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How do small firms respond to tax schedule discontinuities?

Evidence from South African tax registers

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Abstract: In this paper we study the effects of various tax schedule discontinuities on the behavior of small firms using high-quality and population-wide tax register data from South Africa. We use the bunching method to analyse how these discontinuities affect the firm-size distribution. We first examine how the value-added tax threshold affects the sales distribution of firms. We also study the effects of two separate corporate income tax rate kinks. We find sizable bunching at each of these thresholds. The elasticity estimates for the corporate tax kink points are large, ranging from 0.7 to 1.6, whereas the elasticity of the value added is below 0.1. We find some suggestive evidence that part of the response is driven by tax evasion.

Keywords: developing countries, value-added tax, corporate tax, VAT threshold, corporate tax kink, bunching, small firms
JEL classification: H21, H25, H32, O12

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1 Introduction

Despite the fact that developing countries have been gradually able to raise their tax take, the overall share of taxes from gross domestic product (GDP) in low-income countries was still only around 15 per cent on average in 2013–14.[1] While it is understandable that the size of the public sector in developing countries is smaller than in developed economies, it is clear that many developing countries need to find ways to increase their tax revenues. The need is especially pressing for countries 'graduating' from the low-income group to the middle-income category, as they increasingly need to rely on their own revenue sources to finance developmental and other government outlays when development assistance is phased out. For these reasons, developing country policy makers themselves and aid agencies are equally keen to boost domestic resource mobilization.

It is imperative that the tax increases will be carried out in an efficient and fair manner. An essential element in understanding the welfare consequences that the tax system creates is to have reliable evidence on the causal behavioral impacts of the tax system. In developed countries, what is nowadays regarded as credible evidence are, ideally, studies that use large taxpayer register data to examine the consequences of exogenous changes in the tax treatment over time or over taxpayers. Such 'New Tax Responsiveness' literature has been summarized by e.g. Saez, Slemrod, and Giertz (2012) and Kleven (2015).

However, the literature providing similar microdata-based evidence with credible identification using data from developing countries is extremely scarce, with two studies on Pakistan being the prime exceptions (see Kleven and Waseem (2013) and Best, Brockmeyer, Kleven, Spinnewijn, and Waseem (2015)). The need for more evidence is quite pressing, as it is likely that the elasticity estimates may well differ across countries. Developing countries have, on average, lower revenue-raising capacity, and this impacts the possibilities for tax avoidance and evasion by the taxpayers. The elasticity estimates from developing countries can therefore be greater, at least for this reason.

One particular avenue where the developing countries need to make progress is job and value creation in the formal sector. Much of this is bound to arise from small and medium-sized enterprises (SMEs). Guidance on how tax policies affect the behavior of these SMEs is yet harder to find, even from the developed country environments. The body of research on the impacts of taxes on small business behavior, including tax avoidance and potential growth impacts, is still relatively small, though expanding.

The goal in this paper is to examine the impacts of corporate income taxation and value-added taxation on small and medium-sized firms, using population-wide tax register data from the South African Revenue Service. We utilize the discontinuities in the tax code created by the graduated corporate income tax (CIT) schedule for small business corporations (SBCs) and the threshold level at R1 million[2] in the value-added tax (VAT) structure, below which paying VAT is voluntary to identify the causal effect of

[1] Based on own calculation using the Government Revenue Data set of Prichard, Cobham, and Goodall (2014).
[2] 1,000 rand is approximately 59 euros (and USD67).

taxes on firm behavior. Recent literature, starting from Saez (2010) and summarized in Kleven (2015), has shown that such kinks (where the marginal tax rate increases) and notches (where the average tax rate jumps) give incentives for firms to locate just below the discontinuity points to avoid higher taxes, and this so-called bunching phenomenon can be used to estimate the extent of the distortions the tax system creates. Intuitively, the more firms bunch below these threshold values, the more elastic the tax base is, and the greater the tax distortions are.

The paper contributes to the literature in the following ways. The paper is one of the first to provide evidence on the elasticity of corporate taxable income in developing countries; to our knowledge, this is the first time such tax responsiveness evidence is generated using tax register data from Africa. The paper also studies the responses of firms to multiple discontinuities at the same time. In addition, we also add to the research that studies the impacts of tax policies on small business behavior, including their growth. We also examine in detail the anatomy of the behavioral responses by investigating the extent to which the diagnosed patterns reflect real economic behavior versus tax avoidance or evasion.

In terms of the bunching methods, our paper is most closely related to the analysis of progressive corporate income taxation by Devereux, Liu, and Loretz (2014), who show how bunching across the corporate income tax schedule kinks identifies the elasticity of the corporate income tax base, and to Liu and Lockwood (2015), who demonstrate that bunching around a VAT notch can be used to identify the elasticity of the value added. Both of these elasticities represent sufficient statistics under suitable conditions. Naturally, the work on taxation and development, surveyed recently by Keen (2012) and Besley and Persson (2013) is also closely related.[3] In addition to the studies on Pakistan, Kleven and Waseem (2013) and Best, Brockmeyer, Kleven, Spinnewijn, and Waseem (2015), a number of other paper on taxes in developing countries also utilize taxpayer register data. These include Carrillo, Pomeranz, and Singhal (2014) and Pomeranz (2015) who use taxpayer register data from Ecuador and Chile and combine these data with a field or natural experiment to examine how evasion can be combated. Therefore, the focus in this experimental type of work, which is surveyed by Mascagni (2014), is different: rather than studying more conventional sufficient statistics for determining the overall welfare impacts as the current paper does, they concentrate on avoidance and evasion. There is no doubt that experimental evidence on possibilities to influence evasion is of key importance, but it remains equally useful, we would argue, to simply know more about the overall extent of distortions that current tax systems create. A closely related paper is that of Bachas and Soto (2015), who estimate the distortions caused by the peculiar Costa Rican corporate income tax system where the average tax rate increases at certain thresholds by utilizing bunching around these notches. Using additional data from tax audits, they argue that the response is almost entirely due to evasion. The Costa Rican and Pakistani notch-based systems are, of

[3]The consequences of the VAT systems in developing countries has been a topic of great interest. Theoretical modeling include Emran and Stiglitz (2005) and Keen (2008), whereas empirical assessment using macrodata are provided by Keen and Lockwood (2010) and Alavuotunki and Pirttilä (2015).

course, highly interesting, but since the systems are so uncommon, the external relevance of that research for other developing countries may not be that great.

The paper proceeds as follows. Section 2 presents the institutional framework of the South African tax system. Section 3 outlines the conceptual background for the analysis as well as the empirical strategy we use in the estimations. Section 4 describes the data and it also includes some descriptive material. The actual estimation results are presented in Section 5. Section 6 covers some extensions to the basic analysis while Section 7 concludes.

2 Institutions

South Africa is an upper-middle-income country (GNI per capita was USD6,800 in 2014) and is a member of the BRICS (Brazil, Russia, India, China, and South Africa), a group of major emerging economies. According to the figures in the data set of Prichard, Cobham, and Goodall (2014), the total tax revenue including social security payments was 27 per cent of GDP in 2012, whereas the average for upper middle countries was 23 per cent. In particular, revenues from the corporate income tax are a significant source in South Africa (5.5 per cent of GDP as opposed to 3 per cent in the comparison group of other upper-middle-income countries). Taxes on goods and services (which include the revenue from the VAT) stood at 10 per cent and 9 per cent of GDP in South Africa and other upper-middle-income countries, respectively. While the revenue-raising capacity in South Africa appears stronger than in other developing countries, the needs for revenue are also great to enable the government to finance social protection and other activities which are needed to combat the high inequality levels in society. Finally , in comparison to other countries in sub-Saharan Africa, South Africa is estimated to have a smaller share of the informal sector in the economy. Estimates of the informal sector size in South Africa (using the enterprise-based definition of the informal sector) as a portion of GDP ranges approximately between 5 per cent and 12 per cent. Recent informal sector estimates for other African countries are scarce, but a study by AfDB and OECD (2008) noted that the informal sector constituted almost a third of GDP in 2002. This proportion is even higher for countries such as Zimbabwe, Tanzania, and Nigeria.

2.1 The corporate income tax

The South African Revenue Service (SARS) is the tax authority in the Republic of South Africa and it collects, among other taxes, the CIT, which forms part of the taxes that are levied under the Income Tax Act No. 58 of 1962. Resident companies, with the exception of gold-mining companies, SBCs and micro businesses, are currently subject to a flat tax rate of 28 per cent. In addition, dividends are taxed at the shareholder level with a 15 per cent rate.

The focus of this paper is on SBCs. The government has implemented a graduated, progressive CIT

for small businesses to boost their operations by levying a lower tax rate. In order to be eligible for this tax relied, the conditions detailed below must be met:

- Company shareholders or members of the cooperative or close corporation must be natural persons during the year of assessment
- The shareholders or members are not allowed to own shares or any interest in the equity of any other company, with the exception of other SBCs
- Gross income should not exceed R20 million for the year of assessment[4]
- A limit of 20 per cent is placed on the amount of non-capital receipts and accruals as well as capital gains that can be collectively classified as invest income and income from rendering a personal service
- Entities classified as a personal service provider as defined in the Fourth Schedule of the Income Tax Act do not qualify for the SBC regime[5]

When examining bunching in the corporate income tax, we limit the sample to firms that are eligible for the small business income tax.

The tax rates and thresholds values of the small business income tax are given in Table 1. During the years we examine, there has been two threshold values, around R60,000 (where the CIT rate jumps from 0 to 10 per cent) and around R300,000 (where the CIT rate further increases to 28 per cent). We use the actual values for the lower threshold on an annual basis and center the data around the threshold. Starting from 2014, a third kink was introduced, but the data we use do not cover years when this new system has been operational.

[4]The threshold was R14 million before 2013.

[5]In addition, entities that qualify for the SBC regime are allowed to write-off all plant and machinery brought into use for the first time for trade purposes (excluding mining and farming activities), and that is used directly in a process of manufacture or similar process. Moreover, a qualifying entity may choose to claim depreciation on assets other than manufacturing which was acquired on or after 1 April 2005. Overall, these tax concessions have been criticized by Davis Tax Committee (2014) on the grounds that a relief in an income tax does not help unprofitable firms, which comprised about 47 per cent of the active SBC population in the 2013 tax year. In addition, they expressed concern with regards to: (1) the misuse of the incentive by secondary trades; (2) the high costs associated with administering the incentive in the form of professional fees; (3) the lack of merit in determining the incentive by tax cost of incorporation; and (4) the complexity of the SBC definition.

Assessment period	Taxable income (Rand)	Tax rate
01/04/2009 – 31/03/2010	R1 – R54,200	0%
	R54,201 – R300,000	10% of amount above R54,200
	R300,001 and above	R24,580 + 28% of amount above R300,000
01/04/2010 – 31/03/2011	R1 – R59,750	0%
	R59,7511 – R300,000	10% of amount above R59,750
	R300,001 and above	R24,300 + 28% of amount above R300,000
01/04/2011 – 31/03/2012	R1 – R59,750	0%
	R59,751 – R300,000	10% of amount above R59,750
	R300,001 and above	R24,025 + 28% of amount above R300,000
01/04/2012 – 31/03/2013	R1 – R63,556	0%
	R63,557 – R350,000	7% of amount above R59,750
	R350,001 and above	R20,051 + 28% of amount above R350,000

Table 1: Corporate income tax rates for small businesses. Source: SARS.

In addition to these tax incentives, micro businesses with a turnover below R1 million have been able to choose if they are taxed according to the corporate income tax schedule or according to a presumptive turnover tax, where the tax is levied using a progressive scale on turnover. However, data on the turnover tax returns is not available, and we cannot therefore examine the responses to the turnover tax. This can be considered as a minor issue, since the turnover tax has really not been popular at all. As illustration, revenue collected from the turnover tax during the 2014–15 financial year amounted to only R17.5 million, or 0.2 per cent of total tax revenue. The corresponding figures for revenue collected from companies were R185 billion or 18.7 per cent.

2.2 The value-added tax (VAT)

South Africa has a fairly wide base of goods that are taxed according to the standard rate of 14 per cent. The VAT is levied on the majority of domestic goods and services supplied, in addition to imported goods. VAT is also levied on imported services, provided that the recipient of the service is a resident and the service is requested for purposes of exempt, private, or non-taxable activities. A limited set of goods and services attract a zero rate or are fully exempt from VAT.[6] It should be noted that VAT is levied on an inclusive basis, implying that product prices or quotes should be inclusive of VAT. Vendors primarily choose to account for VAT on either a monthly or bi-monthly basis.

Entities are required to register for the VAT if the total value of taxable supplies exceeds R1 million in any consecutive 12 month period. Entities with a written contractual agreement to supply taxable goods or services in excess of R1 million in the next 12 months are also required to register.

In terms of voluntary registration, entities making taxable supplies of more than R50,000 during the past 12 months, which represents the minimum voluntary threshold, are allowed to register for VAT.

[6]Examples of zero rated supplies include: certain basic foodstuffs; fuel levy goods; sale of a business or unit as a going concern; farming goods; goods temporarily imported for repairs; exports; and international transport. Examples of exempt supplies include: certain financial services; donated goods or services sold by non-profit bodies; residential accommodation in a dwelling (excluding holiday accommodation); passenger transport in South Africa by taxi, bus or train; and educational services provided by recognized educational institutions.

Similarly, entities with a written contractual agreement to deliver taxable supplies in excess of R50,000 in the next 12 months may also register voluntarily. Interestingly, the Davis Tax Committee (2014: 32) points out that 50 per cent of all VAT registrations consist of vendors with turnover below the R1 million threshold. In addition, the Committee is of the view that the VAT registration threshold is in line with international standards and should not be raised at this stage, as was proposed by certain professions and businesses.

3 Conceptual framework

3.1 Tax incentives around the thresholds

In this section we describe the tax incentives created by the VAT threshold notch and corporate income tax kinks for firms. For practical reasons, we analyze the incentive effects on the behavior of firms as both the VAT and the corporate tax are levied and (nominally) paid by firms. However, the decisions are commonly made by a single owner (or a couple of owners) since all discontinuous jumps in the tax schedules described above affect the behavior of (relatively) small firms. We illustrate these incentive changes around the thresholds mostly by graphical analysis. Note also that we concentrate solely on tax incentives and ignore other potentially relevant costs caused by these discontinuities, such as compliance costs around the VAT threshold.

We begin by examining the VAT rate changes around the VAT threshold. Assume first that firms have smooth and heterogeneous preferences over gross sales that are generated mostly by the effort of an owner and inputs needed for producing the output. Figure 1 describes the budget set around the VAT notch. The figure shows the effect of the VAT notch system where exceeding the threshold creates a discontinuous jump in the remitted monetary value of VAT. The simplified tax function excluding other taxes than the VAT is $T(s) = [\tau_s(s - zs)] \cdot \mathbf{1}(s > s^*)$, where s^* is the VAT threshold and τ_s is the VAT rate. $0 \leq z < 1$ and zs denote the linear function of tax-deductible purchases z needed to generate s. In the figure, the remitted VAT from below s^* is denoted by $\triangle T(s^*)$.

In the absence of the VAT threshold firms locate themselves along the 45-degree budget line based on their preferences. When introducing the VAT notch, firms below or directly at the threshold (Type A firm in the figure) do not change their behavior. Type B firm represents the marginal bunching firm with sales $s^* + \triangle s$ before the introduction of the threshold who is exactly indifferent between locating at s^* or s^B. Thus firms with sales between $s^*$and $s^* + \triangle s$ will move to just below the threshold, which creates an excess mass of firms at s^* in the sales distribution.

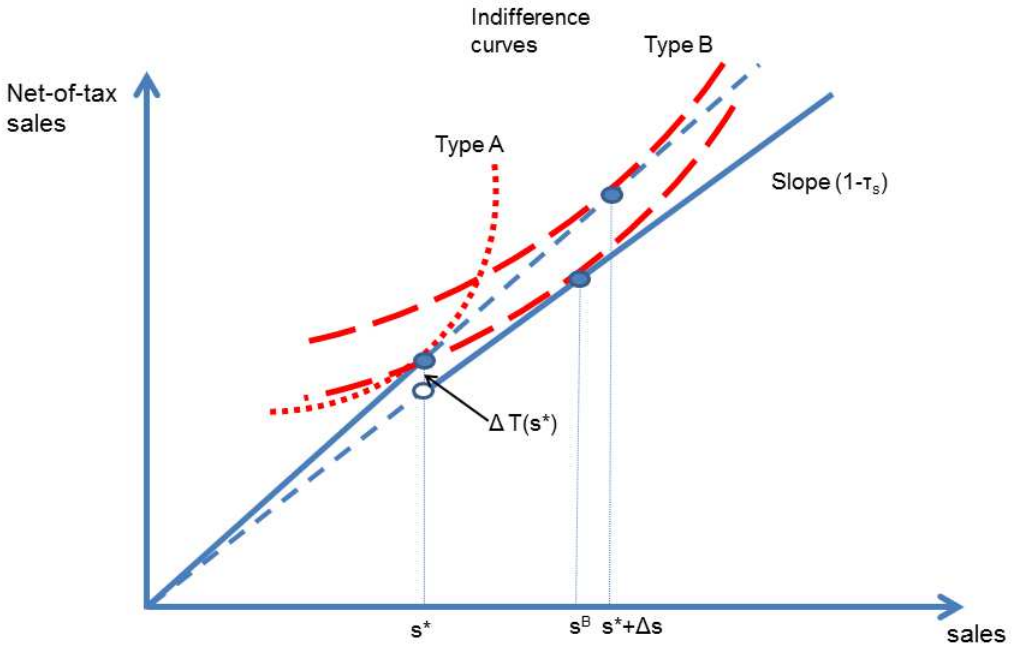

Figure 1: Bunching at VAT rate notch. Source: Authors' illustration. .

Figure 2 instead displays bunching at the corporate income tax kink where tax liability increases gradually above the threshold. Assume again well and smoothly behaving preferences but now over corporate income. The corporate tax function is $T(P) = \tau_p P + \triangle\tau_p(P - P^*) \cdot \mathbf{1}(P > P^*)$, where P is the level of profits, P^* is the corporate tax kink point and τ_p is the marginal corporate tax rate below the kink and $\tau_p + \triangle\tau_p$ above the kink. Similarly as above for the VAT threshold, firms at or below P^* do not change their behavior when the kink is introduced (Type A), but a fraction of firms located between P^* and $P^* + \triangle P$ will bunch around the threshold (Type B).

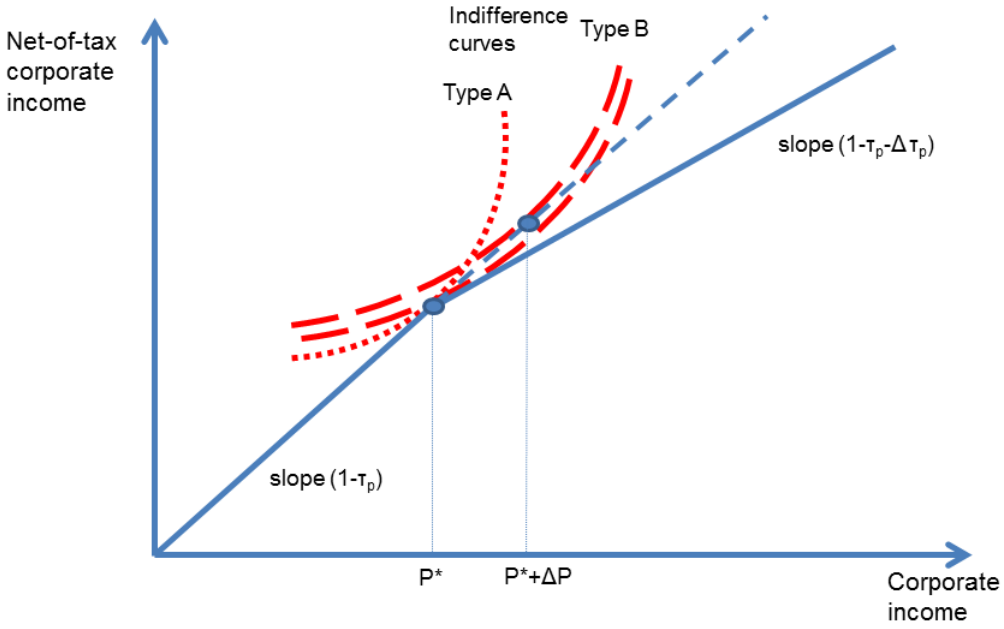

Figure 2: Bunching at corporate income tax rate kink. Source: Authors' illustration.

3.2 Empirical strategy

We estimate the excess masses in the VAT notch and both corporate income tax kinks following earlier bunching literature (e.g. Saez (2010), Chetty, Friedman, Olsen, and Pistaferri (2011)). We describe the estimation strategy solely on the VAT rate notch as the method is very similar also for the corporate income kink analysis with a single exception that we explain below.

The counterfactual density is estimated by fitting a flexible polynomial function to the observed distribution, excluding an area around the VAT notch threshold point from the observed distribution. First we center sales distribution in terms of threshold such that the threshold is exactly at zero, and group firms into small sales bins. Then we estimate a counterfactual density by regressing the following equation and excluding the region around the threshold $[s_L, s_H]$ from the regression

$$c_j = \sum_{i=0}^{p} \beta_i (s_j)^i + \sum_{i=s_L}^{s_H} \eta_i \cdot \mathbf{1}(s_j = i) + \varepsilon_j \tag{1}$$

In equation (1), c_j is the count of firms in bin j, and s_j denotes the sales levels in bin j. The order of the polynomial is denoted by p. The fitted values for the counterfactual density are given by $\hat{c}_j = \sum_{i=0}^{p} \beta_i (s_j)^i$.

The excess bunching is estimated by relating the actual number of firms close to the threshold within (s_L, s^*) to the estimated counterfactual density in the same region:

$$\hat{b}(s^*) = \frac{\sum_{i=s_L}^{s^*}(c_j - \hat{c}_j)}{\sum_{i=s_L}^{s^*}\hat{c}_j/N_j} \tag{2}$$

where N_j is the number of bins within $[s_L, s^*]$.

As in earlier literature, we determine the lower limit of the excluded region (s_L) based on visual observations of the distribution. Intuitively, s_L represents the point in the distribution where the bunching behavior begins, i.e. the density of firms begins to increase. Due to imperfect control and uncertainty about the exact amount of sales, it is likely that we do not observe sharp bunching exactly at the threshold but rather a cluster of firms on a region below it.

When we analyze the VAT threshold, we follow the approach of Kleven and Waseem (2013) to define the upper limit. We determine s_H such that the estimated excess mass $\hat{b}_E(s^*) = (\sum_{i=s_L}^{s^*} c_j - \hat{c}_j)$ equals the estimated missing mass above the threshold, $\hat{b}_M(s^*) = (\sum_{s>s^*}^{s_H} \hat{c}_j - c_j)$. We apply this convergence condition by starting from a small value of s_H and increasing it gradually until $\hat{b}_E(s^*) \approx \hat{b}_M(s^*)$. This definition for s_H denotes the upper bound of the excluded range, and thus the lower bound for estimated excess bunching (Kleven and Waseem 2013).[7] This condition states that firms who bunch at the threshold come from the region directly above it.

In the analysis of CIT kinks, the estimation strategy is otherwise similar as described for the VAT threshold but the definition of upper limit differs from the above. We follow a standard method in the (kink) literature where the excluded range, including both the lower and upper limits, can be determined visually (Kleven 2015). Thus we define the upper limit to be as far from the kink point as the lower limit. Therefore, if the lower limit is, for example, 10 bins away from the centered kink point (0) such that it gets value -10, the upper limit is then 10. Finally, following the earlier literature, we estimate the excess mass around the kink points by relating the observed distribution within the lower and upper limits to the estimated counterfactual within the same region (compared to the VAT notch where the excess mass is estimated within the lower limit and the notch point).

As is customary in the literature we calculate standard errors for all the estimates using a residual-based bootstrap procedure. We generate a large number of distributions by randomly resampling the residuals from equation (1) with replacement, and generate a large number of new estimates of the counterfactual density based on the resampled distributions.[8] The standard errors for each estimate are

[7] Kleven and Waseem (2013) apply this convergence condition to estimate the counterfactual density around individual income tax notches in Pakistan. For individual tax rate kink points in Denmark, Chetty et al. (2011) determine the upper limit visually, and then iteratively adjust the counterfactual density above the kink point such that it includes the excess mass at the kink. This makes the estimated counterfactual density equal to the observed density. These procedures are intuitively similar, but the convergence method of Kleven and Waseem (2013) typically provides a smaller estimate for excess bunching. In addition, the convergence method provides a more justified approach to define the upper limit of the excluded region when estimating the counterfactual density.

[8] In the VAT threshold analysis the bootstrap procedure takes into account the iterative process to determine s_H.

defined as the standard deviation in the distribution of the estimate.

The excess bunching can be turned into elasticity estimates using the formulae that are familiar from the literature. The elasticity estimates of the kink point are derived using the formula (see Bastani and Selin 2014):

$$\varepsilon_{P^*} = \frac{dP}{d(1-\tau)}\frac{1-\tau}{P} = \frac{b_E}{P^*\hat{c}(P^*)log\left(\frac{(1-\tau_P)}{(1-\tau_P-\triangle\tau_P)}\right)},$$

where, as above, P denotes income, τ the corporate income tax rate that jumps at a kink point P^* from τ_P to $\tau_P + \triangle\tau_P$, and $\widehat{c}$ depicts the counterfactual density in the absence of the tax incentive. In the case of a notch in the VAT schedule, the elasticity is calculated with the following quadratic formula, as in Kleven and Waseem (2013):

$$\varepsilon_{s^*} = \frac{ds}{d(1-\tau)}\frac{1-\tau}{s} \approx \frac{(\triangle s/s^*)^2}{\triangle t_s}$$

where $\triangle t_s = [((\triangle s - s^*) - (z\triangle s - zs^*)) + (s^* - zs^*)]t_s/\triangle s$ is the relative increase in VAT payments caused by exceeding the threshold by s and z is the tax-deductible purchases (as the VAT is paid only for value added). As the firms exceed the VAT threshold, it need to pay also VAT for sales below s^*.

4 Data and descriptive statistics

The data used for this paper was obtained as part of the firm-level research program that forms part of the collaborative effort between the National Treasury of South Africa (NT), the South African Revenue Service (SARS) and the World Institute for Development Economics Research of the United Nations University (UNU-WIDER). This program has made it possible for the first time to perform research on highly disaggregated tax register data, which by definition are not survey based, over a multi-year time frame.

The company tax register information was extracted from the SARS core systems by the SARS Revenue Planning, Analysis, Research and Reporting (RPARR) division. All entities classified as a company or close corporation need to register as a taxpayer within 21 business days after becoming liable for income tax or liable to submit a return. Data for all incorporated companies, excluding entities that have opted to make use of the turnover tax regime, have to complete the Income Tax Return for Companies (ITR14) return and need to submit within 12 months of the financial year end.

According to SOUTH AFRICAN REVENUE SERVICE (2013), the ITR14 return was introduced in May 2013 as part of the modernization drive by SARS, with the ultimate aim of reducing the administrative burden for taxpayers as well as improving the efficiency and accuracy of SARS. Prior to the

introduction of the ITR14 return, the IT14 return was in use. The ITR14 return is dynamic and in digital format, which allows a company to create a customized tax return. The main improvements of the ITR14 return compared to the IT14 return can be summarized as follows. First, the ITR14 return contains pre-populated information on the company and will be customized based on the type of company (i.e. SARS company category descriptions) where smaller companies will complete a shorter and more simplified form compared to larger, more complex entities. Second, assessments are done instantaneously and a Notice of Assessment is e-mailed to the company should they choose this option. Third, an indication of a company's expected assessment is provided for convenience.

The company tax register database is available from 2009 to 2014, but according to the SARS appraisal, data from 2009 is incomplete and may be unrepresentative. This is why we in this paper concentrate on years 2009–13. In the analysis regarding the VAT notch, we utilize the whole data set, whereas when studying bunching around the kink points of the CIT system, we restrict the sample to those firms that fulfill the eligibility criteria of small business taxation.

Tables 2 and 3, respectively, provide summary statistics for the sample used to estimate the responses for the CIT of small businesses and the VAT notch. As expected, firms in the SBC sample are bigger and more profitable than firms used in the VAT sample.

VARIABLES	N	mean	sd
Taxable income	100,049	114,298	102,126
Final: Income - sales	98,790	2.37E+06	2.20E+06
Final: Income - cost of sales	92,040	1.46E+06	1.72E+06
Final: Expenditure - Employee Expenses	93,945	318,295	375,435
Final: Expenditure - Expenses control total	99,182	314,469	519,957
Capital	100,049	957,829	1.00E+06
Equity	100,049	373,505	450,986
Expenditure	100,049	1.16E+06	1.08E+06
Balance_sheet	100,049	1.33E+06	1.35E+06
Value added	92,032	1.01E+06	854,520

Table 2: Summary statistics for the SBC sample used in bunching estimates. Source: Authors' calculations based on SARS data.

VARIABLES	N	mean	sd
Taxable income	163,599	-127,086	430,617
Final: Income - sales	172,858	913,250	277,055
Final: Income - cost of sales	154,680	419,115	263,458
Final: Expenditure - Employee Expenses	161,049	181,258	158,004
Final: Expenditure - Expenses control total	124,002	283,972	350,197
Capital	172,858	936,956	2.59E+06
Equity	172,858	362,127	1.24E+06
Expenditure	172,858	714,462	494,325
Balance_sheet	172,858	1.30E+06	3.57E+06
Value added	154,680	497,614	265,485

Table 3: Summary statistics for the VAT sample used in bunching analysis. Source: Authors' calculations based on SARS data.

Figure 3 illustrates the distribution of profits for small businesses for years 2009–2013. The vertical lines depict the kink points in the CIT schedule. The lower kink points (around R60,000) have been adjusted annually according to the inflation rate. The upper kink point, which stood for the earlier years at R300,000, was raised to R350,000 in 2013. It is evident already from this graph that the tax incentives matter. There is a clear concentration of firms in the neighborhood just below the kink points, and the extent of this concentration appears large.

The distribution of sales is depicted in Figure 4 for firms for which sales exceed R100,000. Also this figure shows that the the tax incentives, in this case the VAT threshold level of R1 million, seems to drive firm behavior. But in this case, the peak in the distribution appears smaller in magnitude.

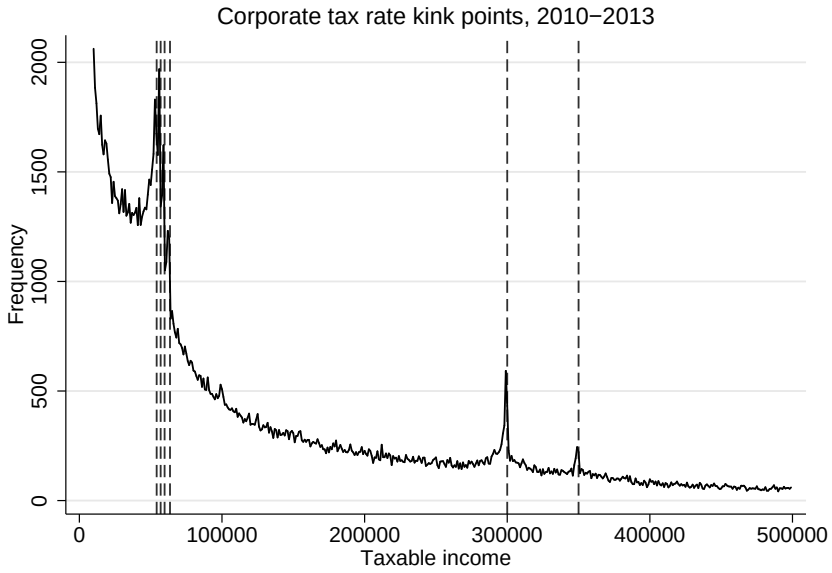

Figure 3: Distribution of taxable income for small businesses, 2010-2013. The vertical lines depict kink points in the tax schedules in different years. Source: Authors' calculations based on SARS data.

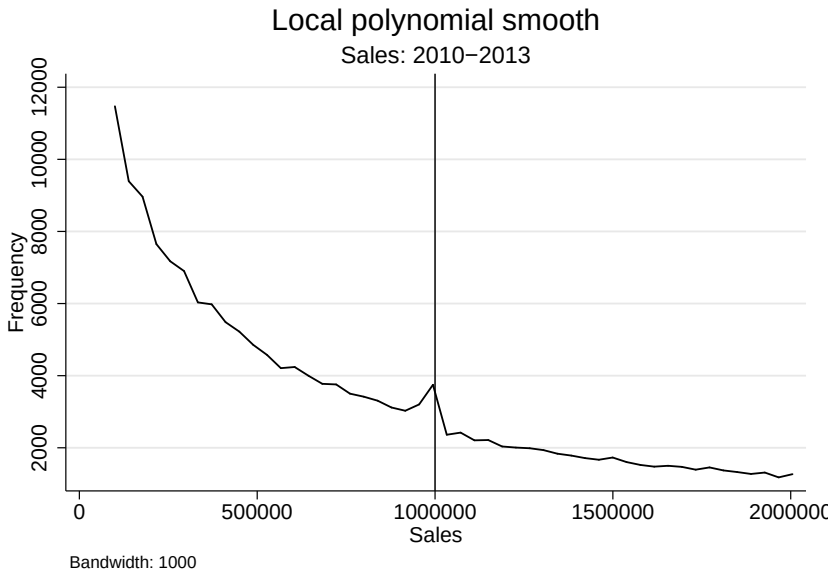

Figure 4: Distribution of sales for firms whose sales exceeds 100,000 rand, 2010–2013. The vertical line depicts the notch point in the VAT schedule. Source: Authors' calculations based on SARS data.

5 Results

5.1 Corporate income tax kinks

Figure 5 shows the corporate income distributions around both tax kinks for all firms using pooled data from 2010–2013. The upper panel of Figure 5 shows the firm distribution and the counterfactual around the lower CIT kink, and the lower panel displays the distribution and counterfactual around the upper kink. The figure plots the observed corporate income distributions (solid line) and counterfactual distributions (dashed line) relative to both of these thresholds in bins of R1,000 in the range of +/- R50,000. The threshold is marked with dashed vertical lines. The excluded region $[s_L, s_H]$ in the estimation of the counterfactual is marked with solid vertical lines.

Figure 5 shows that excess bunching is striking at both of these CIT kinks. A significant proportion of firms locate themselves just below the thresholds. The estimates for excess bunching are very large and strongly significant statistically. Consequently, the implied elasticity estimates are also relatively large, 0.75 and 1.63 for the lower and upper kink points, respectively. These imply that the corporate income tax kinks clearly affects reported profits of small businesses and that the implied excess burden is considerable.

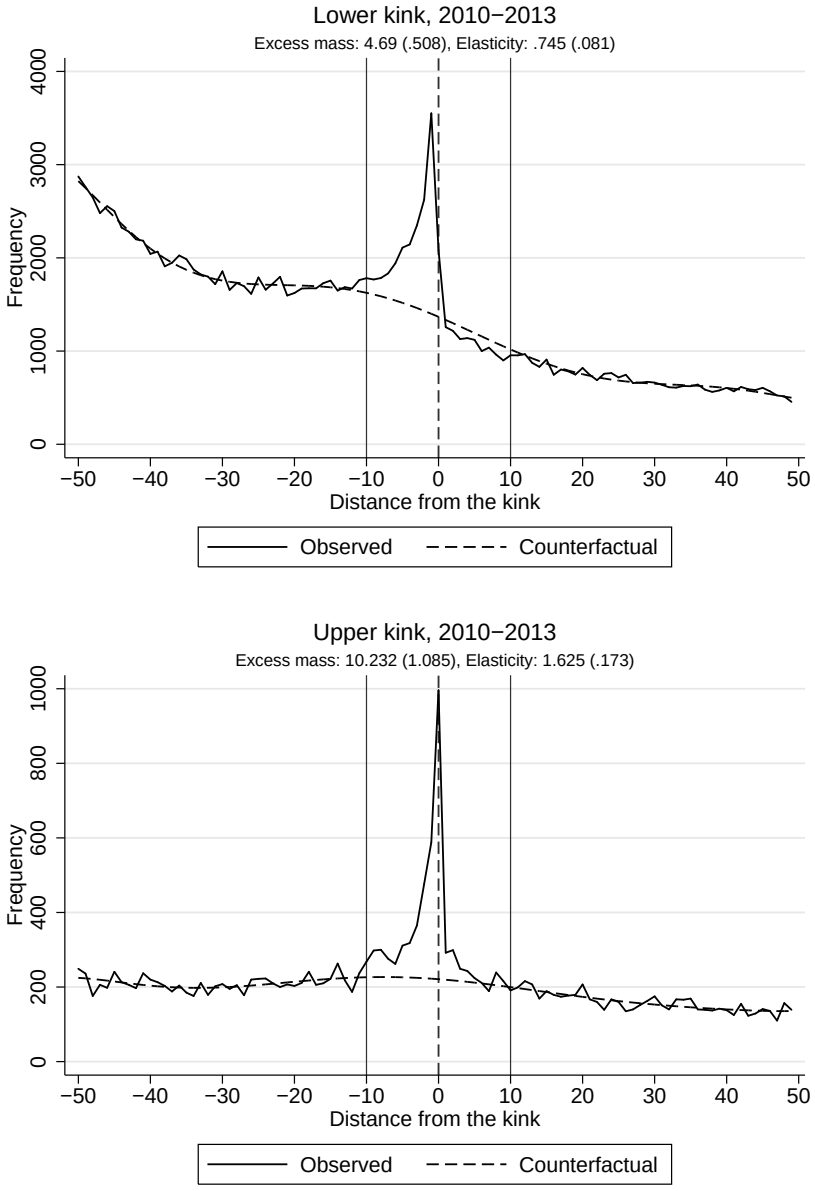

Figure 5: Bunching at the corporate income tax rate kinks. Source: Authors' calculations based on SARS data.

5.2 VAT threshold

Figure 6 shows the sales distribution around the VAT threshold for all firms in our estimation sample using pooled data from 2010–13. The figure plots the observed sales distribution (solid line) and counterfactual distribution (dashed line) relative to the threshold in bins of R10,000 in the range of +/- R500,000 from the threshold. The threshold is marked with a dashed vertical line. The excluded region $[s_L, s_H]$ in the estimation of the counterfactual is marked with solid vertical lines.

The figure denotes the estimate for the excess mass at the threshold with bootstrapped standard

errors, and the estimate for the upper limit of the excluded region, s_H, which is determined by the iterative process. The upper limit also denotes the sales response of the marginal bunching firm, Δs. Excess bunching is measured by relating the number of firms in the observed sales distribution to the counterfactual density within the region $[s_L, 0]$.

Figure 6 shows that excess bunching is evident. A significant proportion of firms locate themselves just below the VAT threshold. The estimate for excess bunching is notable and strongly significant statistically. These imply that the VAT threshold clearly affects reported sales of small businesses. But the implied elasticity estimate is small. While the large tax change implicit in a notch lowers the elasticity estimates for any given excess bunching, it still seems that firms' response to the VAT threshold is more muted than the response to CIT kinks.

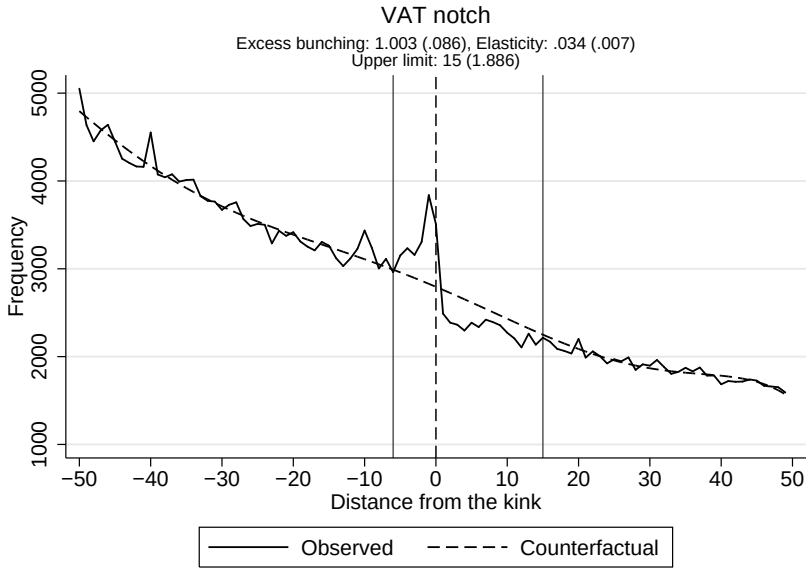

Figure 6: Bunching at the VAT notch. Source: Authors' calculations based on SARS data.

6 Extensions

6.1 Anatomy of bunching

One of the most interesting questions that can be asked is what drives the results presented above. Are firms choosing to locate just below the threshold values genuinely smaller (so that the response to tax incentives would represent real economic behavior—truly lower scale of economic activity) or can then somehow evade part of the taxes? In the case of the VAT notch, the firms could choose to not to report all value added, and therefore if measured by employment costs or by profitability, they would appear to be larger firms the comparison group just above the threshold. In the case of the CIT, the firms

could, for instance, report more costs than they truly have in order to locate themselves close to the kink point.[9] This would show up as a reduced profits rate or, indeed, greater costs.

To fix ideas, we first illustrate a conceptual model for the CIT kink, extending the work by Devereux, Liu, and Loretz (2014) by allowing for tax evasion. Consider a case where the firm owner can hide part of their gross income, δ_y, with a cost of $\phi_y(\delta_y)$. Alternatively, the owner can also exaggerate costs with a cost of $\phi_c(\delta_c)$, where δ_c depicts the fabricated costs. The profits of the firm are given by

$$P = y - c(y) - T - \phi_y(\delta_y) - \phi_c(\delta_c), \tag{3}$$

where $c(y)$ depicts the minimum costs needed to reach gross sales y. The tax payment T in a given tax bracket β is determined by

$$T = \tau_\beta(B_\beta - P_\beta) + E, \tag{4}$$

where P_β is the lower income level of the bracket, E depicts other tax payments by the firm and B_β is the tax base. The latter is given by

$$B_\beta = (y - \delta_y) - \alpha\left[c(y) + \delta_c\right]. \tag{5}$$

In this formulation, α denotes the share of costs that are tax deductible. In general, α is strictly between zero and one.

The firm owner maximizes profits (equation (3)) with respect to sales y and the extent of evasion δ_y and δ_c subject to the tax constraint, (4). This yields first-order conditions

$$c'(y) = \frac{1 - \tau_\beta}{1 - \alpha\tau_\beta}$$

$$\phi'_y(\delta_y) = \tau_\beta$$

$$\phi'_c(\delta_c) = \alpha\tau_\beta.$$

In comparison of the case where the firm would not have tax evasion opportunities, the tax evasion implies that the sales of the evading firm are underreported and costs overreported. Since the incentive for evasion is increasing in the tax rate, the evading firms' sales and costs jump at the threshold, compared to those of a firm that truly reports its financial items. This also implies that visual inspection of different financial sheet items for firms just below and above the kink points can reveal if evasion is likely to play

[9] In addition, the owners could try to channel some of their private expenditure to their firm's accounts.

a role in driving the bunching behavior.

We examine this issue in an indirect and descriptive way by presenting the distribution of various variables in profit and loss account and the balance sheet of the firms. This evidence is presented in Figures 7, 8 and 9 for the case of the lower kink in the CIT schedule, the upper kink in the CIT schedule and the VAT notch, respectively. While most of the variables behave quite smoothly across the threshold values, it appears that wages are somewhat greater for firms just below the lower threshold of the CIT kink and the VAT notch. On the other hand, the dip in the size of the firms just below the upper kink in the CIT regime could indicate intertemporal tax planning. It can be the case that owners keep their firms small on purpose to maintain to benefit from the lower tax rate. The sharp pattern in excess bunching around the upper kink points to the same direction. These observations could indicate some evasion behavior, but more careful analysis is required to draw stronger conclusions on the anatomy of responses.

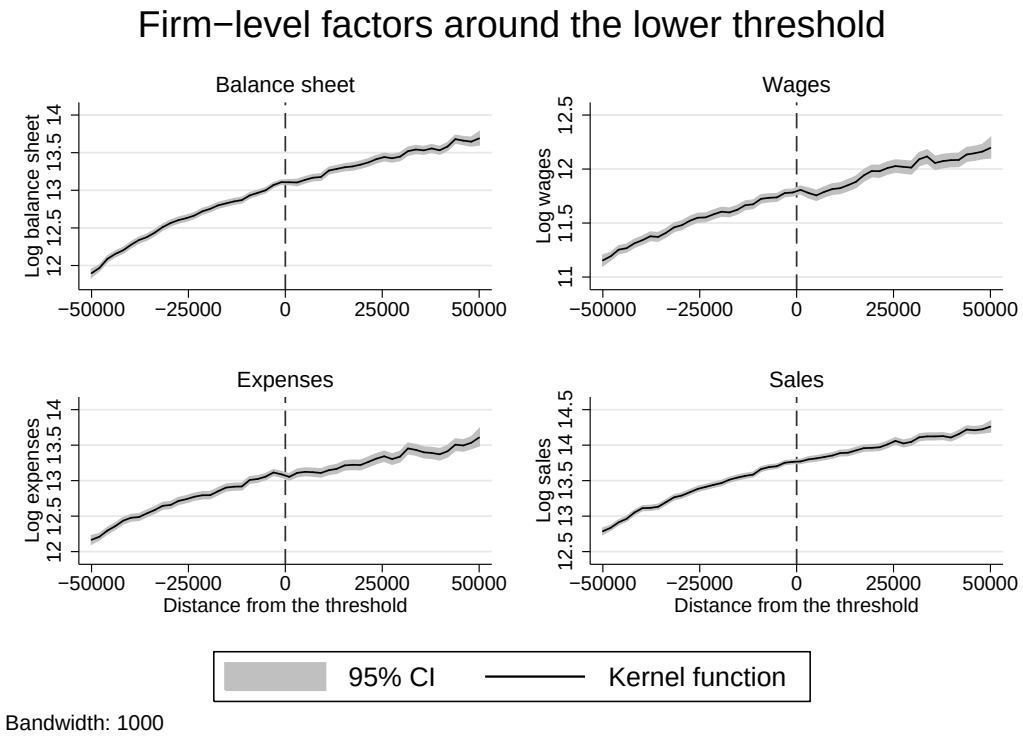

Figure 7: Anatomy of the response around the lower kink in CIT. Source: Authors' calculations based on SARS data.

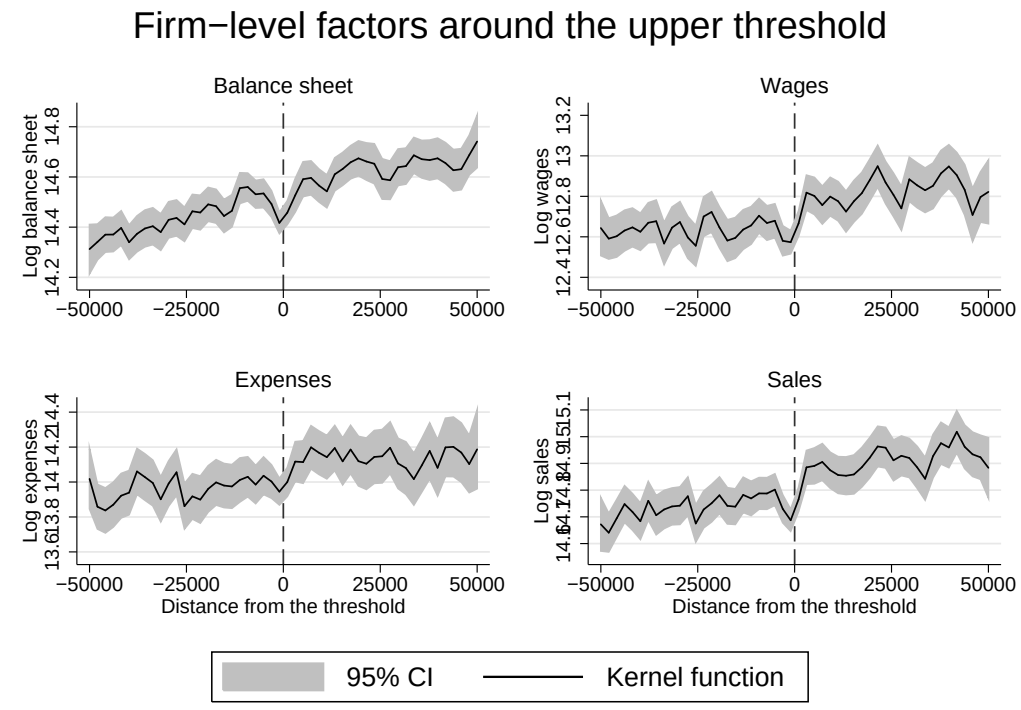

Figure 8: Anatomy of the response around the upper kink in the CIT. Source: Authors' calculations based on SARS data.

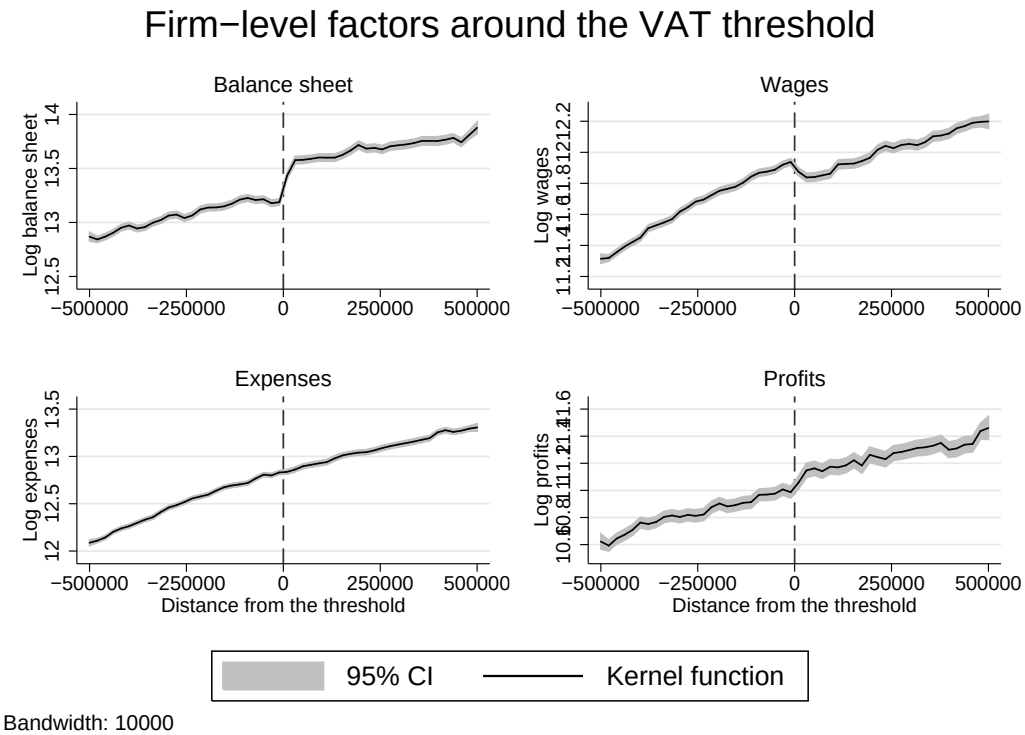

Figure 9: Anatomy of the response around the VAT notch. Source: Authors' calculations based on SARS data.

6.2 Growth effects

We examine the impacts of the threshold levels on firm dynamics in two ways. First, we study the persistence in the likelihood to stay in a same bin over two consecutive years. These results are presented in Figure (10) for the CIT kinks and in the upper panel of Figure (12) for the VAT notch. All these graphs suggest that bunching firms are more 'stuck' in the location of their profits and sales. We also examine the growth rates of firms locating just below and above the threshold levels. This evidence is presented in Figure (11) for the CIT kinks and in the lower panel of Figure (12) for the VAT notch. While the confidence intervals are fairly wide, if anything, these graphs also suggest that firms below the threshold levels grow at a lower pace.

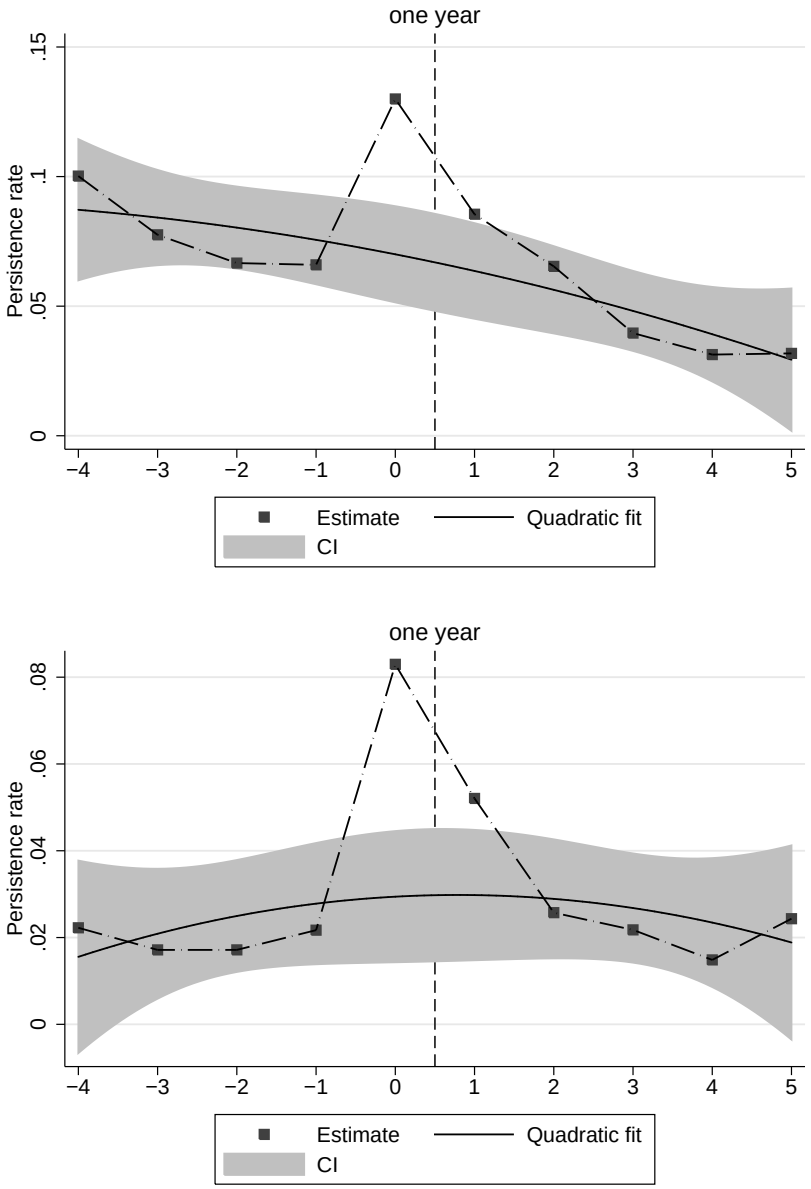

Figure 10: 1-year persistence rates around the lower (above) and upper (below) kink in the CIT. Source: Authors' calculations based on SARS data.

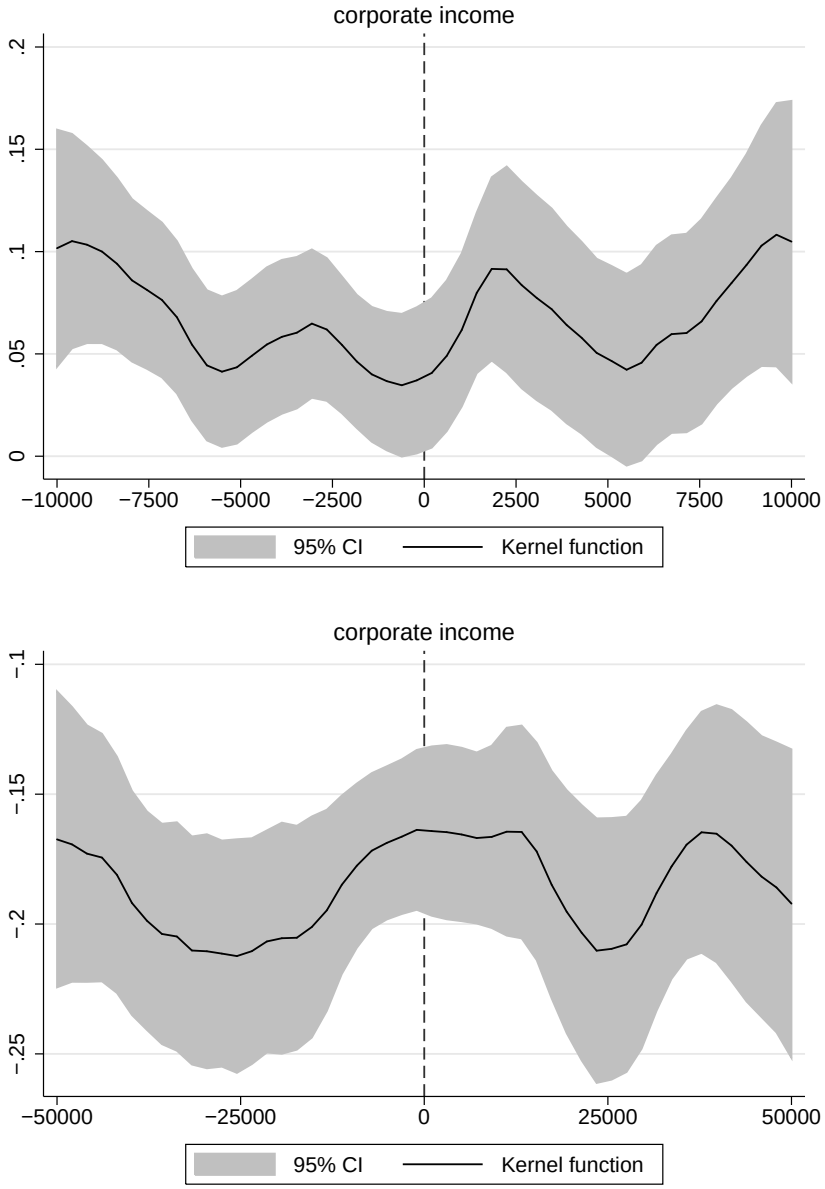

Figure 11: Growth rates around the lower (above) and upper (below) kink in the CIT. Source: Authors' calculations based on SARS data.

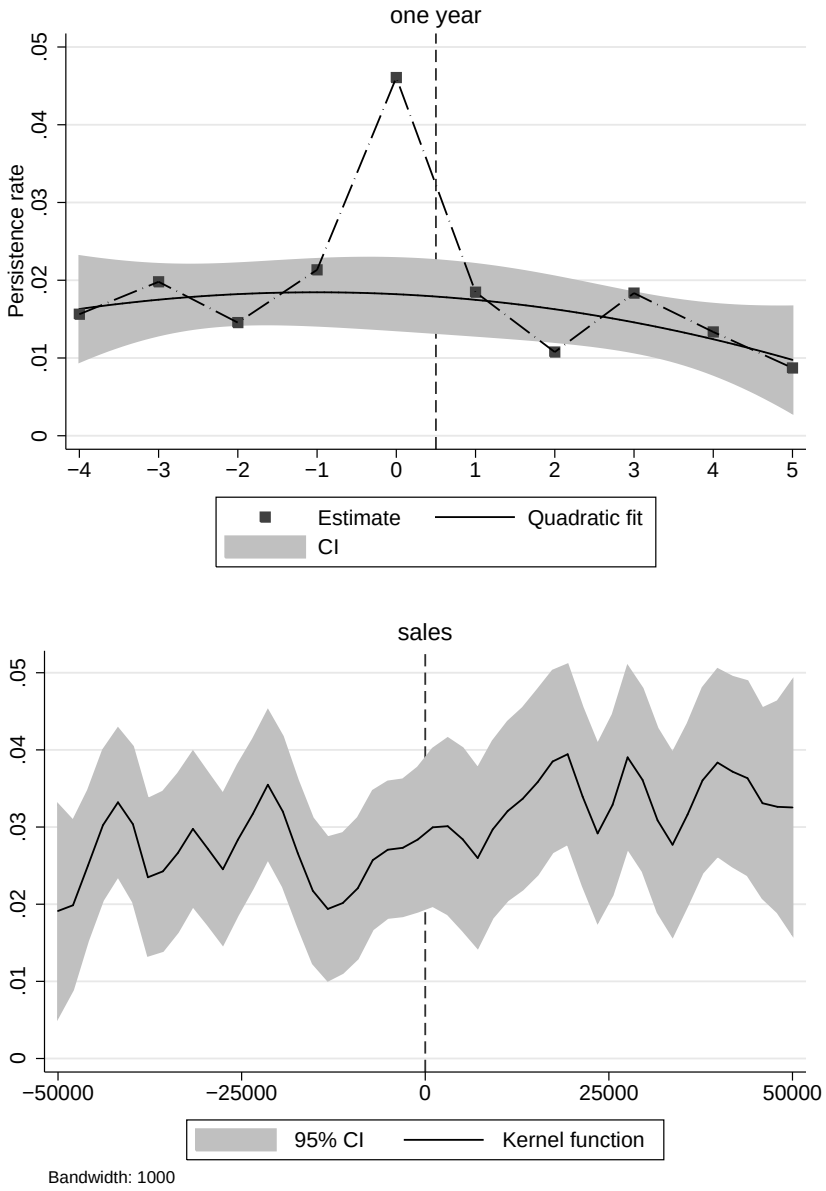

Figure 12: 1-year persistence rates (above) and growth rates (below) around the VAT threshold. Source: Authors' calculations based on SARS data.

7 Conclusions

The paper examined the elasticity of corporate income tax base and the value added to changes in the CIT and VAT rates using population-wider registered data from the South African Revenue Service for years 2010–2103. The results, based on examining the bunching behavior around corporate income and VAT thresholds, show that firms clearly react to these tax incentives. The implied elasticity estimates for the corporate income tax base are very large, which means that the excess burden of the corporate

income tax is considerable. The elasticity of the value added is, in turn, very small. This suggests that optimization frictions of reaching the VAT threshold are much higher than those in adjusting reported profits for the corporate income tax.

Another finding is that firms may use tax evasion strategies to be able to locate just below the threshold points. Finally, the presence of the threshold levels in these size-based tax policies slows down firm growth. This is a cost whose importance needs to be weighed against the potential benefits of supporting small businesses with graduated corporate income tax rate schedules.

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