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Abstract

This paper provides novel evidence on the relationship between firm size and effective corporate tax rates using full-population administrative tax data from 13 countries. In all countries, small firms face lower effective tax rates than mid-sized firms due to reduced statutory tax rates and a higher propensity to register losses. In most countries, effective tax rates fall for the largest firms due to the take-up of tax incentives. As a result, a third of the top 1 percent of firms face effective tax rates below the global minimum tax of 15 percent. The minimum tax could raise corporate tax revenue by 27 percent in the median sample country.

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Keywords: Corporate Effective Tax Rate, Global Minimum Tax, Firm Size, Tax Incentives

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1 Introduction

The corporate income tax is a key source of government revenue, particularly for developing countries where it constitutes 15-20% of tax revenue. Yet, a common perception is that many firms, and especially large corporations, increasingly pay lower taxes on their profits. This view is fueled both by a race to the bottom in statutory tax rates and by increasing competition between governments to offer tax incentives to attract investment, such as tax credits, income exemptions and reduced rates. In this paper, we document how the take-up of tax incentives lowers effective tax rates and how it varies across the firm-size distribution.

To describe effective tax burdens, we leverage a unique dataset comprising all firm-level corporate income tax returns in 13 developing countries spanning a wide range of income levels. On average, we find that countries spend a substantial amount — 0.9% of GDP — on corporate tax incentives, consistent with the common labeling of these incentives as 'tax expenditures'. The benefits of tax expenditures accrue disproportionately to both small firms and very large firms (top 1% in sales). In the median country in our sample, 30% of the largest 1% of firms face effective tax rates (ETRs) below 15%, the minimum tax rate agreed upon by the OECD/G20 Inclusive framework's Pillar II. Given the incentives that a global minimum tax could create, we estimate that corporate tax revenue could increase by up to a quarter in the median sample country.

While tax evasion and profit shifting have been extensively studied before (e.g. Carrillo et al. 2017; Tørsløv et al. 2022), tax expenditures have received less attention. This is in part due to limited access to high-quality microdata. Our first contribution is to develop a consistent measure of effective tax rates across multiple countries, relying on comparable data sources and definitions. The data cover 13 countries with varied income levels and population sizes in Africa (Ethiopia, Eswatini, Rwanda, Senegal, and Uganda), Latin America (Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, and Mexico), and Eastern Europe (Albania and Montenegro). By using administrative data, we include all tax-registered firms, a much larger group than those covered by survey or financial data in developing countries.[1] Although tax reporting requirements are not homogeneous across countries, we harmonize the relevant variables used to define

[1]Tax return data miss the informal sector, but they still have much wider coverage than financial data which in most developing countries cover only the largest firms. Survey data often have poor coverage among the largest firms. Firm censuses, where they exist, cover all firms but rarely contain data on tax liabilities and profits.

profits and tax liabilities. We define ETRs as the corporate tax liability divided by net profit. Net profit is revenue minus material, labor, operational, depreciation, and financial costs. Hence, when calculating net profit, we deduct standard production costs but do not deduct country-specific tax expenditures that affect the tax base or tax rate. Differences between the ETR and statutory rate are thus due to policy-driven tax expenditures, such as special investment incentives, tax credits, preferential rates, and loss carry-forwards, and not due to differences in firms' profitability.[2]

Our second contribution is to show that firm size is a key determinant of tax rate dispersion within countries. In all 13 sample countries, ETRs reach a peak at the eighth or ninth decile of firm size, and then tend to decline for the largest firms.[3] The rising slope of ETRs over the lower part of the firm-size distribution is explained by a higher propensity to register losses for smaller firms, and by the existence of reduced tax rates for small firms in some countries. More strikingly, ETRs fall for the largest firms in a majority of countries (9 out of 13) and are flat in the rest. On average across our sample countries, the largest 1% of firms face ETRs that are 2.5 percentage points lower than those of other top decile firms. In a regression analysis, we find that the lower ETRs at the top are mainly due to exemptions of income from the tax base and to the take-up of tax credits—often aimed at attracting investments—and not due to differential patterns of loss-making or differential statutory rates. The drop in ETRs at the top holds across industries, when computing ETRs over multiple years, and with alternative definitions of firm size.

Finally, we use the data to assess the scope and revenue potential of the landmark agreement for a global corporate minimum tax rate of 15% (Pillar II of the OECD/G20 Inclusive Framework called GloBE). We cannot account for all details of the Pillar II provisions but simulate a simple minimum tax of 15% applied to the largest firms. Such a global minimum tax would encourage countries to ensure that large firms pay at least 15% of their profits in tax in each country where they operate since multinational firms would be taxed in their headquarter countries if their subsidiaries escape taxation abroad. Although 11 out of 13 sample countries have statutory tax rates at or above 25%, the number of firms potentially impacted by a minimum tax is large: in the median country 30% of the largest firms currently face ETRs below 15%. In the best case scenario where all of the

[2]Loss carry-forward could be considered a deferred payment instead of a tax expenditure. Yet in four sample countries they are not permitted, and when permitted, regulations differ on the amount and duration of carry-forward allowed.
[3]In the median sample country (based on per capita GDP) — Guatemala — a firm at the 90th percentile has revenue of USD 4.5 million.

top 1% firms fall under the scope of the minimum tax, corporate tax revenue could rise by 27% of baseline in the median country (equivalent to 0.6% of GDP).

Beyond the revenue gains from a global minimum tax, the ETR patterns we uncover have implications for the efficiency of taxation. Seminal public finance work shows that an efficient corporate tax system—i.e. one that does not distort firms' decisions—should feature uniform tax rates (Diamond and Mirrlees, 1971; Dasgupta and Stiglitz, 1972). Differences in ETRs can distort the firm-size distribution (Guner et al., 2008; Bento and Restuccia, 2017), lead to excessive industry concentration (Martin et al., 2022), and lower total output (Garicano et al., 2016; Amirapu and Gechter, 2020). The differences in ETRs across firm-size groups we document are large and systematic and hence likely to cause such distortions. In particular, we show that mid-sized firms, often considered engines of growth and employment creation (Acemoglu et al., 2018; Akcigit and Kerr, 2018), face the highest ETRs.[4]

While tax expenditures reduce revenue and introduce distortions, they are typically offered to increase investment, in particular by foreign firms, and to encourage innovation. From a unilateral perspective, offering such incentives may be a rational choice that welfare-maximizing governments are compelled to make given global tax competition. Depending on the context, the effect of tax expenditures on investment can be positive (Ohrn, 2019, 2018), and provide large societal returns (e.g. through technology spillovers as in Alfaro-Urena et al. (2022)) or negative (e.g. through perverse incentives for low-quality patent adoption as in Wei et al. (2021)). Instead of conducting a full-fledged welfare analysis of tax incentives in a specific context, we systematically document the fiscal cost of tax incentives and that large firms benefit the most, uncovering a consistent relationship between ETRs and firm size, which can inform cost-benefit analyses and welfare calculations.

The paper is organized as follows. Section 1.1 places our work in the context of the literature. Section 2 describes our data and method. Section 3 documents the ETR-firm-size relation. Section 4 examines the factors explaining the drop in ETRs at the top. Section 5 examines the potential revenue gains from a global minimum tax. Section 6 concludes.

[4]ETR differences by firms size are also relevant for tax equity since larger firms are owned by richer individuals, employ formal workers, and pay higher wages (La Porta and Shleifer, 2014; Ulyssea, 2018), and because higher corporate taxes reduce workers' wages (Fuest et al., 2018; Suárez Serrato and Zidar, 2016).

1.1 Related Literature

Our work connects to several strands of literature. First, we contribute to the literature on firms' strategies to minimize tax payments. While tax evasion (Slemrod, 2019) and tax avoidance via profit shifting (e.g. see Tørsløv et al. 2022, Bilicka 2019, Beer et al. 2020) received most attention, we document another channel: the use of tax expenditures. The limited evidence we have thus far points to their importance: Klemm (2010) details the types of tax expenditures and argues that they are frequent in low-income countries. Garcia-Bernardo et al. (2022) show that only a moderate share of the fall in ETRs worldwide in recent years is attributable to profit shifting, with the remainder due to domestic tax policy changes, including tax expenditures. Better understanding firms' use of tax expenditures matters for tax revenue and for economic activity.[5] We are the first to document the extent to which tax expenditures reduce firms' ETRs in a diverse set of countries.

Second, the literature on tax evasion and avoidance shows that tax minimization strategies strongly vary with firms size: tax evasion rates decrease with firm size (Best et al., 2022; Basri et al., 2019; Bachas et al., 2019), while tax avoidance increases (Gumpert et al., 2016; Davies et al., 2018). Yet, the relationship between tax expenditures and firm size has not been systematically investigated before. We do this with granular data and along the entire (formal) firm-size distribution, uncovering an important non-linearity in the ETR-firm-size relationship.

Third, our work relates to a literature at the intersection of economics and accounting that examines the ETR-firm-size relationship (see Janský (2022) for a survey and Table A.1 for a summary). These papers differ in their methods (data and ETR definition) and results. We make progress by using tax administrative data for many countries and a common ETR definition. Unlike previously used financial accounts data with narrow coverage in low- and middle-income countries (LMICs), our data cover all formal sector firms. We use an ETR definition that can be measured consistently across countries to expose common patterns in the ETR-firm-size relationship. The previous literature—probably due to methodological differences—has not come to a

[5] Since tax evasion and avoidance have been shown to have real effects, it is likely that tax expenditures have similar real effects. For instance, Egger and Wamser (2015), de Mooij and Liu (2020) and de Mooij and Liu (2021) show that the tightening of anti-avoidance rules reduced MNEs' investment in affected destination countries. Suárez Serrato (2022) and Bilicka (2022) document labor-market consequences of anti-avoidance rules. Alstadsæter et al. (2022) show that firms engaging in profit shifting pay higher wages for managers, a finding echoed in Souillard (2022).

consensus about the sign (or shape) of the ETR-firm-size relationship.[6] Our evidence instead is largely consistent across countries, pointing to an inverse U-shaped pattern in the ETR-firm-size relationship.

Finally, we connect to the literature on tax capacity in LMICs. Corporate taxes are a larger source of revenue for LMICs than for high-income countries (Besley and Persson, 2013). Governments also rely on firms to collect other taxes (Kopczuk and Slemrod, 2006; Garriga and Tortarolo, 2022). Thus, an erosion of the corporate tax base can be costly, and a distortionary corporate tax may be particularly detrimental to growth in LMICs. We show that LMICs forgo a sizable share of revenue in tax benefits to the largest firms. Conversely, our simulations suggest that a minimum tax could raise tax revenue substantially.

2 Data and Methodology

2.1 Data

We use corporate tax records from 13 countries, listed in Table 1. Each dataset captures the universe of corporations filing tax returns in the country over a five to ten-year span. In our main analysis, we focus on the latest cross-section which occurs between 2015 and 2019, depending on the country. Administrative tax data contain precise information on firms' taxable income, costs, and all tax exemptions which allows for a breakdown of the tax burden. Unincorporated firms are excluded, as their tax treatment differs across countries. Appendix B details each country's tax system and how we deal with special tax regimes which apply in some countries. Although administrative tax data are increasingly used by researchers (Pomeranz and Vila-Belda, 2019; Mascagni et al., 2016), our study is the first to use micro tax data from a large number of countries.

The data include countries in Africa, Latin America, and Eastern Europe, and cover a wide range of income levels (from Ethiopia with a GDP per capita of 500 USD to Costa Rica with a GDP per capita of 10,000 USD) and population sizes (from Montenegro with 628,000 inhabitants to Mexico with 128 million inhabitants). The number of firms in each dataset correlates with a country's size and income level, ranging from 2,800 firms in Senegal to 460,000 in Mexico. The

[6] In a majority of studies the data suggest that the ETR-firm-size relation is negative. However, other studies document positive, flat or non-linear relationships.

share of profitable firms in the population varies from around 60% in Mexico to 85% in Senegal. Most countries feature statutory CIT rates between 25% and 30%, but Albania and Montenegro apply low statutory rates of 15% and 9% respectively.

2.2 Methodology

Objective We aim to compute ETRs that are comparable across countries with different tax systems and tax reporting requirements. Thus we select concepts from the CIT returns that are consistently used across countries. To the best of our ability we aim to distinguish variables that measure 'standard' deductions—allowed in all countries and for all firms, and reflecting economic costs—and variables measuring tax expenditures, which can be country and firm-specific.

Accounting concepts We consider the concepts that can be consistently measured across countries' tax returns and the accounting relations between them in Figure 1. Total revenue is composed of sales plus other incomes (e.g. non-operating incomes, rents, interests). The deductions that firms typically subtract from their revenue to calculate their profits include the cost of material inputs, labor, and capital costs, as well as financial costs, and depreciation of capital. We call the difference between revenues and costs "net profit" (or loss). This concept is not always directly reported in tax returns as a line item, but can always be reconstructed. We consider that net profit is the best proxy for economic profit that can be constructed from tax return data.

Net profit differs from taxable profit as the latter concept excludes tax-exempt incomes and reintegrates non-tax-deductible costs. After this, investment incentives, capital allowances, and other deductions are applied to obtain the gross tax base, and loss carry-forward is accounted for to obtain the net tax base. Multiplying the net tax base by the statutory tax rate yields the gross tax liability. We validate the data cleaning and variable construction process by ensuring that when we divide the gross tax liability by the net tax base we obtain the statutory tax rate.

Computing Effective Tax Rates We define a firm's ETR as the net tax liability divided by the net profit. The numerator, net tax liability, is the tax due net of any after-tax deductions and credits, but ignoring advanced payments and withholding of taxes already paid. Hence, any deduction that is subtracted either from the tax base (proxied in our methodology by net profit) or from the gross

tax liability is taken into account as tax expenditures that lower the effective tax burden that a firm faces. By taking the ratio of net tax liability over net profit, we obtain an ETR which reflects the gap between the statutory and effective tax rate due to tax expenditures.

This ETR measure is transparent and arguably comparable across countries. To construct it we distinguish two concepts: that of standard deductions, which should reflect economic costs (material, labor, operating costs, and depreciation), and that of tax expenditures, which should reflect policy choices (e.g. preferential rates, exemptions, and tax credits). Standard deductions are removed from the tax base to obtain net profit (our ETR denominator) but tax expenditures are not. Drawing the line between standard deductions and tax expenditures of course requires some choices. For example, the time schedule of depreciation can vary across countries and asset classes, raising the question of whether accelerated depreciation should be treated as a standard deduction or count as a tax expenditure (we decided on the latter). Typically, however, the concepts included under tax expenditures are more country-specific than standard deductions: definition of non-deductible expenses and exempt incomes, capital allowances and investment incentives, special tax rates as a function of sales or activity, and loss carry-forwards (which are permitted in some countries and not in others).[7]

Discussion A potential caveat is that net profit (our denominator) may deviate from true economic profit due to tax evasion and avoidance. Under imperfect enforcement, firms may underreport sales, inflate costs, or shift profits abroad, which would lower reported net profit and hence the net tax liability. As our measure does not capture the extent to which firms lower their tax burden through these channels, it is an upper bound on the true effective tax rate that firms face on their realized (instead of reported) profits. Relatedly, firms' decision to use tax expenditures could interact with tax evasion and avoidance decisions.[8] Our data do not allow us to investigate these issues further as evasion is unobservable and we cannot consistently identify multinationals,

[7]Previous studies used a range of denominators, including earnings before interest and tax (Adhikari et al., 2006); earnings before interest, taxes, depreciation, and amortization (Lazăr, 2014); gross income excluding variable costs (Nicodème, 2002); and measures adjusting taxable income in ad-hoc ways (Wu et al., 2012). Our ETR measure allows all costs, including depreciation, management, and financial expenses to be deducted from the denominator. We consider our measure the best proxy for economic profit that can be calculated from administrative tax data in a consistent manner across countries.

[8]For example, tax planning could impact both international profit shifting and tax incentives take-up. By computing an ETR measure based on net profit (after the deduction of all standard production costs), we do not consider tax avoidance taking place before this stage, for example through capital depreciation rules.

nor their affiliates, nor shifted profits. Instead, we focus on measuring the importance of tax expenditures as a share of firms' reported net profit, holding evasion and profit-shifting opportunities fixed. We also note that Dyreng et al. (2017) show that ETRs have decreased in the same way for domestic and multinational firms, suggesting that this distinction may not be first-order.

3 Effective Tax Rates and Firm Size

3.1 Aggregate Tax Expenditures

We construct firm-level effective tax rates (ETRs) with the data and methods described in section 2. The last three columns of table 1 show for each country the top statutory tax rate, the average ETR for all firms (imputing a zero ETR for loss-making firms), and the average ETR for profitable firms. We use the difference between the top statutory tax rate and the firm-specific ETRs multiplied by their net profits to compute firm-level tax expenditures. By aggregating across firms, we obtain the total tax expenditures, which we express as a share of each country's GDP. This measures the forgone revenue due to corporate tax expenditures absent behavioral responses.

Figure A.2a displays our aggregate corporate income tax expenditure estimates, ranking countries by GDP per capita. For countries in our sample tax expenditures represent 0.87% of their GDP on average. The magnitude varies across countries: Albania and Ethiopia's CIT expenditures are close to zero, while all other countries' tax expenditures are over 0.5% of GDP, and Costa Rica and Honduras display expenditures in excess of 1.7% of GDP. In Figure A.2b, we include for comparison data from an additional 66 countries, available in the Global Tax Expenditure Database, which collects information from official tax expenditure reports (Redonda, von Haldenwang and Aliu, 2022).[9] The average CIT tax expenditures in this extended sample of 79 countries are slightly lower than in our sample but still substantial at 0.63% of GDP.

Figure A.2c shows the correlation between our tax expenditure estimates and the estimates from government tax expenditure reports, for the 11 countries with overlap. The correlation is high but below one: in particular, our method yields higher estimates for African countries. Note that the methods to compute official tax expenditures differ substantially across countries: reduced

[9]Following international standards, tax expenditures should be computed yearly. In practice, developing countries do not systematically produce these reports, and computation methods vary significantly by country.

rates or deferred payments are not counted as expenditures everywhere—they tend to be counted in high-income countries but rarely in LMICs. In low-income countries, tax expenditure reports don't always cover all special tax regimes, sometimes explicitly stating so.[10] The reporting weakness in official data is reinforced by the observation that poorer countries display lower tax gaps than richer countries, which could reflect incomplete measurement rather than true differences. Compared to the data from those reports, our CIT expenditure estimates are homogeneous and comparable.

3.2 Country-Level ETR-Firm-Size Curves

Which firms benefit from the sizable aggregate tax expenditures documented above? We rank firms based on their size within their country and assign each firm to a percentile of revenue from 1 to 100. To study the behavior of the largest firms, we further separate the top 1 percentile of firms into five bins, each representing 0.2% of firms. We then measure the average ETR across firms in each quantile. We show average ETRs by quantiles for two samples of firms. The first sample considers all firms, including zero-profit and loss-making firms to which we assign a zero ETR. The second sample is restricted to profitable firms (keeping the quantiles of revenue constant).

Figure 2 shows the pattern of ETRs in each of the 13 countries, for all firms. We rank countries by their top statutory tax rate (STR), ranging from 9% for Montenegro to 30% in half of the countries. We show the average ETR in each firm-size quantile and a polynomial fit capturing the ETR-firm-size relationship. The grey shaded area corresponds to the top 1% of firm size, which is graphically expanded to zoom in on the largest firms' ETRs. We observe two main patterns. First, in every country the ETR rises between the first and ninth decile of firm size. The difference in ETRs between the first and ninth deciles is large in some countries—e.g. 19 percentage points in Costa Rica—and smaller in others—e.g. 1.2 percentage points in Senegal. Second, the relationship between firm size and ETRs flattens or reverses within the top decile. In most countries, the largest firms (top 1%) pay a lower ETR than other top decile firms. Together, these patterns produce a humped-shaped relation in most countries, such that firms at the ninth decile of the size distribution face the highest ETR. This pattern is most visible in countries with a higher statutory tax rate.

What factors can explain the relationship between ETRs and firm size? We next analyze the

[10] For example, Table 1 of Rwanda's 2020-2021 tax expenditure report prepared by the Finance Ministry qualifies its income tax expenditure estimate, stating that it "*excludes some tax expenditures not currently measurable*".

role of loss-making firms (to which we assigned an ETR of zero), and of reduced statutory tax rates, which apply for smaller firms in several countries. To examine this graphically, we restrict the sample to profitable firms only, and compute the firm-specific gap $ETR_i - STR_i$, where STR_i is the statutory tax rate applied to the firm, which, depending on the country, may be a function of its revenue or profits. We then take the average of the firm-specific gaps at each quantile of the size distribution, in each country.[11]

Figure 3 plots each country's resulting pattern as a function of firm size. The ETR-firm-size relationship is now flatter than in Figure 2: in 10 out of 13 countries the relation is flat between the first and ninth decile; only Ethiopia, Mexico, and Rwanda retain a positive slope. The flattening of the slope is partly due to the fact that smaller firms are more likely to report zero or negative profits, and hence have a zero ETR, and partly due to the reduced STRs offered to small firms in Albania, Costa Rica and Ecuador.[12] At the top of the distribution, however, the ETR continues to drop in most countries, especially in high-STR countries. In Ecuador, the Dominican Republic, Eswatini, Costa Rica, Mexico, Rwanda, Senegal, Uganda, and Honduras, profitable firms in the top 1% pay a lower ETR than the average firm in the top decile. In Montenegro, Albania, Guatemala, and Ethiopia the relationship between ETRs and firm size is flat at the top.

3.3 Robustness of the ETR-Firm-Size Relation

We now show that the ETR-firm-size pattern we uncover is not driven by specific methodological choices: the pattern replicates within economic sectors, with a longer time horizon for defining the ETR, and with alternative firm size measures. To succinctly test multiple dimensions of robustness, we summarize the individual country patterns by constructing a synthetic average country: we take the average of the ETR at each quantile across countries, weighing countries equally. Figure 4a displays the average ETR across the firm-size distribution, for profitable firms, for our 13 countries. The synthetic average country repeats the humped-shaped pattern of rising ETRs between the first and ninth decile, and a marked fall in ETRs within the top decile, especially for the 1% largest firms (ranked within each country).

Figure 4b shows the ETR-firm-size relationship after dividing firms into the four main sectors

[11] The quantiles remain fixed, based on the full sample of firms.

[12] The relevance of losses is consistent with Christensen et al. (2022) who show that the majority of firms in the US achieve low ETRs through net operating loss carry-forward.

of activity: agriculture (primary), industry and construction (secondary), retail, and services. In each sector, we observe a humped-shaped pattern similar to the aggregate pattern. Industrial firms show the largest drop in ETRs at the top, but the fall is also marked for firms in services, while retail and agricultural firms display smaller drops.[13]

Figure 4c shows ETRs calculated over multiple years, ranking firms based on revenue from the most recent cross-section. Multi-year ETRs are measured using total tax liability divided by total net profit over several years. We can do this for a two-year period in all countries and for a maximum period of five years in 12 countries. The sample of countries thus changes with the time horizon we consider, but the results are consistent across time horizons, and very similar to those from the latest cross-section of tax returns, despite the fact that losses and profits are now averaged over the period. The fall in ETRs at the top is even a bit larger when more years of data are used.

Finally, our results are robust to alternative definitions of firm size, including the payroll and total assets (Figure A.4). We observe payroll and total assets in eight countries. The pattern with revenue quantiles replicates almost exactly with alternative size measures, even though the size measures are imperfectly correlated.[14]

4 Tax Advantages for the Top 1 Percent

Firms in the top 1% of the size distribution are of systemic importance: they represent 53% of the aggregate revenue of formal sector firms, 57% of total profit, and 54% of total corporate taxes levied, on average for our sample (Table A.2). The largest firms are also likely to be (part of) a multinational firm, although our data identify multinationals only in some countries. Given the importance of top firms, we now examine the mechanisms that reduce ETRs at the top.

We quantify in a regression setting the role of firm characteristics and the different types of tax provisions in accounting for the drop in ETRs at the top. Given the nonlinearity of the ETR-firm-size pattern, we restrict the sample to firms in the top 10% of size in each country, and consider the impact on the ETR of belonging to the top 1%. As an order of magnitude, the median country has

[13] Differences in statutory tax rules between sectors are moderate and typically smaller than differences across firms of different sizes.

[14] Across all firms, the average of the country-specific correlation coefficients between revenue and payroll (asset) percentiles is 0.8 (0.7).

20,000 registered firms and thus the top 1% consists of the 200 largest firms (see Table A.3).[15]

Concretely, we estimate the following model for the last cross-section of profitable firms:[16]

$$ETR_i = \gamma_0 + \gamma_1 D_i^{Top1} + \underline{\gamma_k} X_{\underline{k},i} + \epsilon_i, \tag{1}$$

where ETR_i is the effective tax rate of firm i, and D_i^{Top1} is a dummy which takes the value 1 if firm i belongs to the top 1% of revenue in its country. The coefficient γ_0 measures the average ETR for firms located between the 90th and 99th size percentile, and γ_1 measures the difference in ETR of the top 1% of firms (the 99th percentile) compared to other top decile firms. $X_{\underline{k},i}$ is a vector of firm-specific variables including firm characteristics and dummies for the different types of tax expenditures that take value one if a firm files a non-zero amount.[17]

We estimate equation 1 separately for each country and display the average of the γ_1 coefficients across countries in Table 2 (country-specific results are shown in Table A.6). In column (1), we do not include any controls: on average across countries, firms in the top 1% of the size distribution pay 2.5 percentage points less in taxes than other top decile firms. The coefficient on the top 1% dummy is negative and significant in 8 out of 13 countries.

Column (2) controls for firm characteristics such as sector, location in the capital city, firm age, and foreign ownership where available. Columns (3) to (7) control for different types of tax expenditures one by one: reduced tax rates, exempt incomes, special deductions (e.g. R&D deductions), re-timing (e.g. loss carry-forwards), and tax credits deducted from the tax liability.

We find that the ETR differential for the top 1% drops most due to tax credits claimed by large firms: on average the γ_1 coefficient shrinks by 40% (Column 7). Importantly, these tax credits do not represent a compensation for taxes already paid elsewhere as shown by Figure A.5. Firm characteristics (Column 2) explain around 34% of the coefficient drop. This is mostly absorbed by sector, location, and age dummies that capture special provisions not always present in the tax form, such as special economic zones or support for young firms. Exempt income (Column 4)

[15] We also run analyses for the bottom 90% of the firm distribution where we regress the ETR on the percentile of revenue to account for the increasing trend in ETR across countries. Results are shown in Table A.4 and confirm the importance of reduced tax rates in the progressiveness of the ETR, as shown in Section 3.

[16] Regressions on the full sample to account for present year losses do not explain the drop in the ETR for the top 1%.

[17] Comparing firms in the top 1% to other firms in the top decile rather than estimating the ETR-firm-size gradient across quantiles within the top decile is our preferred approach, as it is transparent and reduces the need for functional form assumptions. We show robustness to other specifications in Table A.5.

and re-timing provisions (Column 6) also play a role: each accounts for about 15% of the ETR difference on average. Finally, Column 9 controls for all our explanatory variables at once: 83% of the coefficient on the top 1% dummy is explained but 17% remains unexplained with our method.

This is because we only control for tax incentives with dummy variables, instead of actual amounts. Taking into account the amounts, i.e. fully decomposing the STR-ETR difference into the different drivers, is not possible with our methodology and with the requirement that tax expenditure concepts are harmonized across countries. This is because some tax expenditures are deducted from the tax base while others are deducted from the tax liability, and these concepts interact. For instance, the importance of losses in explaining low ETRs depends on the extent to which a firm used special deductions to lower its tax base. We do not engage in a full accounting decomposition of the ETR, as this would require a country-specific exercise, and distract from our focus on the general ETR-firm-size pattern and its comparison across countries.

Discussion We would ideally like to categorize and study tax expenditures by their intended rationale, but doing this transparently with tax return data is challenging: some provisions have generic names, while others have precise names but refer to laws stating multiple objectives. Frequently, line items on tax returns concern several tax provisions and objectives. To try to specify the intent and importance of specific tax provisions, we draw, in addition to the tax return forms, on each country's tax expenditure reports. Table A.7 lists for each country the availability of each type of provision (based on the tax form): claims for tax credits (the most important tax provision in explaining the ETR drop at the top) and exempt income are available in 8 of the 13 sample countries. The countries where neither is available are the ones with flatter ETR-firm-size profiles: the low tax rate Balkan countries (Albania and Montenegro), and Ethiopia.

The analysis of the names of individual tax provisions yields tentative lessons. Overwhelmingly, the rationale concerns foreign direct investments, job creation and local economic development. These types of tax expenditures are often targeted at firms in special economic zones (SEZs). Indeed, the largest single provision listed in tax expenditure reports in Costa Rica, the Dominican Republic, Ecuador, and Honduras concerns tax credits and income exemptions for firms in SEZs; in Costa Rica, it represents 0.95% of GDP.[18] Tax provisions for firms in SEZ also appear to play a

[18]Not all firms in SEZ are required to file corporate taxes (e.g. Honduras). Thus, some firms might be absent from our dataset altogether. Including these firms in the analysis would likely strengthen our results.

major role in African countries where our data measure large tax gaps (Eswatini, Senegal, Rwanda, and Uganda), even though official tax expenditure reports do not reflect this. Other objectives for tax expenditures appear more Pigouvian in their intention, such as those targeted at environmental protection and health benefits. Finally, other stated objectives are to reduce discrimination, encourage the employment of disadvantaged or disabled workers, and promote cultural activities. Yet, these later categories of tax expenditures represent a much smaller share of GDP.

5 Policy Implications: Scope of a 15% Minimum Tax

In November 2021, 137 countries that are members of the OECD/G20 Inclusive Framework on base erosion and profit shifting (BEPS) reached an agreement to overhaul international tax rules by 2024. A key piece of this agreement is a 15% global minimum corporate tax rate called GloBE.[19] GloBE allows headquarter countries of multinationals (MNEs) to claim a top-up tax if profits reported by MNEs' subsidiaries in other countries are taxed at an effective tax rate below 15%. In turn, this top-up tax could allow source countries hosting the affiliates of MNEs to raise their ETRs without deterring investment. This is because a rate increase in MNE source countries to match the global minimum tax rate would not raise the tax burden faced by MNEs, but merely redistribute the minimum tax gains from the residence country to the source country.[20]

We now examine the implications of a global minimum tax in our sample of countries. These low and middle-income countries have few domestic MNEs and are hence unlikely to benefit from direct claims to under-taxed profits (Baraké et al., 2022). Yet, a minimum tax would allow them to reform their domestic tax policies, such that subsidiaries of MNEs pay at least 15% taxes on their profits. In the micro-data, we do not always know if firms are subsidiaries of MNEs. Instead, we focus on firms in the top 1% of size in each country: these large firms are more likely to be subsidiaries of MNEs, and governments' incentives to change tax policy will be most pressing for this size segment, regardless of firms' affiliation. In Honduras, where we observe MNE status, 51% of firms in the top percentile are MNE affiliates, compared to 19% in the top decile.

[19]The OECD statement on the agreement can be read here and the GloBE rules here.

[20]The OECD published a paper specifically to advise developing countries on how to reform their tax incentives in light of the new agreement (OECD, 2022). It states that "*Pillar Two and the GloBE Rules, in particular, should empower governments to pursue tax reform and remove tax incentives where the costs outweigh the benefits from such incentives*", and later, "*Given the global character of Pillar Two, inaction would only lead to forgone revenues.*".

Figure 5a shows for each country the share of firms facing an ETR below 15% among profitable top 1% firms, ranking countries in descending order of statutory tax rates. Across countries, the share of top firms that face an ETR below 15% is 25% on average, and the variation in this share is limited: the largest share is in Eswatini with 38% and the lowest in Ethiopia with 7%.[21]

What are the tax revenue implications of implementing a 15% minimum tax? We simulate potential tax revenue gains, as a percentage of baseline revenue collection across all firms, from applying a 15% minimum tax rate to all top 1% firms.[22] These simulations are mechanical, since we assume that firms' economic and reporting behavior remains unchanged.[23] Figure 5b shows that these simulations predict on average an increase in corporate tax collection of 29%, although the results vary strongly across countries. In half of the countries, a 15% minimum tax would raise at least an additional 27% of baseline revenue. On average the CIT collects 2.2% of GDP in our countries. A 27% increase hence corresponds to a substantial 0.6% of GDP.

Discussion Our estimates represent an upper bound on revenue gains, in the best-case scenario where countries pass legislation reducing tax expenditures once GloBE is approved and have the administrative capacity to implement these changes. In practice, it is more unlikely that countries opt for more marginal changes and phase out selected tax incentives gradually. Despite a strong case for reviewing tax expenditures (Fuest et al., 2010), the costs of renegotiating tax treaties and contracts often protected by stabilization provisions might be too high. Further, many countries may not find it desirable to remove tax incentives given the unpredictable investment response of MNEs to the global minimum tax.

Our simulations complement existing simulations of the revenue effects of the global minimum tax (Baraké et al., 2022; Cobham et al., 2021; Devereux et al., 2020; OECD, 2020).[24] Our estimates are higher than the OECD's estimates, but in line with those in Baraké et al. (2022). Existing

[21] We exclude Montenegro, where the statutory tax rate is 9% and thus all firms face an ETR below 15%.

[22] To keep the analysis simple and transparent, we do not apply the carve-outs whereby a multinational can exclude from its income used to calculate the ETR 5% of payroll costs and 5% of the carrying value of tangible assets.

[23] As previously discussed, if incentives to avoid taxes and shop around jurisdictions for lower rates are curbed by GloBE, the first-order response in profits would arise from a real decrease in economic activity. While this is possible, the low rate of 15% mitigates this concern. Besides, all countries in our sample except Albania and Montenegro are high-tax jurisdictions and thus unlikely to be affected negatively by reduced profit shifting.

[24] Also related is Johannesen (2022) who examines the welfare effect of the global minimum tax in a tax competition model, Ferrari et al. (2022) who consider the general equilibrium effect of GloBE on MNEs location choice and profit shifting, and Clausing (2020) who examines the effect of the US minimum tax (GILTI).

simulations focus on the direct revenue gains which mostly accrue to MNE residence countries, i.e. high-income countries.[25] Instead, we focus on the indirect effects of reduced tax competition, which allows for ETRs to be set at the global minimum tax rate in all countries. We also observe the exact reported profits and ETRs of individual firms and can provide specific estimates of revenue gains from the application of a minimum tax. This contrasts with previous work that relies on aggregate data for residence-source-country pairs, drawn from the Country-by-Country reporting (CbCR) data, and macro estimates of ETRs. These data suffer from several measurement issues (discussed in Cobham et al. 2021 and OECD 2020) and are incomplete for developing countries. Due to the incomplete and confidential nature of the data, the above studies only publish country-specific estimates of revenue gains for countries appearing in the CbCr data, and group other countries into income-level groups.[26]

6 Conclusion

In this paper, we construct corporate effective tax rates by firm size in a consistent manner across 13 countries, using tax return data. We uncover large economy-wide gaps between effective and statutory tax rates, a rise in ETRs with firm size until the 85-90th percentile of the size distribution, and a fall in ETRs for the largest firms in most countries. The planned global minimum tax provides an opportunity for countries to raise ETRs in a coordinated manner to recover lost tax revenue.

The fact that the top firms currently face lower tax burdens could lead to an allocation of resources away from medium firms, key engines of growth and employment. Further research is needed to examine the efficiency costs of tax expenditures, especially those benefiting the largest firms, and compare them to the intended societal benefits. Another open question is the extent to which tax expenditures are intentionally targeted at large firms or whether large firms are better informed and more skilled in taking up tax expenditures offered to all firms. Future research could also shed light on the interactions between the use of tax expenditures and tax avoidance behavior.

[25] An exception is scenario 4 in the OECD (2020) simulations, which considers the possibility that countries may increase their ETR in response to the minimum tax, but only presents aggregate results by country income groups.

[26] Only Cobham et al. (2021) publish country-level revenue gains estimates for 196 countries in an online appendix, based on the data imputation procedure presented in Garcia-Bernardo and Janský (2021).

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Tables and Figures

Table 1: Descriptive Statistics on Countries and Data

(1) **Country (ISO Code)**	(2) **Panel Years**	(3) **GDP pc (cons. 2010 US$)**	(4) **Nbr. of Firms**	(5) **Avg. Turnover (Thousand US$)**	(6) **Net Profit>0 (%)**	(7) **Max Statutory Tax Rate (%)**	(8) **Avg. ETR (%) All firms**	(9) **Avg. ETR (%) Profitable firms**
Albania (ALB)	2015-2019	5,209.4	19,237	1,146.5	80.7	15	9.8	11.6
Costa Rica (CRI)	2006-2019	10,047.0	58,621	1,687.9	79.0	30	14.8	18.7
Dominican Rep. (DOM)	2006-2015	6,661.9	38,028	1,785.3	64.750	27	15.8	24.0
Ecuador (ECU)	2014-2019	5,097.1	48,477	2,162.5	77.2	28	16.5	20.4
Eswatini (SWZ)	2013-2018	4,773.9	3,805	376.0	66.9	27.5	14.6	21.3
Ethiopia (ETH)	2010-2016	514.1	15,037	2,227.4	70.3	30	17.5	24.9
Guatemala (GTM)	2006-2019	3,413.3	22,994	3,321.9	67.1	25	13.5	18.9
Honduras (HND)	2014-2019	2,241.2	23,706	1,564.5	74.7	25*	22.2	26.7
Mexico (MEX)	2010-2015	10,037.2	461,458	3,077.1	58.5	30	12.7	21.1
Montenegro (MNE)	2011-2019	8,545.5	19,402	607.3	58.9	9	2.4	4
Rwanda (RWA)	2010-2017	802.8	12,905	459.080	84.5	30	12.1	14.2
Senegal (SEN)	2010-2018	1,547.1	5,732	3,641.8	59.2	30	27.3	26.8
Uganda (UGA)	2015-2019	956.9	16,083	587.080	62.6	30	15.1	22.1

Note: This table presents summary statistics on firms in the 13 countries in our data. All statistics are from administrative corporate tax records, except for the GDP per capita (column 4) which is from the World Development Indicators. Column (2) shows the years available in the data for each country. We use the most recent year to compute metrics shown in columns (3) to (9). The effective tax rate (ETR) can be larger than the statutory tax rate due to the reintegration of non-taxable deductions in the net profit definition (see Figure 1). This table is discussed in Section 2.1 and 2.2. Appendix B provides additional details on each country's corporate tax system.

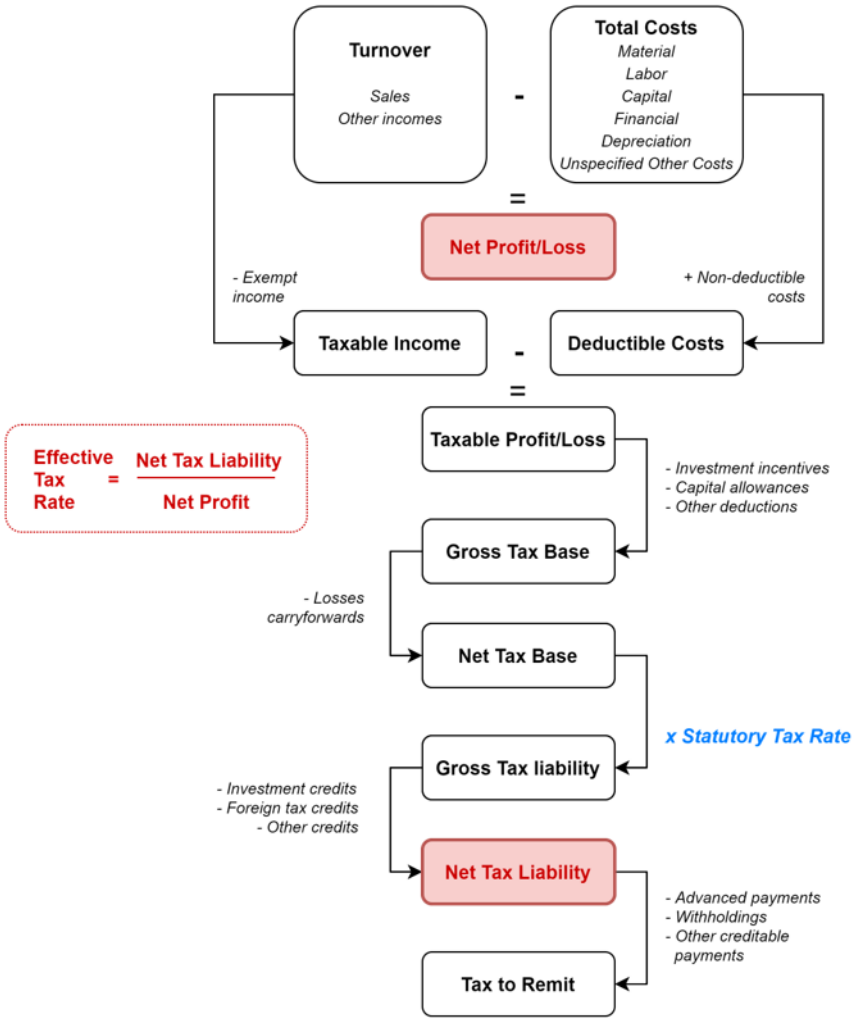
*The maximum statutory tax rate for Honduras is 25%. However, firms paying the asset tax instead of the corporate tax face an STR that is roughly equal to 34% of that on taxable profits.

Table 2: Explaining the Relationship Between Effective Tax Rates and Firm Size Within the Top Decile of Firm Size

	Outcome: Effective Tax Rate							
	Baseline	+ Controls for firm characteristics	+ Dummies indicating use of tax expenditures					
Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regressor: Dummy Top 1% (unweighted cross-country average of country-specific point estimates)	−2.49	−1.65	−2.45	−2.09	−2.35	−2.11	−1.50	−0.43
N countries with negative point estimate	11	10	11	11	11	10	10	5
N countries where lower one-sided t-test rejects null	8	7	8	8	8	6	6	3
N countries	13	13	13	13	13	13	13	13
Controls:								
Firm characteristics		×						×
Reduced rate dummy			×					×
Exempt income dummy				×				×
Special deduction dummy					×			×
Re-timing dummy						×		×
Tax credits dummy							×	×

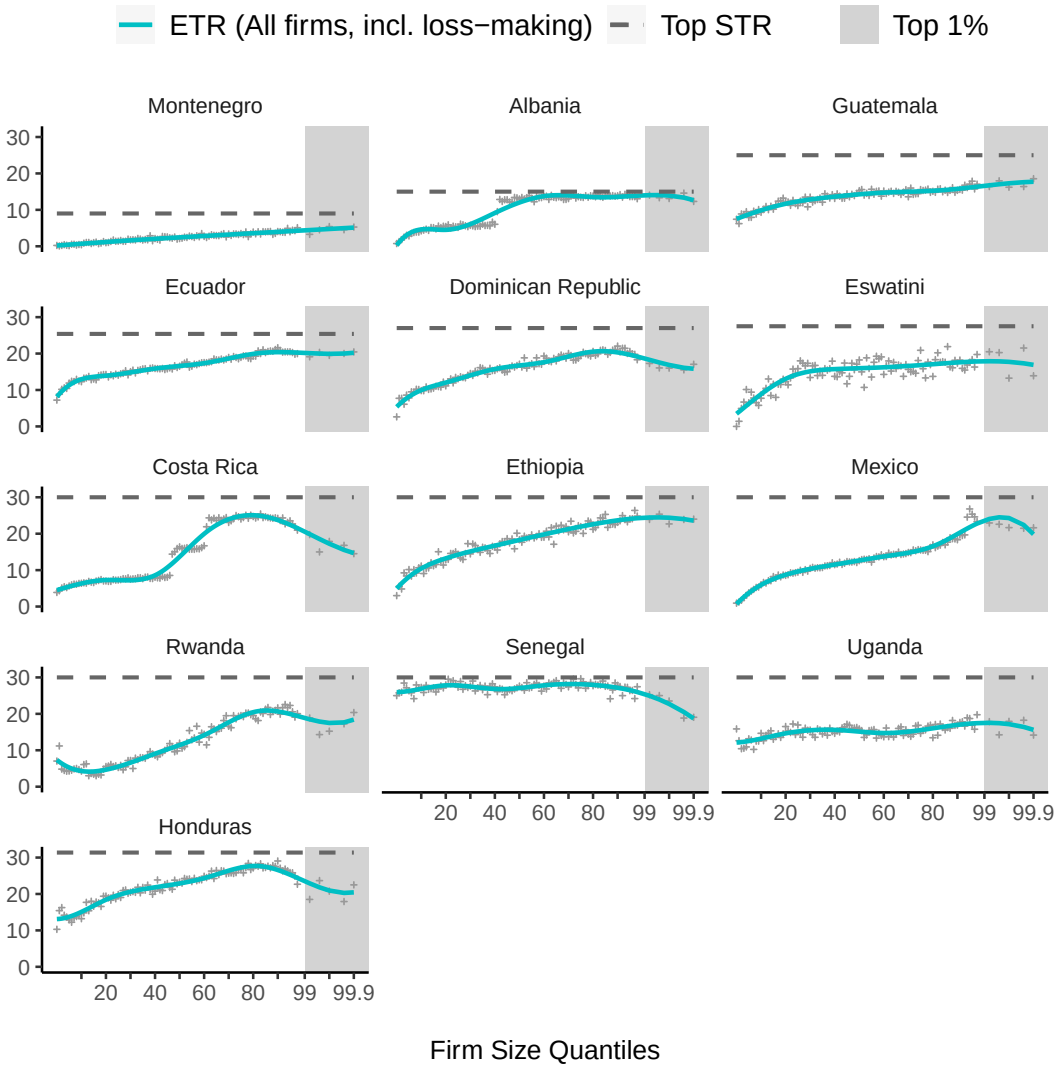
Note: This table presents regression results analyzing the drivers of the ETR-firm-size relationship among firms in the top decile of the firm-size distribution. The sample is restricted to firms within the top size decile only (revenue percentile 90 and above), so we focus on the decreasing part of the relationship between ETR and firm size. We focus on profitable firms, holding the size percentile fixed based on the full sample. We regress the ETR on a dummy tagging firms in the top one percentile of the firm-size distribution (Dummy Top 1%, equation 1). Column (1) only includes the Top 1% dummy. Column 2 controls for firm characteristics (sector dummies, capital city and location dummy, foreign ownership dummy, and firm age) where this information is available. In columns (3) to (7), we control one by one for dummy variables indicating whether or not the firm made use of each of the different tax provisions that can explain the ETR slope. In the first row of the table, we report the unweighted average of the β_1 coefficients on the top 1% dummy across countries. The second row reports the number of countries for which the coefficient is negative, and the third row reports the number of countries for which a one-sided t-test rejects the null hypothesis that the coefficient is zero at a 5% significance level. Country-specific coefficients are detailed in Table A.6 and robustness to different choices for the main regressor (indicator for largest firms) is shown in Table A.5. See Table A.7 for details on available tax provisions by country. This table is discussed in Section 4.

Figure 1: Key Concepts and Variables



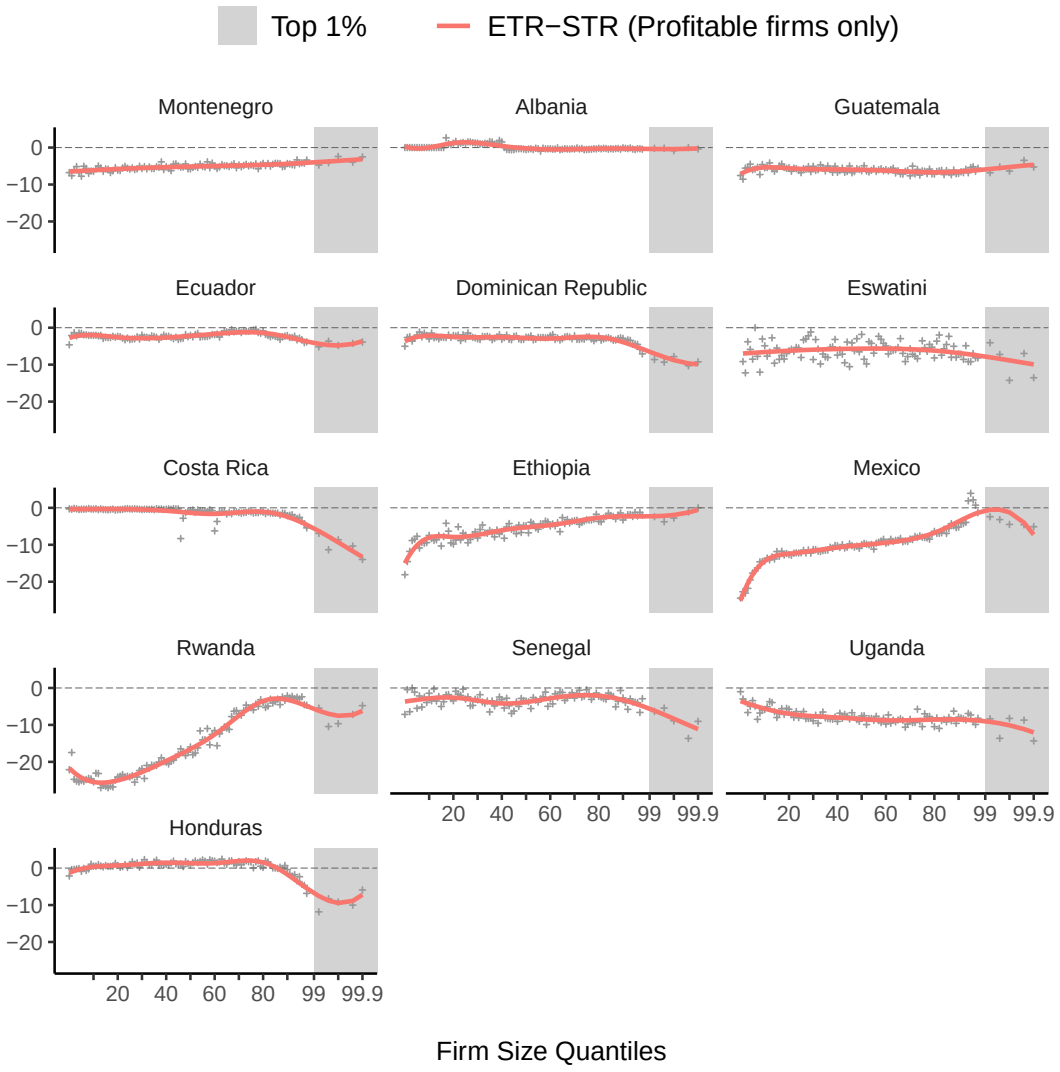
Note: This figure presents the key fiscal concepts and variables used in this study, constructed in a harmonized way in 13 countries. All costs are deducted from revenue to derive the net profit/loss concept which we use to compute the effective tax rate. As the denominator in our ETR measure, we use the net tax liability, which is the annual amount in corporate income tax due. For loss-making firms, the ETR is set to zero. This figure is discussed in Section 2.2.

Figure 2: Effective Tax Rates and Firm Size, All Firms



Note: This figure shows effective tax rates (ETRs) as a function of firm-size quantiles, for all 13 countries in our data. The grey crosses show the average ETR at each quantile. Loss-making fims are assigned a zero ETR. The blue line is a cubic smoothing spline with six knots, estimated using the R function ggformula::geom_spline. Firm-size quantiles (x-axis) are based on firms' revenue. The quantiles correspond to percentiles between the 1st and 89th percentile (white area), and to 0.2% bins between the 99th and 100th percentiles (grey shaded area). This figure is discussed in Section 3.2. Figure A.3 replicates this figure, focusing on profitable firms only. Figure A.6 shows the robustness of the pattern to parameters of the fit.

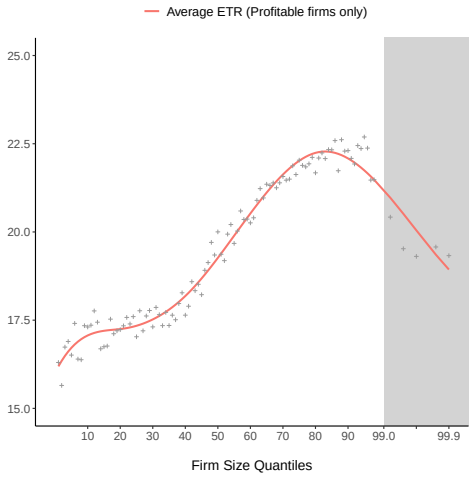
Figure 3: Effective Tax Rate Minus Statutory Tax Rate, Profitable Firms



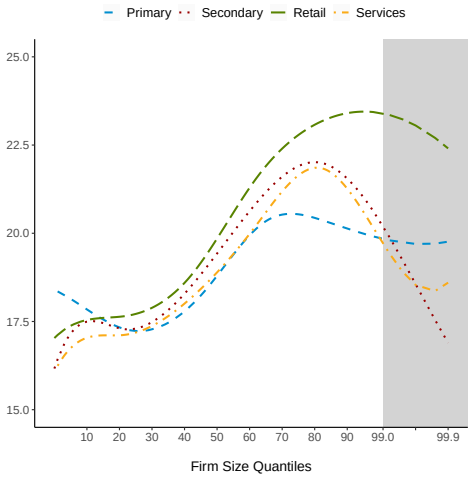
Note: This figure shows the difference between the ETR and the statutory tax rate (STR) as a function of firm-size quantiles, for all 13 countries in our data. The grey crosses show the average ETR-STR difference for each quantile. We include only profitable firms. Everything else is as in Figure 2. This Figure is discussed in Section 3.2.

Figure 4: Effective Tax Rates and Firm Size: Robustness

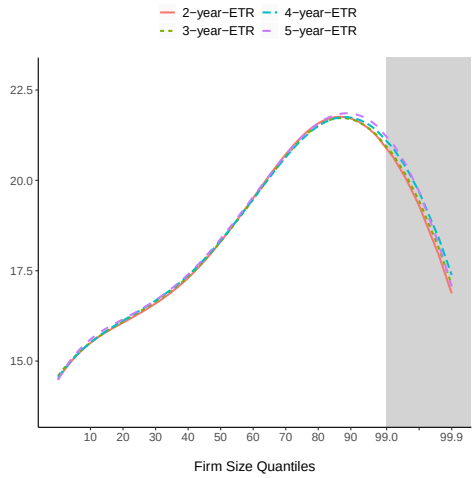
(a) Cross-Country Average ETR



(b) ETR by Sector



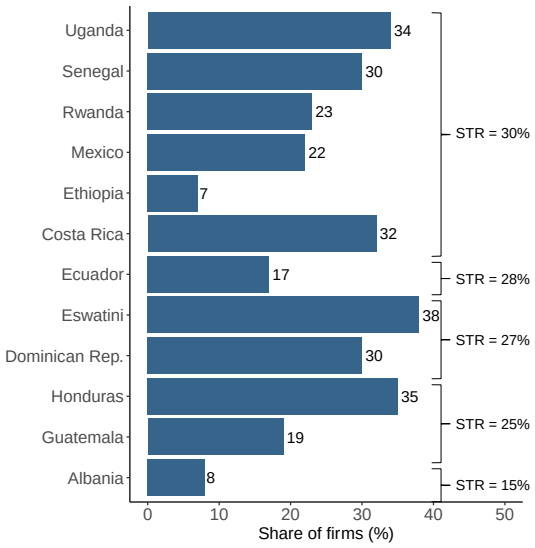
(c) Lifetime ETR



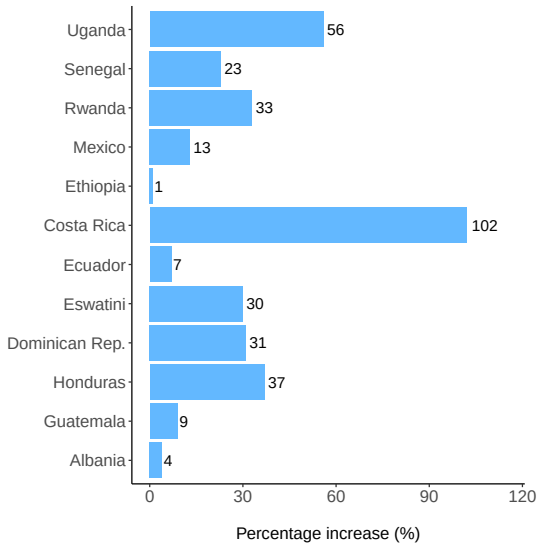
Note: These figures present robustness tests for the ETR-firm-size relationship. Panel (a) serves as a benchmark, presenting the average ETR by firm size for profitable firms. We take the average across panels (i.e. countries) in Figure A.3 for each quantile, weighing countries equally, and then obtain the fit over quantiles with a cubic smoothing spline with six knots (alternative fits are shown in Figure A.6). Panel (b) shows the average ETR-firm-size relationship across countries for four large sector groups (primary, secondary, retail and services). Panel (c) presents a multi-year measure of the ETR (from $N = 2$ to $N = 5$ years) where the ETR for firm i is $\sum_{n=1}^{N}(CIT_{i,n})/\sum_{n=1}^{N}(NetProfits_{i,n})$. By construction, the different lines in Panel (c) rely on different samples, as we can compute the N-year-ETR only for firms that are in the panel at least N-1 years before the most recent cross-section. All curves are cubic smoothing splines with six knots, estimated using the R function ggformula::geom_spline. This figure is discussed in Section 3.3.

Figure 5: Scope and Tax Revenue Potential of a 15% Minimum Tax

(a) Share of Top 1% Firms with ETR Below 15%



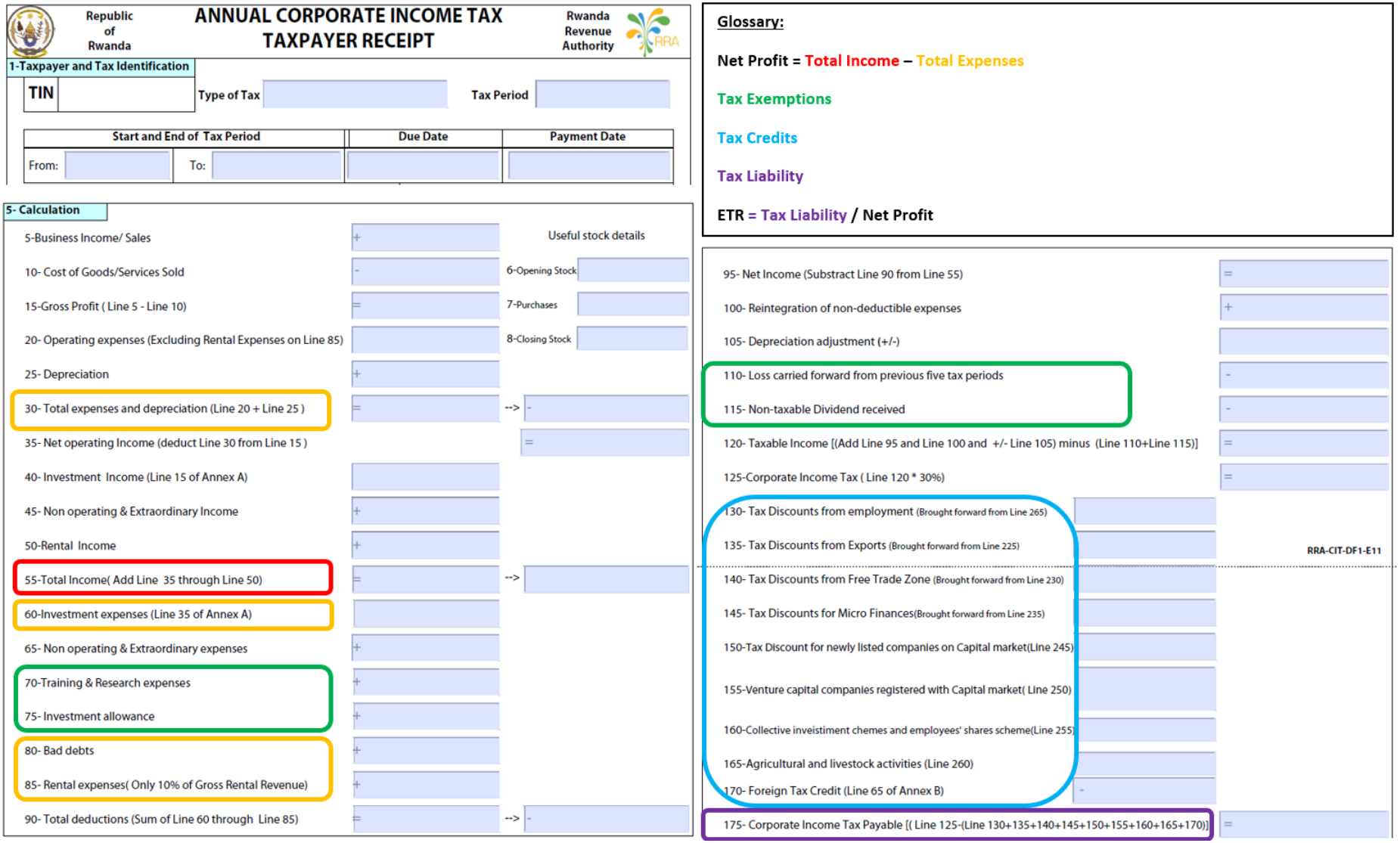
(b) Simulated Revenue Gains of 15% Min. Tax



Note: Panel (a) shows the share of firms in the top 1% of the size (revenue) distribution that have an ETR below 15% in the most recent data cross-section. Panel (b) shows the hypothetical revenue gains from requiring all firms in the top 1% to pay an ETR of 15% at least (i.e. we simulate an ETR of 15% and the associated tax liability for top firms with an actual ETR below 15%), compared to the actual sum of CIT liabilities of all firms in the latest cross-section. These figures are for profitable firms, for the 12 countries in our sample with statutory tax rates at or above 15%. Montenegro is not part of the calculations since its statutory tax rate is 9%. This figure is discussed in Section 5.

A Appendix: Additional Figures and Tables

Figure A.1: Example of A Corporate Tax Return Form: Rwanda



Republic of Rwanda

ANNUAL CORPORATE INCOME TAX TAXPAYER RECEIPT

Rwanda Revenue Authority

1-Taxpayer and Tax Identification

TIN | Type of Tax | Tax Period

Start and End of Tax Period		Due Date	Payment Date
From:	To:		

5- Calculation

5-Business Income/ Sales	+	Useful stock details	
10- Cost of Goods/Services Sold	-	6-Opening Stock	
15-Gross Profit (Line 5 - Line 10)	=	7-Purchases	
20- Operating expenses (Excluding Rental Expenses on Line 85)		8-Closing Stock	
25- Depreciation	+		
30- Total expenses and depreciation (Line 20 + Line 25)	=	--> -	
35- Net operating Income (deduct Line 30 from Line 15)		=	
40- Investment Income (Line 15 of Annex A)			
45- Non operating & Extraordinary Income	+		
50-Rental Income	+		
55-Total Income(Add Line 35 through Line 50)	=	-->	
60-Investment expenses (Line 35 of Annex A)			
65- Non operating & Extraordinary expenses	+		
70-Training & Research expenses	+		
75- Investment allowance	+		
80- Bad debts	+		
85- Rental expenses(Only 10% of Gross Rental Revenue)	+		
90- Total deductions (Sum of Line 60 through Line 85)	=	--> -	

Glossary:

Net Profit = Total Income – Total Expenses

Tax Exemptions

Tax Credits

Tax Liability

ETR = Tax Liability / Net Profit

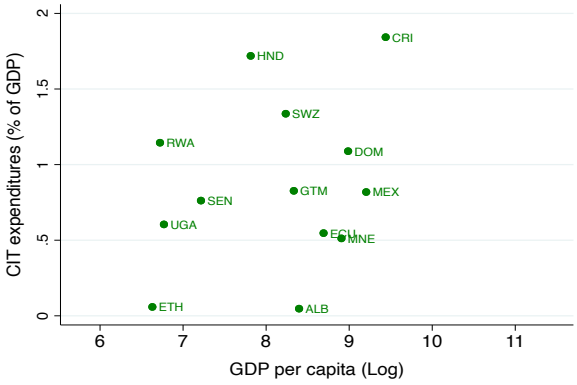
95- Net Income (Substract Line 90 from Line 55)		=
100- Reintegration of non-deductible expenses		+
105- Depreciation adjustment (+/-)		
110- Loss carried forward from previous five tax periods		-
115- Non-taxable Dividend received		-
120- Taxable Income [(Add Line 95 and Line 100 and +/- Line 105) minus (Line 110+Line 115)]		=
125-Corporate Income Tax (Line 120 * 30%)		=
130- Tax Discounts from employment (Brought forward from Line 265)		
135- Tax Discounts from Exports (Brought forward from Line 225)		
140- Tax Discounts from Free Trade Zone (Brought forward from Line 230)		
145- Tax Discounts for Micro Finances(Brought forward from Line 235)		
150-Tax Discount for newly listed companies on Capital market(Line 245)		
155-Venture capital companies registered with Capital market(Line 250)		
160-Collective inveistiment chemes and employees' shares scheme(Line 255)		
165-Agricultural and livestock activities (Line 260)		
170- Foreign Tax Credit (Line 65 of Annex B)	-	
175- Corporate Income Tax Payable [(Line 125-(Line 130+135+140+145+150+155+160+165+170)]		=

RRA-CIT-DF1-E11

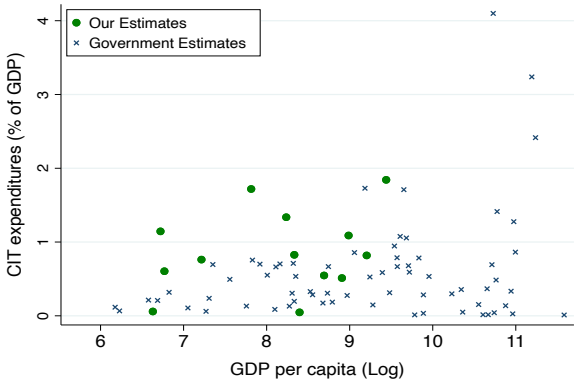
Note: This figure presents an example of the corporate tax return for Rwanda. Circled in color are the general concepts we use across countries. This figure is discussed in Section 2.2.

Figure A.2: Corporate Tax Expenditures as a Share of GDP

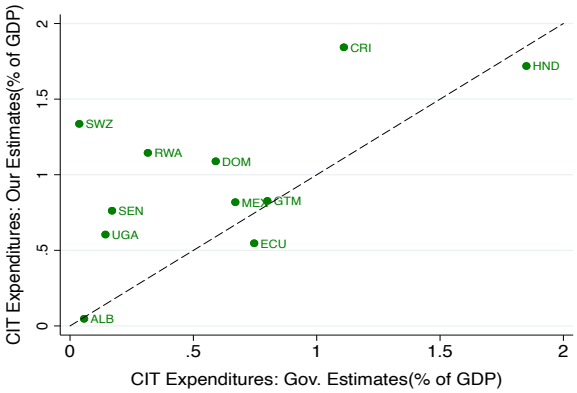
(a) Administrative micro-data



(b) Global CIT Expenditures

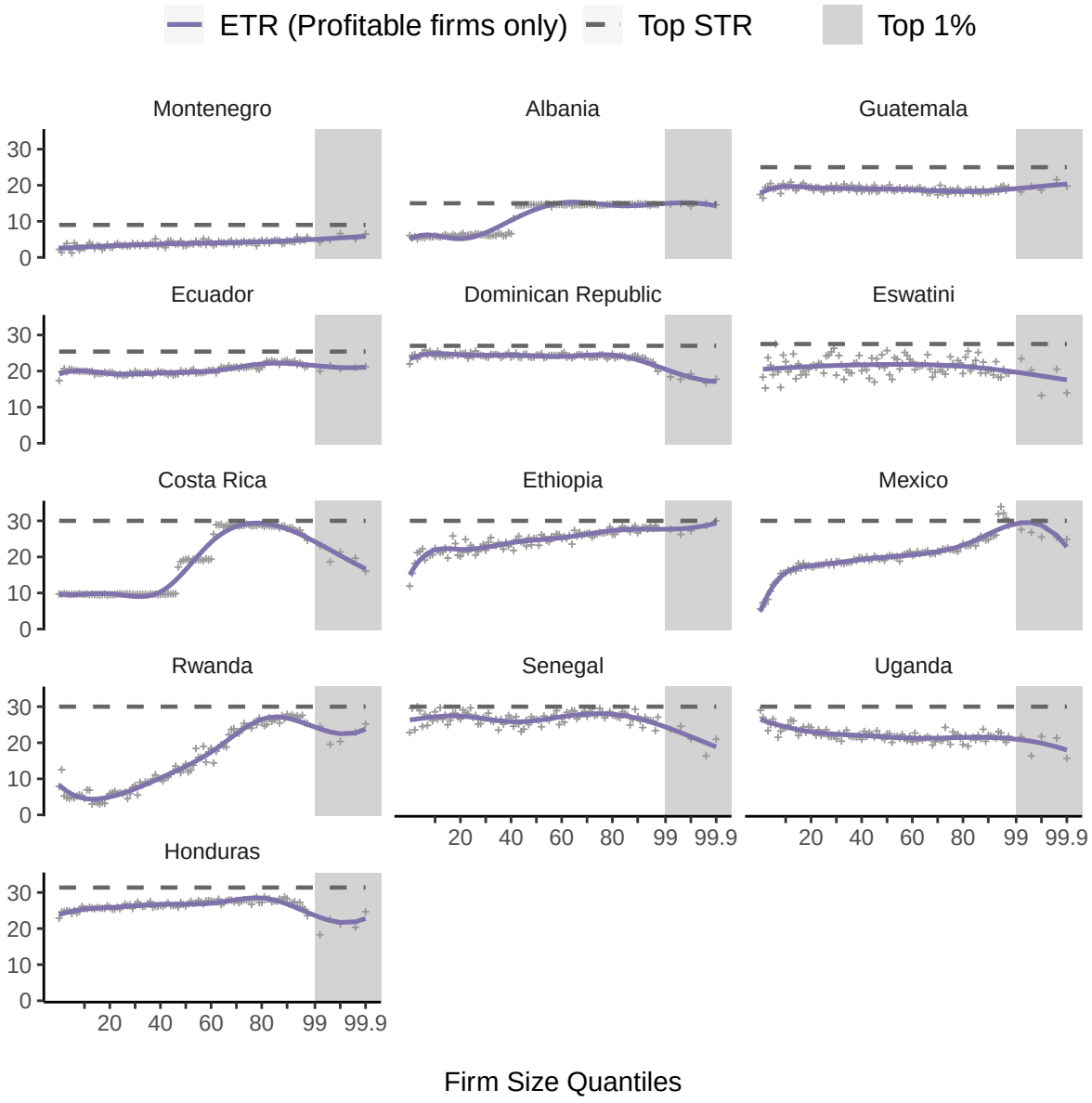


(c) In-sample Comparison: Our Estimates vs. Government Estimates



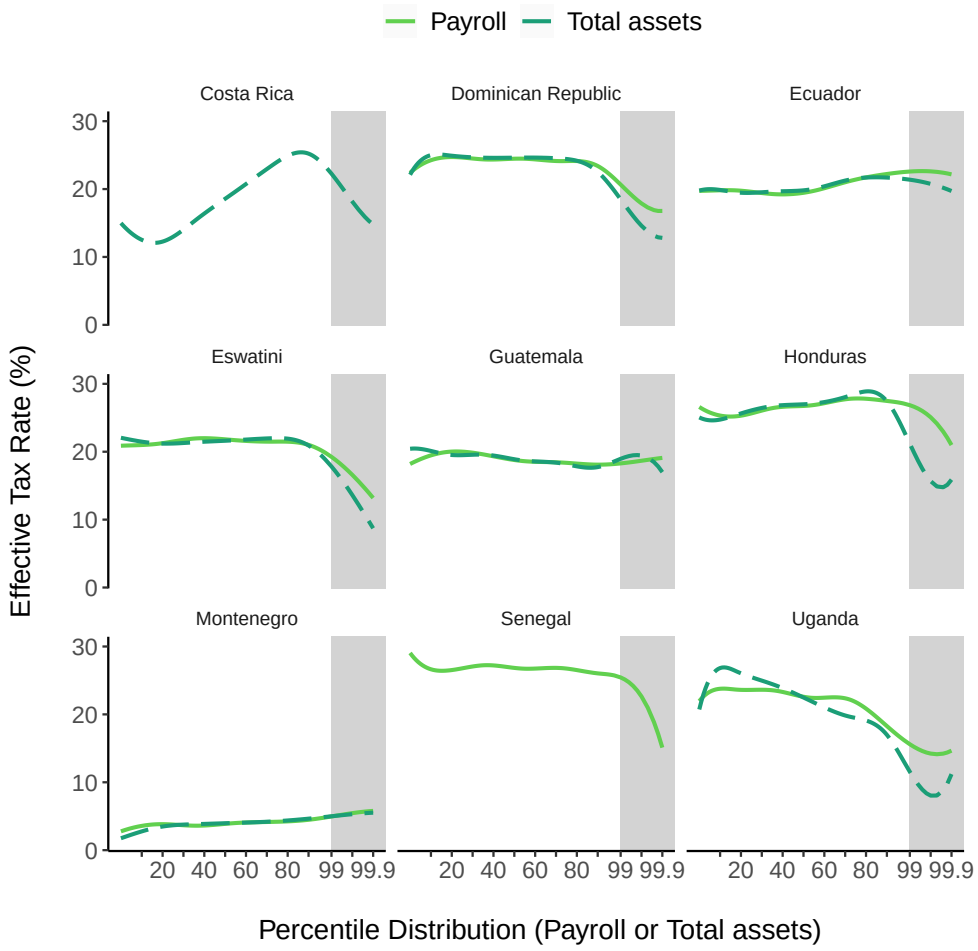
Note: This figure shows estimates for the size of corporate income tax expenditures as a share of countries' GDP. Panel (a) shows our estimates for the 13 sample countries, ranked by per capita log GDP (2015 constant USD from the World Bank). Panel (b) adds estimates of CIT expenditures from 66 additional countries, available in the Global Tax Expenditure Dataset (GTED), for a total sample size of 79 countries. The new estimates come from countries' official tax expenditure reports, which based on international standards should be completed yearly. In practice, developing countries do not systematically produce tax expenditure reports, and when they do, the methods vary significantly depending on each country's definition and statistical capacity. Panel (c) shows the correlation between our estimates of tax expenditures, and those from official tax expenditure reports, for the 11 sample countries where both are available. The dotted line is the 45-degree line. For sample countries, we adjust the GTED tax expenditure numbers when further details are available in the country's tax expenditure report, to include all relevant expenditures. To compute aggregate tax expenditures from the microdata, we first use the difference between the top statutory tax rate and the firm-specific ETRs multiplied by their net profits to compute firm-level tax expenditures. We then aggregate these tax expenditures across firms, within country, and divide it by the sum of corporate tax liabilities, yielding a ratio of foregone CIT revenue to actual tax revenue. We multiply this ratio by the CIT collection as a share of GDP (using tax revenue data from Bachas et al. 2022) to obtain total tax expenditure as a share of GDP. This figure is discussed in Section 3.1.

Figure A.3: Effective Tax Rates and Firm Size, Profitable Firms



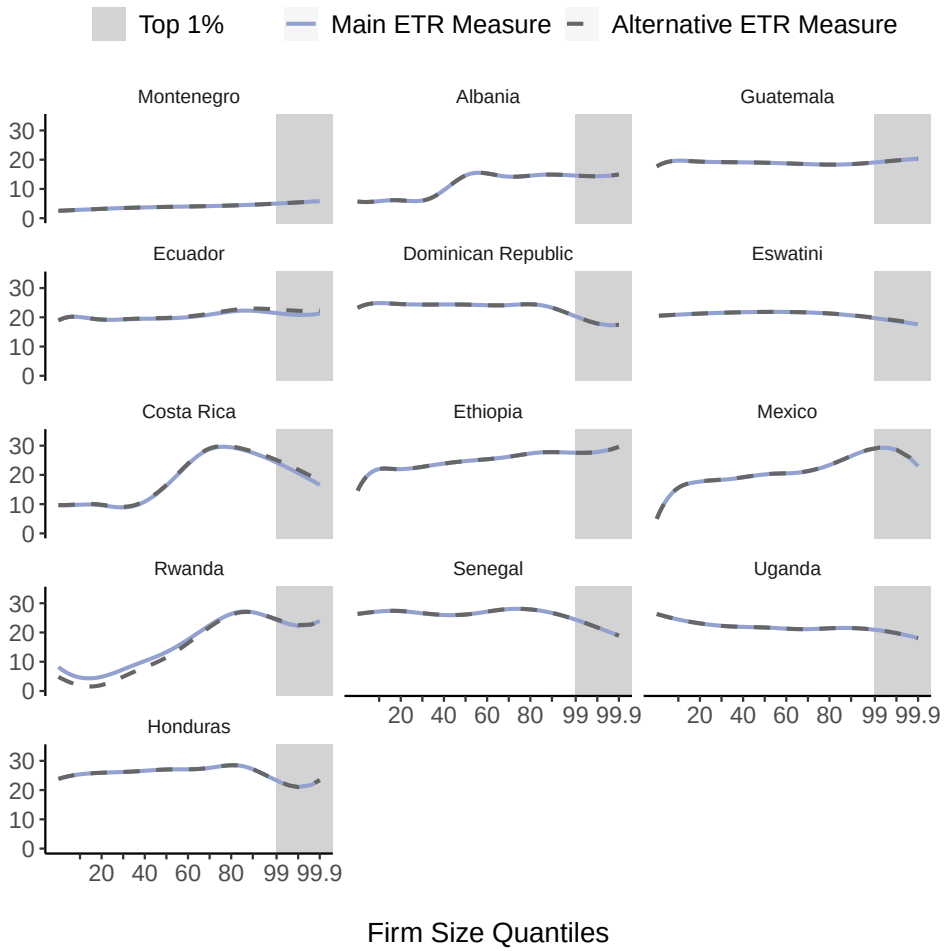
Note: This figure is identical to Figure 2 but focuses on profitable firms only. The figure shows effective tax rates as a function of firm-size quantiles, where size quantiles are determined based on revenue in the full population of firms (including zero-profit and loss-making firms).

Figure A.4: Alternative Firm Size Measures: ETR by Percentiles of Payroll and Total Assets



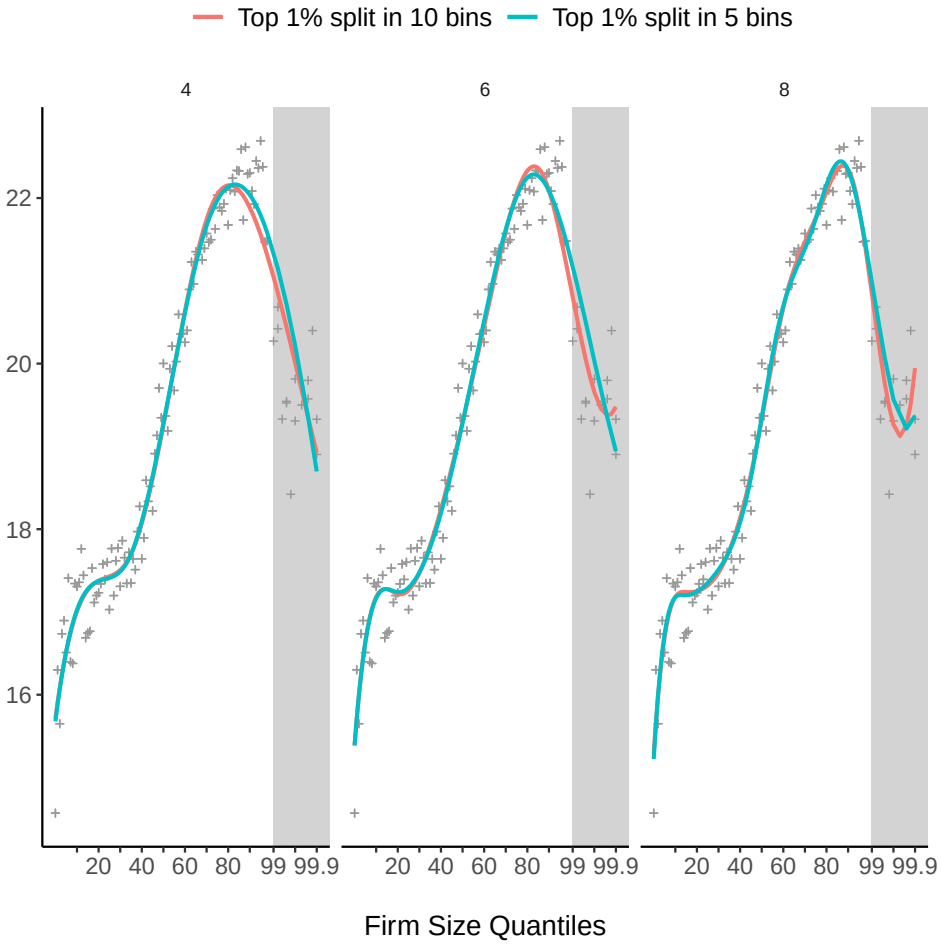
Note: This figure shows the effective tax rate by firm size (similar to Figure A.3), but uses firms' annual payroll (solid line) and total assets (dashed line) instead of revenue to construct firm-size quantiles (x-axis). Given the limited availability of those data, this can only be done for a sub-sample of countries. Across all firms, the average country correlation coefficient between revenue and payroll percentiles is 0.8, and the correlation coefficient between revenue and total assets percentiles is 0.7. This figure is discussed in Section 3.3.

Figure A.5: Effective Tax Rates and Firm Size
Alternative ETR Measure in Which Foreign Tax Credits Are Not Deducted from Net Tax Liability



Note: This figure shows the effective tax rate by firm size (similar to Figure A.3), comparing our main ETR measure (dashed line) with an alternative measure (solid line). When constructing this alternative measure, we do not deduct foreign tax credits from a firm's net tax liability, nor do we deduct credits labeled as "Other", which may be foreign tax credits. This figure is discussed in Section 4.

Figure A.6: Average ETR-Firm-Size Distribution: Robustness of Fit



Note: This figure shows the robustness of our fit of the average ETR by firm size for profitable firms. The middle panel replicates our preferred specification from Figure 4, Panel (a), in which we fit a cubic smoothing spline with six knots. In the left and right panels, we use four and eight knots respectively to fit the spline. In each panel, the blue line shows the specification in which we split the 1% into 5 bins. The red line is based on splitting the top 1% into 10 bins.

Table A.1: A Summary of the Literature on Effective Tax Rates and Firm Size

(1) Reference	(2) Data	(3) Country	(4) Numerator	(5) Denominator	(6) Firm Size Measure	(7) ETR & Firm Size
Yuzhu et al. (2022)	US	Financial data	Cash taxes paid	Pre-tax income	Total asset	Negative
Gaertner et al. (2021)	US	Financial data	Cash taxes paid	Pre-tax income	Total asset	Negative
Bach et al. (2019)	France	Tax return data	Tax expenses	Net profit	Turnover Number of employees	Negative
Lazăr (2014)	Financial data	Romania	Income tax expense	Net profit Turnover	Total assets	No relationship
Wu et al. (2012)	Financial data	China	Tax expenses	Net profit	Total assets	Positive
Guha (2007)	Financial data	India	Income tax expense	Net income	Total assets	Negative
Richardson and Lanis (2007)	Financial data	Australia	Income tax expense	Net profit Turnover	Total assets	Negative
Adhikari et al. (2006)	Financial data	Malaysia	Tax expenses	Operating income Turnover	Total assets	Negative
Janssen (2005)	Financial data	The Netherlands	Tax expenses	Operating income Turnover	Total assets	Negative
Rego (2003)	US	Financial data	Income tax	Pre-tax income	Turnover	Negative
Nicodème (2002)	Financial data	OECD	Tax expenses	Net income	Turnover Capital Total assets	Negative
Kim and Limpaphayom (1998)	Financial data	Hong Kong Korea Malaysia Taiwan Thailand	Income tax liability	Gross profits Net income	Turnover	Negative
Gupta and Newberry (1997)	Financial data	USA	Income tax expense	Net income Turnover	Total assets	No relationship
Kern and Morris (1992)	Financial data	USA	Income tax expense	Net income Gross profits	Turnover	No relationship
Wang (1991)	Financial data	USA	Tax expenses	Net income Gross profits	Turnover Total assets	Positive
Porcano (1986)	Financial data	USA	Income tax expense	Net income		Negative
Zimmerman (1983)	Financial data	USA	Tax expenses	Gross profits	Turnover	Positive
Stickney and McGee (1982)	Financial data	USA	Tax expenses	Net income	Turnover Total assets	No relationship
Gauthier and Reinikka (2006)	Survey data	Uganda	Tax expenses	Turnover	Number of employees	Inverse U-shape
Gauthier and Gersovitz (1997)	Survey data	Cameroon	Tax expenses	Turnover	Number of employees	Inverse U-shape
Mascagni and Mengistu (2019)	Tax return data	Ethiopia	Income tax expense	Gross profits	Turnover	U-shape
Carreras et al. (2017)	Tax return data	South Africa	Tax expenses	Gross profits	Turnover	U-shape
Mascagni et al. (2016)	Tax return data	Rwanda	Income tax expense	Gross profits	Turnover	Negative
Halleux and Valenduc (2007)	Tax return data Financial data	Belgium	Income tax expense	Net income	Total assets Value added Number of employees	Depends on size measure
Clark (2004)	Tax return data	Canada Belgium	Income tax liability	Gross profits Net income	Total assets Gross taxable income	Inverse U-Shape

Note: This table summarizes the key papers studying the relationship between effective tax rates and firm size. We do not include papers that estimate effective tax rates but do not relate them to firm size. The denominators used to estimate effective tax rates in the original studies were relabeled to match one of the four concepts used in this paper: net profit (our preferred measure), operating profit, gross profit, and revenue. This table is discussed in Section 1.1.

Table A.2: The Top 1% Firms as a Share of the Total Distribution

	Year	Revenue (%)	Profit (%)	CIT (%)	Payroll (%)
Average		**53.5**	**57.2**	**54.3**	**42.5**
Albania	2019	47.9	38.1	41.8	NA
Costa Rica	2019	63.0	79.1	56.1	NA
Dominican Republic	2015	60.0	67.3	65.0	45.9
Ecuador	2019	55.2	62.9	63.6	38.3
Eswatini	2018	55.0	60.5	49.8	54.8
Ethiopia	2016	60.5	63.8	64.7	NA
Guatemala	2019	49.0	55.3	54.8	33.6
Honduras	2019	55.6	58.7	55.3	39.2
Mexico	2015	46.7	55.7	57.6	NA
Montenegro	2019	52.9	41.5	45.7	41.2
Rwanda	2017	52.0	50.3	64.4	NA
Senegal	2018	48.8	62.2	50.8	35.5
Uganda	2019	49.3	48.1	36.9	51.2

Note: This table presents summary statistics on the top 1 percent of the firm-size distribution for all countries. We compute revenue for the top 1 percent, as a share of total revenue in our full sample. We do the same for profits, corporate income liability, and payroll. Payroll information is only available in selected countries. This table is discussed in Section 4.

Table A.3: Number of Observations by Country and Quantile Bin

Percentiles	(1) ALB	(2) CRI	(3) DOM	(4) ECU	(5) ESW	(6) ETH	(7) GTM	(8) HND	(9) MEX	(10) MNE	(11) RWA	(12) SEN	(13) UGA
Panel A: All Firms													
90	192	586	380	38	484	150	230	237	4614	194	129	57	160
98	192	586	380	38	484	150	229	237	4614	194	129	57	160
99	192	586	380	38	484	150	229	237	4614	194	129	57	160
Panel B: Profitable Firms													
90	173	509	340	31	427	130	185	198	3388	168	98	46	117
98	167	500	341	36	418	133	187	200	3745	174	95	49	134
99	170	499	343	34	440	129	186	191	3903	164	93	47	129

Note: This table presents the number of observations for each revenue percentile bin, by samples and by countries, for the most recent cross-section available. This table is referred to in Section 4.

Table A.4: Explaining the Relationship Between Effective Tax Rates and Firm Size Deciles 1 to 9

	Outcome: Effective Tax Rate							
	Baseline	+ Controls for firm characteristics	+ Dummies indicating use of tax expenditures					
Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regressor: Percentile (1-89) (unweighted cross-country average of country-specific point estimates)	0.08	0.07	0.04	0.08	0.08	0.07	0.08	0.04
N countries with positive point estimate	10	9	10	10	11	9	11	11
N countries where upper one-sided t-test rejects null	9	8	8	9	9	8	10	9
N country	13	13	13	13	13	13	13	13
Controls:								
Firm characteristics		×						×
Reduced rate dummy			×					×
Exempt income dummy				×				×
Special deduction dummy					×			×
Re-timing dummy						×		×
Tax credits dummy							×	×

Note: This table is similar to Table 2, but focuses on firms in deciles 1-9 of the size distribution. Instead of a dummy indicating firms in the top 1 percent of the size distribution, the main right-hand-side variable in the regressions displayed here is the firm-size (revenue) percentile. Everything else is as in Table 2. This table is referred to in Section 4. Country-specific coefficients are detailed in Table A.6.

Table A.5: Explaining the Relationship Between Effective Tax Rates and Firm Size at the Top: Robustness to Different Regressors

	Panel A: Sample is Top 10% of Firm Size					Panel B: Sample is Top 20% of Firm Size				
Regressor:	Top 1% dummy (1)	Top 2% dummy (2)	Top 3% dummy (3)	Top 0.1% dummy (4)	Percentiles (5)	Top 1% dummy (6)	Top 2% dummy (7)	Top 3% dummy (8)	Top 0.1% dummy (9)	Percentiles (10)
Unweighted cross-country average of country-specific point estimates	−2.49	−1.64	−1.45	−3.01	−0.19	−2.52	−1.63	−1.37	−3.15	−0.04
N countries with negative point estimate	11	10	10	9	9	9	9	9	9	8
N countries where lower one-sided t-test rejects null	8	6	7	5	8	7	6	7	4	6
N countries	13	13	13	13	13	13	13	13	13	13

Note: This table shows the robustness of our regression results from Table 2, column 1, to different choices for the regressor and sample. Panel A restricts the sample to the top 10 percent of the size distribution (as in our main specifications), while panel B restricts to the top 20 percent. We regress the ETR on a dummy tagging the largest firms, where the largest firms are either in the top one percent of the firm-size distribution (as in our main specification in Table 2, column 1), or in the top 2 percent, top 3 percent or top 0.1 percent. In columns 5 and 10 regress the ETR on a continuous percentile variable.

Table A.6: Explaining the Relationship Between Effective Tax Rates and Firm Size
Regression Table with Country-Specific Coefficients

Sample:	Profitable Firms							
	Baseline	Firm Characteristics	Reduced Tax Rates	Exempt Income	Special deductions	Re-timing	Tax Credits	All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regression A – Coefficient is Top 1% Dummy (Within Decile 10 Only)								
Top 1%	**-2.49**	**-1.65**	**-2.45**	**-2.09**	**-2.35**	**-2.11**	**-1.5**	**-0.43**
Albania	-0.01	0.1	-0.01	-0.01	-0.01	-0.03	-0.01	0.03
Costa Rica	-7.23 ***	-3.51 ***	-7.23 ***	-4.93 ***	-7.23 ***	-7.23 ***	-2.87 ***	0.11
Dominican Republic	-4.67 ***	-2.65 ***	-4.67 ***	-4.67 ***	-4.51 ***	-4.65 ***	-4.77 ***	-2.92 ***
Ecuador	-1.19 ***	-1.17 ***	-1.18 ***	-0.69 *	-0.89 **	-1.19 ***	-0.47	-0.02
Eswatini	-1.31	-0.81	-1.31	-0.06	-1.25	-1.48	-0.82	0.1
Ethiopia	-0.03	-0.33	-0.04	-0.03	-0.03	0.08	-0.03	0.1
Guatemala	0.72	1.1 *	0.72	0.84	0.72	0.72	0.68	0.9
Honduras	-4.95 ***	-3.73 ***	-4.37 ***	-5.71 ***	-4.96 ***	-4.95 ***	1.91 ***	0.68
Mexico	-2.91 ***	-2.06 ***	-2.91 ***	-2.91 ***	-2.92 ***	-3.01 ***	-2.83 ***	-2.02
Montenegro	0.61 *	0.77 **	0.61 *	0.61 *	0.61 *	0.61 *	0.61 *	0.77 **
Rwanda	-4.47 ***	-3.36 ***	-4.47 ***	-4.12 ***	-3.8 ***	-0.64	-3.94 ***	0.51
Senegal	-4.49 ***	-5.16 ***	-4.49 ***	-3.05 **	-4.28 ***	-4.5 ***	-4.49 ***	-3.54 ***
Uganda	-2.48 **	-0.71	-2.48 **	-2.48 **	-2.03 *	-1.22	-2.48 **	-0.29
Regression B – Coefficient is Turnover Percentile (1 to 89)								
Percentile (1-89)	**0.08**	**0.07**	**0.04**	**0.8**	**0.08**	**0.07**	**0.08**	**0.04**
Albania	0.15 ***	0.14 ***	0 *	0.15 ***	0.15 ***	0.14 ***	0.15 ***	0
Costa Rica	0.31 ***	0.3 ***	0.01 ***	0.31 ***	0.31 ***	0.31 ***	0.31 ***	0.02 ***
Dominican Republic	-0.01 ***	-0.01 ***	-0.01 ***	-0.01 ***	-0.01 ***	0	-0.01 ***	0
Ecuador	0.03 ***	0.04 ***	0.02 ***	0.04 ***	0.03 ***	0.03 ***	0.04 ***	0.03 ***
Eswatini	0.01	0.01	0.01	0.01	0.01	0	0.01	0
Ethiopia	0.09 ***	0.07 ***	0.09 ***	0.09 ***	0.09 ***	0.05 ***	0.09 ***	0.03 ***
Guatemala	-0.01 ***	0	-0.01 ***	-0.01 **	-0.01 ***	-0.01 ***	0.01 ***	0.02 ***
Honduras	0.04 ***	0.03 ***	0.03 ***	0.04 ***	0.04 ***	0.04 ***	0.05 ***	0.03 ***
Mexico	0.11 ***	0.11 ***	0.11 ***	0.11 ***	0.11 ***	0.04 ***	0.11 ***	0.04 ***
Montenegro	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***	0.02 ***
Rwanda	0.29 ***	0.29 ***	0.29 ***	0.29 ***	0.29 ***	0.31 ***	0.29 ***	0.3 ***
Senegal	0.01 **	-0.03 ***	0.01	0.02 ***	0.02 ***	0	0.01 **	-0.02
Uganda	-0.04 ***	-0.04 ***	-0.04 ***	-0.04 ***	0.01	-0.02 ***	-0.04 ***	0.02 ***

Levels: $^{***}p < .01$, $^{**}p < .05$, $^{*}p < .1$

Note: This table presents detailed results for the country-specific regressions which are summarized in Tables 2 and A.4. The structure of the table and regression specifications are as described in the footnotes. This table is referred to in Section 4.

Table A.7: List of Available Tax Provisions by Country

Country	Exempt Income	Non-Deductible Costs	Re-timing	Special deductions	Tax Credits
Albania	No	Yes	Yes	No	No
Costa Rica	Yes	Yes	No	Yes	Yes
Dominican Republic	No	No	Yes	Yes	Yes
Ecuador	Yes	Yes	Yes	Yes	Yes
Eswatini	Yes	Yes	Yes	Yes	Yes
Ethiopia	No	No	Yes	No	No
Guatemala	Yes	Yes	No	Yes	No
Honduras	Yes	Yes	No	Yes	Yes
Mexico	No	No	Yes	Yes	Yes
Montenegro	No	No	No	No	No
Rwanda	Yes	Yes	Yes	No	Yes
Senegal	Yes	Yes	Yes	Yes	Yes
Uganda	Yes	Yes	Yes	Yes	No
Count	8	9	9	9	8

Note: This table presents the list of tax provisions and exemptions that exist in each country. We harmonize the concepts under categories and detail whether these concepts appear in the country's tax form and hence in our data (Yes) or not (No). Non-deductible costs are costs that firms incur but cannot deduct from their tax base, so they are typically added back to the net profit. Re-timing refers to loss carry-forward or loss carry-backward provisions. Special deductions include all tax provisions that can be claimed to lower the tax *base* (e.g. R&D expenses, capital, and investment allowances). Tax credits are applied directly to lower the tax *liability* (e.g. sector-specific incentives, green investments, export promotion or Free Economic Zones, foreign tax credits). This does do not include withholding or prepayments as they do not reduce the annual liability. This table is mentioned in Section 4.

B Online Appendix: Tax Schedules

Some countries supplement their corporate tax policies with alternative taxes which are levied either instead of or in addition to the corporate tax liability. Given the country-specific nature of these regimes, we deal with them on a case-by-case basis. In broad terms, we include in our analysis firms that pay the statutory tax rate or a reduced tax rate on profits. We typically drop firms paying a minimum tax, and firms in simplified or unified tax regimes, which are usually for small firms only and require a different return.

Albania The statutory corporate tax rate (STR) was 15 percent during the years covered by our data (2015 to 2019). In 2019, smaller firms with revenue below 14 million ALL benefited from a 5 percent reduced tax rate, and firms with revenue below 5 million ALL were fully exempt. The relevant revenue thresholds for the rate reduction and exemption have changed over the years.

Costa Rica The highest statutory corporate tax rate was 30 percent during the years covered by our data (2006 to 2019). The tax system includes two other tax brackets for smaller firms with tax rates at 10 and 20 percent. The tax rate is applied to profit, but the tax brackets are based on firms' revenue. The tax bracket thresholds are inflation-adjusted annually.

The Dominican Republic The statutory corporate tax rate was 27 percent for all firms in 2015. Over the span of our panel, the statutory rate changed several times: it was 28 percent in 2014, 29 percent from 2011 to 2013, 25 percent from 2007 to 2010, and 30 percent in 2006.

Ecuador The STR was 22 percent from 2013 to 2017, and increased to 25% percent in 2018. In 2018, micro-firm with revenue below 1,000,000 LCU are still subject to the 22% rate, as well as firms in the mining and extractive industry. The STR can also be 28%, depending on the company's shareholders structure (a corporate structure where at least 50% of the firms is owned by tax haven residents) and disclosure compliance (at least 50% of undisclosed shareholders).

Eswatini The STR was 27.5 percent from 2014 to 2018, and 30 percent in 2013.

Ethiopia The STR was 30 percent over the span of our data (2011 to 2016).

Guatemala The STR was 25 percent over the span of our panel (2006 to 2019). Firms with a profit rate below a threshold are taxed on turnover. We do not include these firms in our analysis.

Honduras The STR is 25% since 2017 and was 30% from 2014 to 2016. A Solidarity Contribution tax is also applied on top for firms with a taxable income over HNL 1 million. The Solidarity Contribution tax rate is 5%. A minimum tax on turnover at a rate of 1.5 percent was applied to firms above a turnover threshold. These firms pay either the corporate income tax on profits or the tax on turnover, whichever is larger. The threshold for the minimum tax application has been gradually raised over time. As result, only 0.3 percent of firms in our

sample (within the very largest firms) paid the minimum tax in 2019. We hence exclude minimum tax payers from the sample. In addition, some firms in Honduras are subject to the asset tax in lieu of the CIT: firms pay 1 percent on the excess above L3 million of their total assets. We keep firms paying the asset tax in the sample because these firms are subject to whichever tax liability is greater–between the CIT and the Asset Tax–and we would drop a large share of the largest firms from the sample if we dropped asset tax payers. Those firms are not subject to an STR of 25%, so we compute an STR that firms are subject to in the following fashion:$STR_i = (SolidarityTaxBase_i * 0.05 + NetTaxBase_i * 0.25)/(NetTaxBase_i)$. In that sense, the maximum STR for Honduras can reach 34%. The tax liability we take into account for the ETR calculation is the greater of the two tax liabilities. In the ETR calculation, if the denominator (e.g. net profit) is smaller or equal to zero, but taxes paid is greater than zero (due to the asset tax), we set the ETR to the maximum STR.[27]

Mexico The STR was 30 percent for all firms during the span of our panel (2010 to 2015). The data we use for Mexico are open source and have been altered before release by the tax administration (SAT) to ensure the data are fully anonymized. First, they added an error term to all reported amounts, drawn from a mean-zero normal distribution. Then, they dropped observations for which total income was larger than three standard deviations above the median, which means in practice that the data do not contain the very top firms.[28]

Montenegro Montenegro's statutory corporate tax rate was 9 percent over the span of the panel (2011 to 2019).

Rwanda Rwandas statutory corporate tax was 30 percent during the period covered by our data (2010 to 2017). There are specific regimes for smaller firms, such as a flat tax and a lump sum tax, but we do not include these firms in the analysis.

Senegal During the period covered by our data (2010 to 2018), Senegal applied a corporate tax of 30 percent on positive taxable profits, and an alternative minimum tax of 0.5 percent of turnover on firms with negative taxable profits. The maximum amount cannot be more than XOF 5 million.

Uganda The STR was 30 percent over the span of our data (2015 to 2019). Small firms with revenue below certain thresholds pay a simplified tax. We do not include these firms in our analysis.

[27] Finally, in Honduras, we also drop the 11 percent of firms filing manually in 2019 (instead of online), because we do not observe net profit for them. Other papers working with Honduras data do the same (Lobel et al. 2021).
[28] For details on how the data have been altered, see here.

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