The Elasticity of Taxable Income Across Countries

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Abstract

We use administrative tax data from 17 developed and developing countries to calculate the within-country corporate elasticity of taxable income (ETI) and investigate differences between these estimates. We develop a new structural empirical method using the observed distribution of taxable income that exploits the differential tax treatment of business income for firms earning positive and negative taxable income. Our ETI estimates range between 1.9 for Canada and 0.04 for Uruguay, and these differences are much smaller than the range found in the literature (0 to 5). We use our estimates, a large set of predictors, and a random forest estimation to provide out-of-sample ETI estimates for 248 countries and find an average elasticity of 0.59. We then show differences in elasticities across countries are explained by country characteristics (52%), tax system characteristics (31%), and firm characteristics (16%).

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1 Introduction

The corporate elasticity of taxable income (ETI) is a key parameter to determine the welfare implications of corporate taxes. As policymakers frequently re-visit optimal corporate tax policy, it is critical to understand how firms respond to corporate taxes and how these responses differ across countries. This is even more salient given the on-going global tax reform negotiations.[1] While empirical estimates of the ETI exist for firms located in a few countries, the variation across these estimates is large, predicting anything between a 0% and 50% change in taxable income in response to a 10% change in the net-of-tax rate (e.g., Bachas and Soto, 2021; Coles et al., 2022; Devereux et al., 2014; Krapf and Staubli, 2020; Lediga et al., 2019).[2] Moreover, these estimates are based on different econometric methods. As a result, it is difficult to interpret and compare these estimates across countries, limiting their applicability to on-going global corporate tax policy debates.

In this paper, we develop a new structural model of corporate behavior and estimation method that we deploy worldwide. This approach holds the empirical methods fixed across administrative data sets, allowing cross-country differences in the ETI to be attributed to country-specific parameters, including differences in the tax systems, firm characteristics, and other country characteristics. Our model clarifies that the elasticity of corporate taxable income is not a structural parameter but can be calculated using a structural parameter that determines firms' real responses to taxation, the elasticity of income. We estimate this structural parameter using data on the distribution of taxable income building on pioneering work by Saez (2010), Kleven and Waseem (2013), Bertanha et al. (2023), and Coles et al. (2022). We also develop a statistical package that allows us, and others, to implement our methods consistently across countries.[3] In fact, we use this statistical package within each administrative tax data environment while adhering to any data-sharing agreement that is required of each country-specific tax data user.

We implement our method using administrative data from the following 17 countries: Canada, Chile, China, Costa Rica, Dominican Republic, Ecuador, France, Greece, Guatemala,

[1]For example, the Organization for Economic Co-operation and Development (OECD) has lead the largest multi-national corporate tax negotiation in recent history, referred to as the Global Tax Deal. This reform would, among other changes, harmonize the minimum corporate tax rate faced by corporations across tax jurisdictions (e.g., a 15% global minimum tax). The OECD estimates that mismatches in tax policy cost countries \$100 to \$240 billion in lost revenue every year. `https://www.oecd.org/tax/beps/about/`

[2]Modeling convention for the corporate elasticity of taxable income generates an elasticity with respect to the net-of-tax rate, or 1 - τ, where τ is the statutory tax rate. An increase in the net-of-tax rate reflects a decrease in the statutory tax rate.

[3]The package and code to simulate data can be found at `www.nathanseegert.com/code`.

Honduras, Montenegro, Norway, Rwanda, Senegal, Slovakia, South Africa, and Uruguay. These countries are drawn from a wide variety of regions, economies, and tax systems. In most cases, our study provides the first estimate of the ETI for these countries. Notable exceptions include Costa Rica, Slovakia, and South Africa (Bachas and Soto, 2021; Bukovina et al., 2024; Lediga et al., 2019).

The structural model we propose is a neoclassical model of firms with heterogeneous productivity and fixed costs. Firms choose their level of capital to maximize profits, which are increasing and concave in capital. Equilibrium capital is determined by the traditional Hall-Jorgenson condition where their marginal product of capital is equal to the external rate of return r divided by the net-of-tax rate $1-t$. The tax distorts the equilibrium capital choice. Our setting has a kinked tax schedule, where the tax rate increases for taxable income beyond a kink point. This tax feature distorts the taxable income distribution, creating bunching, which allows us to estimate the structural model. With the model parameter estimates, we can calculate the real and reporting elasticities of taxable income and show they are heterogeneous across firms.

Our structural model of firms allows for two dimensions of heterogeneity: productivity and fixed costs. This heterogeneity allows our model to match the dispersed distribution of income that includes negative values. In contrast, most papers estimating elasticities of taxable income focus on individuals where negative income is negligible, and therefore, those methods explicitly exclude the possibility of negative income (e.g., Saez, 2010). Our model allows us to have negative income and two dimensions of heterogeneity, which we estimate using a censoring model following recent advances in this literature (Bertanha et al., 2018, 2023; Coles et al., 2022). We also provide nonparametric bounds and semi-parametric estimates of elasticity using the state-of-art methods (Bertanha et al., 2024). Our structural model generates estimates of the elasticity of income –the structural parameter– which we convert to the elasticity of taxable income that is heterogeneous across firms depending on their fixed costs. We report elasticities of taxable income in what follows, as those are most comparable to the existing literature.

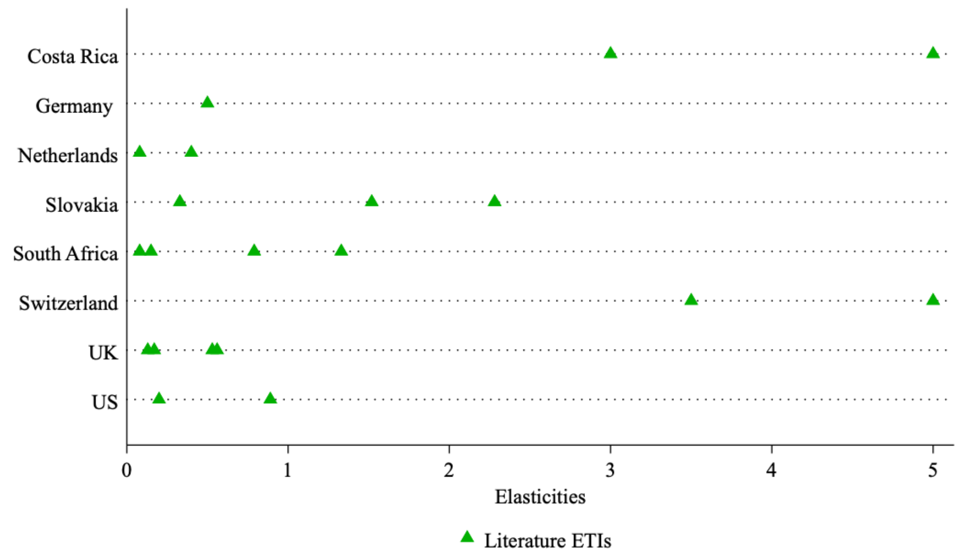
We find smaller cross-country variation in the corporate elasticity of taxable income than previous estimates suggest. In particular, our estimates of the real elasticity of taxable income range from 0.04 in Uruguay to 1.9 in Canada. In other words, firms in Canada are the most sensitive to changes in marginal tax rates — these firms respond to a ten percent increase in net-of-tax rate by increasing taxable income by 19.1 percent and Uruguayan firms are the least sensitive to marginal tax rates — these firms respond to a ten percent increase in the net-of-tax rate by increasing taxable income by 0.4 percent. These estimates suggest that the efficiency costs of higher tax rates are larger in Canada than in Uruguay.

We conclude by providing first steps in understanding why the elasticity of taxable income differs across countries. We show that our elasticity estimates are negatively correlated with statutory tax rates and positively related with GDP per capita and formality in the economy. We use a random forest prediction model and a large set of country-level predictors to estimate the contribution of different factors in explaining differences in elasticities across countries. The random forest model consistently chooses formality, the 10th percentile of firm revenue, and the logarithm of total taxes paid as the best predictors of elasticity. These results are robust when using three- or four-factor models, with a correlation of 0.97 between the predicted elasticities. Our Shapley decomposition shows that country characteristics explain the most of the differences in elasticities across countries (52% of the difference), followed by tax system features (31%) and firm characteristics (16%). Finally, we produce out-of-sample predicted values for 248 countries and find the average elasticity is 0.59, with a minimum of 0.11 and a maximum of 1.47.

Our estimates contribute to a literature that has focused on estimating the elasticity of taxable income as a key parameter of understanding individual and corporate behavior and a focal policy input (Feldstein, 1995). Early studies of the elasticity of taxable income for individuals used various methods and data, likely contributing to the wide range of early estimates between -0.83 and 3 (Feldstein, 1995; Goolsbee, 1999).[4] A more recent and quickly growing literature focuses on the corporate elasticity of taxable income. Gruber and Saez (2002), Coles et al. (2022), and Devereux et al. (2014) provide estimates of 0.2, 0.89 for the US and 0.5 for the UK. Again, these papers used different methods, the first an instrumental variable approach similar to the individual income literature, the second a control group method, and the third a bunching estimator similar to the individual literature. Subsequent literature has focused on producing estimates of the corporate elasticity of taxable income based on taxpayer behavior in different countries: Costa Rica (Bachas and Soto, 2021), Germany (Dwenger and Steiner, 2012), the Netherlands (Bosch and Massenz, 2023), South Africa (Lediga et al., 2019), Switzerland (Krapf and Staubli, 2020), and Slovakia (Bukovina et al., 2024). This recent work on the corporate elasticity of taxable income has led to a range

[4]For example, there was wide dispersion in the implementation of instrumental variable approaches outlined by Auten and Carroll (1999) and Gruber and Saez (2002) and extended by Gelber (2014), Kopczuk (2005), Giertz (2005), and Weber (2014). In addition, many papers leverage taxpayer bunching at kinks and notches in the tax schedule to estimate the elasticity of taxable income following pioneering work by Saez (2010) and Kleven and Waseem (2013).

Figure 1: **Dispersion in existing estimates**



Notes: This figure graphs past estimates in the literature from different countries. This figure includes estimates from Costa Rica (Bachas and Soto, 2021), Germany (Dwenger and Steiner, 2012), the Netherlands (Bosch and Massenz, 2023), South Africa (Lediga et al., 2019), Switzerland (Krapf and Staubli, 2020), Slovakia (Bukovina et al., 2024), and the US (Coles et al., 2022; Gruber and Saez, 2002), the UK (Devereux et al., 2014).

of estimates from 0 to 5. We depict these estimates in Figure 1. There are several reasons why these estimates may vary so dramatically. First, there may be differences in country, tax system, and firm characteristics across countries. These differences are important to quantify and understand for policy. Second, the difference might be methodological, as in the individual literature, the method employed to estimate the corporate elasticity of taxable income varies across estimates. One of the contributions of our paper is to minimize this source of variation.

Our main contribution is to estimate the most comprehensive set of corporate elasticities across countries. Given the importance of elasticities in determining welfare implications of global corporate tax policy, it is crucial that policymakers have access to a set of comparable cross-country estimates. This extends the literature in several ways. First, we build a new empirical method to estimate elasticities across countries. Second, we provide a statistical package allowing administrative data users worldwide to add comparable estimates. Finally, we use machine learning methods to produce elasticity estimates for 248 countries worldwide, which can be used until more precise estimates can be obtained. No such effort has been made previously.

The cross-country differences in elasticities that we find suggest that harmonizing tax rates globally would result in varying costs and benefits for each country. For example, it has been long understand that global tax competition leads to a race-to-the-bottom in corporate tax rates as countries compete with each other for investment. Underpinning this dynamic is the notion that firms can easily relocate operations across taxing jurisdictions to take advantage of lower corporate tax rates. Consequently, harmonizing initiatives, such as, the OCED's effort to introduce a global minimum tax, will likely affect the migration of firms across countries. The estimates and methods produced in this paper provide a foundation for future work that explores how firms will respond to these and other corporate tax policy proposals, especially in a global tax environment.

2 Neoclassical Two-Period Model

In this section, we develop a two-period neoclassical model of corporate behavior. With this model, we derive a relationship between bunching at a kink point in the marginal tax schedule and the elasticity of taxable income with respect to the net-of-tax rate. This model is robust to many additional features, though for ease of exposition, we present a parsimonious model.[5]

2.1 Model Fundamentals

Consider a firm, denoted i, that is owned by a single shareholder and begins period 1 with retained earnings, X_i. Firms are heterogeneous in their productivity, captured by A_i, and their fixed costs, captured by C_i. In period 1, firm i chooses its level of capital in period 2, K_i. Firms choose their level of capital in period 2 by determining the amount of retained earnings to distribute as a dividend payment ($D_i \geq 0$), and the amount of equity to issue ($E_i \geq 0$); $K_i = X_i + E_i - D_i$.[6] In addition to equity, shareholders may hold government bonds with a tax-exempt rate of return, $r > 0$.

[5]The neoclassical model presented in this section is consistent with the more in depth model presented in Patel et al. (2014) that includes debt and dividend taxation.

[6]For ease of exposition, attention is restricted to equilibria where the firm does not pay out a dividend and issue equity concurrently. In the general model in Patel et al. (2014), the restriction that a firm does not pay out a dividend and issue equity concurrently is derived as equilibrium behavior with a dividend tax. The restriction does not change the following analysis.

In period 2, capital generates income net-of-depreciation costs according to a strictly concave production function

$$I_i(K_i) = \frac{1+e}{e} A_i^{1/(1+e)} K_i^{\frac{e}{1+e}}. \tag{1}$$

Here, e determines the curvature of the production function and the elasticity of income with respect to the net-of-tax rate. More importantly, e is also an input to the elasticity of *taxable income* with respect to the net-of-tax rate, the parameter of interest. Finally, profit is income net of fixed costs. Modeling fixed costs is important to match the data since a large proportion of firms report negative profits.[7]

$$F_i(K_i) = I_i(K_i) - C_i. \tag{2}$$

In our baseline model, taxable income is equal to profits $Y_i(K_i) = F_i(K_i)$. In Appendix A, we expand the model to allow firm i to also choose how much to avoid or evade taxation ρ_i, such that $Y_i(K_i) = F_i(K_i) - \rho_i$. Our estimation is robust to this addition, and we relegate it to the appendix as the real and reporting responses are not the focus of this paper.[8]

At the end of period 2, all firms liquidate, returning their principal and profits to their shareholders.

With this model in mind, firm i chooses K_i to maximize its value to its shareholder:

$$\max_{K_i} \quad V_i = X_i - K_i + \frac{(1-t_c)Y_i(K_i) + K_i}{1+r}, \tag{3}$$

where $X_i - K_i = D_i - E_i$ are net distributions in period 1 valued by its shareholder.

The benefit of higher capital in period 2 is higher profit. Profit is taxed at the rate t_c and discounted at the rate r.[9] The cost of higher capital in period 2 is reduced distributions in period 1 (fewer dividends or more equity issuances).

Consider the case where there is a kink in the marginal tax rate schedule such that $t_c = t_0$ for $Y_i(K_i) \leq \kappa$ and $t_c = t_1$ for $Y_i(K_i) > \kappa$, where $t_0 < t_1$. Under this marginal rate schedule,

[7]Firms often also have the ability to carry-forward losses to future periods. Loss carry-forwards have several implications. First, loss carry-forwards provide firms with losses in the past a stock of credits that they can use to lower their taxable income in future periods. As a result, we expect that tax systems with more generous loss carry-forwards to have higher elasticities. Second, loss carry-forwards have implications for the effective tax rates especially around a kink at zero. We discuss losses and effective tax rates more in Section 4.

[8]For more information on the real and reporting trade-off, see Coles et al. (2022).

[9]The equilibrium rate of return r is assumed to be exogenous, abstracting from all general equilibrium effects.

the objective function faced by the firm is

$$\max_{K_i} \quad V_i = X_i - \frac{1}{1+r} r K_i \tag{4}$$
$$+ \mathbb{I}(Y_i(K_i) \leq \kappa) \frac{(1-t_0)Y_i(K_i)}{1+r}$$
$$+ \mathbb{I}(Y_i(K_i) > \kappa) \frac{(1-t_0)\kappa + (1-t_1)(Y_i(K_i) - \kappa)}{1+r},$$

where $\mathbb{I}(Y_i(K_i) \leq \kappa)$ and $\mathbb{I}(Y_i(K_i) > \kappa)$ are indicator functions for taxable income being below or above the kink.

2.2 Model Solution

Firms choose their capital in period 2 to equalize the marginal benefit and marginal cost of additional capital. Traditionally, the Hall-Jorgenson formula (Hall and Jorgenson, 1967) sets the marginal product of capital equal to the alternative rate of return given by the risk- and tax-free rate r divided by one minus the corporate tax rate. The marginal product of capital decreases with capital because the income function is increasing and concave in capital. Firms subject to higher tax rates have higher alternative rates of return and firms increase their marginal product of capital by decreasing their level of capital.

Our setting updates the Hall-Jorgenson formula for firms that are subject to a piece-wise linear tax schedule with a kink. To provide intuition, it is helpful to consider firm capital choices for three representative firms that differ based on the curvature of their production function, seen in Figure 2. Before we discuss their optimal choice of capital under the kinked tax schedule in panel (c), we consider their behavior when faced with kink-free schedules in panels (a) and (b).

In panel (a) of Figure 2, Firms 1, 2, and 3 are subject to the lower tax rate, t_0, below the kink. In this case, the Hall-Jorgenson formula applies, and all firms set their marginal product of capital equal to the alternative rate of return $\partial Y_i(K_i)/\partial K_i \equiv Y_i'(K_i) = r/(1-t_0)$. In equilibrium, Firm 3 sets their capital such that their taxable income is below the kink. Firms 1 and 2, by comparison, set their capital such that their taxable income is above the kink, but at that level they are not subject to t_0.

In Panel (b) of Figure 2, we depict the capital choice of these same firms when they face a higher tax rate $t_1 > t_0$. The higher tax rate leads to a higher alternative rate of return, $r/(1-t_1)$. Firm 1 sets their marginal product of capital equal to the alternative rate of return, $\partial Y_i(K_i)/\partial K_i \equiv Y_i'(K_i) = r/(1-t_1)$, and in this case, their taxable income with this new level of capital is still above the kink. This is their equilibrium behavior. When Firm 2 sets their marginal product of capital equal to the alternative rate of return, their taxable income is below the kink, where they are subject to the lower tax rate. However, Firm 2 would produce taxable income above the kink if it was subject to the lower tax rate. As a result, Firm 2 will set their taxable income exactly at the kink point in equilibrium, where their marginal product of capital that is greater than the alternative rate of return with the lower tax rate but less than alternative rate of return with the higher tax rate. We depict the equilibrium level of capital for each of these firms in panel c of Figure 2.

Formally, we derive the equilibrium capital and taxable income by taking the derivative of firm value with respect to capital in two regions where the derivative exists.

$$\frac{\partial V_i}{\partial K_i} = \begin{cases} \frac{1}{1+r}\left(-r + (1-t_0)\frac{\partial Y_i(K_i)}{\partial K_i}\right), & Y_i(K_i) < \kappa \\ \frac{1}{1+r}\left(-r + (1-t_1)\frac{\partial Y_i(K_i)}{\partial K_i}\right), & Y_i(K_i) > \kappa. \end{cases} \tag{5}$$

The solution for taxable income $Y_i(K_i)$ has a similar form to solutions derived in different contexts in this literature (Bertanha et al., 2023; Coles et al., 2022; Saez, 2010):

$$Y_i(K_i) = \begin{cases} \frac{1+e}{e} r^{-e}(1-t_0)^e A_i - C_i, & A_i \leq \underline{A}_i \\ \kappa, & \underline{A}_i < A_i < \overline{A}_i \\ \frac{1+e}{e} r^{-e}(1-t_1)^e A_i - C_i, & A_i \geq \overline{A}_i. \end{cases} \tag{6}$$

The thresholds are found by setting the optimal taxable income equal to the kink κ with both tax rates:

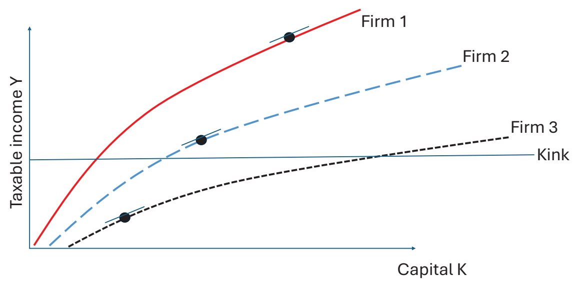
$$\underline{A}_i = (\kappa + C_i)/\theta_0, \quad \text{and} \quad \overline{A}_i = (\kappa + C_i)/\theta_1, \tag{7}$$

where $\theta_c = \frac{1+e}{e} r^{-e}(1-t_c)^e, c = 0, 1$.

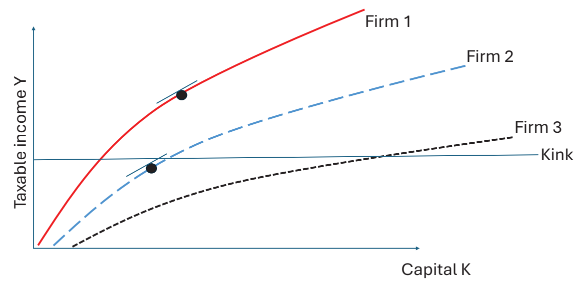
2.3 Elasticities

The key parameter in our model is e, which is a structural parameter that determines the curvature of the profit function. In addition, e determines how much firms adjust their capital in response to a change in tax rate and, therefore, characterizes the elasticity of

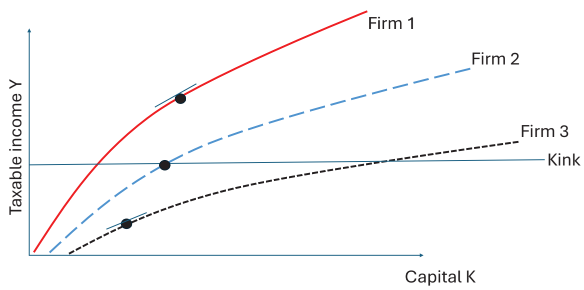
Figure 2: **Firm optimization**



a Low alternative rate of return $r/(1 - t_0)$



b High alternative rate of return $r/(1 - t_1)$



c Equilibrium capital and taxable income

Notes: This figure depicts three firms in panels a, b, and c that are subject to a piecewise tax schedule with a tax rate t_0 below the kink in taxable income and subject to the tax rate $t_1 > t_0$ above the kink. Panel a depicts three firms and their capital choices with a low alternative rate of return such that $Y_i'(K_i) = r/(1-t_0)$. Note, Firms 1 and 2 choose capital such that taxable income is above the kink point. Panel b depicts three firms and their capital choice with a high alternative rate of return such that $Y_i'(K_i) = r/(1 - t_1)$. Note, we focus on Firms 1 and 2, Firm 1 continues to choose capital such that their taxable income is above the kink point but Firm 2 chooses capital such that their taxable income is below the kink point. Firm 3 would again choose capital such that their taxable income is below the kink. Panel c depicts the equilibrium capital taxable income choices with the piecewise linear tax schedule with a kink.

taxable income with respect to the net-of-tax rate. To see this, we write equilibrium income, net of depreciation costs, as

$$I_i^* = \frac{1+e}{e} r^{-e}(1-t_c)^e A_i.$$

This representation of income is simply the profit function before taking into account fixed costs C_i.

The elasticity of income with respect to the net-of-tax rate is given by

$$\frac{\partial I_i^*}{\partial(1-t_c)} \frac{(1-t_c)}{I_i^*} = e\frac{1+e}{e} r^{-e}(1-t_c)^{e-1} A_i (1-t_c) \frac{1}{I_i^*} = e \tag{8}$$

The elasticity of *taxable income* with respect to the net-of-tax rate, ε depends on the elasticity of income. In particular, we show that the elasticity of taxable income is heterogeneous across firms:

$$\begin{aligned} \varepsilon_i = \frac{\partial Y_i(K_i)}{\partial(1-t_c)} \frac{(1-t_c)}{Y_i(K_i)} &= \frac{\partial I_i^*}{\partial(1-t_c)} \frac{(1-t_c)}{Y_i(K_i)} = e\frac{I_i^*}{Y_i(K_i)}. \\ = e\left(1+\frac{C_i}{Y_i}\right) \end{aligned} \tag{9}$$

This calculation suggests that firms with larger fixed costs as a percentage of profits will be more responsive to corporate tax changes.

Coles et al. (2022) shows that the elasticity of taxable income is a combination of the real and reporting responses. Here, we focus on the real response. In Appendix A, we show how this equation is updated when we allow for reporting responses. In addition, we show that our estimation of the real response is robust to allowing firms also to have a reporting response. Therefore, with our estimate of e and additional structure, we show how we can calculate heterogeneous elasticities of taxable income with or without reporting responses.

Equation (6) maps the unobserved variables A_i and C_i to the observed variable Y_i. This mapping depends on the kink point κ, the value of production amenities to the left of the kink $\theta_0 = \frac{1+e}{e} r^{-e}(1-t_0)^e$ and on the right $\theta_1 = \frac{1+e}{e} r^{-e}(1-t_1)^e$, and the income elasticity e. We can use this mapping to write the mixed continuous-discrete distribution of $Y_i(K_i)$, which is observed by the researcher, as a function of the continuous distribution of (A_i, C_i), which is unobserved. The identification problem consists of using this mapping to back out e using the observed distribution of Y_i, which requires assumptions on the unobserved distribution of (A_i, C_i). We discuss solutions to this problem in the next section.

3 Empirical Methods

In this section, we describe our new empirical method to estimate the elasticity of income with respect to corporate tax rates, that is, the parameter e. Our method exploits variation in tax rates, taxable income, measures of productivity, and fixed costs across firms to estimate how responsive firms are to changes in tax rates in each country.

We start with the mapping between observables and unobservables in Equation (6). A desirable empirical method solves for e as a function of the distribution of the data Y_i while imposing minimal assumptions on the distribution of the unobserved variables (A_i, C_i). In order to make progress on this identification problem and propose an empirical method, we draw a parallel with Bertanha et al. (2023). Bertanha et al. (2023) study a related yet different problem where researchers seek to identify the elasticity of labor supply with respect to income taxes. Their mapping between observables and unobservables is simpler than ours in at least three dimensions (compare our Equation (6) to their Equation (3)). First, they have one unobserved variable while we have two, A_i and C_i. Second, their observed income variable and kink point are always positive allowing for the log transformation, which is not possible in our case because of negative profits and a kink that is zero in most contexts. Third, the threshold values on the unobserved variable A_i that dictates the three regimes in Equation (6) is firm-specific in our case while constant across individuals in their case. In light of these differences, we develop a novel bunching method by transforming our problem into the problem studied by Bertanha et al. (2023) and applying their empirical methods to the transformed problem in order to identify our parameter of interest e.

Our model includes two unobserved variables, productivity A_i and fixed costs C_i. We first estimate the fixed costs C_i using variation in revenue R_i and deductions D_i and their positive relationship through the production function (Coles et al., 2022). In what follows we treat C_i as known and give the details of the estimation of C_i in Appendix B.2. Once we have C_i for every firm i, we create a variable W_i as income Y_i plus C_i divided by the fixed cost C_i,

$$W_i = \frac{Y_i + C_i}{C_i}. \tag{10}$$

Assume the kink point κ equals zero, which is the most common case, and use Equation (6) along with the definition of W_i to obtain

$$W_i = \begin{cases} \theta_0 A_i/C_i, & \text{if } A_i/C_i \leq 1/\theta_0, \\ 1, & 1/\theta_0 < A_i/C_i < 1/\theta_1, \\ \theta_1 A_i/C_i, & \text{if } 1/\theta_1 \leq A_i/C_i, \end{cases} \tag{11}$$

where the kink value now equals one.

The mapping in Equation (11) relates one unobserved variable A_i/C_i to the observed variable W_i. The variable W_i and the kink point are always positive, which allows for a log transformation. Finally, the threshold values on the variable A_i/C_i that dictates the three regimes in Equation (11) are constant across firms. It turns out that the mapping in Equation (11) is of the same kind of the mapping studied by Bertanha et al. (2023).

The empirical methods proposed by Bertanha et al. (2023) seek to identify the difference of the logs of the slope coefficients divided by the difference of the logs of one minus the tax rates. In terms of our notation, their methods seek to identify

$$\frac{\log(\theta_1) - \log(\theta_0)}{\log(1-t_1) - \log(1-t_0)} = e,$$

where the equality follows from the definitions of θ_0 and θ_1 given in (6). Therefore, applying the empirical methods of Bertanha et al. (2023) to the variable W_i yields estimates for our parameter of interest e.

The empirical methods of Bertanha et al. (2023) seek to identify the elasticity parameter under various types of assumptions on the distribution of the unobserved variable, which in our case corresponds to A_i/C_i. It is known that identification is impossible when the distribution of A_i/C_i belongs to the nonparametric class of all continuous distributions (Blomquist and Newey (2017), Bertanha et al. (2018)). Thus, bunching is only informative of the elasticity with assumptions stronger than continuity. Conversely, parametric assumptions on the distribution of A_i/C_i yield identification of the elasticity but are often deemed too strong. In the next paragraphs, we propose two empirical methods that balance the two extremes.

The first method relies on the weakest type of assumption and yields partial identification of the elasticity e. The assumption is that the probability density function of A_i/C_i is Lipshtiz continuous with slope bounded by a constant $M \in (0, \infty)$. Under this nonparametric class of distributions, Theorem 2 of Bertanha et al. (2023) gives analytical expressions for upper and lower bounds on e. The expressions depend on M and other quantities that can be estimated from the data. We refer to this first method as nonparametric bounds.

The nonparametric bounds provide insights into the heterogeneity across countries without relying on strong assumptions. These bounds nest the original estimators that either assume $M = 0$ or the so-called trapezoidal approximation (Chetty, 2009; Saez, 2010). Given a reasonable value for the slope restriction, M, we produce bounds for all countries in our sample. By varying M, we are able to examine the sensitivity of elasticity bounds to assumptions on the heterogeneity distribution.

The second empirical method point identifies the elasticity by relying on additional firm-level data X_i and a semi-parametric distributional assumption on A_i/C_i. Bertanha et al. (2023) show how to estimate the parameters of (11) using Tobit regressions with a censoring point in the interior of the distribution. Tobit regressions typically assume normality of A_i/C_i conditional on X_i. Lemma 1 by Bertanha et al. (2023) shows that such normality condition is not necessary for identification of the elasticity. In fact, a sufficient condition requires that the distribution of A_i/C_i equal an average of normal random variables, where the average is taken over the distribution of X_i. We assess this part of the assumption in our data by comparing model best-fit distributions with raw histograms of the data. Note that this second method relies on stronger assumptions that the first method above.

We can further loosen the distributional assumptions by estimating a truncated Tobit model, where we allow the estimation to use only data closer and closer to the kink point. Intuitively, the distributional assumption that a mixture of normal distributions approximate the distribution of A_i/C_i only needs to hold over the truncated region rather than the full support. Further, we can graph the estimates of the elasticity over different truncation windows to examine the sensitivity of estimates to the distributional assumptions. Finally, we note that in the absence of additional data X_i this method simply assumes normality of A_i/C_i local to the interval $[1/\theta_0, 1/\theta_1]$.

Our proposal is for researchers to utilize both methods to assess the robustness of elasticity values to different types of assumptions, from the weaker assumption of the nonparametric bounds to the stronger distributional assumption of the Tobit regressions. In either method, the researcher should conduct a sensitivity analysis by varying the strength of the assumption and examining how elasticity values change. In the first method, the researcher varies the maximum slope value M around values that are consistent with slope magnitudes observed in the distribution of W_i. In the second method, the researcher varies the truncation window around values for which the model best-fit distributions are similar to raw histograms of the data. Bunching is most informative on the elasticity parameter whenever elasticity values are robust to these sensitivity analyses across methods. We showcase our proposal in the empirical section.

4 Datasets and Results

In this section, we briefly summarize the datasets used and present estimates of the corporate elasticity of taxable income across all 17 countries in our sample. Each estimate was performed separately and is based on administrative tax data which reflects average firm sensitivity to tax rates within the context of the tax system in which they operate. Each country has information on taxable income that is common across all settings and a set of covariates that differ across countries, but always include at least a measure of revenues and depreciation to allow us to estimate fixed costs.

4.1 Datasets

In this paper, we use corporate tax returns datasets from the following 17 countries: Canada, Chile, China, Costa Rica, Dominican Republic, Ecuador, France, Greece, Guatemala, Honduras, Montenegro, Norway, Rwanda, Senegal, Slovakia, South Africa, and Uruguay. We provide detailed information on each dataset used in this paper in Appendix B. That information includes details on the data itself, how it was accessed, which time period was used to estimate the ETIs as well as a brief description of the corporate tax system in each country.

The countries included in our sample represent places with different tax systems, firm characteristics, and country fundamentals. We summarize these characteristics in Tables 1, 2 and 3 using data from Center for Business Taxation tax database, World Development indicators datasets and Orbis, respectively. Countries in our sample have tax rates that range from 10% in Montenegro to 33% in France, some allow indefinite loss carry forwards (e.g. Chile, France), some allow only 3 years (Senegal) or none (Guatemala), most have no loss carry backs, but 3 allow some. Firms also differ across countries in our sample, with Slovakia and Greece having relative small average firm sizes and South Africa and Canada relatively large average firms. Finally, countries in our sample represent an entire range of formality levels (from 1 in Dominican Republic to 5 in Canada and Norway), range from better governance (Canada and Chile) to worse governance (Ecuador and Honduras) and are small in terms of population (Uruguay or Montenegro) and relatively large (France and China).

These heterogeneities are one of the key features of our sample as they allows us to consider differences in ETIs between countries. Firms may be more or less responsive across countries for many reasons. First, there are tax-system-specific reasons that could explain variation in the elasticity. For example, the tax rules around losses (e.g., whether and how long firms can carry forward losses) and the amount of credits offered provide firms with different abilities to adjust. Second, there are firm-specific reasons that could explain variation in the elasticity. For example, if the average firm size is smaller in Greece than Norway and smaller firms respond more to higher tax rates than large firms, we should expect a higher elasticity in Greece. There are also important interactions between firm- and tax-system-specific characteristics. For example, a tax credit for energy exploration will have a larger affect in countries with a larger energy sector. Finally, differences in formality of the economy, governance quality, GDP pc and size of country could affect the elasticity.

In Table 4 column (4) we include information on the time periods that our datasets cover. These range between 2002 - 2004 in Greece to 2018 in Chile and 2010-2020 in Senegal and Rwanda. In Column (3), we show how many firms or observations were used in each country estimations; these range from 14,415 firms in Senegal to 856,968 observations in Norway. Further, in Table B3 in the Appendix, we provide additional information on the functional form assumptions, proxies for variable costs and estimation methods for the fixed costs transformations that are used to produce the elasticities we discuss in the next subsection.

Table 1: Tax System Characteristics

Country	tax rate	loss carry forward	loss carry back	loss cons.	min tax	tax holiday
Canada	0.17	20	3	No	Yes	No
Chile	0.20	indefinitely	No	No	No	Yes
China	0.26	5	No	No	No	Yes
Costa Rica	0.30	5	No	No	No	Yes
Dominican Republic	0.27	5	No	Yes	No	No
Ecuador	0.24	5	No	No	No	No
France	0.33	indefinitely	3	Yes	Yes	No
Greece	0.27	5	No	No	No	No
Guatemala	0.29	No	No	No	Yes	No
Honduras	0.25	3	No	No	Yes	Yes
Montenegro	0.10	5	No	Yes	No	Yes
Norway	0.27	indefinitely	2	Yes	No	No
Rwanda	0.31	5	No	No	No	No
Senegal	0.28	3	No	Yes	Yes	No
Slovakia	0.23	7	No	No	No	Yes
South Africa	0.32	indefinitely	No	Yes	No	Yes
Uruguay	0.26	5	No	No	No	No

Note: Statutory corporate tax rates are averages across 2003-2019 and come from CBT Tax Database. Other tax system characteristics are from 2013. All countries have VAT registration (over some threshold) and payment advances (monthly or quarterly).

Table 2: Firm Characteristics

Country	mean assets	mean revenues	mean nb empl	p10 assets	p90 assets	p99 assets
Canada	3,690,000,000	312,000,000	473	18,300,000	11,700,000,000	48,400,000,000
Chile	620,000,000	71,600,000	3,382	707,220	946,000,000	9,510,000,000
China	171,000,000	147,000,000	412	386,456	118,000,000	2,870,000,000
Costa Rica	630,000,000	90,700,000	519	7,967,706	1,420,000,000	9,450,000,000
Dominican Republic	357,000,000	31,100,000	1,399	2,613,614	427,000,000	11,500,000,000
Ecuador	375,000,000	64,800,000	679	12,100,000	1,170,000,000	4,890,000,000
France	16,900,000	4,546,513	26	37,703	3,157,918	59,000,000
Greece	5,153,476	3,679,307	22	174,401	8,967,624	56,800,000
Guatemala	570,000,000	70,000,000	.	9,269,739	1,620,000,000	7,570,000,000
Honduras	799,000,000	194,000,000	873	335,000,000	1,820,000,000	3,520,000,000
Montenegro	22,900,000	8,937,527	151	182,616	53,100,000	211,000,000
Norway	12,400,000	2,768,294	9	14,821	3,783,857	73,100,000
Rwanda	19,400,000	11,000,000	4	794,872	58,500,000	58,500,000
Senegal	463,000,000	33,600,000	365	103,000,000	1,160,000,000	1,380,000,000
Slovakia	2,937,793	1,648,581	23	6,755	1,949,026	27,500,000
South Africa	4,100,000,000	1,110,000,000	1,133	1,973,567	5,850,000,000	69,200,000,000
Uruguay	93,000,000	56,000,000	400	6,425,247	283,000,000	761,000,000

Note: Firm-level data comes from Orbis BvD and represents averages for 2004 - 2019. p10 is the 10th percentile of the distribution of assets, p90 is the 90th percentile and p99 is the 99th percentile.

Table 3: Country fundamentals.

Country	log GDP pc	formality indicator	governance quality	natural resource % of GDP	Gini	Population (millions)
Canada	10.78014	5	1.621819	2.049432	32.98571	34.6918
Chile	9.59025	4	1.139309	14.58098	45.8	17.48027
China	8.8976	3	-0.5064042	3.519723	38.82857	1354.643
Costa Rica	9.263985	2	0.5895917	1.270095	48.48571	4.66
Dominican Republic	8.809672	1	-0.3152389	1.412396	44.38571	9.676
Ecuador	8.675005	2	-0.6731671	10.19361	45.52857	15.50593
France	10.6094	4	1.194863	0.0477846	32.08571	63.2422
Greece	9.979443	4	0.4322493	0.2159785	34.75714	10.95273
Guatemala	8.223197	2	-0.6011419	2.40512	48.3	15.30093
Honduras	7.708287	2	-0.6099824	2.272047	49.34286	8.494933
Montenegro	8.889891	4	0.054069	1.026309	37.81429	0.6197333
Norway	11.38479	5	1.735056	7.807353	27.35714	5.016933
Rwanda	6.55917	2	-0.322274	6.405539	44.4	10.5166
Senegal	7.206065	2	-0.193571	4.067019	38.3	13.82213
Slovakia	9.780702	4	0.7509375	0.3854126	25.32857	5.4044
South Africa	8.798475	3	0.2712481	6.393447	63	53.06447
Uruguay	9.651616	3	0.7902966	1.567556	39.9	3.427

Note: Country-level fundamentals data comes from World Bank World Development Indicators. We provide details of data sources and definitions for each variable in Table B6.

4.2 Results

To ease comparison across countries, we start by reporting a single income elasticity estimate, e, for each country with standard errors. Note that this income elasticity is equivalent to taxable income elasticity, ϵ, when the fixed costs are zero.[10] We summarize our estimates in Table 4 focusing on our preferred specifications based on 60% of the data. In column (1), we present elasticity estimates themselves, in column (2) we include standard errors, in column (3) we show the number of firms (or observations) that are being used to estimate elasticities, and in column (4) the sample duration. Our elasticity estimates range from 0.04 in Uruguay to 1.9 in Canada, which implies that a 10% increase in the net-of-tax rate results in a between 0.4% and 19% of an increase in taxable income. Eleven countries in our sample have ETIs below 0.5, four above 1 and the remaining two have ETIs between 0.5 and 1. As such, most of our estimates are considerably lower than the prevailing estimate of the responsiveness of U.S. corporations, which are predicted to respond to a 10% increase in the net-of-tax rate with an increase in taxable income of 8.9%.

Uruguay, Ecuador, and Guatemala have the lowest ETIs in our sample. They all have mid-range corporate tax rates, with relatively low loss offset provisions, but are very different in terms in their country fundamentals. Uruguay has relatively high GDP per capita, quite good governance and relatively higher formality of their economy with low reliance of natural resources. In turn, Ecuador relies heavily on natural resources, has very poor governance and lower formality and GDP per capita. On the other end of the spectrum, economies like Canada, Greece, Chile and Montenegro all have ETIs above one, yet they are all very different both in terms of corporate tax rates and country fundamentals. For example, Montenegro has a 10% tax rate and Greece has 27% tax rate. Canada has very high GDP per capita, very formalized economy, exceptionally high governance quality and low reliance on natural resources. Chile relies heavily on natural resources, while Greece and Montenegro have relatively lower governance quality. Some of those countries, such as, for example, Greece, have historically struggled to raise revenue to fund the provision of public goods, consistent with the hypothesis that Greek tax payers are very sensitive to tax rates and/or the Greek tax authority struggles with tax administration and enforcement. In all, no definite patterns emerge in which high tax rates, reliance on natural resources, or different firm distribution appear be characteristics of countries with higher ETIs. We return to this analysis in depth

[10] To showcase the distribution of the taxable income elasticity estimates across different fixed costs and to allow the reader to convert e to ϵ at different values of fixed costs, we summarize the distribution of $(\frac{C}{Y})$ across all countries in our sample in Table B5.

in Section 5 of this paper, where we systematically evaluate all of the potential country-level observable determinants of differences in ETIs.

The novelty of this paper lies in the fact that we can compare our ETI estimates across countries and the differences must be driven by country, firm or tax system fundamentals, for example, differences in the risk preferences of the firms and/or the detection and enforcement mechanisms of the tax authority, as highlighted by canonical models of optimal tax evasion (Allingham and Sandmo, 1972). Recall that past empirical estimates of the corporate elasticity of taxable income have varied from close to zero to as high as five. Here, we show that across a wide range of countries, the elasticity of taxable income is much less variable than was previously suggested, with our top estimates being less than half of what the top ETI estimates in the literature are. This reduction in variability has important consequences for policymakers considering changes in business tax policy, an area of active policy debate. Our new estimates suggest that tax receipts may be considerably less affected by changes in business tax rates than previous literature suggests.

Table 4: Corporate Elasticity of Taxable Income: cross-country comparison.

Country	Elasticity of income (1)	Std. error (2)	Firms (3)	Years used (4)
Canada	1.907	0.068	10,056	2012-2019
Chile	1.122	0.057	14,148	2018
China	0.295	0.009	269,225	2009
Costa Rica	0.394	0.001	542,880	2006-2020
Dominican Republic	0.463	0.005	118,033	2006-2015
Ecuador	0.075	0.001	98,742	2014-2018
France	0.379	0.001	716,950 (obs)	
Greece	1.194	0.063	25,712	2002-2004
Guatemala	0.08	0.001	82,238	2006-2020
Honduras	0.14	0.002	44,065	2014-2020
Montenegro	1.243	0.019	45,898	2011-2020
Norway	0.703	0.002	284,336	2006-2013
Rwanda	0.101	0.005	76,896	2010-2020
Senegal	0.163	0.004	14,415	2010-2020
Slovakia	0.770	0.067	48,922	2013
South Africa	0.477			2010-2018
Uruguay	0.042	0.001	126,255	2012-2016

Notes: This table presents estimates of the corporate elasticity of income across countries, outlining the fraction of the data used. Note that the elasticity of income reported here is equal to the Elasticity of Taxable Income (ETI) evaluated for a firm with zero fixed costs.

Importance of truncation The reason why our preferred estimates use only a fraction of data is that the normality assumption is often too strong using 100% of the raw data. This can be seen in panels (d) across Figures D3 -D7 in Appendix B: the normality assumption produces a poor fit. Consequently, estimates based on that assumption are inappropriate, but truncating the data typically improves the appropriateness of that assumption. We demonstrate this in panels (e) across Figures D3 -D7 in Appendix B, which use our preferred fraction of data. Here, we see that the fit of the normal density is much better using 60% of the data – this is our preferred specification as it balances the trade-off between the appropriateness of the identifying assumption with power of the estimator.[11]

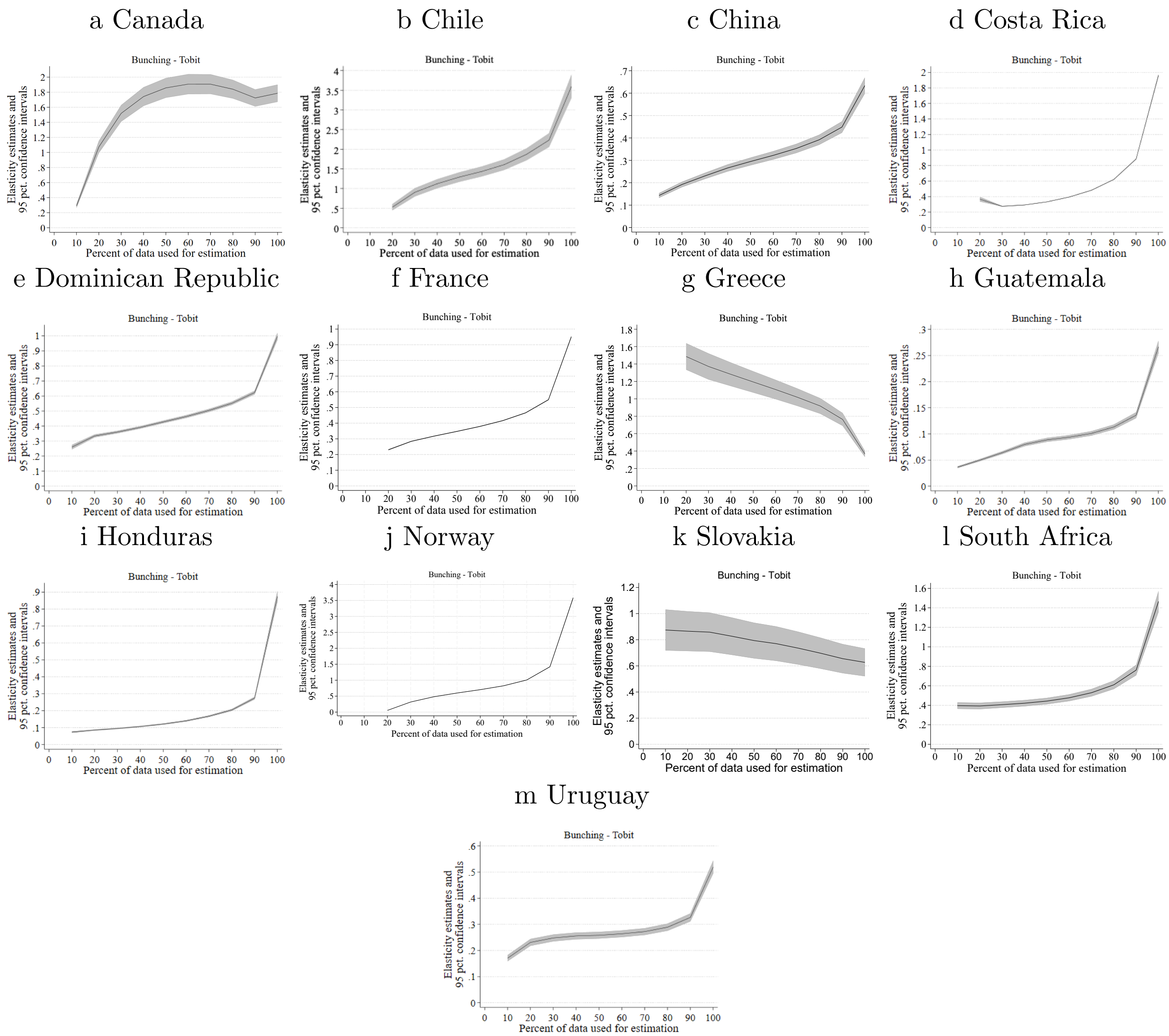
Amongst all countries in our sample, Greece is a context in which the ability to estimate the counterfactual density using truncated data is an especially meaningful innovation because it avoids the complication of the bimodal distribution of firms. Further, most countries in our sample (Chile, China, Costa Rica, Dominican Republic, France, Guatemala, Honduras, Norway, South Africa and Uruguay) have a small share of very large and very small firms – outliers in the distribution. As such, estimates using 100% of the data are quite sensitive to these outliers, as demonstrated across panels of Figure 3, which depict a substantial spike in the elasticity of taxable income relative to the elasticity of taxable income using 80-90% of the data. For this reason, estimates using large shares of the data are unlikely to identify the underlying elasticity of taxable income.

In turn, in the case of Slovakia, the raw data shown in panel (a) in Figure D6 is very bell-shaped, which is consistent with normally distributed data. Indeed, the fit of the normal distribution looks good even using 100% of the data, shown in panel (d) of that Figure. In this case, the normal distribution misses the peak of the distribution near the mean, but otherwise fits the data well. Consistent with this, Figure 3 shows little variation in the estimated elasticity across a wide range of truncation.

Nonparametric bounds In Figure 4 we present bounds on our elasticity estimates across different assumptions on the maximum slope of the unobserved density. Specifically, in each figure we plot the bounds on our estimates based on variation in the slope of the counterfactual distribution between the theoretical lower and upper bound, including a trapezoidal assumption that is the canonical assumption of Saez (2010). This graph allows us to evaluate

[11] We complement these results by showing the raw data used for each country in panel (a) of Figures D3 -D7. Across all countries, we see clear evidence of bunching at $0 in profits. This a point where the marginal corporate tax rate increases sharply from 0% to, for example, 25% in China, from 0% to 28% in Norway, and from 0% to 23% in Slovakia.

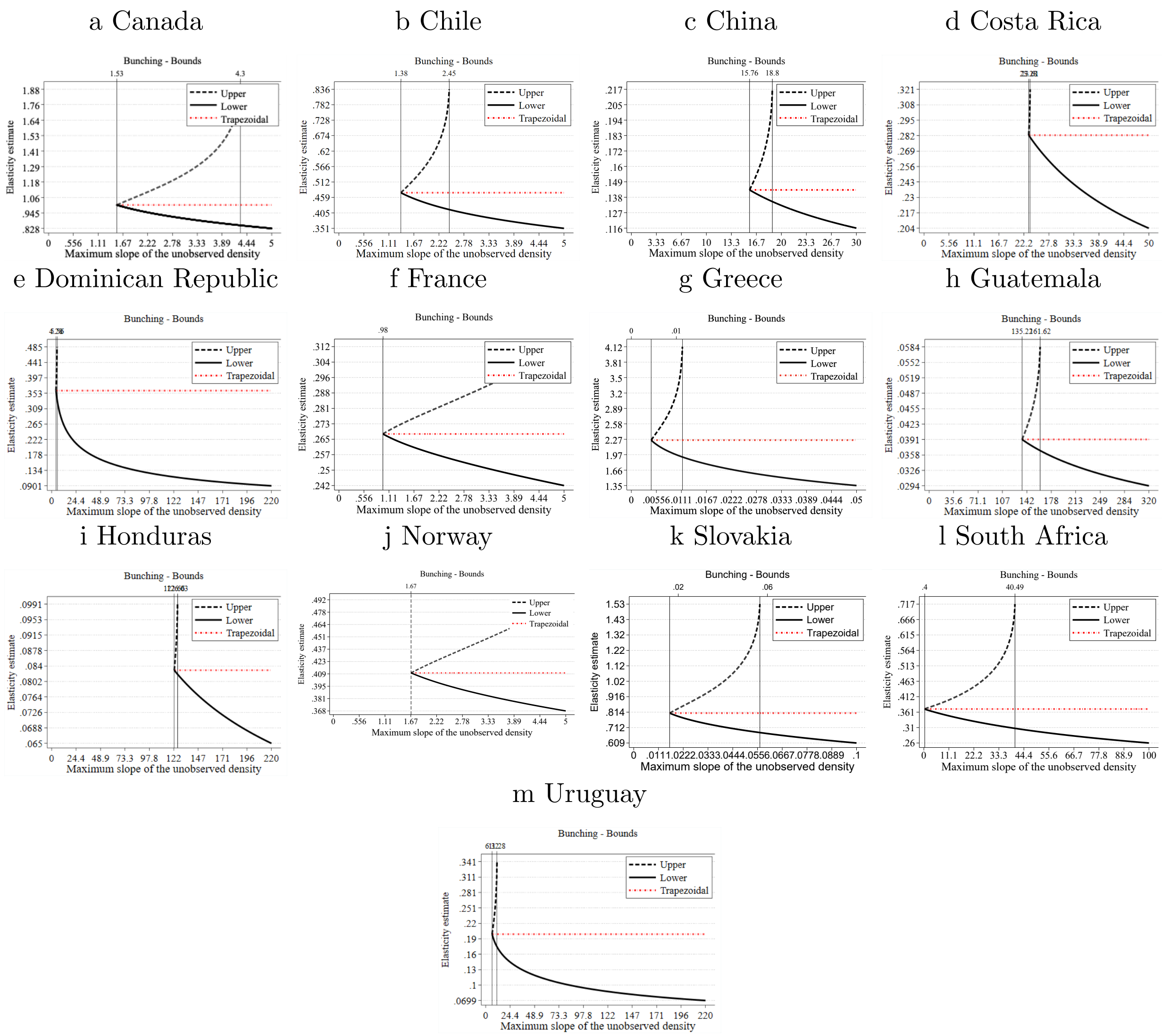
Figure 3: Corporate Elasticity of Taxable Income: cross-country comparison of elasticity estimates across fraction of data used.



Notes: This figure plots the variation in the estimated elasticity of taxable income based on the amount of data used in the estimation.

the appropriateness of these slope assumptions in the context of our estimator in addition to providing bounds on the range of elasticity estimates that are possible under this model. For example, based on the maximum slope of the unobserved density, the elasticity of taxable income lies between 0.116 and 0.217 for Chinese firms and between 0.26 and 0.717 for South African firms. In panel (g) we see that Greek firms are quite sensitive as the possible

Figure 4: Corporate Elasticity of Taxable Income: cross-country comparison of bunching bounds.



Notes: This figure plots diagnostic tools for the traditional bunching estimate. Specifically, each figure plots the resulting upper and lower bounds on e using the nonparametric bounds method.

elasticity estimates range between 1.35 and 4.12 depending on the assumed slope of the counterfactual distribution.

5 Cross country elasticities

5.1 Predicting elasticities

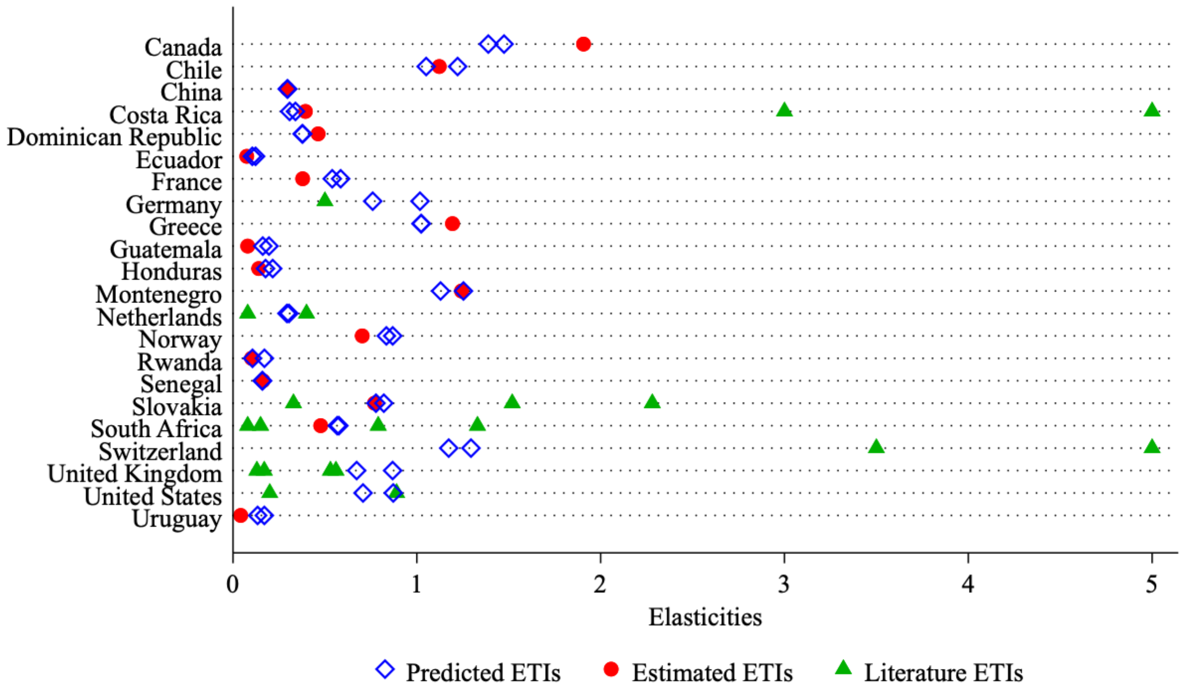
We use a random forest prediction model, our estimated elasticities, and 95 country-level observable characteristics that we list in Table B6 in the Appendix to expand our knowledge of the elasticity of corporate taxable income across the world. We group the country-level observable characteristics into three broad categories: tax system characteristics, characteristics of firms, and country fundamentals such as size, population, GDP, exports or foreign direct investment. We use data from the Center for Business Taxation, Orbis Bureau van Dijk, and World Bank, respectively.[12] The advantage of these data sources is that they have broad coverage, which later allows us to predict elasticities to many countries outside of our sample. We also perform an imputation of the country-level observable characteristics to increase coverage. The random forest prediction model consistently chooses three factors as its best fit regarding the mean-squared error and R-squared; see Figure B1. The estimates are stable over a large range of choices and in the following sections we report estimates using three and four factors.

5.2 Comparing elasticity estimates

In Figure 5, we compare our predictions from the random forest (denoted by a blue diamond) with estimates from this paper (denoted by a red circle) and from the previous literature (denoted by a green triangle). This provides 22 comparison countries; in six countries, we have estimates from our paper and the literature (Costa Rica, China, Greece, Norway, Slovakia, and South Africa); in four countries we have estimates only from the literature (Germany, Switzerland, UK, US), and in 12 countries we have estimates only from our paper. We do not find a pattern regarding whether the predicted, estimated, or literature elasticities are the largest. For example, let us consider the three countries for which we have all three estimates. In Costa Rica, the literature's estimates are the largest, followed by those that we estimated in this paper and then the predicted ones. The differences with the literature's estimates is likely due to data, methods, and sample differences. In South Africa and Slovakia, our estimated and predicted elasticities are between the ones from the literature. Our predicted estimates across the three and four-factor models are similar across countries and in many cases more similar than the other estimates. Our predicted estimates

[12]See: https://oxfordtax.sbs.ox.ac.uk/cbt-tax-database.

Figure 5: **Predicted Elasticities**



Notes: This figure plots the predicted ETIs using the top 2 selected combinations of variables using a Random Forest. These specifications include models with 3 and 4 features. We plot the predicted ETIs in blue crosses, the estimates ETIs in filled red circles, and the previous literature ETIs in filled green triangles.

are also similar to our estimated estimates and those in the literature (which are not included in the estimation). For example, our predicted elasticity estimates are very similar to the literature's estimate for the United States, where we do not have an estimate and thus is not in our training sample. More generally, the predicted values provide reasonable estimates of the estimated elasticities and previous elasticities from the literature to lend credibility to using the out-of-sample predicted values for countries without an estimate.

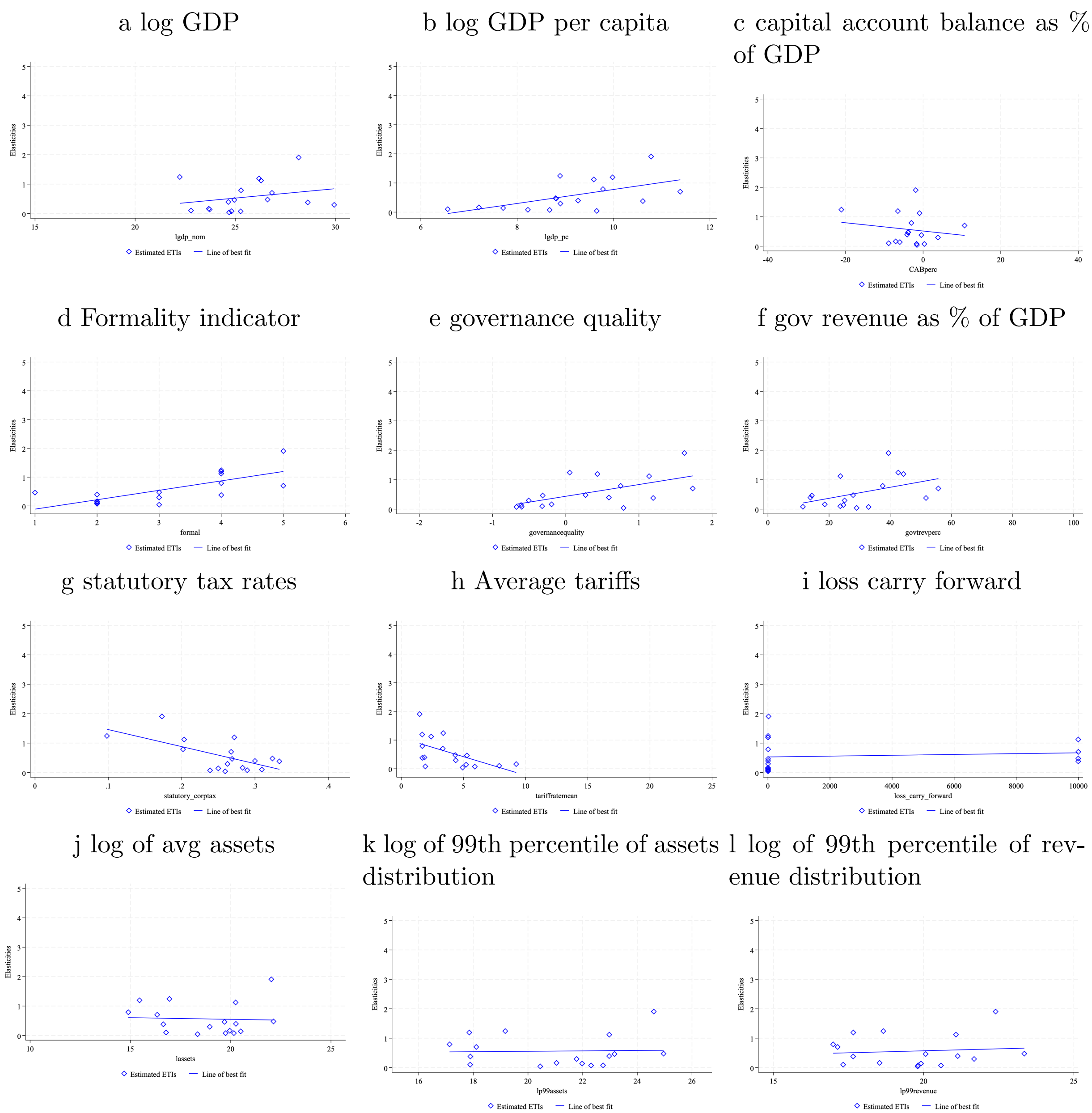
5.3 Why are elasticities different across countries?

We provide simple correlations of our estimated elasticities and key variables to begin to understand why elasticities differ across countries. Figure 6 graph our elasticity estimates in blue diamonds and the line of best fit shown in blue. In each of these figures, the elasticity is on the vertical axis and the variable of interest is on the horizontal axis. We find that the elasticity estimates positively correlate with log GDP, log GDP per capita, formality, governance quality, and government revenues as a percent of GDP. We find the elasticity estimates negatively correlate with the capital account balance as a percent of GDP, statutory tax rates, and average tariffs. Finally, we find little correlation with the log of firms' average asset size, the log of the 99th percentile of assets in the firm distribution, and the log of the 99th percentile of firm revenue. In general, these correlations show that country fundamentals, tax system characteristics, and firm characteristics seem to be correlated (though to different degrees) with our elasticity estimates.

In Figure 7 we graph the contribution of of the three focal factors (log tax revenue, formal economy, and the 10th percentile of firm revenue) in explaining differences across elasticities based on the Shapley additive explanation (SHAP). This method calculates the marginal contribution of a feature across all possible combinations (Shapley values). The advantage of this method is that it considers complex interdependencies of different factors. For each country, the estimate starts with a base level of 0.55. Then, if a factor contributes positively to the difference from the base, it is shown above the base and in blue. If, instead, a factor contributes negatively to the difference from the base, it is shown below the base and in red. For example, the log of tax revenues adds to the elasticity for Canada while it adds negatively to Costa Rica. This comparison highlights that the same factor can cause estimates in some countries to be greater or less than the base estimate. Overall, this analysis provides a first step to understand the differences in elasticities across countries better, but much more work is needed on this subject.

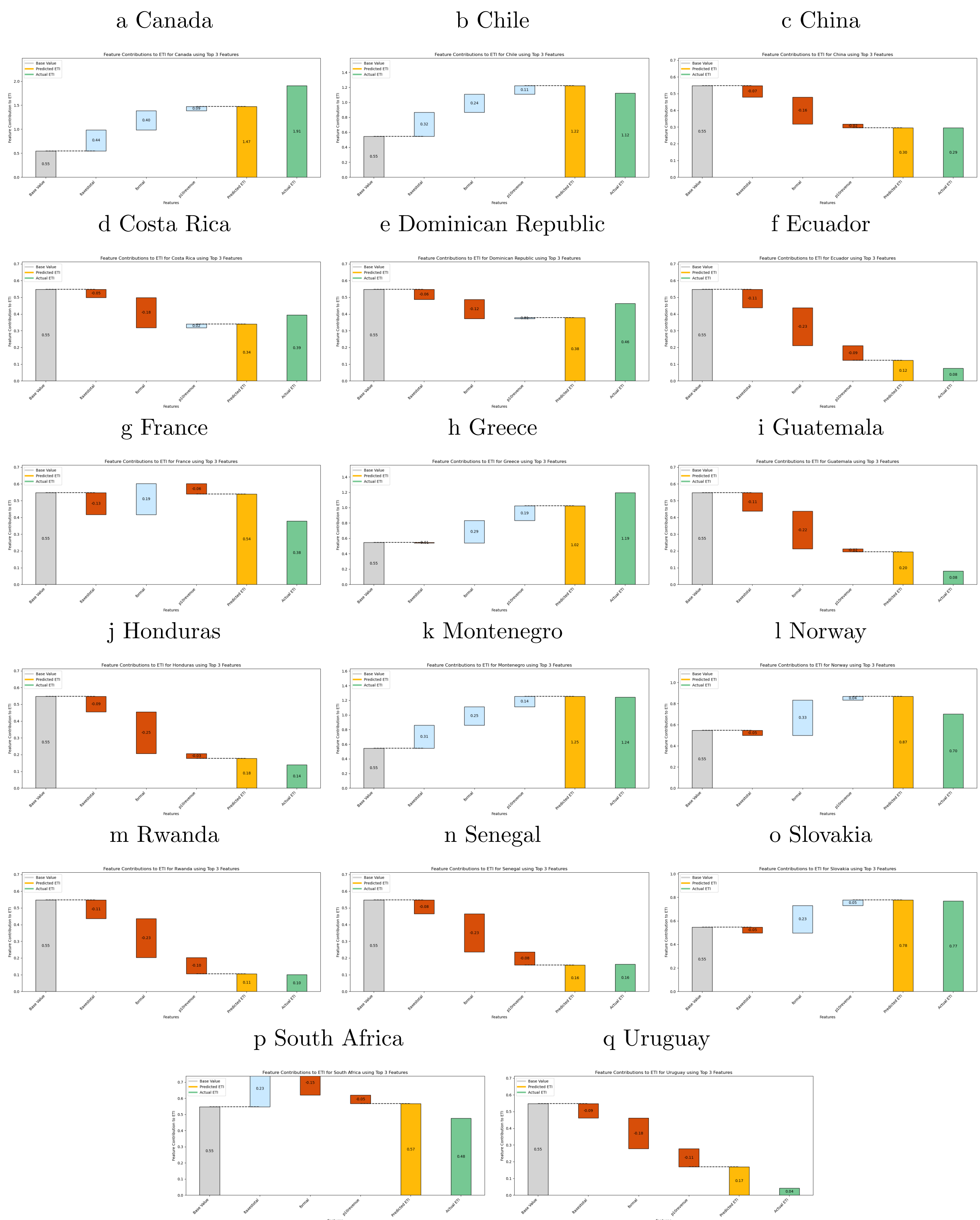
In Table 5, we provide the SHAP estimates for each country and each factor. Each factor adds positively to some countries and negatively to others. On average, the positives nearly equal the negatives, as the average within factor is near zero across all countries. The average absolute value shows that the most important factor affecting a country's elasticity is how formal its economy is. On average, how formal an economy is changes the country's elasticity by 0.23 from a base of 0.55. In comparison, the log of tax revenues and the 10th percentile of firm revenue changes a country's elasticity by 0.14 and 0.07, respectively. Said differently, country characteristics account for 52% of the difference in elasticities, tax system characteristics 31%, and firm characteristics 16%.

Figure 6: Elasticity correlates across observables.



Notes: This figure plots the correlations between our estimated elasticities and observable country level characteristics. The blue line represents the linear estimation of best fit. Each correlate is listed in the figure title.

Figure 7: **Contribution of factors to deviations from average ETI estimates**



Notes: This figure quantifies the role of different factors in explaining differences in the corporate elasticity across countries. The factors that increase a country's elasticity are shown in blue and factors that decrease a country's elasticity are shown in red.

Table 5: **Percentage contribution of factors to deviations from average ETI**

Country	Log tax revenues	Formal	10th percentile firm revenue
Canada	0.44	0.40	0.09
Chile	0.32	0.24	0.11
China	-0.07	-0.16	-0.02
Costa Rica	-0.05	-0.18	0.02
Dominican Republic	-0.06	-0.12	0.01
Ecuador	-0.11	-0.23	-0.09
France	-0.13	0.19	-0.06
Greece	0.01	0.29	0.19
Guatemala	-0.11	-0.22	-0.02
Honduras	-0.09	-0.25	-0.03
Montenegro	0.31	0.25	0.14
Norway	-0.05	0.33	0.04
Rwanda	-0.11	-0.23	-0.10
Senegal	-0.08	-0.23	-0.08
Slovakia	-0.05	0.23	0.05
South Africa	0.23	-0.15	-0.05
Uruguay	-0.09	-0.18	-0.11
Average	0.02	-0.001	0.01
Average absolute value	0.14	0.23	0.07

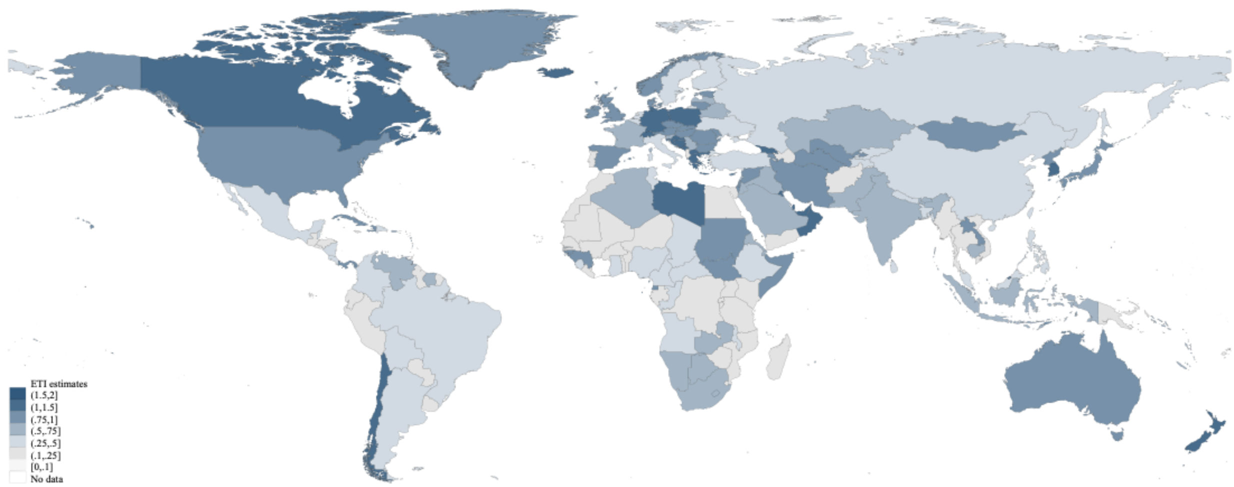
Notes: This table quantifies the role of different factors in explaining deviations from average ETI across countries.

5.4 How elastic are corporations around the world

Finally, we extend our prediction of elasticity estimates to 248 countries across the world—the near universe. One of our paper's main contributions is the large number of corporate elasticity estimates (17) we produce using administrative data from those countries and a consistent empirical method. While this collection of estimates is substantial and provides a considerable extension to the previously existing estimates for 8 countries, a large number of countries remain without an elasticity estimate. We offer two approaches to obtain those elasticity estimates. First, if a researcher in a country has access to administrative tax data, they can use the method and code developed in this paper to estimate their country's ETI. Second, if they do not have access to that data, they can use our predicted elasticity produced in this section and reported in Table B7. As shown above, these predictions are based on key factors that describe the countries, firms, and tax systems within them, and they do a relatively good job of predicting the estimates.

In Figure 8, we report predicted elasticities for 248 countries, with dark blue indicating larger elasticities and light blue indicating smaller elasticities. We find substantial variation in the elasticities across and within each continent, with some countries within each continent having very high predicted elasticities while others have very low ones. For example, in North America, Canada has a large predicted elasticity, Mexico a small predicted elasticity, and the United States an intermediate value. In Asia, Iran and Japan have large predicted elasticities, China and Thailand have small predicted elasticities, and Turkey has an intermediate value.

Figure 8: **Cross-Country elasticity estimates**



Notes: This figure maps the predicted elasticities using our three-factor random forest model. Estimates for each country using our three- and four-factor models are provided in Table B7.

6 Conclusion

This paper provides us with a better understanding of the corporate elasticity of taxable income across the world. We generate the most comprehensive collection of comparable estimates across countries to date, including both developed and developing countries. The fact that all elasticities are estimated using the same methodology allows a meaningful comparison among them.

We find substantial heterogeneity in our elasticity estimates across countries. These differences suggest there is scope for differences in tax regulation and enforcement to have a large effect on this elasticity. More specifically, we show that a large portion of the difference in elasticities is due to country-level fundamentals, tax systems, and firm characteristics that make it easier for firms to respond to changes in tax rates.

A second important result is that we find the differences across countries to be substantially smaller than those found and reported in the literature. Our estimates range between 0.04 and 1.9, while estimates in the literature range from 0 to 5. The substantially smaller range suggests that differences in methods across studies explain a large portion of the differences found across countries. This finding highlights the need to use methods with reasonable and explicit identifying assumptions suited for the context and can be broadly applied across countries for comparative purposes.

The predicted estimates provide a sandbox for future research. For example, we may have thought that if capital moves freely across countries, the elasticity would be the same everywhere. The question arises then to what extent does the variation across countries we observe indicate capital frictions, and the answer to this question may change how we interpret elasticity estimates. Further, is a low elasticity an indicator of a functional tax system or many frictions? Specifically, the high elasticity in Switzerland (both the one we predict and the one in the literature) might imply a porous tax system, but it could also be that capital is more elastic in Switzerland. In addition, important questions remain as to what constitutes a friction. For example, to what extent is uniqueness a friction, such as capital employed in Chile for Cooper mining? Similarly, to what extent do infrastructure and human capital that are complementary to capital create frictions and a lower elasticity? We hope the estimates in this paper provide a starting point for future research to investigate these and other important questions about capital and its responsiveness to tax policy.

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A Real and reporting responses

In this appendix we present a model with the addition of reporting responses. The key takeaway is that our equilibrium and methods for estimating the model primitive e are robust to this addition. We also show how to update the calculation of the elasticity of taxable income with reporting responses.

A.1 Model Fundamentals

Consider a firm, denoted Firm i, that is owned by a single shareholder and begins period 1 with retained earnings, X_i . Firms are heterogeneous in their productivity, captured by A_i, and their fixed costs, captured by C_i. In period 1, Firm i chooses its level of capital in period 2, K_i, and the amount of taxable income that will avoid taxes, ρ_i. Firms choose their level of capital in period 2 by determining the amount of retained earnings to distribute as a dividend payment ($D_i \geq 0$), and the amount of equity to issue ($E_i \geq 0$); $K_i = X_i + E_i - D_i$.[13] In addition to equity, shareholders may hold government bonds with a tax-exempt rate of return, $r > 0$. The cost of avoiding taxes, including the probability of audit and cost of penalty, is given by $c(\rho_i)$, which is increasing and convex.

In period 2, capital generates income net-of-depreciation costs according to a strictly concave production function

$$I_i(K_i) = \frac{1+e}{e} A_i^{1/(1+e)} K_i^{\frac{e}{1+e}}. \tag{A.1}$$

Here, e determines the curvature of the production function. More importantly, e determines the elasticity of income with respect to the net-of-tax rate, which is an input to the elasticity of taxable income with respect to net-of-tax rate. Finally, profit is income net of fixed costs. Modeling fixed costs is important to match the data since a large proportion of firms report negative profits.

$$F_i(K_i) = I_i(K_i) - C_i. \tag{A.2}$$

Taxable income is defined as profit net of the amount of income that the firm decides to avoid or evade ρ_i,: $Y_i(K_i) = F_i(K_i) - \rho_i$.

[13]For ease of exposition, attention is restricted to equilibria where the firm does not payout a dividend and issue equity concurrently. In the general model in Patel et al. (2014) the restriction that a firm does not pay out a dividend and issue equity concurrently is derived as equilibrium behavior with a dividend tax. The restriction does not change the following analysis.

At the end of period 2, all firms liquidate, returning their principal and profits to their shareholders.

Firm i maximizes its value to its shareholder:

$$\max_{K_i,\rho_i} \quad V = X_i - K_i + \frac{(1-t_c)Y_i(K_i,\rho_i) + \rho_i + K_i - c(\rho_i)}{1+r}, \tag{A.3}$$

where $X_i - K_i = D_i - E_i$ are net distributions in period 1 valued by its shareholder.

The benefit of higher capital in period 2 is higher profit. Profit is taxed at the rate t_c and discounted at the rate r.[14] The cost of higher capital in period 2 is lower distributions in period 1 (fewer dividends or more equity issuances).

Consider the case where there is a kink in the marginal tax rate schedule such that $t_c = t_0$ for $Y_i(K_i,\rho_i) \leq \kappa$ and $t_c = t_1$ for $Y_i(K_i,\rho_i) > \kappa$, where $t_0 < t_1$. Under this marginal rate schedule, the objective function faced by the firm is

$$\begin{aligned}\max_{K_i} \quad V_i =& X_i - \frac{1}{1+r}(rK_i - c(\rho_i)) \\ &+ \mathbb{I}(Y_i(K_i,\rho_i) \leq \kappa)\frac{(1-t_0)Y_i(K_i,\rho_i) + \rho_i}{1+r} \\ &+ \mathbb{I}(Y_i(K_i,\rho_i) > \kappa)\frac{(1-t_0)\kappa + (1-t_1)(Y_i(K_i,\rho_i) - \kappa) + \rho_i}{1+r},\end{aligned} \tag{A.4}$$

where $\mathbb{I}(Y_i(K_i,\rho_i) \leq \kappa)$ and $\mathbb{I}(Y_i(K_i,\rho_i) > \kappa)$ are indicator functions for taxable income being below or above the kink.

A.2 Model Solution

Formally, we derive the equilibrium capital, tax avoidance, and taxable income by taking the derivative of firm value with respect to capital and avoidance in two regions where the derivative exists.

$$\frac{\partial V_i}{\partial K_i} = \begin{cases} \frac{1}{1+r}\left(-r + (1-t_0)\frac{\partial Y_i(K_i,\rho_i)}{\partial K_i}\right), & Y_i(K_i,\rho_i) < \kappa \\ \frac{1}{1+r}\left(-r + (1-t_1)\frac{\partial Y_i(K_i,\rho_i)}{\partial K_i}\right), & Y_i(K_i,\rho_i) > \kappa. \end{cases} \tag{A.5}$$

[14] The equilibrium rate of return r is assumed to be exogenous, abstracting from all general equilibrium effects.

$$\frac{\partial V_i}{\partial \rho_i} = \begin{cases} \frac{1}{1+r}\left(-c'(\rho_i) + t_0\right), & Y_i(K_i, \rho_i) < \kappa \\ \frac{1}{1+r}\left(-c'(\rho_i) + t_1\right), & Y_i(K_i, \rho_i) > \kappa. \end{cases} \tag{A.6}$$

The solution for taxable income $Y_i(K_i)$ has a similar form to solutions derived in different contexts in this literature (Bertanha et al., 2023; Coles et al., 2022; Saez, 2010):

$$Y_i(K_i) = \begin{cases} \frac{1+e}{e} r^{-e}(1-t_0)^e A_i - C_i - \rho_i, & A_i \leq \underline{A}_i \\ \kappa, & \underline{A}_i < A_i < \overline{A}_i \\ \frac{1+e}{e} r^{-e}(1-t_1)^e A_i - C_i - \rho_i, & A_i \geq \overline{A}_i. \end{cases} \tag{A.7}$$

The thresholds are found by setting the optimal taxable income equal to the kink κ with both tax rates;

$$\underline{A}_i = (\kappa + C_i + \rho_i)/\theta_0, \qquad \text{and} \qquad \overline{A}_i = (\kappa + C_i + \rho_i)/\theta_1. \tag{A.8}$$

A.3 Elasticities

Here, we update the calculation of the elasticity of taxable income to account for both real and reporting responses. Critically, we note that the elasticity of income that we estimate remains a key piece to this calculation.

$$\begin{aligned} \varepsilon &= \frac{\partial Y_i(K_i, \rho_i)}{\partial (1-t)} \frac{(1-t)}{Y_i(K_i, \rho_i)} \\ &= \left(\frac{\partial F_i(K_i)}{\partial (1-t)} - \frac{\partial \rho_i}{\partial (1-t)} \right) \frac{(1-t)}{Y_i(K_i, \rho_i)} \qquad \text{(A.9)} \\ &= \frac{1}{Y_i(K_i, \rho_i)} \left(eF(K_i) + e_\rho \rho_i \right) \end{aligned}$$

(A.10)

Note to use the elasticity of taxable income for welfare analysis, it is also important to consider whether the reporting response (or to what extent the reporting response) is a resource cost or a transfer. For a more detailed discussion of the reporting response and its implications for welfare see Coles et al. (2022).

B Additional results

B.1 Additional descriptive statistics

Table B1: Transition probabilities across bins of income distribution.

Greece				
	bin -1	bin 0	bin 1	bin 2
bin -1	76.48	0.17	16.04	7.32
bin 0	14.51	55.78	22.58	7.13
bin 1	14.49	0.35	78.21	6.95
bin 2	13.9	0.16	8.93	77.01
Slovakia				
	bin -1	bin 0	bin 1	bin 2
bin -1	74.28	0.08	17.62	8.02
bin 0	42.67	12.89	27.11	17.33
bin 1	37.48	0.26	53.34	8.91
bin 2	20.85	0.11	11.23	67.80
Norway				
	bin -1	bin 0	bin 1	bin 2
bin -1	69.03	3.69	16.97	10.31
bin 0	20.91	43.14	25.93	10.03
bin 1	15.25	20.39	56.84	7.52
bin 2	14.92	14.14	10.87	60.07

Notes: This table shows the set of transition probabilities for firms to move between 3 bins of taxable profits, bin 0: zero taxable profits, bin 1: Q1-Q4 of the distribution of non-zero taxable profits and bin 2: Q5 of the distribution of non-zero taxable profits.

Table B2: Average firm revenues and variable costs for zero and non-zero profit reporters.

	(1) mean at zero taxable profits	(2) mean away from zero taxable profits	(3) difference	t-stat
Canada				
Chile revenues	2.391e+08	8.497e+08	-6.106e+08***	-17.503
Chile var costs	19506086.357	1.343e+08	-1.148e+08***	-24.080
Chile obs	2803	9076	11879	
China				
Costa Rica				
Dominican Republic				
Ecuador				
France				
Greece revenues	961067.257	1036162.997	-75095.740	-0.949
Greece var costs	962286.968	1024718.976	-62432.008	-0.789
Greece obs	411	50573	50984	
Guatemala				
Honduras				
Montenegro				
Norway revenues	11170799.289	4874725.996	6296073.293***	80.788
Norway var costs	9775212.073	4371239.255	5403972.817***	76.987
Norway obs	209041	940519	1149560	
Rwanda				
Senegal				
Slovakia revenues	720813.999	383557.586	337256.413*	1.885
Slovakia var costs	33714.470	17139.223	16575.246**	2.132
Slovakia obs	132	65125	65257	
South Africa				
Uruguay				

Notes: This table presents the average of revenues for firms that locate at zero taxable profits (column 1) and those that do not (column 2). We define firms that do not locate at zero taxable profits as those in the first 4 quantiles of the distribution of firm revenues (omitting Q5). We present descritpives across all 5 quantiles of firm revenues in Table B4 in the Online Appendix.

B.2 Additional empirical model details

Table B3: Summary of fixed costs estimation data and methods.

country	(1) Functional form assumption	(2) variable costs proxy	(3) panel/ cross-section
Canada	log-log	Total expenses from the Income Statement	panel with firms fixed effects
Chile	quintic	wages	cross section
China	cubic	interest deductions	cross section
Costa Rica			
Dominican Republic			
Ecuador			
France			
Greece	log-log	tax deductions	repeated cross section
Guatemala			
Honduras			
Montenegro			
Norway	quintic	operational costs and financial costs	panel, with firm fixed effects
Rwanda			
Senegal			
Slovakia	log-log	depreciation of long-term tangible and intangible assets	cross section
South Africa	cubic	operational costs, financial costs, and other expenses	repeated cross section
Uruguay			

Notes: This table presents the variables choices that were used for the fixed costs estimations across countries.

Table B4: Summary of firm revenues at different points of taxable income distribution.

	(1) zero Y_i	(2) Q1	(3) Q2	(4) Q3	(5) Q4	(6) Q5
Canada						
Chile revenues	2.391e+08	2.929e+09	1.709e+08	5.264e+08	1.260e+09	6.088e+09
Chile obs	2803	2269	2269	2269	2269	2269
China						
Costa Rica						
Dominican Republic						
Ecuador						
France						
Greece means	961067.257	1104444.062	423020.427	750993.331	1478831.646	2881366.464
Greece obs	411	12644	12643	12643	12643	12643
Guatemala						
Honduras						
Montenegro						
Norway means	11170799.289	10570609.618	1463759.561	5376842.814	5439418.140	27329069.436
Norway obs	209041	235002	235127	235051	235165	234870
Rwanda						
Senegal						
Slovakia revenues	720813.999	783725.104	136814.720	244167.556	500836.667	2878196.730
Slovakia obs	132	16282	16281	16281	16281	16281
South Africa						
Uruguay						

Notes: This table presents the average of revenues for firms across 5 quantiles of taxable income distribution (columns 2-6) and at zero taxable profits (column 1).

Table B5: Summary of fixed costs scaling parameter.

	Mean	1pct	5pct	10pct	25pct	Median	75pct	90pct	95pct	99pct	N
Canada											
Chile	0.08	-192.22	-5.86	-1.85	-0.34	0.03	1.05	4.56	11.53	127.58	11345
China											
Costa Rica											
Dominican Republic											
Ecuador											
France											
Greece	-0.01	-1.00	-0.50	-0.08	-0.02	0.01	0.04	0.12	0.24	1.00	63000
Guatemala											
Honduras											
Montenegro											
Norway	-120.76	-27415.47	-26.65	-7.58	-1.66	-0.81	0.29	5.16	22.18	17441.16	1175215
Rwanda											
Senegal											
Slovakia	0.01	-0.62	-0.05	-0.02	-0.00	0.00	0.01	0.04	0.09	0.60	81406
South Africa											
Uruguay											

Notes: This table presents the distribution of fixed costs scalar,($\frac{C_i}{Y_i}$), across countries. C_i is the estimated firm-level fixed cost parameter, while Y_i is the taxable profits. Note that Y_i can be negative.

B.3 Additional information predicting elasticities

This appendix provides additional details and results with our random forest analysis to predict elasticities. Table B6 provides a list of the characteristics we use in our random forest analysis. We include variables in three categories: tax system characteristics, country characteristics, and firm characteristics. The random forest procedure chooses the variables and the number of variables to include in our out-of-sample prediction. Figure B1 graphs the mean squared error and R-squared of the model as the number of factors increases from 1 to 20. The lowest MSE and the highest R-squared occur with three factors. We use three factors, specifically an index for how formal the economy is, the 10th percentile of firm revenue in the country, and the log of total taxes, as our baseline. We also provide estimates using a fourth factor, log firm revenue. The estimates are similar across using these two different models. Finally, Table B7 provides our out-of-sample predictions for 248 countries. Of course, if a researcher has access to tax administrative data, they can use the methods in this paper and code posted at `www.nathanseegert.com/code` to estimate their country-specific elasticities. Without that data or other data and methods, this table provides an estimate using our large sample of countries.

Table B6: List of all variables used in the random forest procedure.

variable name	variable description	source
	Tax system characteristics	
statutory_corptax	statutory corporate tax rate	CBT tax database
loss_carry_forward	loss carryforward allowed years	CBT tax database
loss_carry_back	loss carryback allowed years	CBT tax database
national_loss_consolidation	dummy if loss consolidation allowed	CBT tax database
minimumtax	dummy if minimum ltax	CBT tax database
taxholiday	dummy if tax holiday	CBT tax database
SEZs	dummy if special economic zone	CBT tax database
EATR_oecd	effective average tax rate	OECD + CBT tax database
EMTR_oecd	effective marginal tax rate	OECD + CBT tax database
taxestotal	total tax revenues	OECD + CBT tax database
ltaxestotal	log total tax revenues	OECD + CBT tax database
taxesTTRprofit	total tax revenues	OECD + CBT tax database
ltaxesTTRprofit	log total tax revenues	OECD + CBT tax database
taxesTTRlabor	total tax revenues	OECD + CBT tax database
ltaxesTTRlabor	log total tax revenues	OECD + CBT tax database
taxesTTROther	total tax revenues	OECD + CBT tax database
ltaxesTTROther	log total tax revenues	OECD + CBT tax database
expenditure$_{percGDP}$	total tax revenues	OECD + CBT tax database
	Country characteristics	
lgdp_nom	logarithm of normial GDP (USD)	WDI
lgdp_pc	logarithm of GDP per capita (USD)	WDI
gdp_gr	GDP growth	WDI
gini	Inequality: Gini	WDI
govtexpperc	Government expenditrues as perc of GDP	WEO
govtrevperc	Government revenues as perc of GDP	WEO
FDI_bopUSD	Foreign direct investment, net (BoP, current US$)	WDI
FDI_inflows_percGDP	Foreign direct investment, net inflows (% of GDP)	WDI
FDI_outflows_percGDP	Foreign direct investment, net outflows (% of GDP)	WDI
CABperc	Current account balance as perc of GDP	WEO
exports_percGDP	Exports of goods and services (% of GDP)	WDI
improts_percGDP	Imports of goods and services (% of GDP)	WDI
manuf_exp	Manufactures exports (% of merchandise exports)	WDI
manuf_imp	Manufactures imports (% of merchandise imports)	WDI
manuf_va_percGDP	Manufacturing, value added (% of GDP)	WDI
natresourcerents_percGDP	Total natural resources rents (% of GDP)	WDI
tariffratemean	Tariff rate, applied, weighted mean, all products (%)	WDI
formal	Index built based on the quantiles of the distribution of the percent of firms that are formally registered	WB Informal Economy Database
epayments	percentage of payments received electronically	ISORA
taxadminexp_GDPshare	Tax administration expenditures (% of GDP)	ISORA
ltaxadminstaff	logarithm of Tax administrationstaff (total FTE)	ISORA
lPopulation	logarithm of population	WEO
governancequality	governance quality: average of voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption	WGI
exchrate	exchange rate USD	
	Characteristics of firms within each country	
ageofirm	age of firm	Orbis BvD
percfirmwith10percfown		Orbis BvD
pctfcompetingagain		Orbis BvD
infemplpropr		Orbis BvD
lassets	logairithm of the average firm total assets	Orbis BvD
lp90assets	logairithm of the p90 of firm total assets	Orbis BvD
lp10assets	logairithm of the p10 of firm total assets	Orbis BvD
lp99assets	logairithm of the p99 of firm total assets	Orbis BvD
lrevenue	logarithm of average firm revenues	Orbis BvD
lp90revenue	logarithm of the p90 of firm revenues	Orbis BvD
lp10revenue	logarithm of the p10 of firm revenues	Orbis BvD
lp99revenue	logarithm of the p99 of firm revenues	Orbis BvD
lnbempl	logarithm of the average firm number of employees	Orbis BvD
lp90nbempl	logarithm of the p90 firm number of employees	Orbis BvD
lp10nbempl	logarithm of the p10 firm number of employees	Orbis BvD
lp99nbempl	logarithm of the p99 firm number of employees	Orbis BvD
lnbfirms	logarithm of the number of firms	Orbis BvD
llarge	logarithm of the number of above median size firms	Orbis BvD
lsmall	logarithm of the number of below median size firms	Orbis BvD
assetratio90_10	ratio of total assets of the p90 to p10 firm	Orbis BvD
share_small	share of below median firms in all firms	Orbis BvD

Figure B1: Mean squared error and R-squared as number of factors increase

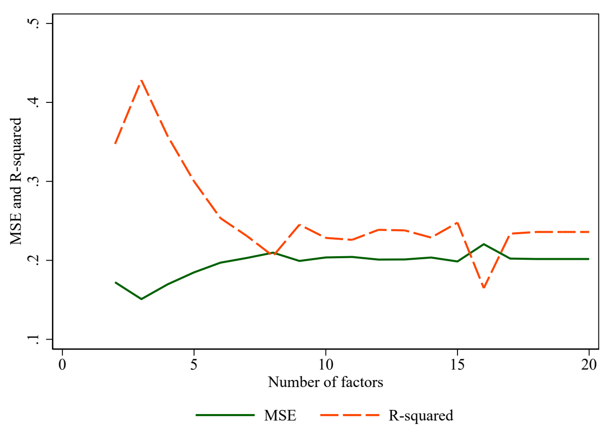


Table B7: Predicted ETIs across the world.

Beginning of Table		
Country	3 predictors (1)	4 predictors (2)
1 Afghanistan	0.17	0.25
2 Albania	0.21	0.15
3 Algeria	0.73	0.63
4 American Samoa	0.83	0.64
5 Andorra	0.76	0.64
6 Angola	0.25	0.27
7 Anguilla	1.10	1.02
8 Antarctica	0.28	0.24
9 Antigua and Barbuda	0.12	0.17
10 Argentina	0.42	0.39
11 Armenia	0.96	0.84
12 Aruba	0.89	0.75
13 Australia	0.82	0.79
14 Austria	0.96	0.73
15 Azerbaijan	0.24	0.22
16 Bahamas	0.23	0.21
17 Bahrain	1.40	1.28
18 Bangladesh	0.26	0.28
19 Barbados	0.24	0.34
20 Belarus	0.65	0.57
21 Belgium	0.45	0.40
22 Belize	0.32	0.29
23 Benin	0.21	0.19
24 Bermuda	1.25	1.25
25 Bhutan	0.74	0.60
26 Bolivia	0.30	0.25
27 Bonaire	0.28	0.24
28 Bosnia and Herzegovina	1.12	1.04
29 Botswana	0.72	0.58

Continuation of Table B7		
Country	3 predictors	4 predictors
30 Bouvet Island	0.28	0.24
31 Brazil	0.41	0.35
32 British Indian Ocean Territory	0.28	0.24
33 Brunei Darussalam	1.40	1.18
34 Bulgaria	0.93	0.93
35 Burkina Faso	0.24	0.21
36 Burundi	0.22	0.22
37 Cabo Verde	0.25	0.25
38 Cambodia	0.71	0.61
39 Cameroon	0.27	0.26
40 Canada	1.47	1.39
41 Cayman Islands	0.95	0.91
42 Central African Republic	0.28	0.29
43 Chad	0.28	0.28
44 Chile	1.22	1.05
45 China	0.30	0.30
46 Christmas Island	0.28	0.24
47 Cocos (Keeling) Islands	0.28	0.24
48 Colombia	0.37	0.32
49 Comoros	0.73	0.68
50 Congo	0.30	0.31
51 Congo, Democratic Republic of the	0.20	0.16
52 Cook Islands	0.29	0.30
53 Costa Rica	0.34	0.31
54 Croatia	1.06	1.01
55 Cuba	0.86	0.72
56 Curacao	0.81	0.65
57 Cyprus	0.78	0.63
58 Czechia	0.83	0.86
59 Cote d'Ivoire	0.25	0.37
60 Denmark	0.77	0.64
61 Djibouti	0.74	0.63

Continuation of Table B7		
Country	3 predictors	4 predictors
62 Dominica	0.88	0.73
63 Dominican Republic	0.38	0.38
64 Ecuador	0.12	0.11
65 Egypt	0.13	0.18
66 El Salvador	0.22	0.20
67 Equatorial Guinea	0.95	0.78
68 Eritrea	0.65	0.58
69 Estonia	0.78	0.82
70 Eswatini	0.19	0.46
71 Ethiopia	0.28	0.39
72 Falkland Islands	0.28	0.24
73 Faroe Islands	0.84	0.65
74 Fiji	0.22	0.22
75 Finland	0.45	0.59
76 France	0.54	0.59
77 French Guiana	0.23	0.21
78 French Polynesia	0.98	0.77
79 Gabon	0.25	0.34
80 Gambia	0.38	0.38
81 Georgia	1.28	1.06
82 Germany	1.02	0.76
83 Ghana	0.28	0.29
84 Gibraltar	1.39	1.25
85 Greece	1.02	1.02
86 Greenland	0.84	0.69
87 Grenada	0.23	0.26
88 Guadeloupe	0.28	0.24
89 Guam	0.84	0.69
90 Guatemala	0.20	0.16
91 Guernsey	0.89	0.72
92 Guinea	0.79	0.67
93 Guinea-Bissau	0.96	0.81

Continuation of Table B7		
Country	3 predictors	4 predictors
94 Guyana	0.24	0.27
95 Haiti	0.98	0.80
96 HIMI	0.28	0.24
97 Holy See	0.28	0.24
98 Honduras	0.18	0.22
99 Hong Kong	0.72	0.72
100 Hungary	0.77	0.81
101 Iceland	1.18	1.11
102 India	0.51	0.44
103 Indonesia	0.53	0.52
104 Iran	0.82	0.81
105 Iraq	0.75	0.57
106 Ireland	0.81	0.67
107 Isle of Man	0.81	0.65
108 Israel	0.76	0.56
109 Italy	0.38	0.52
110 Jamaica	0.16	0.19
111 Japan	0.97	0.76
112 Jersey	0.29	0.29
113 Jordan	0.75	0.52
114 Kazakhstan	0.72	0.59
115 Kenya	0.16	0.14
116 Kiribati	0.89	0.68
117 Korea KP	0.82	0.85
118 Korea KR	1.09	0.84
119 Kuwait	1.23	1.24
120 Kyrgyzstan	0.25	0.26
121 Lao PDR	0.77	0.57
122 Latvia	0.71	0.79
123 Lebanon	0.53	0.38
124 Lesotho	0.67	0.53
125 Liberia	0.23	0.26

Continuation of Table B7		
Country	3 predictors	4 predictors
126 Libya	1.03	0.98
127 Liechtenstein	1.27	1.06
128 Lithuania	0.83	0.93
129 Luxembourg	0.79	0.66
130 Macao	0.83	0.73
131 Madagascar	0.16	0.15
132 Malawi	0.28	0.18
133 Malaysia	0.26	0.29
134 Maldives	1.22	1.05
135 Mali	0.16	0.18
136 Malta	0.46	0.45
137 Marshall Islands	0.74	0.77
138 Martinique	0.23	0.21
139 Mauritania	0.22	0.21
140 Mauritius	0.70	0.57
141 Mayotte	0.28	0.24
142 Mexico	0.47	0.43
143 Micronesia	0.66	0.60
144 Moldova, Republic of	0.79	0.83
145 Monaco	0.96	0.84
146 Mongolia	0.79	0.66
147 Montenegro	1.25	1.13
148 Montserrat	0.96	0.80
149 Morocco	0.19	0.14
150 Mozambique	0.17	0.21
151 Myanmar	0.18	0.33
152 Namibia	0.69	0.50
153 Nauru	0.81	0.65
154 Nepal	0.27	0.25
155 Netherlands	0.29	0.30
156 Netherlands Antilles	0.29	0.21
157 New Caledonia	0.75	0.58

Continuation of Table B7		
Country	3 predictors	4 predictors
158 New Zealand	1.06	0.81
159 Nicaragua	0.27	0.28
160 Niger	0.16	0.19
161 Nigeria	0.26	0.25
162 Niue	0.23	0.21
163 Norfolk Island	0.28	0.24
164 North Macedonia	1.11	1.04
165 Northern Mariana Islands	0.74	0.66
166 Norway	0.87	0.83
167 Oman	1.23	1.21
168 Pakistan	0.52	0.38
169 Palau	0.72	0.62
170 Palestine, State of	0.84	0.66
171 Panama	0.89	0.74
172 Papua New Guinea	0.21	0.27
173 Paraguay	0.17	0.16
174 Peru	0.16	0.22
175 Philippines	0.28	0.30
176 Pitcairn	0.28	0.24
177 Poland	1.01	0.79
178 Portugal	0.21	0.22
179 Puerto Rico	0.74	0.66
180 Qatar	1.40	1.28
181 Romania	0.81	0.86
182 Russian Federation	0.47	0.61
183 Rwanda	0.11	0.17
184 Reunion	0.23	0.21
185 Saint Barthalemy	0.28	0.24
186 SH	0.28	0.24
187 Saint Kitts and Nevis	0.13	0.22
188 Saint Lucia	0.88	0.70
189 Saint Martin (French part)	0.28	0.24

Continuation of Table B7		
Country	3 predictors	4 predictors
190 Saint Pierre and Miquelon	0.28	0.24
191 Saint Vincent and the Grenadines	0.27	0.29
192 Samoa	0.67	0.53
193 San Marino	0.96	0.74
194 Sao Tome and Principe	0.98	0.78
195 Saudi Arabia	0.72	0.72
196 Senegal	0.16	0.16
197 Serbia	0.73	0.80
198 Seychelles	0.24	0.27
199 Sierra Leone	0.27	0.50
200 Singapore	1.11	1.08
201 Sint Maarten (Dutch part)	0.83	0.67
202 Slovakia	0.78	0.82
203 Slovenia	0.72	0.79
204 Solomon Islands	0.73	0.56
205 Somalia	0.83	0.72
206 South Africa	0.57	0.58
207 SGSSI	0.28	0.24
208 South Sudan	0.81	0.76
209 Spain	0.77	0.83
210 Sri Lanka	0.41	0.39
211 Sudan	0.89	0.72
212 Suriname	0.70	0.54
213 Svalbard and Jan Mayen	0.28	0.24
214 Sweden	0.46	0.58
215 Switzerland	1.29	1.17
216 Syrian Arab Republic	0.98	0.78
217 Taiwan, A Province of China	0.80	0.72
218 Tajikistan	0.27	0.27
219 Tanzania, United Republic of	0.24	0.22
220 Thailand	0.21	0.30
221 Timor-Leste	0.78	0.63

Continuation of Table B7		
Country	3 predictors	4 predictors
222 Togo	0.23	0.26
223 Tonga	0.70	0.54
224 Trinidad and Tobago	0.24	0.24
225 Tunisia	0.27	0.20
226 Turkey	0.50	0.42
227 Turkmenistan	0.83	0.64
228 Turks and Caicos Islands	1.23	1.08
229 Tuvalu	0.81	0.65
230 Uganda	0.22	0.30
231 Ukraine	0.49	0.58
232 United Arab Emirates	1.23	1.14
233 United Kingdom	0.87	0.67
234 United States Minor Outlying Islands	0.28	0.24
235 United States of America	0.87	0.71
236 Uruguay	0.17	0.13
237 Uzbekistan	0.82	0.71
238 Vanuatu	0.67	0.53
239 Venezuela	0.66	0.58
240 Viet Nam	0.22	0.16
241 Virgin Islands (British)	0.88	0.69
242 Virgin Islands (U.S.)	0.83	0.68
243 Wallis and Futuna	0.28	0.24
244 Western Sahara	0.28	0.24
245 Yemen	0.25	0.23
246 Zambia	0.74	0.58
247 Zimbabwe	0.24	0.39
248 Aland Islands	0.28	0.24
Average	0.59	0.53
Median	0.61	0.54
Max	1.47	1.39
Min	0.11	0.11
Correlation	0.97	

Continuation of Table B7		
Country	3 predictors	4 predictors
End of Table		

C Detailed Data Description

In this Appendix, we present detailed data description and information on elasticity estimates for each country. In all graphs and figures we report the elasticity of taxable income evaluated for a firm with zero fixed costs, which is the elasticity of W with respect to the net-of-tax rate. All in-line references to the elasticity of taxable income reflect e_W. As shown in equation (10), the elasticity of Y with respect to the net-of-tax rate is related to the elasticity of W with respect to the net-of-tax rate using a scale factor, $(1 + \frac{F}{Y})$. We provide additional information about the magnitude of this scale factor within each context to allow the reader to convert e_W to e_Y.

C.1 Canada

Tax data The estimations are based on administrative data from the Canada Revenue Agency accessed through Statistics Canada's Microdata Access Division. The data consists of the T2 Corporation Income Tax Return and all its accompanying schedules (forms T2 SCH1 to T2 SCH200). These data contain hundreds of variables such as total revenue, expenses, assets and liabilities, as well as accounting profit, net income (or loss) for tax purposes, some tax deductions such as tax depreciation and losses carried forward, scientific research and experimental development expenditures, charitable donations, etc.

Our sample contains only public corporations (a corporation resident in Canada with a class of shares listed on a Canadian stock exchange) and corporations controlled by a public corporation, for the years 2012 to 2019. We exclude corporations with total expenses below \$100,000 CAD or total assets below \$500,000 CAD as well as those with dividend income representing more than 50% of their total revenue. We further restrict the sample by excluding corporations in the Finance and insurance sector (NAICS 52) as they face different tax rules. Our variable of interest is taxable income before the carryforward of previous years' losses (that is net income (or loss) for income tax purposes minus charitable donations and gifts minus deductible dividends).

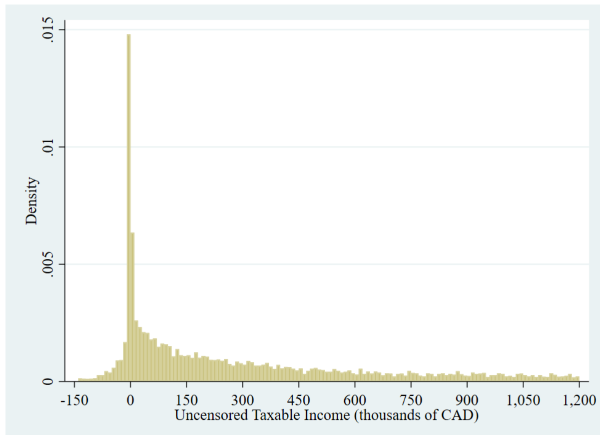
Corporate Tax Context Corporations are liable for federal and provincial corporate income tax on their worldwide income (foreign tax credits are available to offset business income tax paid in other countries). The general corporate tax rate at the federal level is 15% since 2012, and ranges at the provincial level from 8% to 16% for a total tax burden of 26.5% on average in our sample. Expenditures in scientific research and experimental development (SRED) are eligible for a 15% non-refundable tax credit.

Canadian-controlled private corporations (CCPC) with total assets below \$10 million and passive investment income below \$50,000 are facing the small business tax rate on their first \$500,000 of active business income, which is 9% at the federal level and between 0% and 3.2% at the provincial level, for a total tax burden of 11.8% on average. Active business income in excess of \$500,000 is taxed at the general rate of 15%. The SRED credit rate is 35% on the first \$3 million of eligible expenditures for small CCPCs and is refundable. As our sample is limited to public corporations and their subsidiaries, CCPCs are excluded from the analysis.

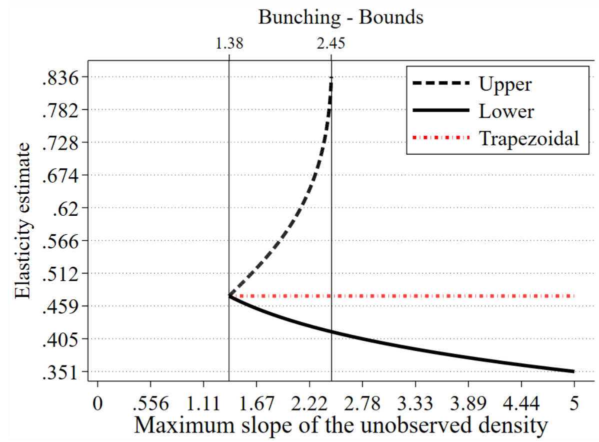
The main differences between book income and taxable income are that only half of capital gains are included in taxable income (taxed at realization, not on an accrual basis), generally more generous tax depreciation rules, some expenses are not deductible for tax purposes (for example only half of meals and entertainment expenses are allowed), and dividends received are generally excluded from taxable income (to avoid double taxation). Non-capital losses can be carried-back to the three previous tax years or carried-forward for 20 years (after which they expire). Unused non-refundable SRED credits can also be carried-back to the three previous tax years or carried-forward for 20 years. Capital losses (50% inclusion rate applying to capital gains also applies to capital losses) can only be applied against capital gains. They can be carried-back to the three previous tax years or carried-forward indefinitely.

Figure D1: Corporate Elasticity of Taxable Income: Chile, 2018

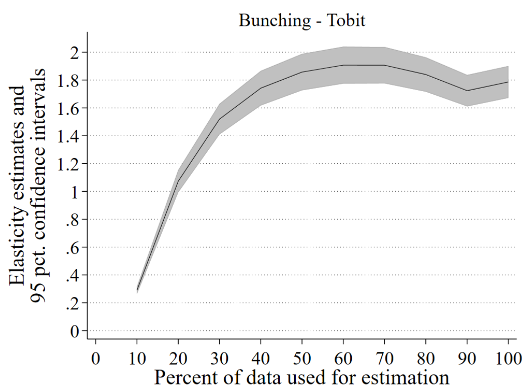
a Raw Data



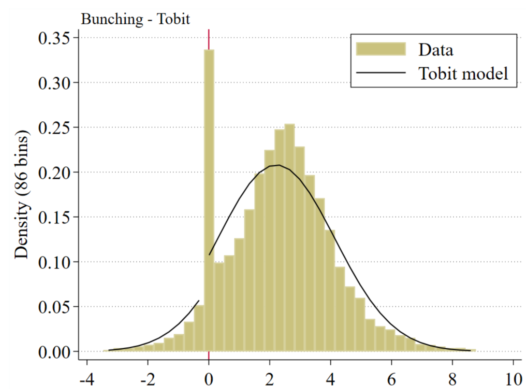
b Bunching Bounds



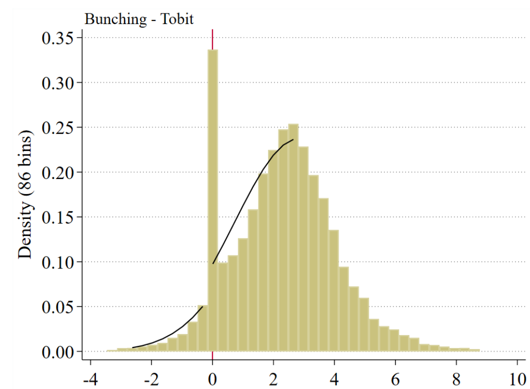
c Variation by Data Used



d Normality, 100% Data



e Normality, 60% Data



Notes: This figure plots diagnostic graphs related to the estimation of the corporate elasticity of taxable income using administrative data from Chinese manufacturing firms in 2009. Panel (a) plots the raw distribution of accounting profit and highlights bunching behavior. Panel (b) plots diagnostic tools for the traditional bunching estimate. Panel (c) plots variation in the estimated elasticity of taxable income based on the amount of data used in the estimation. Panel (d) plots the fit of the normal distribution in the tobit model for 100% of the data. Panel (e) plots the fit of the normal distribution in the tobit model using 60% of the data, and reflects our preferred specification.

C.2 Chile

Tax Data The estimations are based on administrative data provided by the Chilean IRS. We use the universe of income tax returns of firms filing taxes in 2018. The data consists of the full income tax form (F22) for each firm, which contain economic sector, tax regime, sales, VAT debits and credits, wages, operating expenses, financial expenses, tax credits (for fixed assets purchases, Research and Development expenses, training expenses, donations, property taxes paid), depreciation, amortization, taxable income, corporate income tax base, and corporate income taxes paid.

Corporate Tax Context There are two general tax regimes for corporate taxes in Chile, both with a flat rate:

1. Partial-Integration: under this regime the corporate tax rate is 27%, the tax base for personal income taxes is distributed profits and 65% of corporate taxes paid are credited against personal income taxes

2. Full Integration: under this regime the corporate tax rate is 25%, the tax base for personal income is accrued profits, and corporate taxes paid are fully credited against personal income taxes

All firms must choose one tax regime and cannot switch to the other one for 5 years

In addition, there is a unique tax regime for small businesses. Under this regime they pay no corporate taxes, only personal income taxes on distributed profits. There is a cap on annual sales of around USD4 million to be considered small business for tax purposes.

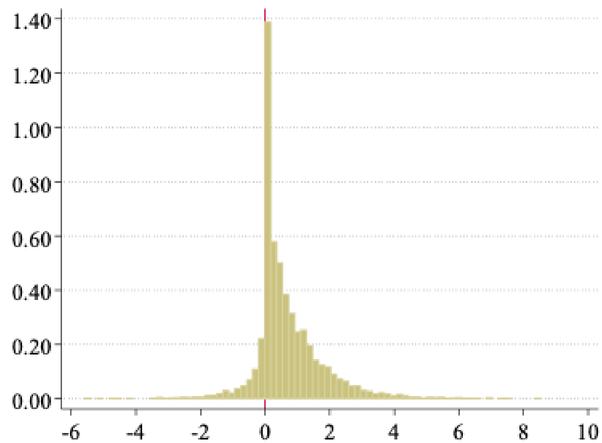
Corporate taxes are paid in an annual tax return filled in April (Form 22, which is the source of the data used), but monthly provisional payments have to be made based on an average of previous years' tax payments. Only loss carryforwards are allowed; no loss carrybacks

There exist two types of investment incentives. The first one, applies to: all firms under full accounting and sales up to USD4 million, which can deduct from the corporate income tax base up to USD200,000. The second one, benefits taxpayers who declare CIT on effective income determined according to full accounting records that acquire, finish build or take in leasing fixed assets, and that register a maximum of average annual sales. The benefit consists of a tax credit, whose magnitude depends on the size of the firm. Firms with average annual sales less than or equal to UF 25,000 (around USD 840,000) receive a tax credit of 6% of the value of the fixed assets, acquired new, finished build during the fiscal year or taken under leasing. Firms with average annual sales of more than UF 25,000 but less than or equal to

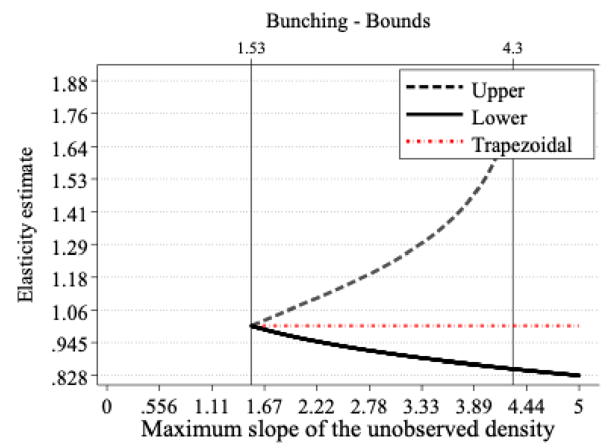
UF 100,000 (around USD 3,365,000), receive a tax credit of either 6% x [(100,000 - annual income) /75,000] or 4%, whichever is larger. Finally, firms with average annual sales of more than UF 100,000 receive a tax credit of 4%.

Figure D2: Corporate Elasticity of Taxable Income: Chile, 2018

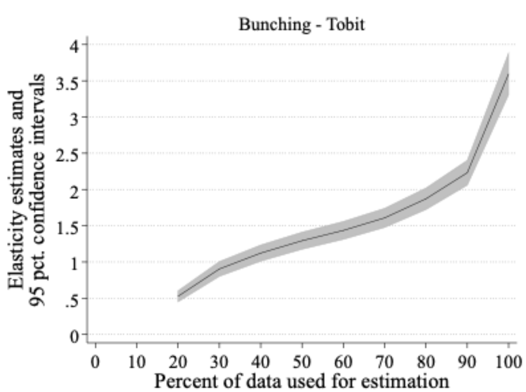
a Raw Data



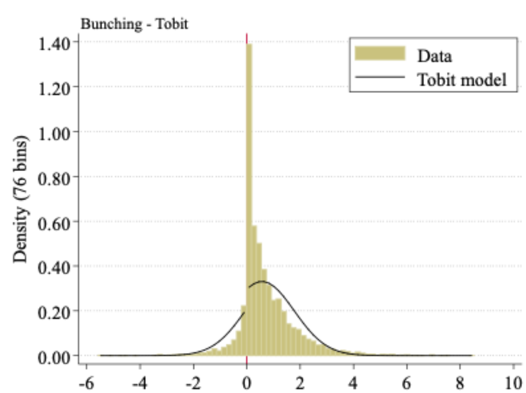
b Bunching Bounds



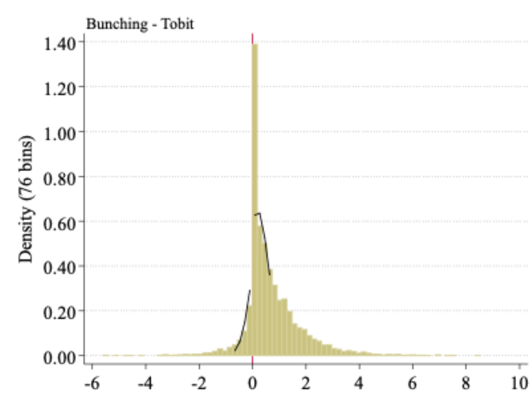
c Variation by Data Used



d Normality, 100% Data



e Normality, 60% Data



Notes: This figure plots diagnostic graphs related to the estimation of the corporate elasticity of taxable income using administrative data from Chinese manufacturing firms in 2009. Panel (a) plots the raw distribution of accounting profit and highlights bunching behavior. Panel (b) plots diagnostic tools for the traditional bunching estimate. Panel (c) plots variation in the estimated elasticity of taxable income based on the amount of data used in the estimation. Panel (d) plots the fit of the normal distribution in the tobit model for 100% of the data. Panel (e) plots the fit of the normal distribution in the tobit model using 60% of the data, and reflects our preferred specification.

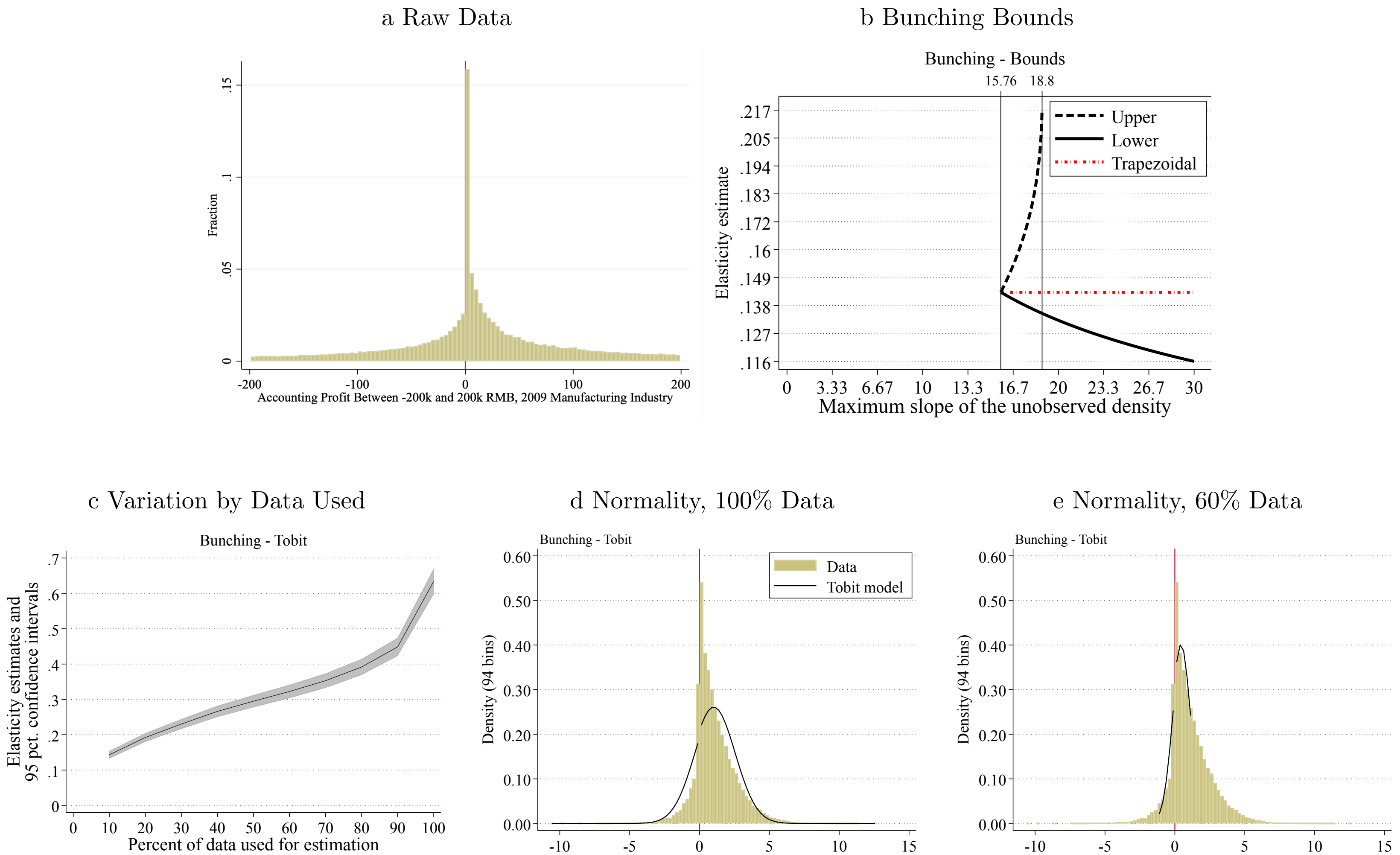
C.3 China

Tax Data Our estimates are based on businesses in the manufacturing industry in China in 2009. Data is drawn from the 2009 China Tax Survey, conducted by the State Taxation Administration (STA) in China — the counterpart to the IRS in the United States. These data provide firm-level information of the components of tax payment in addition to limited financial information for 269,225 firms. Specifically, we observe accounting profit, net profit after tax adjustment, taxable profit, tax adjustments, operating revenue, operating costs, depreciation expenses, total wage and bonus expenses, interest payments, intangible assets purchased, fixed assets held at year end, R&D expenditures, and loss carryforwards from prior tax years.

Corporate Tax Context In 2009 corporations were subject to 17 different taxes within the Chinese business tax system. Most important among these are the Value-Added Tax (VAT), the Corporate Income Tax, the Business Tax, the VAT and Excise Tax on imports, and the domestic Excise tax. In total, these five taxes account for 80% of total corporate tax revenue. VAT and excise taxes are consumption taxes that are levied on goods. Specifically, the VAT taxes the value-added at each stage of goods production and sales, and the baseline VAT rate is 17%. 2009 saw a VAT reform in which firms were allowed to deduct the VAT paid on investment in fixed assets. Excise taxes are levied on a selective list of goods, and business taxes apply to the provision of services, intangible assets, and real estate.

Here, we study how firms respond to the corporate income tax. Prior to 2008, domestic enterprises paid a higher corporate income tax rate than foreign-invested enterprises (33% compared with either 15% or 24%). In 2008, China consolidated corporate income tax rates to a flat 25%, regardless of foreign vs domestic distinctions. Those businesses that faced a preferential rate prior to 2008 were granted a phased-in increase in the corporate income tax rate from 18% – 25% over 5 years. After 2012, all businesses faced the flat 25% rate. Generally, firms are permitted to carry losses from prior tax years forward up to five years to offset current-year positive taxable income.

Figure D3: Corporate Elasticity of Taxable Income: China, 2009



Notes: This figure plots diagnostic graphs related to the estimation of the corporate elasticity of taxable income using administrative data from Chinese manufacturing firms in 2009. Panel (a) plots the raw distribution of accounting profit and highlights bunching behavior. Panel (b) plots diagnostic tools for the traditional bunching estimate. Panel (c) plots variation in the estimated elasticity of taxable income based on the amount of data used in the estimation. Panel (d) plots the fit of the normal distribution in the tobit model for 100% of the data. Panel (e) plots the fit of the normal distribution in the tobit model using 60% of the data, and reflects our preferred specification.

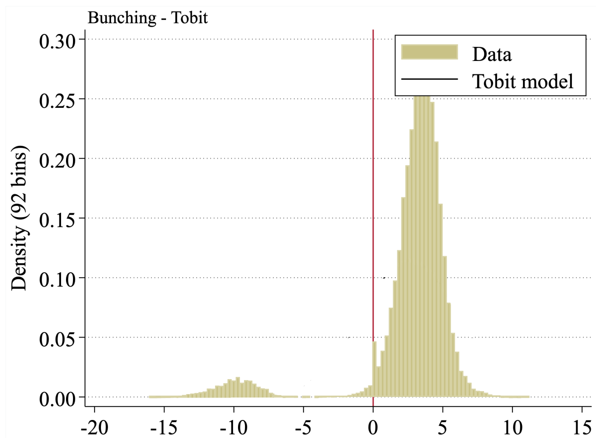
C.4 Greece

Tax Data The Greek sample consists of the population of firms established as corporations (mainly Societe Anonyme, Limited Liabilities Companies, Private Capital Companies) for the period 2002-2004. The dataset has been compiled by using two different sources: tax returns available through the Tax Administration of the Ministry of Finance and financial variables from ICAP, the leading provider in Greece. There are more than 50 variables available from the tax form and more than 100 from ICAP records. Financial information from ICAP is limited to larger corporations based on revenue, asset, and employee size thresholds.

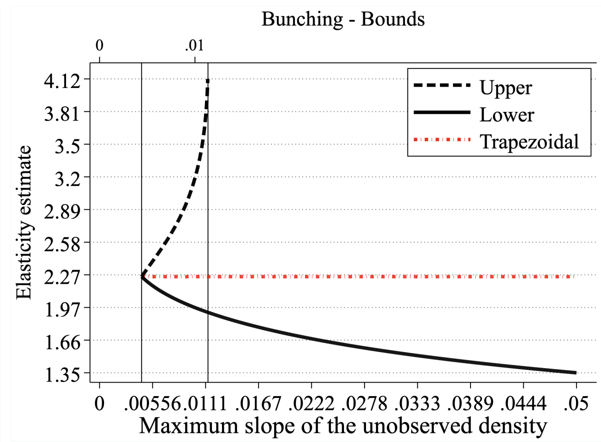
Tax Context The corporate tax system in Greece is extremely complicated, characterized by overregulation and low tax collectability. Resident corporations are taxed on their worldwide income. Until 2003, LLCs were taxed differently compared to SAs: half of their profits were taxed in the name of the company and the rest in the name of the partners (natural persons-owners). Beginning in 2003 all corporations, no matter their specific legal type, are taxed in the same way, i.e., all their profits are taxed in the name of the firm. The statutory corporate tax rate demonstrates noticeable volatility over time: the rate has been changed 9 times in the last 20 years. Advanced tax must be also prepaid up to a certain percentage (which is unstable ranging from 55% to 100% during our study period) of the tax obligation in the current year. Businesses are permitted to carry tax losses forward up to five years to reduce taxable profit.

Figure D4: Corporate Elasticity of Taxable Income: Greece, 2002–2004

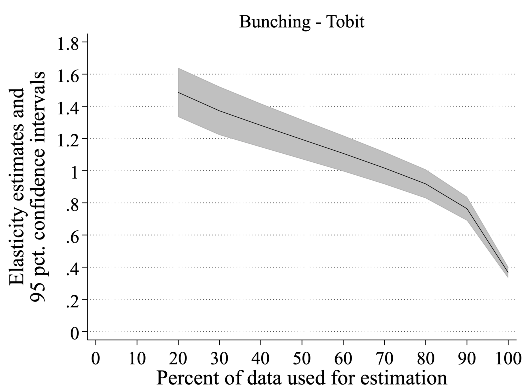
a Raw Data



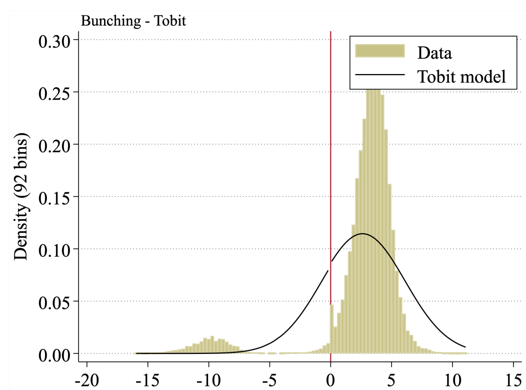
b Bunching Bounds



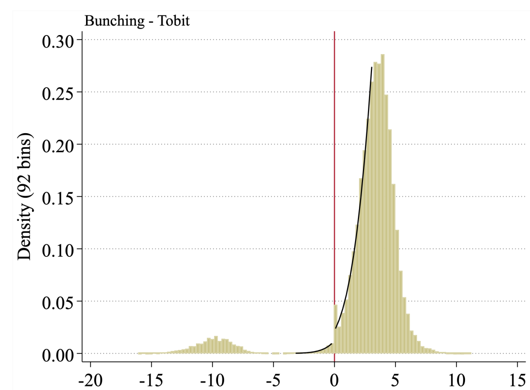
c Variation by Data Used



d Normality, 100% Data



e Normality, 40% Data



Notes: This figure plots diagnostic graphs related to the estimation of the corporate elasticity of taxable income using administrative data from large Greek firms using data from 2002–2004. Panel (a) plots the raw distribution of accounting profit and highlights bunching behavior. Panel (b) plots diagnostic tools for the traditional bunching estimate. Panel (c) plots variation in the estimated elasticity of taxable income based on the amount of data used in the estimation. Panel (d) plots the fit of the normal distribution in the tobit model for 100% of the data. Panel (e) plots the fit of the normal distribution in the tobit model using 60% of the data, and reflects our preferred specification.

C.5 Norway

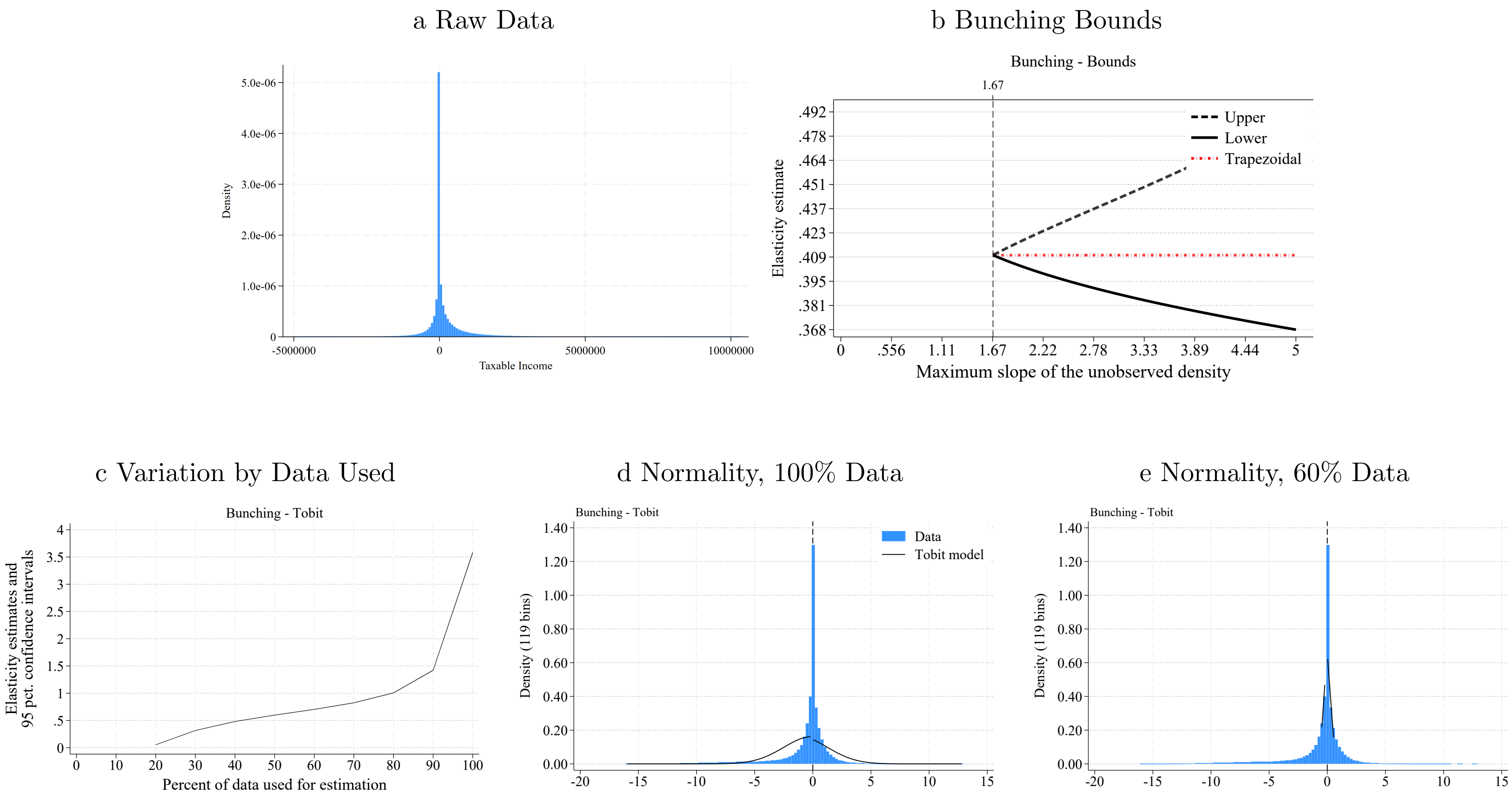
Tax Data We construct our estimation sample from the the universe of Norwegian private and public limited liability firms (AS, *Aksjeselskap* and ASA, *Allmennaksjeselskap*). We draw data from the Norwegian Tax Authority covering the tax years 2006-2013. Information is reported on two mandatory tax forms that must be submitted simultaneously: the actual tax return (form RF-1028) and the income statement (RF-1167). Taxable profit is reported on the tax return and defined as the pre-tax earnings less special deductions. Special deductions include losses from previous years, losses from resource extraction on the Norwegian continental shelf, and group contributions paid to other firms in the corporate group.

Revenue and ordinary deductions are taken from the income statement and computed as the sum of financial and operating income or costs, respectively. For the two-step procedure, we use additional information from the Accounting Register of Norway which collects mandatory balance sheet and profit statement information from all private and public limited liability firms. In addition, we collect information on total intangible fixed assets, depreciation and write-down of fixed assets and long-term liabilities to financial institutions.

Corporate Tax Context During the observation period 2006-2013, Norwegian companies were subject to a flat tax rate of 28% on their corporate profit. This tax base includes the operating and financial profits generated either in Norway or on the Norwegian continental shelf. Income and deductions are assigned to tax years following the realization principle. The tax year is identical to the accounting year and coincides with the calendar year for most firms.

Businesses are permitted to carry tax losses forward to future periods indefinitely to reduce taxable profit. Dividends received by corporate shareholders are exempt from taxation. This also applies to income received from foreign subsidiaries. There is no municipal or local corporate income tax. Finally, businesses face a special tax of 56% on income from offshore production and pipeline transportation of petroleum.

Figure D5: Corporate Elasticity of Taxable Income: Norway, 2006–2013



Notes: This figure plots diagnostic graphs related to the estimation of the corporate elasticity of taxable income using administrative data from Norwegian firms using data from 2006–2015. Panel (a) plots the raw distribution of accounting profit and highlights bunching behavior. Panel (b) plots diagnostic tools for the traditional bunching estimate. Panel (c) plots variation in the estimated elasticity of taxable income based on the amount of data used in the estimation. Panel (d) plots the fit of the normal distribution in the tobit model for 100% of the data. Panel (e) plots the fit of the normal distribution in the tobit model using 60% of the data, and reflects our preferred specification.

C.6 Slovakia

Tax Data We construct our estimation sample based on administrative tax data capturing the population of corporate tax returns in 2013. These data are confidential and owned by the Financial Directorate of the Slovak Republic (FDSR).[15] The data includes tax variables which correspond to individual items recorded on tax return forms. We utilize especially the information about corporate taxable income (or loss) before companies carry forward losses from previous fiscal years (row 400).

We merge the tax return data with additional information from corporate balance sheets and profit and loss statements. The information is publicly available from the Slovak Register of Financial Statements, into which companies are required to submit financial data when they file tax returns to the tax office.

Using these data we limit our analysis to companies with positive (non-zero) sales. In addition, we collect information about the depreciation expense for long-term tangible and intangible assets and information about the net value of non-current intangible assets.

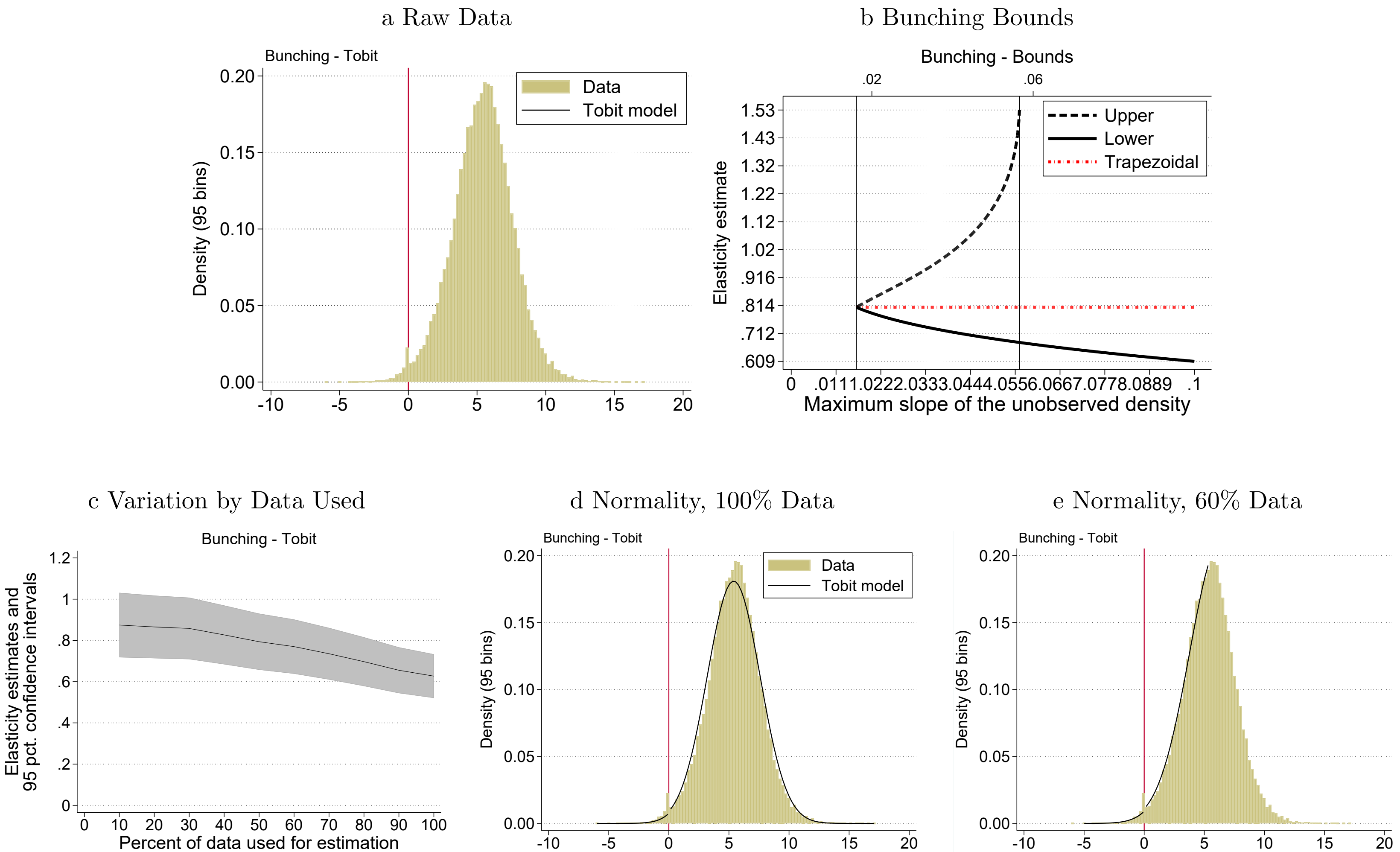
Corporate Tax Context In 2013, governmental tax revenue in Slovakia amounted to 31% of GDP, 11% of which was derived from the corporate income tax. Prior to 2013, incorporated companies were subject to a flat corporate tax rate of 19% on all profits.[16] In 2013, the corporate tax rate increased to 23%. Businesses are permitted to carry tax losses forward to future periods for up to seven years to reduce taxable profit. Loss carrybacks are not permitted.

In addition, companies must register for the VAT once their revenue in the previous 12 months exceeds a fixed threshold specified by the tax law. Furthermore, companies are required to pay quarterly (or monthly) tax advances to the tax office if their tax liability exceeds specific thresholds, also given by the tax law. In 2013, the revenue threshold for mandatory VAT registration was 49,790 euro. The tax liability threshold for quarterly tax advances was 1659.7 euro, while the tax liability threshold for monthly tax advances was 16,597 euro.

[15]FDSR provides the data to other state organs of the Slovak Republic following article 11 of the Slovak Tax Code Act no. 563/2009 on tax secrecy. For details, see: https://www.zakonypreludi.sk/zz/2009-563

[16]In contrast, the profits of unincorporated legal entities, such as sole proprietorships and partnerships, were taxed according to the personal income tax schedule, once profits were attributed to individual partners. Unincorporated companies yet generate only around 4% of tax revenue collected from legal entities.

Figure D6: Corporate Elasticity of Taxable Income: Slovakia, 2013



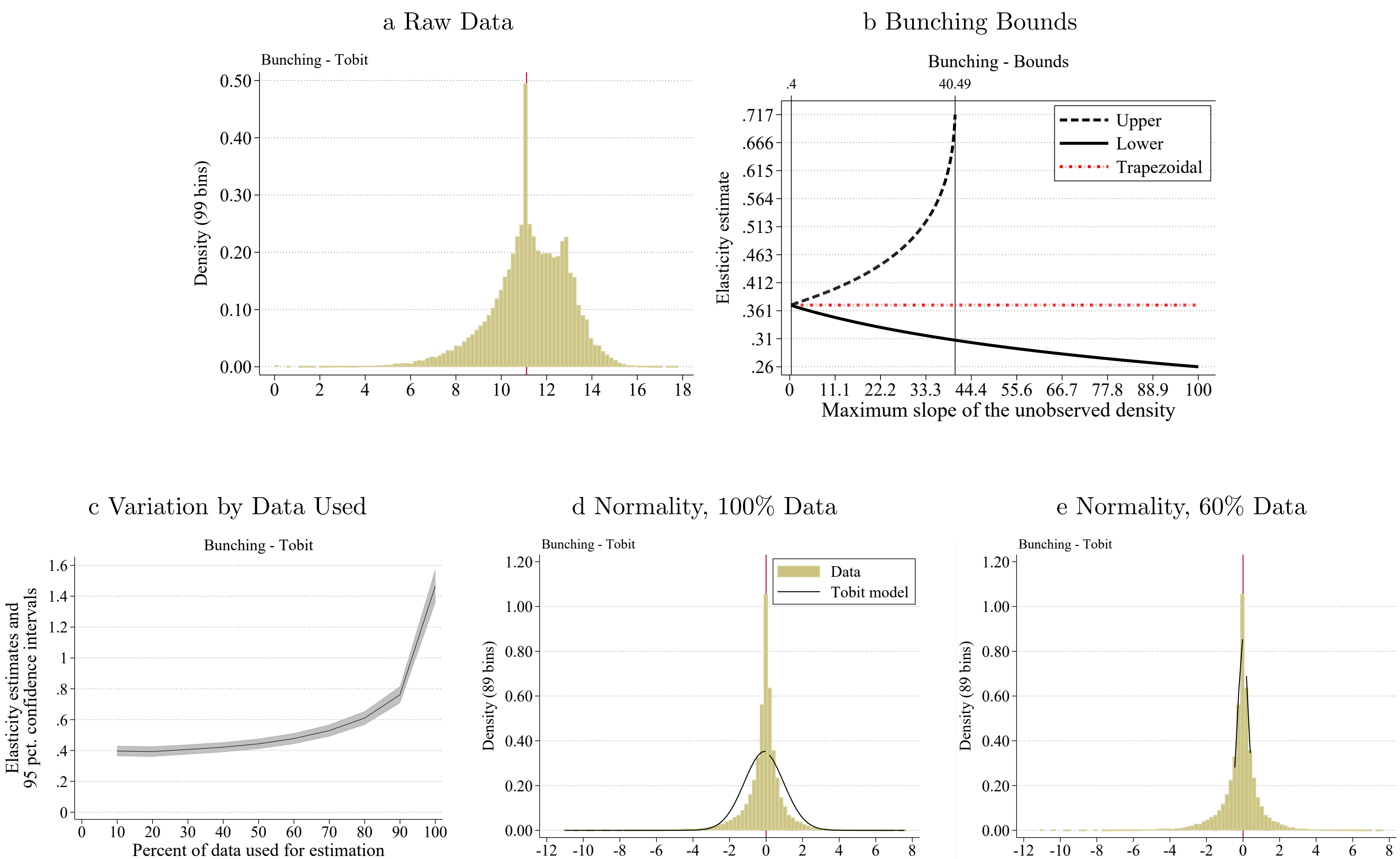
Notes: This figure plots diagnostic graphs related to the estimation of the corporate elasticity of taxable income using administrative data from Slovakian firms using data from 2013. Panel (a) plots the raw distribution of accounting profit and highlights bunching behavior. Panel (b) plots diagnostic tools for the traditional bunching estimate. Panel (c) plots variation in the estimated elasticity of taxable income based on the amount of data used in the estimation. Panel (d) plots the fit of the normal distribution in the tobit model for 100% of the data. Panel (e) plots the fit of the normal distribution in the tobit model using 60% of the data, and reflects our preferred specification.

C.7 South Africa

Tax Data We use administrative corporate tax data from the South African Revenue Service (SARS) which was made available in a joint project with National Treasury (NT) (see Pieterse et al. (2018) for full description of the NT-SARS database). It is an unbalanced panel dataset that includes all kinds of firm's balance sheet items like total assets, sales, cost of sales as well as deduction items like, for example, directors' remuneration, donations, travel expenses. The data also includes exact taxable income from the income statement. In total, the bunching analysis uses 2 million firm-year observations for approximately 200,000 firms.

Corporate Tax Context Corporate income taxes are levied by the national government of South Africa under the Income Tax Act 58 of 1962. The tax system is residence-based, and the headline company tax rate is 28%. All tax returns submitted by a tax-registered firm must be completed electronically or at a SARS branch within 12 months of its financial year end (usually at the end of February). Small and Medium Businesses (SBCs) in South Africa benefit from a progressive tax schedule, starting with a tax rate of 0%. To qualify as a SBC, a company must i) not have elected to be classified as a Micro Business for the year of tax assessment and ii) meet specific criteria. These include, among others, gross income not exceeding R20 million (R14 million prior to the 2013 tax year) and limited shareholding. Depending on the tax year considered, there are two to three tax kinks where the marginal tax rate jumps. For the tax year 2015, for example, the marginal tax rate jumps to 7% at the income threshold 70,000 Rand and then increases to 21% and 28% at threshold values of 365,000 and 550,000 Rand. The tax rate of 28% is then applied to all SBCs with taxable income larger than 550,000 Rand. Over time, the thresholds as well as the tax rates have changed over time.

Figure D7: Corporate Elasticity of Taxable Income: South Africa, 2014



Notes: This figure plots diagnostic graphs related to the estimation of the corporate elasticity of taxable income using administrative data from South African firms using data from 2014. Panel (a) plots the raw distribution of accounting profit and highlights bunching behavior. Panel (b) plots diagnostic tools for the traditional bunching estimate. Panel (c) plots variation in the estimated elasticity of taxable income based on the amount of data used in the estimation. Panel (d) plots the fit of the normal distribution in the tobit model for 100% of the data. Panel (e) plots the fit of the normal distribution in the tobit model using 60% of the data, and reflects our preferred specification.