,

Figure A6: Reported profit margin by gross revenue



(a) Median profit margin



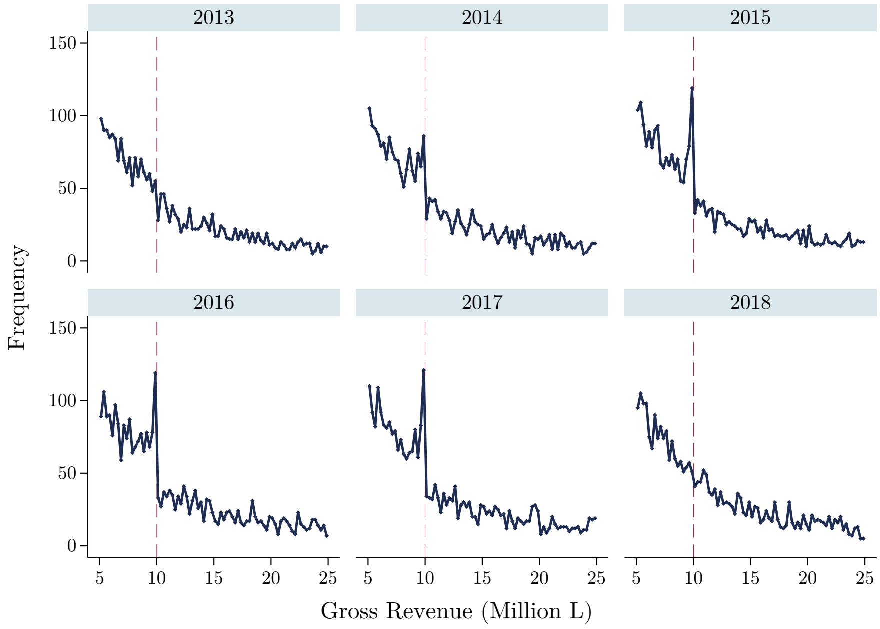
(b) Average profit margin

Note: This figure presents median (Panel A) and average with 95% CI (Panel B) reported profit margins by firms in two groups: 2011-2013, before the introduction of the minimum tax, and 2014-2017, then the minimum tax was in place for corporations with gross revenue above L10 million. The figure illustrates that corporations liable for the minimum tax increase their reported profit margins, consistent with the disappearance of the incentive to over report deductions in order to minimize tax liability. Bins are L500,000 wide in Panel A and L1 million in Panel B. Profit margins are trimmed at the 1st and 99th percentiles in Panel B.

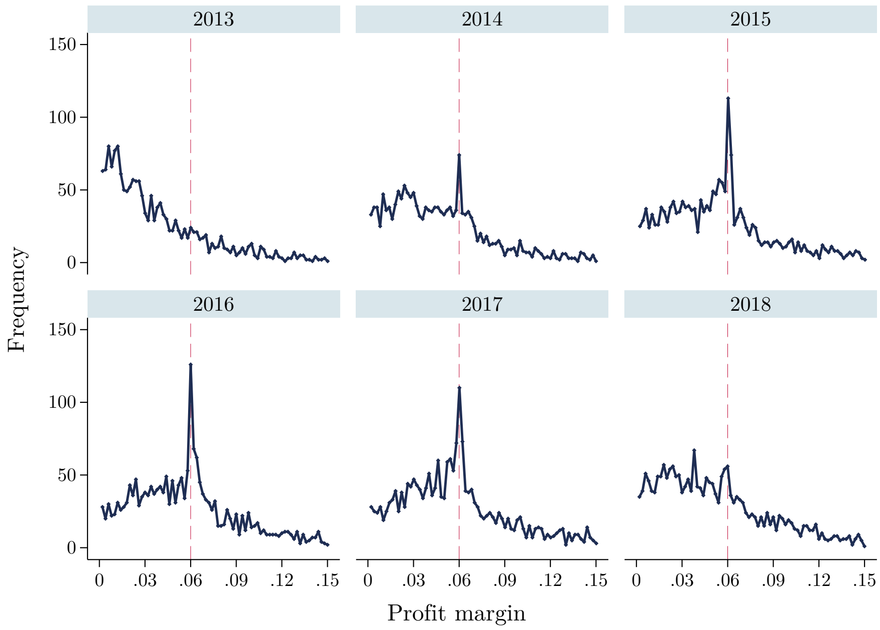
Figure A7: Average number of wage workers by gross revenue (2015-2017 vs. 2018)

Note: This figure presents the average number of wage workers for firms in each gross revenue bin in 2015-2017 (when the exemption threshold was L10 million) and 2018 (when the threshold increased to L300 million). The number of wage workers is computed as the number of unique individuals for which the firm withheld taxes on wages. Firms are not required to withhold taxes if the total amount paid is below the exemption threshold for non-incorporated individuals, so these estimates of number of workers should be interpreted as lower bounds. The sample is limited to firms declaring at least one employee withholding (between 50-60% of firms declaring gross revenue above L5 million).

Figure A8: Robustness: Balanced panel of corporations (2013-2018)



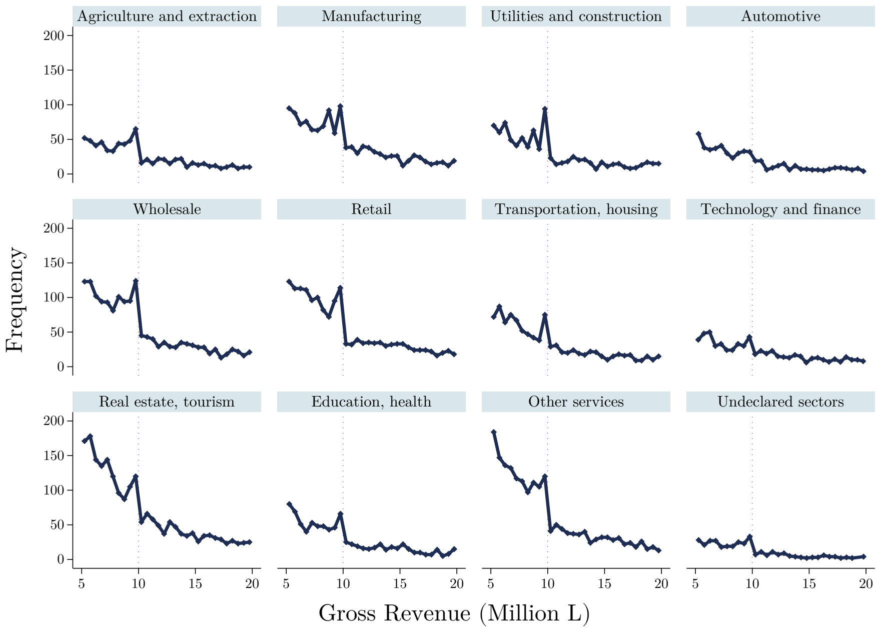
(a) Gross revenue empirical density



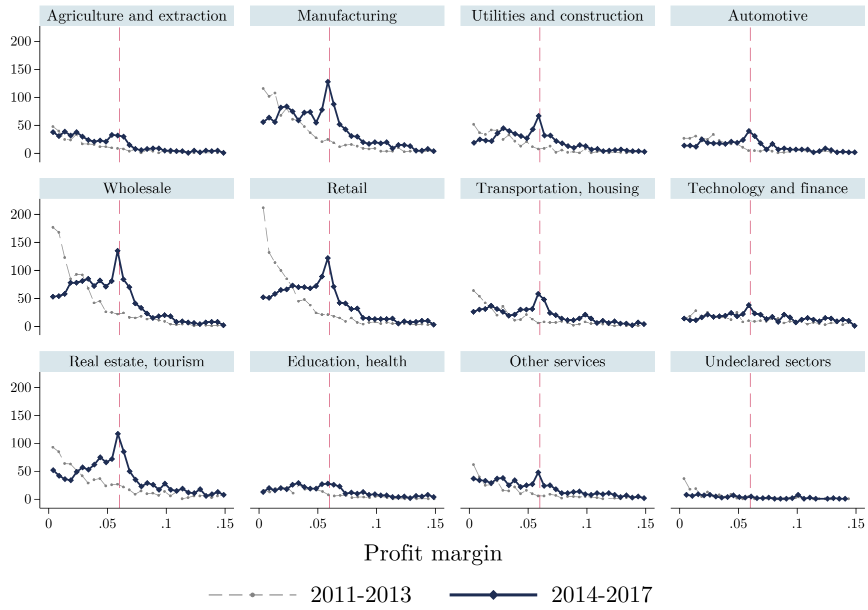
(b) Profit margin empirical density

Note: This figure presents the empirical density of gross revenues (Panel A) and profit margins (Panel B) for a balanced panel of 12,172 firms, for each year in the period 2013-2018. It documents the same pattern observed for the full sample. Panel A shows a smooth distribution of gross revenue around the L10 million notch in 2013 and 2018, but significant excess mass between 2014-2017. This is evidence that taxpayers respond to the minimum tax by strategically bunching below the exemption threshold. Panel B shows that taxpayers liable for the minimum tax increase their reported profit margin and bunch around a 6% margin, which separates the minimum tax and profit taxation regimes. Bins are L250,000 wide in Panel A and 0.2 p.p. wide in Panel B. The sample in Panel B is restricted to firms reporting gross revenue above L13 million in each year.

Figure A9: Robustness: Behavioral responses by economic sector



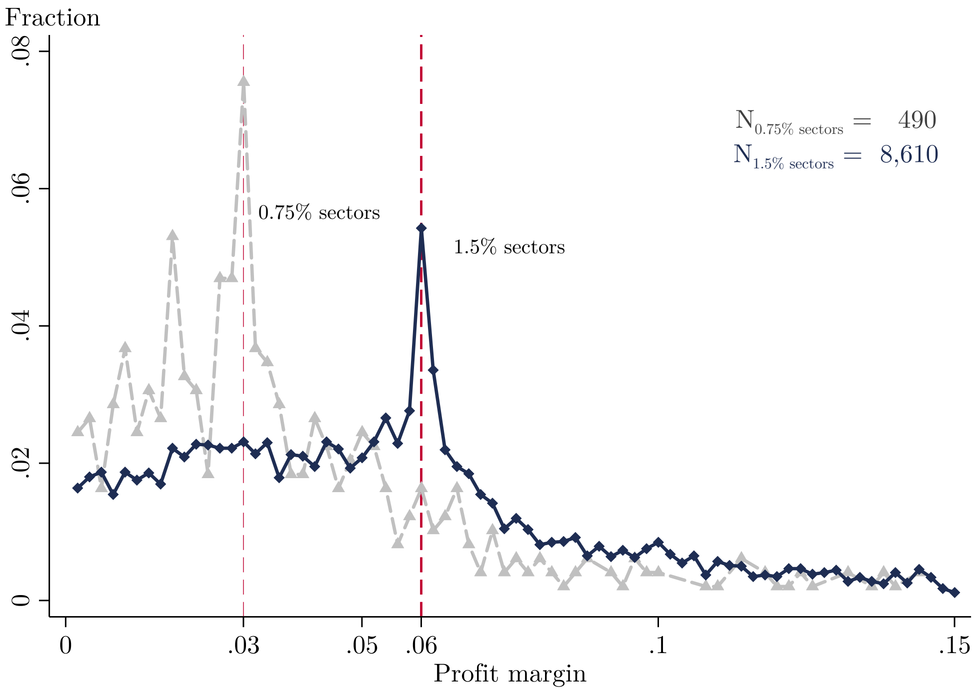
(a) Gross revenue empirical density



(b) Profit margin empirical density

Note: This figure presents the empirical density of gross revenues (panel A) and profit margins (Panel B) for firms in different economic sector for the period 2014-2017 pooled. Panel A documents that bunching below the notch is observed, in different degrees, for firms in the majority of sectors. Panel B shows that before the introduction of the minimum tax (2011-2013) the profit margin distribution is smooth around the 6% kink and presents a steep negative slope. With the introduction of the minimum taxation, the distribution shifts to the right and present excess mass around the kink. Bins are L500,000 wide in Panel A and 0.5 p.p. wide in Panel B. The sample in Panel B is restricted to firms reporting revenue above L13 million (infra marginal to the revenue bunching).

Figure A10: Empirical Density around 6% profit margin threshold - 0.75% vs. 1.5% sectors (2014-2017)



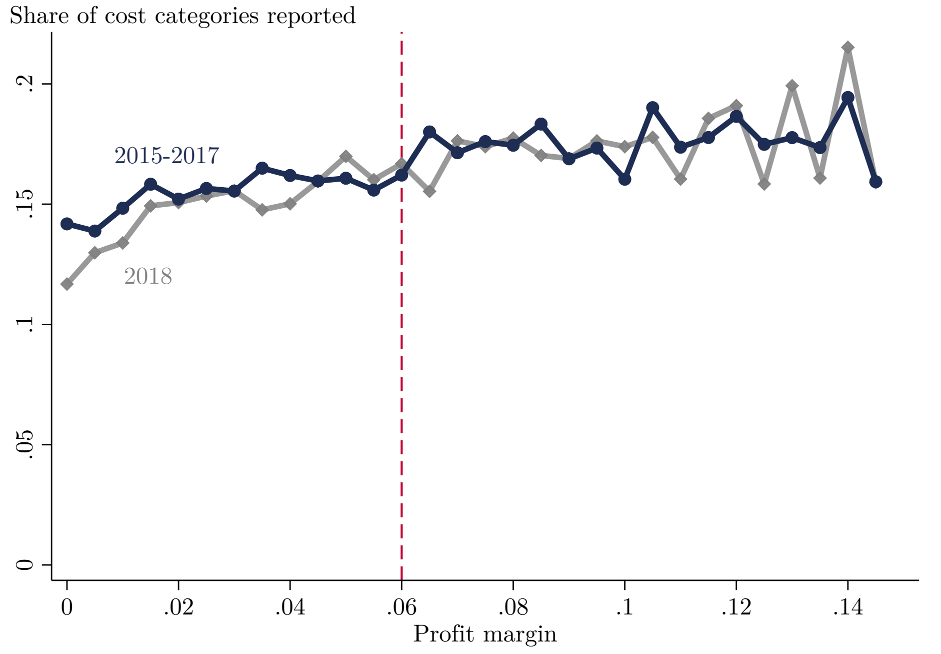
Note: This figure presents the empirical density of reported profit margins for firms subject to the 1.5% minimum tax (in solid blue) and those in sectors subject to the 0.75% rate (in dashed gray) for the period 2014-2017. The sample is restricted to firms reporting revenue above L13 million (infra marginal to revenue bunching). Bins are 0.2 p.p. wide and the first bins starts at 0.1% such that the 6% kink is the midpoint of a bin.

Table A1: Cost evasion responses across economic sectors

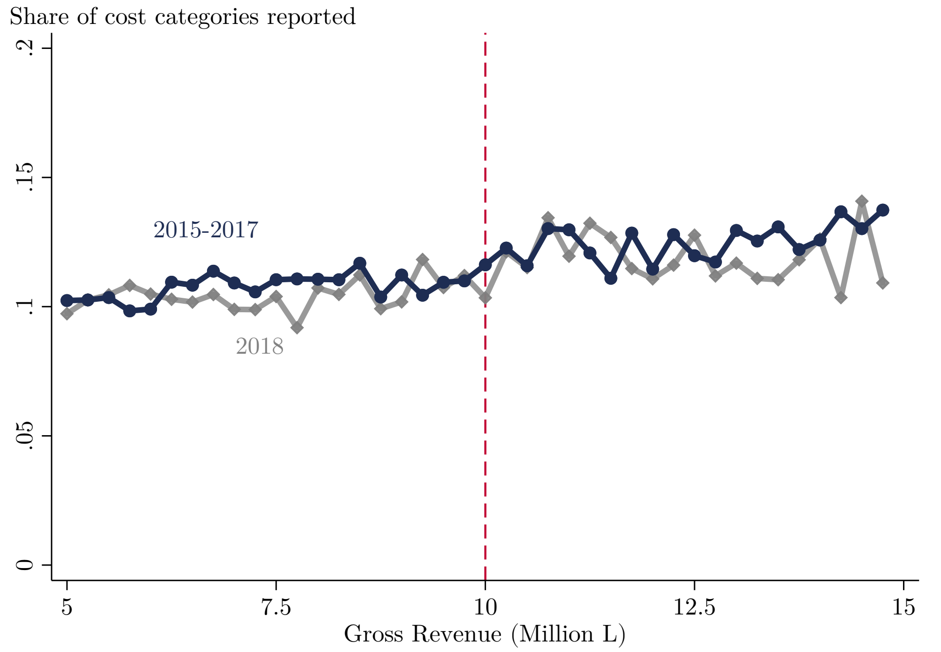
Year	(1) Excess Mass (B)	(2) Bunching(b)	(3) Delta Profit	(4) Estimated evasion ($\epsilon_y = 0.99$)
Agriculture and extraction	38.35	6.06	1.20	-18.52
	(10.02)	*(2.40)*	*(0.50)*	*(7.96)*
Manufacturing	153.10	7.86	1.60	-25.18
	(13.45)	*(1.16)*	*(0.20)*	*(3.87)*
Utilities and construction	61.86	5.55	1.10	-16.85
	(7.52)	*(0.89)*	*(0.20)*	*(3.02)*
Automotive	49.72	7.91	1.60	-25.18
	(6.47)	*(1.54)*	*(0.30)*	*(5.15)*
Wholesale	132.19	5.66	1.10	-16.85
	(13.63)	*(0.81)*	*(0.20)*	*(2.75)*
Retail	85.16	3.71	0.70	-10.18
	(10.82)	*(0.58)*	*(0.10)*	*(2.00)*
Transportation, housing	69.39	8.09	1.60	-25.18
	(8.57)	*(1.76)*	*(0.30)*	*(5.83)*
Technology and finance	28.68	3.80	0.80	-11.85
	(7.22)	*(1.18)*	*(0.20)*	*(4.07)*
Real estate, tourism,other	93.89	4.15	0.80	-11.85
	(12.37)	*(0.67)*	*(0.10)*	*(2.34)*
Education, health, entertainment	31.71	4.59	0.90	-13.52
	(7.82)	*(1.48)*	*(0.30)*	*(4.92)*
Other services	34.21	4.04	0.80	-11.85
	(8.00)	*(1.28)*	*(0.30)*	*(4.26)*
Undeclared sectors	-1.93	-1.11	-0.20	4.82
	(4.98)	*(2.64)*	*(0.50)*	*(8.71)*

Note: This table presents estimates of change in reported profit margins and cost evasion for firms by economic sector, pooled for the 2014-2017 period. The first column reports the estimated excess number of firms (B) while column (2) reports the ratio between excess mass and average counterfactual density in the bunching region (b). Column (3) presents estimated change in profit margin, while column (4) present changes in cost misreporting using the decomposition in Equation 13.

Figure A11: Average number of cost categories with positive deduction



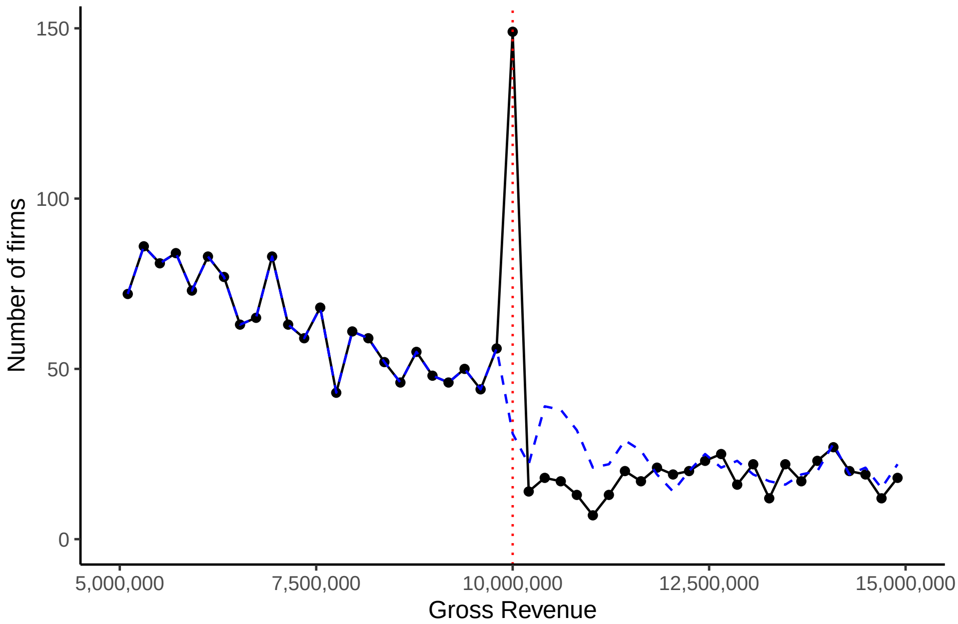
(a) Around 6% profit margin kink



(b) Around L10 million notch

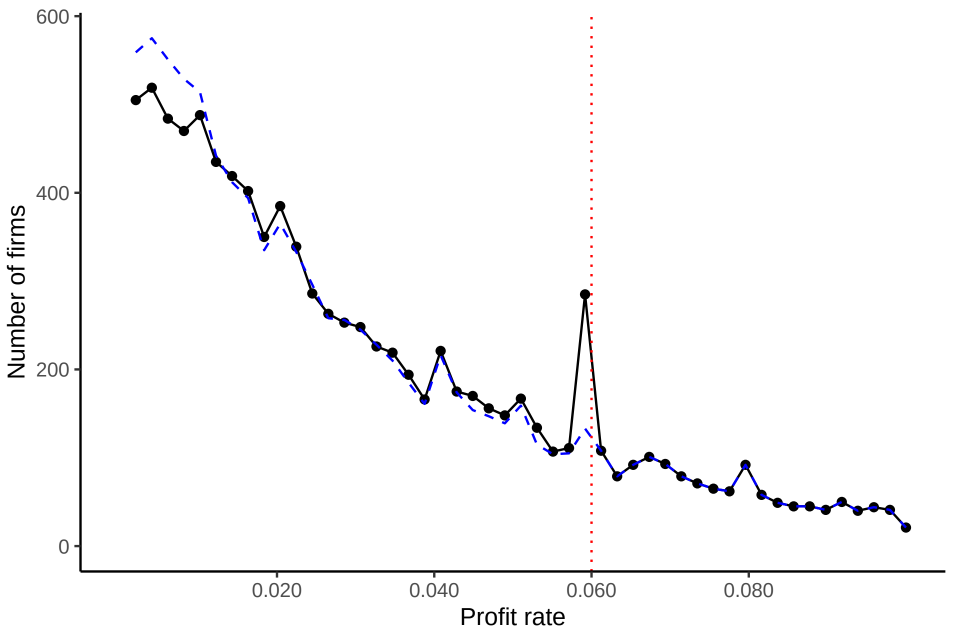
Note: This figure presents the average share of all cost categories reported by taxpayers in each bin. Panel (a) restricts the sample to taxpayers reporting revenue above L12 million and therefore infra-marginal to the revenue bunching behavior. Profit margin bins are 0.5% wide. The blue line represents declarations in the period 2015-2017, when the minimum tax affected a large number of taxpayers, while the gray line refers to declarations in 2018, when only a small subset of corporations were affected by the minimum tax. Panel (b) compares the usage of cost categories across the reported gross revenue distribution, for the period 2015-2017 (blue) and 2018 (gray). Both panels restrict the sample to taxpayers filing electronically, for which detailed cost categories are available.

Figure A12: Calibrated model - bunching on L10 million revenue notch



Note: This figure presents the density of simulated gross revenue using our calibrated model. The blue dashed line is the simulated density under profit taxation, while the solid black line presents the density under a Minimum Tax regime in which firms declaring above L10 million are subject to a minimum tax liability equivalent to 1,5% of their declared gross revenue.

Figure A13: Calibrated model - bunching on 6% profit margin kink



Note: This figure presents the density of simulated profit margin using our calibrated model. The blue dashed line is the simulated density under profit taxation, while the solid black line presents the density under a Minimum Tax regime in which firms declaring above L10 million are subject to a minimum tax liability equivalent to 1,5% of their declared gross revenue. We restrict the simulated sample to firms that choose to declared gross revenue above L12 million and are therefore infra-marginal to the bunching behavior at the notch.

Table A2: Alternative order of polynomial - Profit margin distribution

Year	(1) Excess Mass (B)	(2) Bunching(b)	(3) Delta Profit	(4) Estimated evasion ($\epsilon_y = 0.99$)
Order p = 3	779.64	5.38	1.10	-16.85
	(46.24)	*(0.39)*	*(0.10)*	*(1.44)*
Order p = 4	834.22	6.05	1.20	-18.52
	(40.69)	*(0.38)*	*(0.10)*	*(1.39)*
Order p = 6	788.99	5.49	1.10	-16.85
	(39.83)	*(0.37)*	*(0.10)*	*(1.35)*

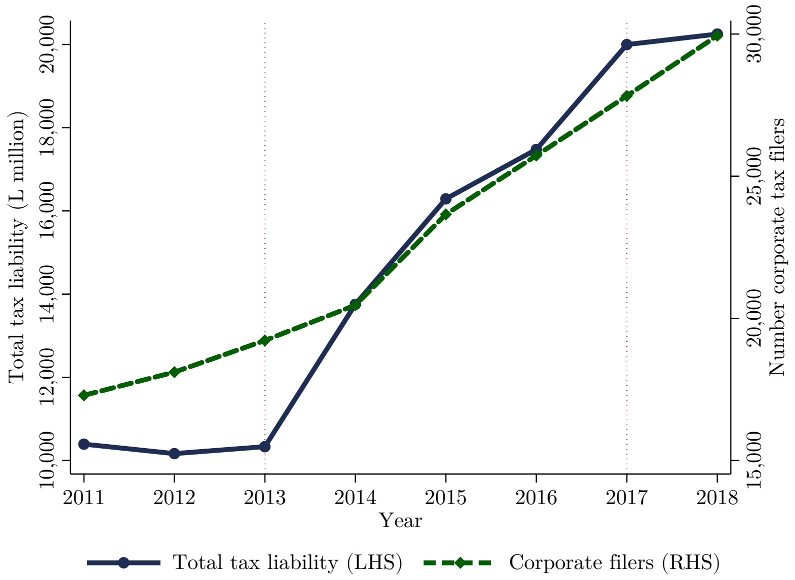
Note: This table presents results from replicating the exercises performed in Table 5 using different order of polynomials to estimate the counterfactual distribution of profit margin for the sample of pooled taxpayers in 2014-2017. The baseline specification uses polynomial regression of order five, while in this table we present results using polynomials of order three, four and six.

Table A3: Alternative order of polynomial - gross revenue distribution

	(1) Excess # Firms (B)	(2) Firms % counterfactual (b)	(3) y_u (upper bound)	(4) Δ Revenue (upper bound)	(5) ϵ_y (upper)	(6) ϵ_y (lower)
Order p = 3	604.30	8.82	14.70	4.70	5.96	0.60
	(34.16)	*(0.70)*	*(0.68)*	*(0.68)*	*(1.36)*	*(0.09)*
Order p = 4	569.91	6.78	12.90	2.90	2.45	0.50
	(30.91)	*(0.60)*	*(0.61)*	*(0.61)*	*(1.09)*	*(0.06)*
Order p = 6	494.55	5.69	12.30	2.30	1.58	0.35
	(25.07)	*(0.63)*	*(0.78)*	*(0.78)*	*(1.29)*	*(0.04)*

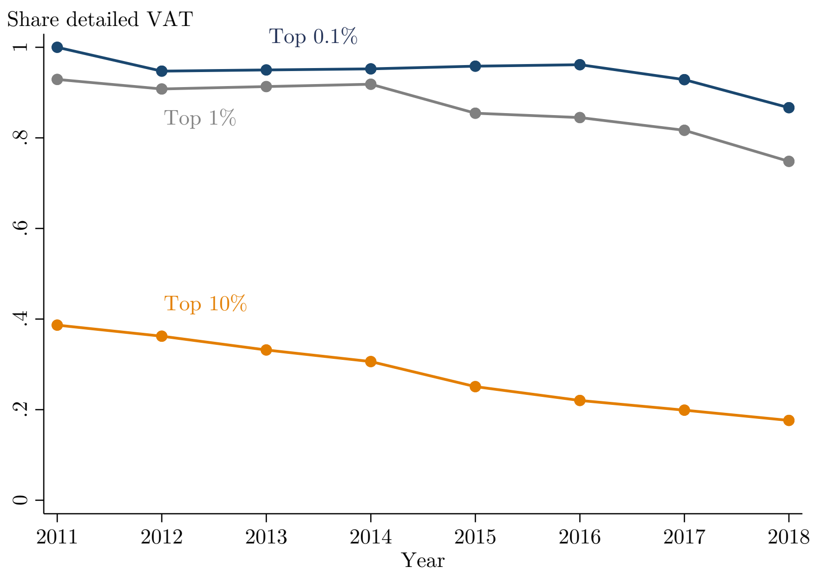
Note: This table presents results from replicating the exercises performed in Table 3 using different order of polynomials to estimate the counterfactual distribution of gross revenue for the sample of pooled taxpayers in 2014-2017. The baseline specification uses polynomial regression of order five, while in this table we present results using polynomials of order three, four and six.

Figure A14: Total corporate tax liability and number of filers



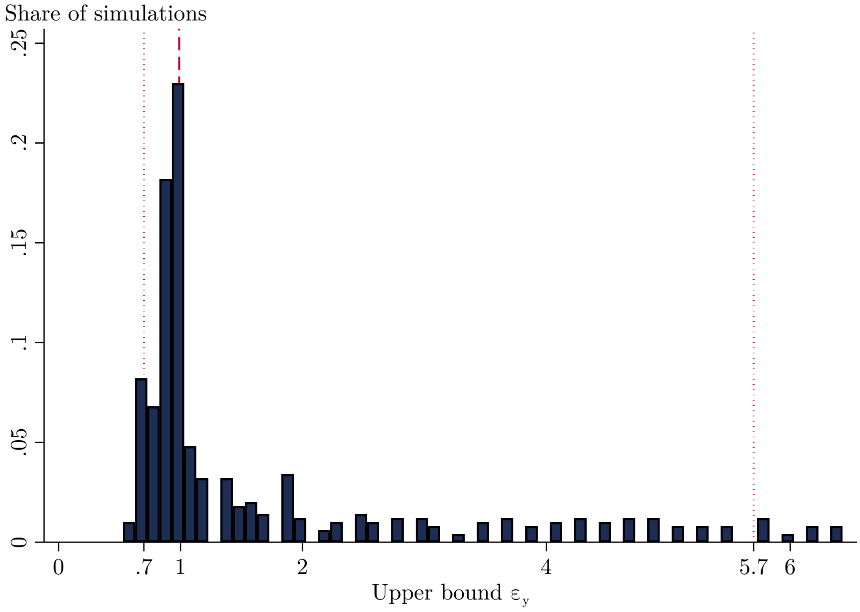
Note: This figure presents, for each year in the period 2011-2018, the total number of corporate tax filers in our sample and the total tax liability. It documents the very significant increase in aggregate tax liability between 2013 and 2014, when the minimum tax was introduced. The sample excludes taxpayers exempt from all income taxes.

Figure A15: Share of taxpayers mandated to file detailed VAT purchases



Note: This figure presents, for each year in the period 2011-2018, the share of taxpayers in each revenue group (top 0.1%, top 1% and top 10%) that are defined as medium or large. These are the taxpayers with an obligation to file individualized information on their purchases to claim VAT deductions, generating independent information on suppliers' revenues. The list of medium and large taxpayers was defined in 2011 and has not changed since. Groups are mutually exclusive, so the group defined as top 1% exclude taxpayers in the top 0.1% and the 10% group all those in the top 1% and 0.1%. The sample excludes taxpayers exempt from all income taxes.

Figure A16: Histogram of revenue elasticity bootstrap estimate for pooled sample (2014-2017)



Note: This figure presents the histogram of 500 bootstrap estimates for the upper bound elasticity using the pooled sample of corporation filing in 2014-2017. The dashed line marks the point estimate of $\epsilon_y = 0.99$, while the two dotted lines mark percentiles 2.5 and 97.5 of the distribution. The empirical 95% confidence interval is $[0.7, 5.7]$. Bins are 0.1 wide.

B Approximating the elasticity with notch

In this section we adapt the exercise of Kleven & Waseem (2013) and Kleven (2018) to obtain the elasticity formula when taxpayers face a notch instead of a kink. The intuition behind the derivation is that we try to recover what would have been the kink that would "replicate" the same behavior observed with the notch. We start by considering the average slope of the indifference curve of the marginal buncher: this IC is tangent to the threshold using the hypothetical kink with slope $(1 - \tau^*)$ and has slope of $(1 - t_0 - \Delta t)$ at the point $y^t + \Delta Y$. In our case, $t_0 = 0$ since the effective marginal rate on revenue is zero below the threshold, and $\Delta t = \tau_y = 0.015$. We can write

$$\frac{\int_{y^T}^{y^t+\Delta Y} I'(y)dy}{\Delta Y} \approx \frac{I'(y^T) + I'(y^t + \Delta Y)}{2} = \frac{(1-\tau^*) + (1-t-\Delta t)}{2} = \frac{(1-\tau^*) + (1-\tau_y)}{2}$$

The implicit tax rate faced by corporations is the change in tax liability when we change the reported revenue from above the threshold to exactly at the notch:

$$t^* = \frac{T(y^t + \Delta Y) - T(y^T)}{\Delta Y} = \frac{\tau_y(y^t + \Delta Y) - \tau_\pi(y^T - \hat{c})}{\Delta Y}$$
$$= \tau_y + \frac{\tau_y y^T + \tau_\pi(y^T - \hat{c})}{\Delta Y}$$

Combining the fact that we have these two approximations to the slope of the IC in that region, and that $\Delta t = 0.015 = \tau_y$, we can write:

$$1 - t^* = \frac{(1-\tau^*) + (1-\tau_y)}{2}$$
$$\tau^* = \tau_y + 2\left(\frac{\tau_y Y^T + \tau_\pi\left(y^T - \hat{c}\right)}{\Delta Y}\right)$$

Plugging in the expression for τ^* in the usual expression for obtaining revenue elasticity when facing changes in marginal taxes we obtain:

$$\epsilon_{y,(1-t)} = \frac{\frac{\Delta Y}{Y^T}}{\frac{\Delta \tau^*}{(1-\tau^*)}} = \frac{\Delta Y}{Y^T}\left(\frac{1-\tau^*}{\tau^* - t_0}\right)$$
$$= \frac{\Delta Y}{Y^T}\left(\frac{1-\tau^*}{\tau_y + 2\left(\frac{\tau_y Y^T - \tau_\pi(Y_T - \hat{c})}{\Delta Y}\right)}\right)$$
$$= \left(\frac{1}{\tau_y\left(2 + \frac{\Delta Y}{Y^T}\right) - 2\tau_\pi \frac{(Y_T - \hat{c})}{Y_T}}\right)\left(\frac{\Delta Y}{Y^T}\right)^2 (1-\tau)$$

Some things are worth noting from this expression. First, for a firm with zero reported profit at the notch ($y^T = \hat{c}$), than the expression above simplifies to

$$\epsilon_{y,(1-\tau)} \approx \left(\frac{\Delta Y}{Y^T}\right)^2 \left(\frac{(1-\tau)}{\Delta \tau}\right)\left(\frac{1}{2 + \frac{\Delta Y}{Y^T}}\right)$$

which is exactly the same expression in Kleven & Waseem (2013). This is the expression we use to calculate the upper bound of elasticities presented in the text, since the taxpayer with highest incentive to bunch has profits only marginally above zero.

Second, note that if profit margin is exactly 6%, then it's true that

$$\tau_y\left(2 + \frac{\Delta Y}{Y^T}\right) - 2\tau_\pi 0.06 = 0.015\left(2 + \frac{\Delta Y}{Y^T}\right) - 2(0.25)0.06 = 0.015 * \frac{\Delta Y}{Y^T}$$

and the elasticity becomes

$$\begin{aligned}
\epsilon_{y,(1-t)} &= \left(\frac{1}{\tau_y(2+\frac{\Delta Y}{Y^T}) - 2\tau_\pi \frac{(Y_T - c)}{Y_T}}\right)\left(\frac{\Delta Y}{Y^T}\right)^2 (1-\tau) \\
&= \left(\frac{Y^T}{0.015\Delta Y}\right)\left(\frac{\Delta Y}{Y^T}\right)^2 (1-\tau) \\
&= \left(\frac{\Delta Y}{Y^T}\right)\frac{(1-\tau)}{\tau_y} = \epsilon_{kink}
\end{aligned}$$

For a taxpayer with 6% reported profit margin, the exemption threshold represents a kink, not a notch, since their tax liability changes continuously around the cutoff.

C Estimation of revenue elasticity lower bound

Following Bachas & Soto (2018), we compute the lower-bound of average revenue elasticity considering that firms with different profit levels (generated by heterogeneity in fixed-costs) will face different incentives to bunch. First, recall that firms with counterfactual profits above 6% or below 0% will not decide to bunch, since they are not affected by the minimum tax. Second, for firms within that profit range, the incentive to bunch is directly proportional to their costs: firms with high costs (low profit margins) will have a strong incentive to bunch since their tax liability at the threshold will be small, while not bunching means a much larger tax liability based on their revenues.

Let $\Psi(y_0, c_0)$ be the joint distribution of revenue and costs. We can then express the amount of bunching taxpayers as

$$\begin{aligned}
B &= \int_c \int_{Y^T}^{Y^T+\Delta Y} \Psi(y_0, c_0) dydc \\
&= \int_c \int_{Y^T}^{Y^T+\Delta Y} \phi_y(y_0)\phi(c_0) dydc \\
&= \int_{Y^T}^{Y^T+\Delta Y} \phi_y(y_0) \int_{c_0} \phi(c_0) dcdy \\
&= \int_{Y^T}^{Y^T+\Delta Y} \phi_y(y_0) \int_0^{m(y_0)} \phi(m_0) dmdy
\end{aligned}$$

where in the second line we assume that the cost and revenue distributions are independent; in the third line we make it explicit that, for any given level of revenue, there is a cost region that will induce bunching; and in the last line we re-write the expression as a function of profit levels instead of cost, and make it explicit that, for any given revenue level, only low-profit taxpayers will bunch, the upper threshold of which depends on the revenue level. Intuitively, for taxpayers very close to the notch, all those potentially affected by the minimum tax will decide to bunch, whereas those farther from it will only bunch if the differential tax liability is large due to their low profits.

In order to connect the cost/profit levels that induce bunching at each revenue level, recall that we previously computed that, for the marginal buncher at revenue level $Y^T + \Delta Y$, we can compute the revenue elasticity as

$$\epsilon_{y,(1-t)} = \left(\frac{1}{\tau_y(2 + \frac{\Delta Y}{Y^T}) - 2\tau_\pi \frac{(Y_T - \hat{c})}{Y_T}} \right) \left(\frac{\Delta Y}{Y^T} \right)^2$$

We can rewrite this equality putting the reported cost $\hat{c}$ in evidence:

$$\hat{c}^* = Y^T \left(1 - \frac{\tau_y}{\tau_\pi} \right) - \frac{\tau_y}{\tau_\pi} \frac{\Delta y}{2} + \frac{(\Delta y)^2}{2\epsilon_y \tau_\pi Y^T}$$

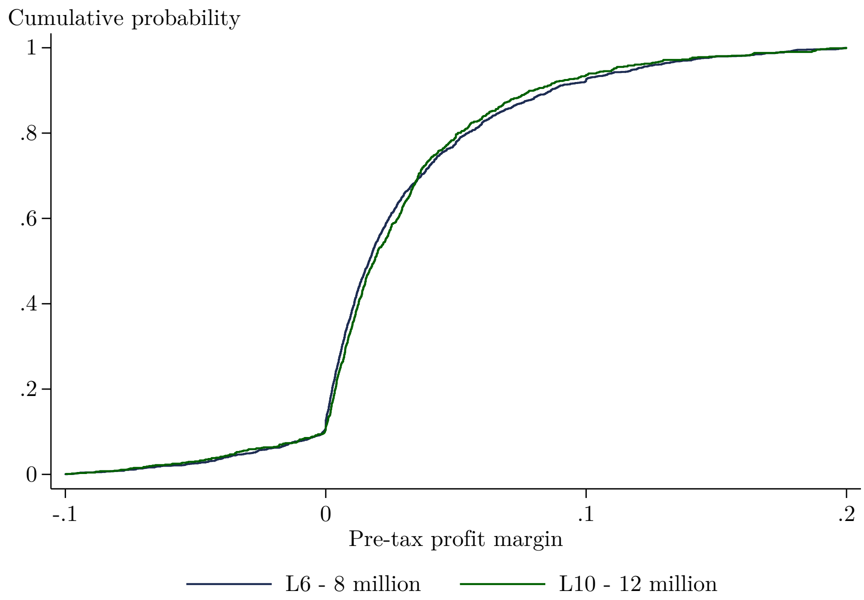
For a given revenue level and elasticity, $\hat{c}^*$ is the cost at the threshold that would make a taxpayer indifferent between bunching and staying above the notch. Any taxpayer with costs above that level, i.e. a lower profit margin, would decide to bunch.

We implement the estimation of the revenue elasticity ϵ_y in the following steps. First, we need to consider the counterfactual profit distribution that would be observed in the absence of the notch. For each period in our sample, we take that to be the observed profit margin density for firms reporting revenue in the interval L6 - 8 million[54]. We then proceed to compute, for each revenue bin (ΔY) and ϵ_y, what is the share of taxpayers with profit margin between 0 and the implied upper bound, and use the counterfactual density to obtain the number of taxpayers that bunch in each revenue bin. This allows us to obtain, for each potential revenue elasticity, the total number of predicted bunchers, which we compare to the estimated number of bunchers. The final elasticity, therefore, is the value that generates the same number of bunchers as the excess mass below the threshold.

We illustrate this procedure in Figure A18 for the pooled sample of taxpayers in 2014-2017. Each of the curves is a simulated density that would prevail under a different revenue elasticity, according to our methodology.

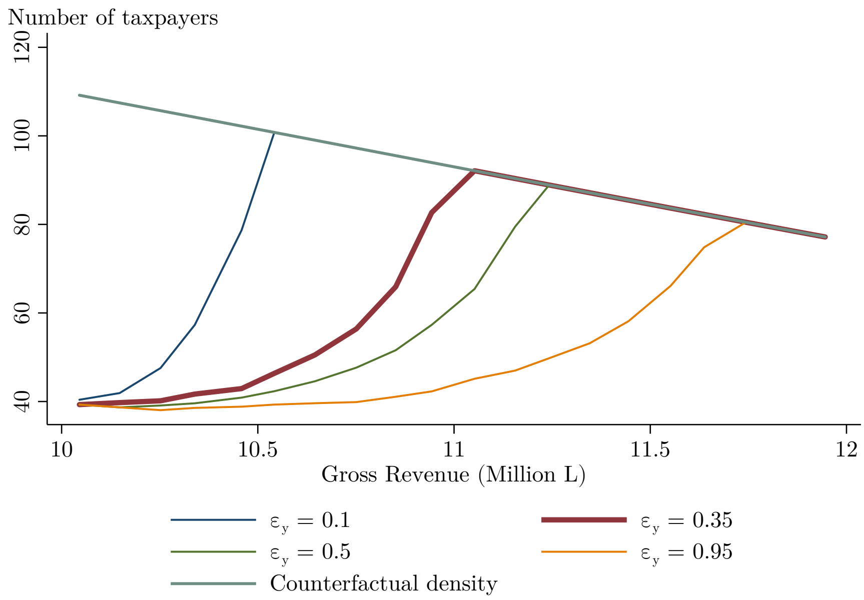
[54]We show in Figure A17 that the profit margin distribution is similar for the L6 - 8 million and L10-12 million range in the period before the introduction of the minimum tax.

Figure A17: CDF of profit margin for different revenue ranges



Note: This figure presents cumulative distribution functions (CDFs) of profit margins in 2011-2013, for corporations reporting gross revenues between L6 - 8 million and between L10-12 million. The distributions are trimmed at -10% and 20%. The profit margin distributions are similar across different revenue levels, suggesting the assumption used to estimate the lower bound revenue elasticity (using profit margin distribution below the L10 million notch as the counterfactual distribution above the notch) is reasonable.

Figure A18: Simulation to obtain average elasticity



Note: This figure presents the predicted density of gross revenues above the L10 million threshold and several simulations of what the density would have been given different revenue elasticities according to the model described above.

D Assessing dominated region with parametric model

As in Kleven & Waseem (2013), we consider a parametric model to assess what is the dominated region in our notch setting, that is, the interval of revenue that is (potentially) strictly dominated for taxpayers to locate at. Consider a simple version of our iso-elastic cost model (with no possibility to overreport costs), where firms are defined by a productivity parameter θ and a fixed-cost parameter α and profits are given by

$$\hat{\Pi}(y,\alpha) = y - \alpha - \frac{\theta}{1+1/e}\left(\frac{y}{\theta}\right)^{(1+1/e)} - T(y,\alpha)$$

First, note that under a pure profit tax ($T(y,\alpha) = \tau_\pi(y - c(y))$), we have that $y^* = \theta$, so the revenue choice reveals the productivity parameter. Under revenue taxation, the optimal revenue choice is $y^* = \theta(1-\tau_y)^e$. Let the productivity of the marginal buncher be $\theta^T + \Delta\theta$. The marginal buncher is indifferent between reporting revenue exactly at the threshold or staying at their best interior solution. Their profit under each decision are given by

$$\Pi_{Bunch} = (1-\tau_\pi)\left(y^T - \alpha - \frac{\theta^T + \Delta\theta}{1+1/e}\left(\frac{y^T}{\theta^T+\Delta\theta}\right)^{1+1/e}\right)$$

$$\begin{aligned}
\Pi_{NotBunch} &= (1-\tau_y)y^* - \alpha - \frac{\theta^T+\Delta\theta}{1+1/e}\left(\frac{y^*}{\theta^T+\Delta\theta}\right)^{1+1/e} \\
&= (\theta^T+\Delta\theta)(1-\tau_y)^{1+e} - \alpha - \frac{\theta^T+\Delta\theta}{1+1/e}(1-\tau_y)^{1+e} \\
&= \frac{(\theta^T+\Delta\theta)(1-\tau_y)^{1+e}}{e+1} - \alpha
\end{aligned}$$

Finally, since the internal solution for the marginal buncher, had they not bunched, could be written as $y^T + \Delta Y = (\theta^T + \Delta\theta)(1-\tau_y)^e$, we can replace the terms involving the (unobserved) taxpayer type with the (observed) thereshold and the (estimable) change in revenue. We then have

$$\begin{aligned}
\Pi_{Bunch} &= \Pi_{NotBunch} \\
(1-\tau_\pi)\left(y^T - \alpha - \frac{y^T+\Delta y}{(1-\tau_y)^e(1+1/e)}\left(\frac{y^T(1-\tau_y)^e}{y^T+\Delta y}\right)^{1+1/e}\right) &= \frac{y^T+\Delta y}{(1-\tau_y)^e}\frac{(1-\tau_y)^{1+e}}{e+1} - \alpha \\
(1-\tau_\pi)(y^T-\alpha) - (1-\tau_\pi)(1-\tau_y)\frac{y^T+\Delta y}{1+1/e}\left(\frac{y^T}{y^T+\Delta y}\right)^{1+1/e} &= \frac{1-\tau_y}{e+1}(y^T+\Delta y) - \alpha
\end{aligned}$$

Let's consider what happens when taxpayers have $e = 0$. Taking the limit of the above equality as elasticity goes to zero we get:

$$
\begin{aligned}
(1-\tau_\pi)(y^T-\alpha)-\frac{1-\tau_y}{1}(y^T+\Delta y)+\alpha=0\\
Lim_{e\to 0}\Delta y=\frac{\tau_y y^T-\tau_\pi(y^T-\alpha)}{1-\tau_y}
\end{aligned}
$$

Some things to note. First, if $1-\alpha/y^T=0.06$, then $Lim_{e\to 0}\Delta y=0$: for taxpayers with "profit margin" equal to 6% and zero elasticity, there exists no dominated region - the notch becomes a kink. For those with $y^T=\alpha$, so they report non-positive profits, $Lim_{e\to 0}\Delta y=\frac{\tau_y * y^T}{1-\tau_y}=L152,000$. These are the taxpayers with strongest incentive to bunch, and the region between L10 million and L10,152,000 is dominated. For those with taxable income rates between 0-6%, the dominated region lies between 0 and L152,000.

In our empirical estimation of elasticity we use bins of L100,000. According to the calculation above, no taxpayers with taxable income rate between 0 - 2% should locate in that region. Using the counterfactual taxable income rate distribution, this group represents approximately 30% of taxpayers, meaning that no more than 70% of taxpayers could be observed reporting revenue above the threshold. As can be seen in Figure A18, for the first bin we observe less than 70 taxpayers while the counterfactual distribution predicts 110 taxpayers. So we cannot reject that, under 0 elasticity, all taxpayers that should bunch have actually bunched. Note that this is an extreme assumption, and we just cannot precisely explore the notch to recover "innatention" as in Kleven & Waseem (2013) or Londoño-Vélez & Ávila Mahecha (2019).

E Model calibration details

We modify firms' profit function by making explicit assumption about the cost and misreporting loss functions. Firms have isoelastic costs and also isoelastic loss function from misreporting costs:

$$
\hat{\Pi}(y,\hat{c})=(1-\tau)y+\tau\mu\hat{c}-\alpha_i-\frac{\theta_i}{1+1/e}\Big(\frac{y}{\theta_i}\Big)^{(1+1/e)}-\frac{B_i}{1+1/\gamma}\Big(\hat{c}-c(y)\Big)^{(1+1/\gamma)}
$$

Each taxpayer is characterized by the vector (θ_i,α_i,B_i) that define productivity, fixed cost and evasion ability, respectively. Given our functional forms, optimal vector of output and reported costs $(y^*,\hat{c}^*(y^*))$ are:

$$
\begin{aligned}
y^* =&\theta(1-\tau_E)^e\\
\hat{c}^*(y^*) =&c(y^*)+B_i\Big(\tau\mu\Big)^\gamma
\end{aligned}
$$

where $\tau_E = \tau\left(\frac{1-\mu}{1-\tau\mu}\right)$. Note that if we have profit taxation then $\mu = 1$ and $\tau_E = 0$, so firm size is undistorted.

In order to calibrate the model, we use data for the 2013, when no notches or kinks were in place. Under profit taxation, we have:

$$\begin{aligned}
y^* =& \theta \\
c(y^*) =& \alpha + \frac{\theta}{1+1/e} \\
\hat{c}^*(y^*) =& \alpha + \frac{\theta}{1+1/e} + \left(\frac{\tau}{B_i}\right)^{\gamma}
\end{aligned}$$

From the first-order conditions of an interior optimum, θ is simply the vector of reported output, which in this model coincides with real output. We also know the elasticity of output e, which we fix to be $e = 0.99$, the upper bound estimated for the pooled years. By using the upper bound of our elasticity estimate we are conservative in the case for using output taxation, since a higher elasticity will limit the potential benefit of the tax.

While we do not observe $c(y^*)$, the real costs, but only the reported costs $\hat{c}^*(y^*)$, we have estimated evasion as a share of profits using the 6% profit margin kink. Let that quantity be $\epsilon_{\hat{c}}$ .Using the fact that at the profit margin kink $(y - \hat{c})/y = \tau_y/\tau_\pi$ we can write:

$$\frac{(\hat{c} - c)}{y} = \frac{(\hat{c} - c)}{(y - \hat{c})} * \frac{(y - \hat{c})}{y} = \epsilon_{\hat{c}}(\tau_y/\tau_\pi) = \epsilon_{\hat{c}} * 0.06$$

Using the equations above, we have that

$$\frac{(\hat{c} - c)}{y} = \frac{\left(\frac{\tau}{B_i}\right)^{\gamma}}{\theta} = 0.06\epsilon_{\hat{c}}$$

In our setting, we do not have variation to identify γ, the elasticity of misreporting costs. Best et al. (2015) explore different profit tax rates for different subset of firms, while Bachas & Soto (2018) use estimates of cost elasticity in two different thresholds. We calibrate our model using the estimate from Best et al. (2015), which is approximately 1.5, which allows us to recover B_i as $B_i = \frac{\tau}{\left(\theta 0.06\epsilon_{\hat{c}}\right)^{1/\gamma}}$

Finally, given the previous we can just obtain the fixed cost vector α by computing

$$\alpha = \hat{c}^* - \frac{\theta}{1+1/e} + \left(\frac{\tau}{B_i}\right)^{\gamma}$$

F Social Contribution Tax and Net Asset Tax

Corporations face a 25% flat tax on yearly profits in Honduras. Three more special provisions affect their potential tax liability, nonetheless. The first is the minimum tax studied in this paper, which was introduced in 2014 and started to phase out in 2018. Since 1994, corporations also faced a net asset tax similar in nature to a minimum tax: if the tax liability under the asset tax is smaller than the profit tax liability, it can be used as a credit, meaning that in practice firms would only pay the profit tax. If the asset tax is larger, firms formally must pay the income tax and the additional difference between the two liabilities. In practice, the asset tax is also a tool to avoid that large corporations minimize their tax liability by inflating costs and driving down taxable income. In the period under study, the net asset tax was 1% of the net assets above L3 million.

The last provision is the Social Contribution (AS for the spanish *Aportación Solidaria*) tax, a surcharge on income tax applying to large firms. Established for the first time as a temporary measure in 2003, the AS tax rate varied between 5-10% in the period of this study and applied to declared taxable income above L1 million (USD 40,000)[55].

In Table A4 we present the distribution of firms by their tax status in each year of the sample. Both the AS and the asset tax existed throughout the analysis period, while the minimum tax was established in 2014. In each year, approximately one-quarter of tax filing corporations pay no income tax - this is often the result of generating no revenue in the period or, more frequently, registering losses. Before the introduction of the minimum tax, around 63% of corporations were liable for income tax and 9% for the net asset tax. With the introduction of the minimum tax in 2014, the share of firms liable for asset tax does not change, but the share paying income tax falls by 8 percentage points as firms start being liable for the minimum tax. Between 1,400 and 1,700 firms were paying the minimum tax before 2018, when the number falls drastically to only 135 once the exemption threshold increases from L10 million to L300 million. The Social Contribution tax was payed by 8-10% of corporations every year, and it is a surcharge on those paying either income or minimum tax, but not the asset tax[56].

We present evidence of taxpayers' response to the incentives posed by the net asset tax and the AS. First, corporations with net assets slightly above the L3 million threshold might have an incentive to bunch below that value, since any assets declared above that value are potentially taxed at 1%. The asset tax liability starts at zero for firms declaring exactly L3 million in assets and increases with a slope of 1% for each additional Lempira in net asset declared. This constitutes a *kink* in the taxpayers' budget set, and one that

[55] A tax reform in 2010 established the AS tax rate at 10% for the first two years and then progressively declined to zero by 2015. With the 2014 tax reform, nonetheless, the tax was made permanent and the tax rate fixed at 5%.

[56] In order to arrive at the final tax liability, the Tax Authority first calculates the maximum between the income tax and the minimum tax liabilities, and add the social contribution liability to that. This value is then compared to the asset tax liability, and the maximum of these two is the final tax liability.

is only relevant for corporations with very low income or minimum tax liability.

In Figure A20 and Figure A21 we present evidence of bunching in declared net assets, for each year between 2014 and 2018 and for the same period pooled together[57]. Throughout the period we observe an excess mass of taxpayers reporting net assets around L3 million, particularly in 2017 and 2018. When pooling all years together and estimating a counterfactual distribution in the same vein as Equation (Equation 8), we estimate an excess mass equivalent to 2 times the density at the threshold and find that the marginal buncher decreases reported net assets by 3% to avoid taxation[58].

We then turn to the Social Contribution tax. Described as a "surcharge" on taxable income above L1 million, in practice the AS introduces a kink on the tax schedule faced by firms: taxable income below L1 million is taxed at 25%, while any amount above that faces a marginal tax rate of $0.25+0.05 = 30\%$. It's worth noting that taxpayers' response to this kink is less straightforward than on personal income taxation: if we consider that taxable income is equivalent to pure profits, then we should expect no behavioral response since pure rents are being taxed. Realistically, production costs such as managers' efforts are not deductible and previous research has documented positive elasticities of corporate taxable income (Devereux et al., 2014).

In Figure A22 and Figure A23 we present evidence that corporations respond to those incentives by bunching at the kink. We present estimates of the corporate taxable income elasticity in Table A5[59]. Estimates for the first years are noisier, but for the period 2014-2018 estimates are precisely estimated and fall in the range of 0.4-0.6. These local estimates, around a kink equivalent to USD 40,000, are similar to the ones obtained by (Devereux et al., 2014) for corporations with taxable income around £10,000 in the UK.

[57]We do not present results for the period 2011-2013 due to data limitations. Before 2014 a much larger share of tax filings were not electronic and a different paper form was used. For those years, there seems to be inconsistencies between the total declared net assets and the sum of its components.

[58]We do not attempt to obtain a net asset elasticity from those estimates, since incentives to bunch will depend both on corporations' gross revenues and taxable income.

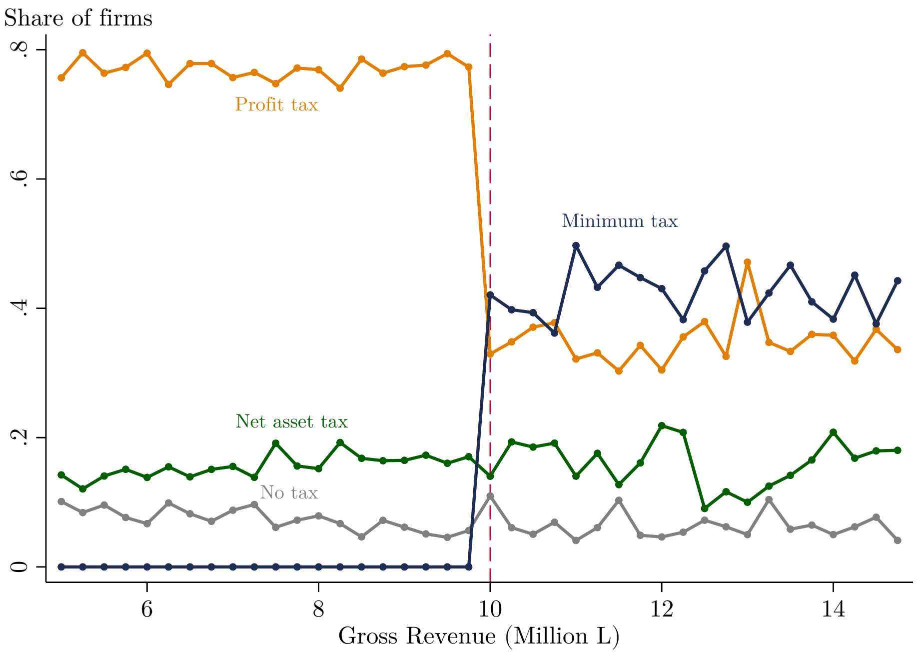
[59]The marginal taxpayer deciding to bunch is locating at an interior optimum so we can express the elasticity simply as $\epsilon_y = \frac{\Delta y/y}{\Delta \tau/(1-\tau)}$.

Table A4: Taxpayer status by year

Year	Not taxed	Income Tax	Asset Tax	Minimum Tax	Total
2011	4,791	10,940	1,563	0	17,294
2012	4,763	11,548	1,798	0	18,109
2013	4,945	12,372	1,906	0	19,223
2014	5,397	11,566	1,891	1,610	20,464
2015	6,237	13,997	1,944	1,480	23,658
2016	6,641	15,553	2,057	1,478	25,729
2017	7,328	16,544	2,281	1,672	27,825
2018	7,946	19,080	2,783	135	29,944

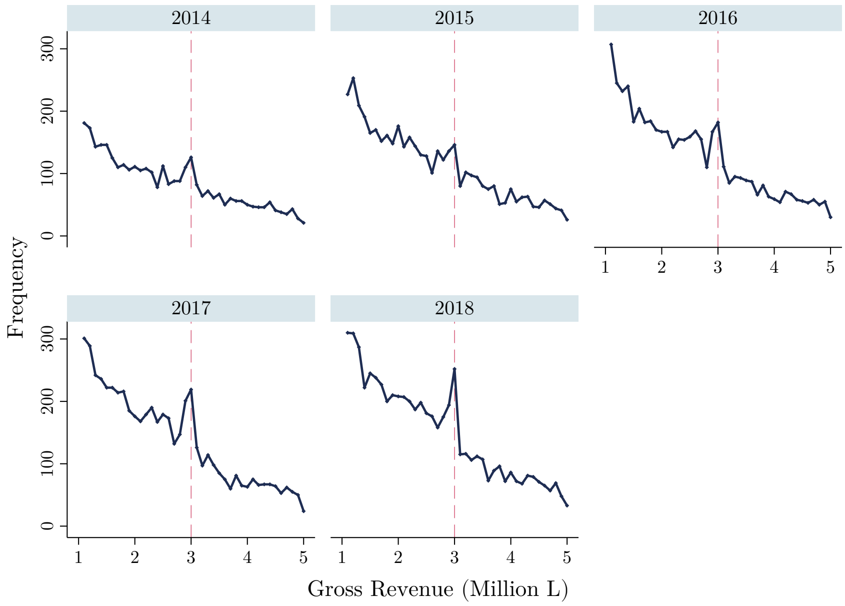
Note: This table presents the distribution of corporate taxpayers each year, according to their tax liability status.

Figure A19: Share of firms liable for each type of tax (2014-2017)



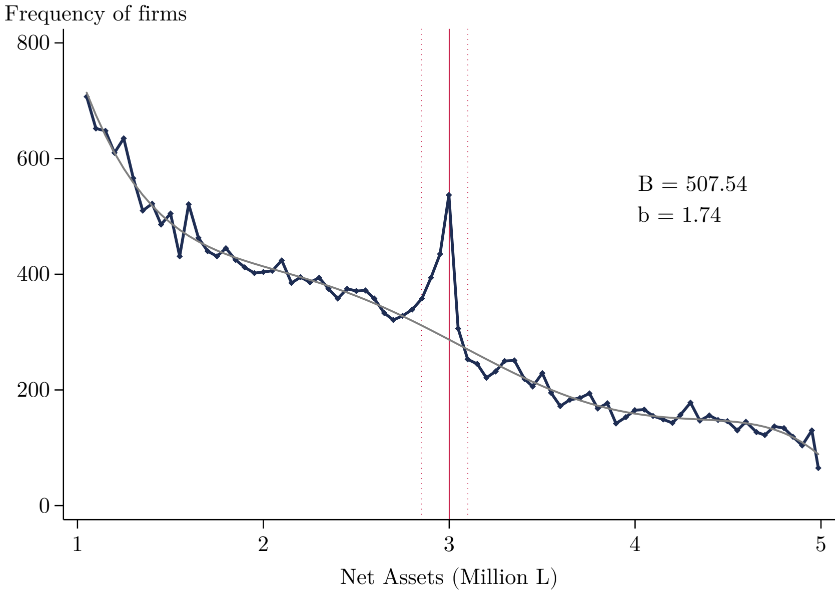
Note: This figure presents the share of firms liable for each type of tax (profit, minimum, net asset or no tax), in each bin of gross revenue for the period 2014-2017 pooled. It shows that when crossing the L10 million exemption threshold the increase in the share of firms paying the minimum tax is mirrored by a decrease in the share of firms liable for profit tax, with little change observed in the share of firms paying the net asset tax or not paying any taxes. The sample excludes corporations exempt from the minimum tax due to sectoral exceptions and/or recent start of operations.

Figure A20: Bunching on L3 million assets - by year 2014-2018



Note: This figure presents, for each year in the period 2014-2018, the empirical density of declared net assets. The data shows an excess mass of taxpayers declaring net assets in the vicinity of L3 million, the exemption threshold for the net asset tax (marked by a red dashed line). Bins are L100,000 wide and the first bin starts at L1.05 million, such that L3 million is the midpoint of a bin.

Figure A21: Bunching on L3 million assets - pooled 2014-2018

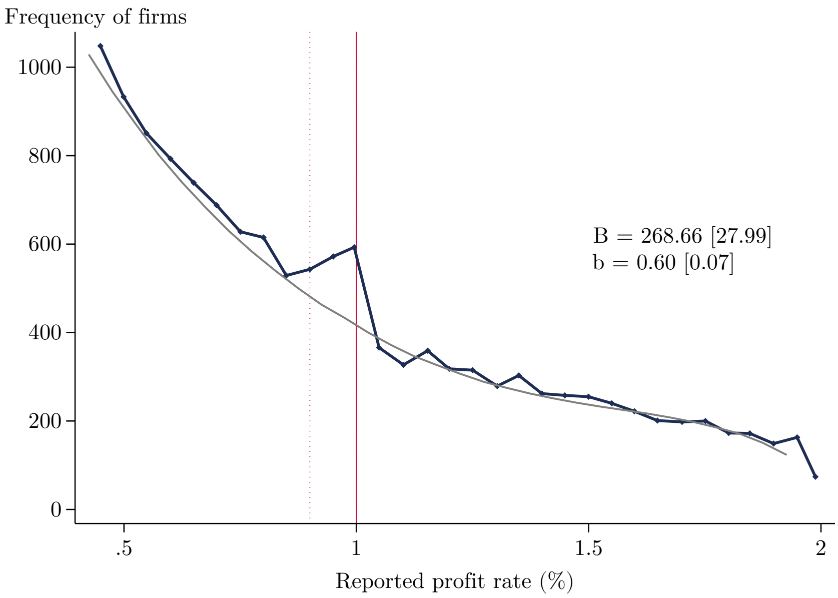


Note: This figure presents, for a pooled sample in the period 2014-2018, the empirical density of declared net assets (blue line) and the estimated counterfactual distribution (gray line), obtained from a similar polynomial specification as Equation 8. Bins are L50,000 wide and the first bin starts at L1.025 million so that L3 million is the midpoint of a bin. The red solid line marks L3 million, the threshold above which firms can be liable for Net Asset taxes, and the dotted lines mark the "excluded region" where we observe excess mass (bunching).

Figure A22: Bunching on L1 million taxable income - 2011-2018

Note: This figure presents, for each year in the period 2011-2018, the empirical density of declared taxable income. There's a clear excess mass of taxpayers declaring taxable income around L1 million, the exemption threshold for the Social Contribution tax, particularly for the latest years in the sample. Bins are L50,000 wide and first bin starts at L425,000 such that L1 million is the midpoint of a bin.

Figure A23: Bunching on L1 million taxable income - pooled 2013-2018



Note: This figure presents, for a pooled sample in the period 2013-2018, the empirical density of declared taxable income (blue) and the counterfactual estimated density (gray), obtained using a polynomial specification similar to Equation 8. Bins are L50,000 wide and first bin starts at L425,000 such that L1 million is the midpoint of a bin. The pooled sample is restricted to 2013-2018 since Social Contribution tax rate was fixed at 5% in that period.

Table A5: Elasticity of taxable income

Year	Excess # Firms (B)	Firms % counterfactual (b)	Δ Taxable income	ϵ_π
2011	8.68	0.15	0.008	0.12
	(12.63)	*(0.23)*	*(0.011)*	*(0.17)*
2012	17.21	0.33	0.017	0.21
	(9.70)	*(0.20)*	*(0.010)*	*(0.15)*
2013	20.42	0.39	0.020	0.30
	(8.79)	*(0.18)*	*(0.009)*	*(0.14)*
2014	38.81	0.61	0.031	0.47
	(16.35)	*(0.27)*	*(0.014)*	*(0.20)*
2015	50.84	0.68	0.034	0.51
	(6.99)	*(0.10)*	*(0.005)*	*(0.08)*
2016	50.43	0.57	0.028	0.42
	(10.65)	*(0.13)*	*(0.006)*	*(0.10)*
2017	55.54	0.63	0.032	0.48
	(13.66)	*(0.17)*	*(0.008)*	*(0.12)*
2018	52.84	0.66	0.033	0.49
	(14.74)	*(0.20)*	*(0.010)*	*(0.15)*
Pooled (2013-2018)	268.66	0.60	0.030	0.45
	(27.99)	*(0.07)*	*(0.003)*	*(0.05)*

Note: This table presents changes in taxable income and elasticities for each year in the period 2011-2018, and also for the period 2013-2018 pooled. The first column reports the estimated excess number of firms while column 2 reports the ratio between excess mass and average counterfactual density in the bunching region. Column (3) presents the change in revenue for the marginal buncher. Column (5) presents the estimated elasticity in each year, and for the pooled sample.

G Minimum taxes around the world

This section presents a summary of corporate minimum tax schemes across low and medium income countries. Table A6 lists several countries that adopted some type of minimum tax for corporations as of 2019, the minimum tax rate (applied to gross revenues, in the majority of cases), the profit tax rate and specific relevant provisions.

We highlight features that are common in several contexts. First, several countries exempt firms in the first 24-36 months of operations, a period where initial investment and set-up costs might legitimately generate low or negative profits (Holland & Vann, 1998). Second, the tax rate applied to gross revenues often falls in the range of 0.5 - 2%, with reduced rates (or exemptions) applied to sectors such as pharmaceuticals, utilities and oil related industries. While this determines a floor for the effective tax rate (tax liability as share of gross revenues) corporations must pay, the implied minimum allowable profit margin (that is, the minimum profit margin reported such that firms are not paying the minimum tax rate) also depends on the corporate profit tax rate. In most countries the minimum allowable profit margin falls in the range of 1.5 - 5%, below the 6% level implied by the 1.5% gross revenue tax and 25% profit tax in place in Honduras in the period 2014-2017. Finally, in all but a few countries the minimum corporate tax provision apply to all firms, regardless of size.

Table A6: Summary of minimum tax provisions around the world

Country	**Minimum tax rate**	**Profit tax rate**	**Details**
Bangladesh	0.6%	25%/35%	Companies are exempt if gross revenues are below BDT 5 million. Reduced rates of 1% for tobacco related manufacturers, 0.75% for mobile phone companies and 0.1% for industrial sectors in first three years of operation. Profit tax rate is 25% for publicly traded companies and 35% for private limited companies.
Benin	1%	30%	Reduced rate of 0.75% for industrial companies.
Cambodia	1%	20%	
Cameroon	2%	30%	
Chad	1.5%	35%	Companies are exempt if gross revenues are below XAF 50 million. Minimum of XAF1 million for small companies and XAF2 million for large companies.
Republic of Congo	1.00%	30%	For firms below XAF 10 million the minimum tax is XAF 500,000.
Cote d'Ivoire	0.5%	25%	0.1% for utilities and 0.15% for financial companies. Minimum tax cannot be less than XOF3 million or more than XOF 35 million. Corporations are exempt in first fiscal year.
Dominican Republic	1%	27%	Tax base is gross assets.
Gabon	1%	30%	Minimum of XAF1 million. Newly incorporated companies are exempt for two years.
Guinea	1.5%	25%	Minimum of GNF15 million.
Guyana	2%	25%/40%	Profit tax rate is 25% for commercial companies and 40% for non-commercial companies
India	15%	30%	Tax base is book profits.
Madagascar	0.5%	20%	The minimum tax is calculated as MGA 320,000 (100,000 for some sectors) plus 0.5% of annual gross revenue.
Mauritania	2.5%	25%	Minimum of MRO 750,000.
Morocco	0.75%	10%/31%	Minimum of MAD3,000. Reduced rate of 0.25% petroleum, utilities and some food production sectors. New companies are exempt for three years. Corporate profit tax schedule is progressive with increasing marginal rates of 10, 17.5 and 31%.
Nicaragua	1-3%%	30%	Firms are exempt in first three years of operations.
Pakistan	1.25%	29%	Lower rates applies to oil (0.5%) and pharmaceutical (0.2%) sectors. An additional "alternative minimum tax" of 17% applies to accounting income.
Philippines	2%	30%	Corporations are exempt in the first three years of operation.
Senegal	0.5%	30%	Mininum of XOF500,000 and maximum of XOF5 million. Minimum tax rate applies to gross revenue in preceding fiscal year.

Note: This table provides a non-exhaustive list of countries that adopted some type of corporate minimum tax as of 2019. Tax base is gross revenues (turnover) unless stated otherwise. *Sources*: Ernest Young Worldwide Corporate Tax Guide 2019 and Deloitte Corporate Tax Rates 2020.