Tax Evasion by Domestic and Multinational Portuguese Firms: A Bunching Analysis

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Abstract

In this paper I use the “ghost” model of tax evasion, predominantly used in the personal tax literature, to examine the behavior of firms earning profits close to zero. I seek to distinguish the behavior of “iceberg” firms, which report only some percentage of their actual income to the tax authorities, from “ghost” firms, which report no economic activity at all. I further differentiate firm behavior by multinational status, predicting how tax evasion by multinational firms differs from that of domestic firms. I subsequently model the effects of an exogenous shock to the cost of evasion for firms in certain sectors of economic activity.

To test the empirical application, I develop a unique identification strategy using a new Portuguese anti-tax evasion measure, and a comprehensive panel dataset of the annual accounts of Portuguese firms. Using the standard bunching estimation technique of Emanuel Saez and subsequent refinements, I measure tax evasion through bunching of firms at zero profits. I use the exogenous shock to evasion costs to set up a difference-in-differences estimation of the bunching response, testing how the magnitude of bunching at zero changes before and after the reform for firms in treated and untreated sectors. I then compare this difference across firms with a presence only in Portugal and those that have an international parent company.

I find significant bunching at zero profits by all firms in all time periods, indicative of tax evasion around that threshold. The difference-in-differences analysis shows less post-reform bunching by firms in sectors targeted by the 2013 law when compared to other firms, indicating that the law had the intended causal effect of decreasing evasion in those sectors. It also appears that the difference is larger for multinational than domestic firms, consistent with the hypothesis that more multinational firms with profits close to zero choose to evade taxes through the iceberg method, while more domestic firms evade as ghosts and will thus appear to bunch less.

Firms earning profits close to zero behave differently than those at other points in the profit distribution, where most research has focused. My analysis of these firms contributes a unique identification strategy and methodological approach to the growing literature on estimation of tax evasion through bunching.
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1 Introduction

Corporate tax revenues represent an important part of total taxes collected by the government in developed economies. Among OECD countries, for example, taxes on corporate income accounted for between five and twenty percent of total taxes collected by all levels of government in 2014 (OECD, 2016).

The collection of corporate tax revenue, however, has become increasingly complex as multinational companies and cross-border business models become more prevalent. This type of business activity is more difficult for individual governments to track, and allows more possibilities for companies to evade taxes and reduce their tax burden. Multinational corporations (MNCs) in particular use various strategies to shift their profits across tax jurisdictions to minimize their total tax bill (see table 1), and in some of the most extreme cases have succeeded in reducing their effective tax rate to nearly zero (Office, 2008). In many cases, the lack of cross-country coordination in tax policy allows companies to do so through entirely legal mechanisms.

Estimates of the global economic impact of profit shifting are difficult to obtain because academic studies tend to focus on a single country or region where confidential data is made available to researchers, limiting the comparability or aggregation of such results (OECD, 2015). However, one IMF analysis estimates the average annual revenue loss may be close to five percent of total corporate tax revenue (IMF, 2014).

Governments across the world are working individually and collaboratively to regulate such practices and recuperate lost tax revenue. The most prominent current effort is the OECD and G20’s Base Erosion and Profit Shifting project (BEPS) to harmonize tax rules across jurisdictions and combat evasion by multinational corporations (OECD, 2015). OECD, G20 and developing countries are working together to develop a set of best practices for taxing profits in the location where economic activity occurs. For such a project to work, however, it is important to fully understand the dynamics of such business practices in the varied economies participating in the project. The business activity, contribution to the economy, and nature of MNCs differ in every country, and therefore we cannot necessarily generalize the results of country-specific profit shifting studies.

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer Pricing</td>
<td>Pricing intra-firm trade in goods and services differently from arms-length trade to accrue more profits in low-tax jurisdictions</td>
</tr>
<tr>
<td>Internal Debt Allocation</td>
<td>Financing investments in high-tax jurisdictions, where interest can be deducted from the tax bill, with loans from low-tax jurisdictions, where tax is paid on interest collected</td>
</tr>
<tr>
<td>IP &amp; Royalties</td>
<td>Transferring rights to an IP-holding company in a different country, funneled royalty payments from the high-tax country through a conduit company in a country where royalty payments aren’t subject to withholding tax</td>
</tr>
<tr>
<td>Shifting between personal and corporate income</td>
<td>Business owners change whether they report income as individual or business, depending on the relative tax rates</td>
</tr>
</tbody>
</table>

Portugal presents a unique case study as a result of the reforms implemented during its economic assistance program from 2011-2014 (European Commission and Affairs, 2011). One of these reforms provided an interesting natural experiment in the form of an exogenous shock to the cost of tax evasion in certain sectors in economic activity, which I use to develop my identification strategy. As of 2013, consumers in Portugal can deduct from their personal tax bill 15% of the VAT paid
in transactions in sectors particularly prone to tax evasion, up to 250€ per household member. Consumers were also entered into a lottery to win a car when they participated in this scheme. This effectively forces firms in these sectors to report these transactions to the tax authorities, making it riskier and thus more costly for them to evade taxes.

I test the effects of this natural experiment using data from the Portuguese Ministry of Finance, which requires firms to submit their annual account information through an electronic database. The anonymized set of these records from 2004-2012 was provided by the Portuguese National Statistical Office. The comprehensive data and unique nature of the natural experiment created by the 2013 law allow me to clearly identify and differentiate firm responses, by sector of economic activity and multinational status.

I seek to quantify the extent of bunching of Portuguese firms at zero gross profits, the first and largest discontinuity in the corporate tax schedule. The positive tax rate on corporate income above zero has interesting and unique effects when compared to other kinks in the income tax schedule. First, this is the largest and most salient jump that firms face in their tax rate as their profits increase, jumping from zero to 12.5-25% depending on the year (see table 4). There is also a very large visible spike of firms at this point in the distribution in every year for which I have data, a spike which is mirrored in the data for other countries.

As a nonparametric estimator of behavioral response to taxation, bunching analysis has gained popularity to avoid common endogeneity issues. The actual distribution of reported taxable income is compared to a constructed counterfactual representing the distribution in the absence of any discontinuity in the tax rate. The density of the distribution in the counterfactual is estimated by fitting a polynomial to the empirical distribution, excluding a range directly around the discontinuity. At points in the distribution where the effective tax rate or monitoring intensity increases, the number of individuals or firms manipulating their income to remain below the threshold can be identified by looking for excess mass at these points.

I use the exogenous shock to evasion costs to set up a difference-in-differences estimation of the bunching response by the firms’ multinational status. I test how the magnitude of bunching at zero changes before and after the reform for firms in treated and untreated sectors, and compare this difference between firms with a presence only in Portugal and those that have an international parent company.

I find significant bunching at zero profits by all firms in all time periods, indicative of tax evasion around that threshold. The difference-in-differences analysis shows less post-reform bunching by firms in sectors targeted by the 2013 law when compared to other firms, indicating that the law had the intended causal effect of decreasing evasion in those sectors. It also appears that the difference is larger for multinational than domestic firms, consistent with the hypothesis that more multinational firms with profits close to zero choose to evade taxes by mis-reporting zero profits, while domestic firms may instead go informal and will thus appear to bunch less.

The remainder of the paper is organized as follows. Section 2 contains a review of relevant literature on profit shifting and bunching, then lay out the theoretical framework in Section 3 and describe my data in Section 4. After a short section 5 on the corporate income tax system in Portugal, I present my results in Section 6.

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1 Informação Empresarial Simplificada (IES)
2 Instituto Nacional de Estatística (INE)
2 Literature Review

Bunching techniques have recently become more common as a way to estimate the behavioral response of individuals and firms to changes in the tax rate. At discontinuities in the tax schedule that coincide with changes in the effective tax rate, we would expect to see an excess mass of firms in the distribution in a window directly before the discontinuity (Chetty et al., 2011). As a nonparametric estimator, bunching analysis has been gaining popularity in the taxation literature to avoid common endogeneity issues, but has mainly been used so far to look at personal income taxation, with fewer authors working on corporate taxation (Chetty, 2012)(Saez et al., 2012)(Saez, 2010a)(Almunia and Lopez-Rodriguez, 2012)(Devereux et al., 2014)(Dekker et al., 2016). The main drawback is that the conclusions obtained with bunching analysis can generally only be applied to the setting or country in which they are tested, making it even more important for researchers to continually test results in different settings.

Researchers have generally examined responses at corporate tax thresholds falling far above zero, meaning that they can ignore the extensive response of firms and focus on intensive margins. Research on the kink at zero is more widespread among the personal tax literature, particularly in the case of the Earned Income Tax Credit in the United States. Emanuel Saez (Saez, 2010b) examined bunching of individual taxpayers at zero earnings, the first and most significant kink in the tax schedule in the United States, and found evidence of bunching particularly by self-employed earners, with an implied tax elasticity of around 0.25. He excluded extensive margin responses from his model, suggesting that his estimate provides a lower bound on the tax response, as it does not capture households who are better off either participating only in the informal market, or ceasing to work. However, the extensive response is likely to be minimal because of the proportional nature of the tax rate, meaning that households with profits close to zero would be better off misreporting zero profits in order to pay zero taxes than exiting the workforce.

Within the general literature on tax evasion, profit shifting by multinational firms has emerged as an increasingly important topic. The Amadeus dataset available through the Bureau van Dijk (Bureau van Dijk, 2015), which includes standardized financial and accounting data for about 21 million of the largest European firms, has been widely used in research on profit shifting in Europe (Dischinger, 2007)(Barion et al., 2010)(Huizinga and Laeven, 2008). Researchers using this dataset look for evidence of profit shifting by examining pre-tax profits or tax bills as a function of statutory nominal tax rates.

Several recent papers have also taken advantage of the availability of firm-level data collected by the German Deutsche Bundesbank, which distinguishes between intrafirm and third-party loans and therefore allows for direct measurement of profit shifting through internal debt allocation. Fuest et al. (2011), for example, use this dataset to show that affiliates use more debt financing as the tax rate in their country increases (Fuest et al., 2011). However, the dataset only includes information on the after-tax profits of subsidiaries, a limitation that makes it difficult to test for the presence of more general profit shifting. Weichenrieder (2007) attempts to do so with a fixed effects model analyzing affiliate profits as a function of the share of ownership of the parent firm, finding evidence that affiliates’ after-tax profitability increases with the tax rate in the country of the parent firm but that the effect of ownership share is statistically insignificant (Weichenrieder, 2007).

Some researchers have been able to gain access to confidential data that allows them to directly measure other kinds of profit shifting. Clausing (2003) uses monthly data from the US Bureau of Labor Statistics on import and export prices, differentiated by whether they are between related parties or not, and finds direct evidence consistent with transfer pricing by firms, estimating that a 1% reduction of the tax rate in the country of destination or origin is associated with a 1.8% reduction in intrafirm export prices and a 2% increase in intrafirm import prices (Clausing, 2003).
Harju and Matikka use a unique panel dataset from the Finnish Tax Administration which includes tax record information on all Finnish businesses and their main owners, allowing them to conduct a first-differences analysis of shifting between corporate and personal income bases in response to exogenous variation in the Finnish tax code (Harju et al., 2015). They also find direct evidence of income shifting consistent with tax avoidance, with a marginal deadweight loss of approximately 0.30 caused by the behavioral response to tax changes.
3 Methodology

3.1 Model

I follow the model of Best et al., where the firm chooses its optimal level of evasion through manipulation of reported costs rather than through misreporting its actual production (Best et al., 2015).

When firm $i$ decides to move to the informal sector, I say that it is a ghost, and its after-tax profit is

$$\Pi_{yi} = R(y_i) - \alpha_s C(y_i) - \beta_s$$  \hspace{1cm} (1)

Where $y_i$ is the output level, and $R(y_i)$ and $C(y_i)$ are total revenue and total costs, respectively. The cost to go underground is sector-specific, and measured by $\beta_s$. The firms have a sector-specific efficiency level, given by the inverse of $\alpha_s [1, \infty)$.

The firm chooses the level of activity that maximizes (1), which satisfies

$$\frac{R'(y_o)}{C'(y_o)} = \alpha_s$$  \hspace{1cm} (2)

where $y_o$ is the optimal activity level for a firm who pays no taxes.

If firm $i$ decides to remain in the formal sector, i.e., act as an iceberg, then its after-tax profit is given by

$$\Pi_{yi,e_i} = R(y_i) - \alpha_s C(y_i) - \gamma_j g(e_i) - \tau(R(y_i) - \mu \alpha_s C(y_i) - e_i)$$  \hspace{1cm} (3)

Where $\tau$ is the tax rate, $e_i$ the level of tax evasion, and $g(e_i)$ is the evasion cost. This type of cost could include hiring extra accountants and lawyers, managing two sets of books, and dealing in cash transactions rather than going through a bank. It is also associated with the probability of being caught evading taxes, with the firm facing a penalty if caught. The evasion cost is scaled by $\gamma_j$, which depends on whether the firm is domestic, $d$, or an affiliate of a multinational, $m$, with $\gamma_m < \gamma_d$. I allow a share $\mu < 1$ of the firm’s costs to be tax deductible.

Iceberg firms may report zero profits or positive profits, depending on which yields the highest net-of-tax return.

The first strategy entails setting a level of evasion $\hat{e}_i$ such that

$$R(y_o) - \mu \alpha_s C(y_o) - \hat{e}_i = 0,$$

with $y_o$ given by (2).

The second strategy is to optimally choose $e_i$ and $y_i$ so as to maximize (3). The optimal evasion and activity levels respect

$$g'(e^*_i) = \frac{\tau}{\gamma_j}$$  \hspace{1cm} (4)

$$\frac{R'(y^*_i)}{C'(y^*_i)} = \alpha_s \frac{1 - \tau \mu}{1 - \tau} > 1$$  \hspace{1cm} (5)

The iceberg firm’s optimal $y^*_i$ is decreasing in $\alpha_s$, and therefore as $\alpha_s \to \infty$, $\Pi_0$ will become negative and the firm will choose to exit the market. There exists therefore some $\hat{\alpha}_s$ such that when $\alpha_s \geq \hat{\alpha}_s$ the firm will exit, and when $\alpha_s < \hat{\alpha}_s$ the firm will stay active. Moreover, the optimal activity level $y^*_i$ is decreasing in $\tau$, increasing in $\mu$. 

\[ \mu \]
The optimal tax evasion for iceberg firms results from a trade-off between the evasion costs and \( \tau \): it decreases with \( \gamma_j \), hence it is lower for domestic firms, and it increases in \( \tau \).

A firm that expects to earn profits very close to zero may deviate from the optimal levels of production and evasion if it can expect to earn after-tax returns equal to or greater than the no-tax case, even with the cost of evasion. If \( e^* \) and \( \tau \) are such that the firm expects to earn negative pre-tax profits \( \Pi_d < 0 \), it can instead choose \( \hat{e} \) such that it mis-reports its taxable income as zero. In this case it would choose \( y^*_{00} \), the optimal level of production in the no-tax scenario:

\[
\Pi_d = R(y^*_0) - \mu_0 C(y^*_0) - \hat{e}_i = 0
\]

\[
R(y^*_0) - \mu_0 C(y^*_0) = \hat{e}_i
\]

where

\[
y^*_i = \frac{R'(y^*_0)}{C'(y^*_0)} = \frac{1 - \tau \mu}{1 - \tau}
\]

\[
\text{and}
\]

\[
R(y^*_0) - \alpha_s C(y^*_0) - \gamma_j g(\hat{e}) \geq 0
\]

\[
R(y^*_0) - \alpha_s C(y^*_0) - \gamma_j g(e^*_i) - \tau [R(y^*_i) - \mu_0 C(y^*_i) - e^*_i]
\]

The firm will falsely report zero profits if the cost of evading at the level \( \hat{e} \) is less than or equal to the cost of evading at the optimal level \( e^*_i \) plus the tax bill resulting from the optimal levels of production and evasion \( y^*_i \) and \( e^*_i \).

In this case the firm’s post-tax returns will be the same as if the tax rate were zero:

\[
\Pi_0 = R(y^*_i) - \alpha_s C(y^*_i)
\]

Its optimal level of production will no longer depend on the tax rate, but only on the sector-specific level of firm inefficiency:

\[
\text{FOC}(y^*_i) : \frac{R'}{C'} = \alpha_s
\]

Within each subset of multinational and domestic firms, along the spectrum of \( \gamma_j \) from 1 to some \( \gamma_j \), there will be a \( \gamma_j \) that divides firms with \( \gamma_j < \gamma_j \) where \( e_i = \hat{e}_i \); \( y_i = y^*_0 \) and firms with \( \gamma_j > \gamma_j \) where \( e_i = e^*_i \); \( y_i = y^* \). This means that there is a discontinuity in the distribution of \( \gamma_i \) where firms move from \( e_i = \hat{e}_i \) to \( e_i = e^*_i \) and \( y_i = y^*_0 \) to \( y_i = y^* \).

We know that the cost of tax evasion for firm \( i \) is increasing in \( \gamma_j \), and therefore that domestic firms will face a higher cost of evasion at a given \( e_i \) than multinationals at a given \( \alpha_s \) and will choose a lower \( e_i \). As a result, given \( \alpha_s \), more multinational than domestic firms will choose to mis-report zero profits.

This marginal firm expecting post-tax profits close to zero when producing at \( y^*_i \) and evading at \( e^*_i \) can also choose to drop out of the formal economy entirely. In this case, the firm will face a fixed sector-specific cost \( \beta_s \) rather than the variable cost of evasion \( g(e_i) \) and will choose to produce \( y^*_0 \):

\[
\max \Pi_y = R(y^*_0) - \alpha C(y^*_0) - \beta_s
\]

A firm in a given sector will choose to drop out of the formal economy rather than mis-report zero profits when the expected cost of going informal is strictly less than the expected cost of evading at the level \( \hat{e}_i \):
\[ \Pi_n = \Pi_0(y_n^0) - \beta_s \]
\[ \beta_s < g(\hat{e}_i) \]  

(10)

where \( \Pi_n \) represents the expected after-tax returns from going informal.

Since the cost of evasion is higher within a given sector for domestic than for multinational firms, we would therefore expect more domestic firms to go informal than to mis-report their profits as zero. This means that when testing empirically for bunching at zero, we should always obtain higher estimated bunching for multinational than domestic firms because more of the response of domestic firms will come from exiting the formal market, which we do not detect in the bunching estimation.

3.2 Bunching

Where corporate tax rates are uniform and firms vary continuously along a given characteristic such as profitability, we would expect firms to locate smoothly along the distribution of taxable income. If, however, the introduction of kinks in the corporate tax schedule induces firms to shift profits, we would see excess mass in the corporate tax distribution as firms bunch below these kinks, and missing mass above. This can result from firms hiding their true profits through legal or illegal means to avoid paying the higher tax rate on income above the kink, or from firms ceasing real economic activity at the point where their profits would exceed the location of the kink.

Bunching analysis has become an increasingly prominent method in the empirical literature for detecting and quantifying such behavior. This approach entails comparing the actual distribution of firms' reported profits to a constructed counterfactual representing the distribution in the absence of any discontinuity in the tax rate. By comparing the two, we can obtain an estimate of the number of firms changing their behavior in response to the tax rate and an estimation of the magnitude of their response in terms of under-reported taxable income and therefore reduced tax revenue.

The existing literature focuses on the intensive response of firms, which would entail reducing production or under-reporting taxable income. With this approach, we calculate the extent of bunching at kinks in the tax schedule given that individuals or firms choose to remain active. As Kleven and Waseem note (p. 686) (Kleven and Waseem, 2013), individuals who would in the absence of a notch far from zero choose earnings slightly above the notch would prefer earnings slightly below the notch than zero earnings, meaning that the extensive response close to the notch can be considered insignificant.

However, near zero profits the extensive response becomes relevant, as firms could choose to either exit the market or take all of their activity underground. In the case of firms, this means that firms which expect earnings slightly above the notch would either choose to truthfully report their profit level or to engage in tax avoidance to shift their earnings slightly below the notch.

Within the distribution of firm profits, kinks or notches in the tax schedule at some point \( z^* \) create a strictly dominated region \( z^* + \Delta z^* \) where a firm can maintain or increase net returns to shareholders without changing the level of production by mis-reporting its pre-tax income. Such tax avoidance is not without costs, however. These costs could for example be associated with hiring extra accountants and lawyers, managing two sets of books, or dealing in cash transactions rather than going through a bank. Another type of cost is associated with the risk of an audit, as in the paper of Almunia and Rodriguez (Almunia and Lopez-Rodriguez, 2012). Because of these costs, not all firms within \( z^* + \Delta z^* \) will seek to move to \( z^* \).

We therefore expect to see three types of behavior by firms located at kink points (see table 2).

We cannot distinguish empirically between firms that exit for tax-related reasons, those that exit because of low profitability, and firms that report exiting the market but actually take their
Table 2: Firm Behavior Types With Profits Near Zero

<table>
<thead>
<tr>
<th>Type</th>
<th>Action</th>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exiters</td>
<td>Go out of business</td>
<td>Fixed costs of remaining in business</td>
</tr>
<tr>
<td>Honest</td>
<td>Truthfully report profits</td>
<td>Costs of evasion</td>
</tr>
<tr>
<td>Evaders</td>
<td>Under-report profits</td>
<td>More post-tax income</td>
</tr>
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</table>

business fully underground to avoid paying any taxes. This means that bunching estimates will only capture the intensive responses of the third category of “evader” firms, which untruthfully report zero profits, yielding a conservative estimate of revenue lost to tax evasion at the zero notch.

3.3 Empirical Strategy

This paper will follow the empirical approach of Emanuel Saez, who analyzed bunching of personal taxable income at zero in the United States. I will implement subsequent refinements of the bunching technique, particularly those of Chetty et al and Kleven and Waseem (Saez, 2010b)(Chetty et al., 2011)(Kleven and Waseem, 2013). The basic idea of this technique is to estimate the difference between the distribution of firms’ actual reported income and what they would have reported in the absence of any discontinuity in the tax schedule.

We therefore introduce a point $K$ in the distribution of corporate income below which firms face a rate of $\tau_1$, and above which income is taxed at the higher $\tau_2$. At this point, some firms will choose to report profits just below $K$ to avoid the increase in taxes.

The fraction $B$ of all firms who choose to do so can be estimated through

$$\int_K^{K+\Delta z} h(z) dz$$

$h(z)$ represents the density distribution of reported firm profits in the absence of any discontinuity in the tax rate (i.e. if all firms faced the same tax rate $\tau_1$, and $K + \Delta z$ represents the highest point along the income distribution where firms choose to move below $K$ in response to the tax rate $\tau_2$. In the case of zero profits, both $K$ and $\tau_1$ are equal to zero.

To estimate this counterfactual distribution of firm taxable, we fit a flexible polynomial to the observed empirical distribution, with firms grouped into $j$ bins by their reported pre-tax net profits:

$$c_j = \sum_{i=0}^{p} \beta_i (y_j)^i + \sum_{i=y_U}^{y_L} \gamma_i 1[y_j = i] + \nu_j$$  \hspace{1cm} (11)

where $c_j$ is the number of firms in bin $j$, $p$ is the order of the polynomial, and $y_U$ is the upper limit of the profits in bin $j$. To accurately construct the counterfactual, we must exclude the contribution of firms around $K$, setting a lower limit of $y_U$ and an upper limit of $y_L$ on the excluded range. This ensures that the counterfactual distribution reflects the profits of firms around the threshold as they would behave if the tax rate remained the same above and below—effectively, if the tax rate were $\tau_1$ for all firms. This accounts for behavior by evaders, who respond to the positive tax rate above the kink point by mis-reporting their income. Honest firms, who report their true profits above the kink point despite the fact that they could reap higher post-tax profits by mis-reporting their income, are reflected in the actual empirical distribution.

The counterfactual distribution on the intensive margin is therefore obtained by estimating the regression with only the included firms:

$$\hat{c}_j = \sum_{i=0}^{p} \beta_i (y_j)^i$$  \hspace{1cm} (12)
The resulting parameter $b(\tau_1, \tau_2)$ therefore represents the excess mass of firms in the distribution located below the kink point $K$, given as the fraction of firms below the kink relative to the density in the counterfactual situation of a constant tax rate $\tau_1$ throughout the entire distribution.
4 Data

The data comes from the accounting records of Portuguese firms, covering the period 2004-2012. Although the dataset comes from records submitted by the entire universe of Portuguese firms, many variables—including profit and tax-related information—are reported only for the subset of firms classified as “sociedades,” which are collectively-owned firms and can be either publicly traded or privately owned. Because there is such limited data on individually-owned firms, I excluded all but the collectively-owned firms, which comprise 32% of the sample.

I then classified each firm as multinational or domestic, using the variable describing the country of ultimate ownership (“país da última unidade de controlo institucional”). If a firm reported any country other than Portugal for this variable, I classified it as multinational, meaning that it is a subsidiary of a firm located in another country. Because the data is anonymized, I was unable to identify Portuguese firms that are the ultimate owners of multinational enterprises. This means that the estimates for multinational firms are likely to represent profit shifting not by the Portuguese subsidiaries, but by the foreign ultimate owners of the multinational conglomerate in response to the headline statutory corporate tax rate in Portugal. Of the collectively-owned firms active between 2010-2014, 3.5% were classified as multinational.

4.1 Descriptive statistics

4.2 Outcome variables

I first test the results using the variable "pre-tax profit-loss," as reported in the each firms' annual account. Since the dataset does not include a variable with each firm’s taxable income, I also construct an approximation of taxable income using the available information to use as a robustness check, which I refer to as “Taxable Income [1].”

I arrive at the constructed Taxable Income [1] variable using the approach of Graham and Kim (Graham and Kim, 2009), who use this method to look at firms’ taxable income in the United States. The authors test the validity of this specification using information from firms’ tax returns, finding that the results hold. This approach is similar to that used by Raj Chetty ((Chetty, 2012)) for Denmark, and Gruber and Saez ((Gruber and Saez, 2002)) for the US to simulate personal taxable income from administrative datasets.

I begin with the variable recording firms' pre-tax profits minus losses. I then add interest and similar earnings, supplemental earnings, earnings from royalties, other unspecified earnings, and deferred tax liabilities. From this total, I subtract interest paid and similar losses and deferred tax credits.

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3The other type of firm is called “impresa individual,” which are firms held by a single individual.
Table 3: Descriptive Statistics: 2010-2014

<table>
<thead>
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<th>2010</th>
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<tr>
<td><strong>A. Profit Variables (Means)</strong></td>
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</tr>
<tr>
<td>Pre-tax profit-loss (th. euro)</td>
<td>51.3</td>
<td>11.2</td>
<td>6.4</td>
<td>20.6</td>
<td>23.4</td>
</tr>
<tr>
<td>Taxable Income [1] (th. euro)</td>
<td>89.2</td>
<td>45.3</td>
<td>37.6</td>
<td>53.9</td>
<td>59.8</td>
</tr>
<tr>
<td><strong>B. Firm Characteristics (Means)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Num Employees</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Sales (th. euro)</td>
<td>935</td>
<td>915.1</td>
<td>878.6</td>
<td>852</td>
<td>851.1</td>
</tr>
<tr>
<td>Interest &amp; similar earnings (th. euro)</td>
<td>4.1</td>
<td>4.2</td>
<td>7.3</td>
<td>8.6</td>
<td>10.7</td>
</tr>
<tr>
<td>Royalties (th. euro)</td>
<td>.22</td>
<td>.23</td>
<td>.24</td>
<td>.32</td>
<td>.25</td>
</tr>
<tr>
<td>Unspecified earnings (th. euro)</td>
<td>14.2</td>
<td>13.2</td>
<td>13</td>
<td>13.4</td>
<td>13</td>
</tr>
<tr>
<td>Deferred tax credits (th. euro)</td>
<td>6.7</td>
<td>5.7</td>
<td>5.3</td>
<td>4.4</td>
<td>4.3</td>
</tr>
<tr>
<td>Interest paid &amp; similar losses (th. euro)</td>
<td>12.1</td>
<td>11.4</td>
<td>11.7</td>
<td>11.1</td>
<td>9.6</td>
</tr>
<tr>
<td>Number of firms (th.)</td>
<td>360.3</td>
<td>360.6</td>
<td>353.6</td>
<td>355.7</td>
<td>362.4</td>
</tr>
</tbody>
</table>

Note: Means are reported only for firms organized collectively. Outliers are identified through visual inspection of the data and excluded.

5 Corporate Taxation in Portugal

As in most developed economies, Portuguese companies are subject to different effective tax rates based on their taxable income. The top statutory corporate tax rate in Portugal has been decreasing for several decades, falling from over 50% in 1985 to 23% in 2015. As part of Portugal’s efforts to consolidate its public finances in the wake of the 2009 European financial crisis, it has introduced a series of reforms to its corporate income tax code, including a federal surtax on income above a certain level.\(^4\) Table 4 shows corporate tax rates in Portugal during the relevant period 2010-2014 for entities resident in Portugal or permanent establishments of non-resident entities.\(^5\)\(^6\) (PricewaterhouseCoopers, 2010)

\(^4\)“Derrama Estadual”
\(^5\)The rates cited here are for resident entities and permanent establishments of non-resident entities that exercise commercial, industrial, or agricultural activities as their main activity in Portugal.
\(^6\)SMEs are micro, small, and medium-sized enterprises, defined according to the European Commission as firms with less than 250 employees and either less than 50 million € in annual turnover or a balance sheet total of less than 43 million €.
Table 4: Corporate Taxation in Portugal: 2010-2014

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base rate - Continental 1</td>
<td>12.5% to 12,500 €</td>
<td>12.5% to 12,500 €</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>25% above 12,500 €</td>
<td>25% above 12,500 €</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMEs:</td>
<td>17% to 15,000 €</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base rate - Madeira 1</td>
<td>10% to 12,500 €</td>
<td>10% to 12,500 €</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>25% above 12,500 €</td>
<td>25% above 12,500 €</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMEs:</td>
<td>17% to 15,000 €</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base rate - Azores 4</td>
<td>8.75% to 12,500 €</td>
<td>8.75% to 12,500 €</td>
<td>17.5%</td>
<td>17.5%</td>
<td>17.5%</td>
</tr>
<tr>
<td></td>
<td>17.5% above 12,500 €</td>
<td>17.5% above 12,500 €</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMEs:</td>
<td>13.6% to 15,000 €</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal surtax</td>
<td>2.5% above 2 million €</td>
<td>2.5% above 2 million €</td>
<td>3% from 1.5 to 10 million €</td>
<td>3% from 1.5 to 7.5 million €</td>
<td>3% from 1.5 to 3.5 million €</td>
</tr>
<tr>
<td></td>
<td>5% above 7.5 million €</td>
<td>7% above 35 million €</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The definition of corporate taxable income and tax payable in Portugal can be seen in Figure 5. Unlike pre-tax profits, taxable income also includes tax deductions and credits for which the company is eligible under Portuguese tax law, and tax credits or losses carried forward from previous accounting periods. A tax loss is defined as negative net profits in a given year. In this case the company reports no taxable income in that year and pays no taxes, but can carry forward the negative balance to reduce its taxable income in a following year in which it has positive net profits. A company can also defer tax credits for which it would be eligible in a year in which it has no taxable income.

In August 2012, the Portuguese government passed a law creating incentives for consumers to ask for receipts for transactions in sectors particularly prone to tax evasion:

- Automotive vehicle maintenance and repair
- Maintenance and repair of motorcycles and motorcycle parts
- Lodging, restaurants, and similar businesses
- Hair salons and beauty institutes

The law, which went into effect at the beginning of 2013, allowed consumers to deduct from their personal tax bill 15% of the VAT paid in these transactions, up to 250 € per household member. Consumers were also entered into a lottery to win a car when they participated in this scheme. By doing so, the government effectively provided an exogenous shock to the cost of tax evasion in these sectors.

**Taxable profit** = Net income + Positive changes in net equity not reflected in the income - Negative changes in net equity not reflected in the income ± Fiscal corrections (e.g. non-deductible costs or non taxable proceeds)

**Taxable income** = Taxable profit - Tax losses from previous accounting periods - Tax Incentives

**Income assessed for corporate tax (IRC)** = Taxable income * Tax rate

**Assessed IRC** = IRC assessed income - Tax credit

**Payable IRC** = Assessed IRC - Withholding at Source - Advance Payments

Figure 1: Portuguese Tax Authority Definition of Corporate Taxable Income and Tax Payable
6 Results

I use bunching analysis to quantify the response of the universe of Portuguese firms to the biggest discontinuity in the corporate tax code, which occurs at zero. I subsequently compare this response to bunching at discontinuities introduced in recent years at higher levels of taxable income. I refine my approach by looking at differences in the bunching response at zero by multinational and sectoral status of firms, defined as follows:

- Multinational firms: ultimate owner in a country that is not Portugal
- Domestic firms: ultimate owner in Portugal
- Sectorally treated firms: in one of the sectors of economic activity targeted by the prior law
- Non-sectorally treated firm: in any other sector of economic activity

This difference-in-differences strategy helps to overcome the difficulty of isolating the tax-related share of the response at zero profits by comparing the bunching response of firms in sectors particularly susceptible to tax evasion before and after the reform affecting their cost of evasion. If the bunching response of these firms is smaller after the reform, this would indicate a significant impact of the discontinuity in the tax rate at zero on firms’ location at zero profits. As a counterfactual, I compare the pre and post-reform differential in the bunching response by firms in targeted sectors to those in non-targeted sectors, where there should be no difference before and after the reform.

Pre-treatment characteristics of the firms can be seen in tables 5 and 6.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (th. euro)</th>
<th>Std. Dev. (th. euro)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic firms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxable Income</td>
<td>22.67</td>
<td>1773.1</td>
<td>710785</td>
</tr>
<tr>
<td>Pre-tax profit</td>
<td>5.9</td>
<td>336.89</td>
<td>710956</td>
</tr>
<tr>
<td>Multinational firms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxable Income</td>
<td>436.71</td>
<td>6052.24</td>
<td>9594</td>
</tr>
<tr>
<td>Pre-tax profit</td>
<td>276</td>
<td>1838.08</td>
<td>9724</td>
</tr>
</tbody>
</table>

I test for bunching at zero in the two years before the reform was announced (2010-2011) and in the first two years it was in place (2013-2014). I do not test for bunching in 2012, the year the
reform was announced, because of uncertainty in how firms would respond given that the law was passed in the middle of the year to take effect starting in the following year. 7

I begin by collapsing each variable into bins of 1,000 euros and creating a variable with the frequency in each bin. Each bin contains frequencies of all firms reporting profits greater than or equal to the lower bound and less than the upper bound. This means that firms reporting exactly zero profits will be included in the first bin with value 1,000. I set the upper and lower bounds of the excluded regions using visual inspection of the frequency plots around zero, setting the lower bound where the distribution below zero spikes up from its trend and the upper bound where it dropped again above zero.

The results are reported below, with bunching mass defined as the height of the empirical distribution proportional to the estimated counterfactual.

The magnitude of the bunching response varies depending on the specification used, although the direction of the results remains the same. When looking only at the sectoral treatment, I find that bunching at zero by firms in treated sectors decreases while bunching by those in untreated sectors increases, consistent with a decrease in evasion by firms in treated sectors - as would be expected if the law had the intended causal effect on firm behavior.

For multinational firms, bunching at zero increases in the post-reform time period for both treated and untreated firms. However, the increase is smaller for multinational firms in treated sectors, consistent again with a decrease in evasion in response to the treatment. The direction of the results is again robust to the specification of the outcome variable.

Bunching at zero by domestic firms in the targeted sectors decreases in the years after the reform by both measures. In nontargeted sectors, I find an increase in post-reform bunching when looking at pre-tax profits but a decrease when looking at Taxable Income [1]. However, the difference-in-difference result is the same for both specifications, with a decrease in bunching by firms in treated sectors when compared to firms in non-treated sectors.

The results when comparing the responses of multinational and domestic firms are generally consistent with the predictions of the model. The estimated bunching at zero is greater for multinational than domestic firms in all cases except treated sectors before the reform (under both specifications of the outcome variable), and non-treated sectors before the reform when measured by pre-tax prof-

\footnote{In 2014, there was no information on the country of each firm’s ultimate owner, so I used firms’ multinational status as reported in 2013.}

<table>
<thead>
<tr>
<th>Bunching at Zero by Sector</th>
<th>Pre-tax net profit</th>
<th>Taxable Income [1]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010-2011</td>
<td>2013-2014</td>
</tr>
<tr>
<td>Treated sectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010-2011</td>
<td>9.083**</td>
<td>9.258**</td>
</tr>
<tr>
<td></td>
<td>(1.2)</td>
<td>(0.439)</td>
</tr>
<tr>
<td>2013-2014</td>
<td>9.146**</td>
<td>8.86**</td>
</tr>
<tr>
<td></td>
<td>(0.7885)</td>
<td>(.6251)</td>
</tr>
<tr>
<td>Difference</td>
<td>-0.937</td>
<td>-0.398</td>
</tr>
<tr>
<td>Non-treated sectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010-2011</td>
<td>8.94**</td>
<td>11.05**</td>
</tr>
<tr>
<td></td>
<td>(1.032)</td>
<td>(0.51)</td>
</tr>
<tr>
<td>2013-2014</td>
<td>9.72**</td>
<td>11.99**</td>
</tr>
<tr>
<td></td>
<td>(1.189)</td>
<td>(1.17)</td>
</tr>
<tr>
<td>Difference</td>
<td>0.78</td>
<td>0.94</td>
</tr>
<tr>
<td>Difference-in-Difference</td>
<td>-1.717</td>
<td>-1.338</td>
</tr>
</tbody>
</table>
## Bunching at Zero by Sector: Multinationals

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Pre-tax net profit</th>
<th>Taxable Income [1]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Treated sectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010-2011</td>
<td>6.92**</td>
<td>5.58*</td>
</tr>
<tr>
<td></td>
<td>(3.57)</td>
<td>(2.9)</td>
</tr>
<tr>
<td>2013-2014</td>
<td>12.39**</td>
<td>31.6**</td>
</tr>
<tr>
<td></td>
<td>(1.73)</td>
<td>(10.17)</td>
</tr>
<tr>
<td>Difference</td>
<td>5.47</td>
<td>26.02</td>
</tr>
<tr>
<td>Non-treated sectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010-2011</td>
<td>8.15**</td>
<td>15.87**</td>
</tr>
<tr>
<td></td>
<td>(2.9)</td>
<td>(.93)</td>
</tr>
<tr>
<td>2013-2014</td>
<td>17.85**</td>
<td>45.69**</td>
</tr>
<tr>
<td></td>
<td>(1.84)</td>
<td>(3.93)</td>
</tr>
<tr>
<td>Difference</td>
<td>9.7</td>
<td>29.82</td>
</tr>
<tr>
<td>Difference-in-Difference</td>
<td>-4.23</td>
<td>-3.8</td>
</tr>
</tbody>
</table>

## Bunching at Zero by Sector: Domestic Firms

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Pre-tax net profit</th>
<th>Taxable Income [1]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Treated sectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010-2011</td>
<td>9.07**</td>
<td>12.4**</td>
</tr>
<tr>
<td></td>
<td>(1.2)</td>
<td>(1.02)</td>
</tr>
<tr>
<td>2013-2014</td>
<td>7.84**</td>
<td>8.4**</td>
</tr>
<tr>
<td></td>
<td>(0.65)</td>
<td>(.55)</td>
</tr>
<tr>
<td>Difference</td>
<td>-1.23</td>
<td>-4</td>
</tr>
<tr>
<td>Non-treated sectors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010-2011</td>
<td>8.89**</td>
<td>12.99**</td>
</tr>
<tr>
<td></td>
<td>(1.24)</td>
<td>(1.17)</td>
</tr>
<tr>
<td>2013-2014</td>
<td>9.236**</td>
<td>11.42**</td>
</tr>
<tr>
<td></td>
<td>(1.11)</td>
<td>(1.09)</td>
</tr>
<tr>
<td>Difference</td>
<td>0.346</td>
<td>-1.57</td>
</tr>
<tr>
<td>Difference-in-Difference</td>
<td>-7.43</td>
<td>-7.43</td>
</tr>
</tbody>
</table>
its, although the difference in this case is very small. The difference-in-differences result is greater for multinational than for domestic firms by both specifications of the outcome variable, consistent with the hypothesis that multinational firms were more likely to respond to the new law by bunching at zero than domestic firms, resulting in a larger estimated bunching response for affiliates of multinational firms.
7 Conclusion

The bunching results indicate that many Portuguese firms mis-report their profits as zero. The decrease in bunching by firms targeted by the Portuguese tax authority through the 2012 reform when compared to non-targeted firms suggests that evasion decreased in intensity in those sectors of economic activity post-reform.

There is also some indication that more multinational than domestic firms responded to the reform by bunching at zero, suggesting that it is more costly for domestic firms to evade through this channel than through others such as going fully informal because they have fewer potential tools for tax evasion. While multinational firms could decrease their tax burden in Portugal post-reform by shifting profits to branches in other countries, domestic firms choosing to stay registered as active enterprises would only be able to either reduce their real economic activity or under-report their full profits to the Portuguese tax authority, an option that carries a higher risk of detection than profit shifting.

This research could be expanded by a parallel analysis of how firm exits depend on multinational status, to test the hypothesis that the differential response to the reform between domestic and multinational firms is caused in part by domestic firms dropping out of the formal economy, and to attempt to quantify that response. If tax records for Portuguese firms could be obtained, these would also be useful to test the robustness of the results.

Understanding whether and to what extent Portuguese firms increase evasion to alleviate increases in the effective tax rate they face, or choose the location of different parts of their business to take advantage of geographic discrepancies in tax rates, contributes important policy implications regarding the most efficient corporate tax schedule and the most efficient use of resources by tax authorities charged with combatting evasion.
8 Appendix

8.1 Pre-tax Profits

Figure 2: Pre-tax Profits Before and After Reform: Domestic Firms

Figure 3: Pre-tax Profits Before and After Reform: Multinational Firms
Figure 4: Pre-tax Profits Before and After Reform: All Firms in Untreated Sectors

Figure 5: Pre-tax Profits Before and After Reform: All Firms in Treated Sectors

Figure 6: Pre-tax Profits Before and After Reform: Domestic Firms in Untreated Sectors
Figure 7: Pre-tax Profits Before and After Reform: Domestic Firms in Treated Sectors

Figure 8: Pre-tax Profits Before and After Reform: Domestic Firms in Untreated Sectors

Figure 9: Pre-tax Profits Before and After Reform: Multinational Firms in Treated Sectors
8.2 Taxable Income [1]

Figure 10: Taxable Income [1] Before and After Reform: Domestic Firms

Figure 11: Taxable Income [1] Before and After Reform: Multinational Firms
Figure 12: Taxable Income [1] Before and After Reform: All Firms in Untreated Sectors

Figure 13: Taxable Income [1] Before and After Reform: All Firms in Treated Sectors

Figure 14: Taxable Income [1] Before and After Reform: Domestic Firms in Untreated Sectors
Figure 15: Taxable Income [1] Before and After Reform: Domestic Firms in Treated Sectors

Figure 16: Taxable Income [1] Before and After Reform: Domestic Firms in Untreated Sectors

Figure 17: Taxable Income [1] Before and After Reform: Multinational Firms in Treated Sectors
References


