Firm Response to VAT Registration Threshold in Ethiopia*

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Abstract

A key challenge in the implementation of value-added tax (VAT) is setting an appropriate threshold level of turnover at which firms are obliged to register for the tax because a high threshold lowers tax revenue while a low threshold imposes high compliance costs for both small firms and the government. We analyze the behavior of Ethiopian manufacturing firms around the government implemented VAT threshold of 500,000 Birr ($25000) after the adoption of VAT in 2003. Using bunching estimation techniques, we show the existence of firm bunching around the threshold: bunching firms lower reported revenue by 48,000 Birr in order to avoid registration. This suggested firm response to the threshold can help governments be more informed about how to choose an optimal VAT threshold.

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1 Introduction

Governments often find it difficult to choose the optimal VAT threshold level of turnover at which firms are obliged to register. The reason is that there is an apparent trade-off between VAT regime under a high threshold and that under a low threshold. Because the goal of VAT is to raise revenue from firms under the system, a high threshold compromises that objective. But a low threshold might impose excessive compliance costs on small firms, and overwhelm the tax authorities with administrative costs. Hence choosing the optimal level is crucial in the implementation of VAT. In Uganda, for instance, "the near-failure of the VAT introduced in 1995 was quelled in large part by rapidly increasing the threshold from $20 000 to $50 000" (Keen and Mintz (2004)). But of a key element in setting an appropriate threshold is to understand firm response around the threshold.

This paper analyzes the behavior of Ethiopian manufacturing firms around the government implemented VAT threshold in Ethiopia. Ethiopia introduced VAT in 2003 with threshold level of 500,000 Birr. Using firm level panel data (1996-2009) from Large and Medium Manufacturing Industries Survey, and bunching estimation techniques, we show the existence of firm bunching around the threshold. We find that bunching firms lower reported revenue by 48,000 Birr in order to avoid registration, which is about 9-10% of revenue of firms within the bunching interval. This suggested firm response to the threshold can help governments be more informed about how to choose an optimal VAT threshold.

We use firm level data from Large and Medium Manufacturing Industries Survey conducted annually by Central Statistical Agency of Ethiopia; a data set that covers all regions of the country, and all manufacturing firms with at least 10 employees. Value added taxation was introduced in Ethiopia on January 1st, 2003. As explained earlier, for practicality and applicability of VAT, the government implemented a 500,000 Birr turnover threshold level at which firms are obliged to register. The key features of this threshold are: all firms above this threshold pay a 15% tax rate on value added, and those firms below the threshold pay much lower 2% tax rate on turnover (revenue). Therefore, VAT eligible firms near the threshold might find worthwhile to give up the benefits of reimbursement of input taxes under the VAT regime for the benefits of the much lower tax rate under the turnover regime. So some firms might lower their reported revenue to avoid VAT registration.

To examine firm bunching, we analyze the reported revenue response of firms to a VAT registration threshold. We follow the techniques from the bunching literature (Saez (2010); Chetty et al. (2011); Kleven and Waseem (2013), Almunia and Lopez Rodriguez (2014)). Thus we estimate the degree of bunching around this threshold. The basic bunching procedure to estimate the reaction of firms to the threshold relies on constructing a counterfactual distribution of reported revenue in the absence of a turnover VAT threshold; we then compare it with the observed distribution to compute the excess mass. Therefore, we use

the observed bunching to estimate the magnitude of evasion responses. We find bunching firms reduce their reported revenue by 48,000 Birr in response to the VAT registration threshold. So firms with revenue slightly above the threshold lower their revenue by about 10% to become VAT eligible.

This paper provides empirical contribution to the theoretical work on the optimal level of VAT threshold as developed by Keen and Mintz (2004). They develop a simple rule characterizing the optimal threshold in terms of a trade-off between tax revenues and collection costs: "between the desires to increase tax revenue, reduce administration and compliance costs, and minimize the distortions arising from the differential treatment of firms above and below the threshold." However, the simple rule characterized in their paper (and in general any rule of characterizing the optimal threshold), cannot be applied without empirically knowing firm behavior and response to the threshold. Our paper presents estimates of these responses.

But empirically, our paper is closer to the work on response of firms to eligibility thresholds in Japan by Onji (2009), and to the study on production vs revenue efficiency with limited tax capacity in Pakistan by Best et al. (2014). Onji (2009) documents the behavioral response caused by a tax threshold in Japan, which introduced VAT in 1989. The VAT gave a preferential tax scheme for small businesses, with eligibility for the scheme at or below 500 million yen in revenue. He finds a policy threshold induces firms to restructure their organizations by splitting some of their member corporations. Best et al. (2014) in contrast analyze firms response to minimum tax schemes whereby firms are taxed on either profits or turnover, depending on which tax liability is larger. They show that these schemes create non-standard kink points, which allow for eliciting evasion responses to switches between profit and turnover taxes using a bunching approach. Using administrative tax records on corporations in Pakistan, they estimate that turnover taxes reduce evasion by up to 60-70% of corporate income. They find that switching from profit to turnover taxation increases revenue by 74% without reducing aggregate profits, despite the production inefficiency that it introduces.

It is also important to mention that this paper is related to other works that find evidence of substantial change in firm behavior around "threshold schemes." In effect, Almunia and Lopez Rodriguez (2014) exploit quasi-experimental variation generated by a Large Taxpayers' Unit in Spain, which devotes additional resources to verifying the transactions reported by firms with more than €6 million in reported revenue. They find that firms bunch below this threshold in order to avoid stricter tax enforcement, and this reaction is stronger in sectors where paper trail is easier to monitor. They also that find the marginal bunching firm reduces reported revenue by about 10% of total revenue.

2 VAT Registration Threshold

As mentioned above, to practically implement VAT, governments in general set a VAT registration turnover threshold. Firms above this threshold must register for VAT, and get taxed on value added only: they charge taxes on sales but they can reclaim input taxes. Firms below the threshold, face a lower 2% tax on turnover(revenue) but cannot get reimbursement on input taxes. Countries vary considerably in their threshold level (see Table 1). The table shows some countries set a very high level ($700,000 in Singapore) while other countries have the level set at zero. Some countries set different thresholds for different industries; for example Indonesia has three different thresholds for services, manufacturing, and retail (increasing in this order). Many countries in which the threshold is very low (including Italy and Peru, where it is zero) apply simplified schemes to the smallest traders while other countries allow firms below the threshold to register voluntarily (Keen and Mintz (2004)). There is variation in the thresholds even within the EU: it is set around $115,000 in the United Kingdom and zero in other countries.

In Ethiopia, VAT is applied to all firms with a turnover of more than 500000 Birr. For firms with less than the turnover threshold of 500000 Birr, a much lower 2% flat rate is applied. The law requires any firm with high enough turnover to register for VAT. Turnover tax is levied on services rendered locally. It is intended to be equivalent to VAT for non-VAT-registered entities. Of course, a firm can understate its turnover. However, if, after review by the tax authority, it appears that a person has understated its turnover, the authority will issue an additional assessment. If the books of account are deemed unacceptable by the tax authority, the tax authority shall assess the tax on the basis of information available or on the basis of market price of such good or service in the market. Hence firms will weigh the benefits of underreporting turnover against the costs of detection.

Studies have show that compliance costs of VAT are highly regressive (Abdella and Clifford (2010)): the financial cost to small businesses as a proportion of their turnover is typically between ten and one hundred times greater than the cost to large businesses (for a small business they are typically 3-5 percent of turnover, as compared to 0.1-0.2 percent of turnover for large businesses). This burden affects particularly small businesses because many of them are non-cash-based businesses, and they have to pay the VAT on their sales before their customers pay them. This causes these small business to have severe cash flow problems, which may force some them out of business. This is one of the reasons why some countries allow businesses with turnover below a certain level to opt out of VAT if their turnover is less than a threshold.

But there is no clear practical mechanism that allows the government to determine which business is VAT eligible. The assessment of VAT eligibility is left to business; and in principle they are supposed to self-report. However, there are plenty of firms who remain outside the VAT net even though they VAT eligible. According to Abdella and Clifford (2010), the main reason for qualified firms to not register for VAT in Ethiopia are: fear

of VAT related legal issues, low capacity of firms implement VAT, backward nature of business operations, etc. Hence setting a low VAT registration threshold encourages VAT evasion by exacerbating the potential issues small scale firms face if they register.

While setting a higher threshold might solve the high compliance costs problems of small firms, it might lead to other issues that some registered firms might face. A high threshold may allow firms with significant size to avoid VAT registration. Registered of similar size might perceive this situation as unfair because of potential unequal competition: VAT registered firms pay a higher tax rate. This unequal competition might induce these registered firms to exit the VAT net. Despite this potential problem, it might be desirable for tax authorities to still set a high threshold because of their low fiscal capacity. In countries such as Ethiopia where fiscal administration have limited capacity, the number of firms that have to be handled by the VAT administration can be sharply reduced by setting a high turnover threshold (Keen and Smith (2006)). They also argue that revenue given up by having a high threshold may be small compared to the saving of administration costs to the authorities and compliance costs to the taxpayer, because the potential tax base is commonly very strongly concentrated in the largest companies. And because firms not registered for VAT cannot claim reimbursement from taxes paid on inputs, they essentially pay a non-zero effective rate of tax.

The government implicitly assumes that VAT feasibility and applicability hinges on the fact that VAT registration requirement depends on firm size. Reasons to define a threshold include the costs of compliance with VAT due to small scale, and the optimal balance between a low flat turnover tax and a VAT tax. The wide variation of VAT threshold levels across countries illustrates the lack of agreement of what is the optimal level. This lack of consensus is due to fact that there is no unified theory or empirical results suggesting what the optimal level of threshold should be. Informing about firm behavior around the threshold is a step forward in finding a solution to this problem.

3 Theoretical Framework

Let the firm profit function be denoted by:

$$\Pi = y - mx \tag{1}$$

where y is total revenue (price is assumed to be 1, so y also denotes output); x is intermediate input (which are VAT deductible) and m is its price.

Firms face different type of taxes depending on whether they are registered for VAT or not. If registered, a firm pays $T_v = \tau_v (y - mx)$ where τ_v is the VAT rate. If not registered, the firm pays $T_t = \tau_t y$. An under

reporting firm will minimize total tax liabilities between the VAT and turnover regimes.

$$T(y) = min\left\{\tau_v\left(y - mx\right), \tau_t(y + mx)\right\} \tag{2}$$

So firms switch between VAT tax and turnover tax when:

$$\tau_v\left(y - mx\right) = \tau_t y + \tau_t mx \Leftrightarrow \frac{mx}{y} = \frac{\tau_v - \tau_t}{\tau_v + \tau_t} \tag{3}$$

Thus taxes paid under VAT is greater than taxes paid under turnover when:

$$\frac{mx}{y} \leq \frac{\tau_v - \tau_t}{\tau_v + \tau_t} \tag{4}$$

Without loss of generality, we assume the cost of evasion from underreporting revenue is:

$$c_e = \delta \centerdot (y - \bar{y}) \centerdot \theta \tag{5}$$

where δ is probability of detection, $\bar{y}$ is reported revenue, and θ is the fine imposed by government. Then a firm will under report revenue if equation (4) holds and $\Pi_t - \Pi_v > c_e$. So for firms just above the threshold who underreport revenue to a small amount just to become VAT ineligible, might face a small evasion cost c_e, and thus will under report if:

$$\frac{mx}{y} \leq \frac{\tau_v - \tau_t}{\tau_v + \tau_t} = 0.76 \tag{6}$$

since $\tau_t = 0.02$ while $\tau_v = 0.15$

That is these firms will under report to become VAT ineligible when ratio of inputs to revenue is less than 76%. Now to obtain a measure of firms' behavioral response to the VAT threshold, we use a first-order approximation and relate the number of bunching firms to the change in reported revenue of the marginal buncher, following the bunching methodology by Almunia and Lopez Rodriguez (2014) (first proposed by Saez (2010)). We define the number of bunching firms at the VAT threshold as:

$$B = \int_{y^T}^{y^T + d\bar{y}^S} g_0\left(\bar{y}\right) d\bar{y} \approx g_0\left(y^T\right) d\bar{y}^S \tag{7}$$

where where $g_0\left(y^T\right)$ denotes the height of the density distribution at the threshold level without an implemented VAT threshold; y^T is the VAT threshold level. $d\bar{y}^S$ is the change in reported revenue by the marginal buncher and is interpreted as the length of the interval where the density is zero (measured in 10,000 of Ethiopia, which the range of intervals used in our bunching estimation as we will see later) . This length is also know as the length of the hole in the distribution. From the approximation in equation (7), the bunching estimator can be defined as the ratio of excess bunching over the height of the counterfactual

density at the VAT threshold:

$$b \equiv \frac{B}{g_0\left(y^T\right)} \approx d\bar{y}^S \tag{8}$$

4 Empirical Strategy

We present the empirical procedure to estimate the reported revenue response of firms to a VAT registration threshold. To estimate firm bunching, we follow the techniques from the bunching literature (Saez (2010); Chetty et al. (2011); Kleven and Waseem (2013), Almunia and Lopez Rodriguez (2014)).

To analyze the behavioral response of firms around the turnover threshold, we estimate the degree of bunching around this threshold. So, we compute a counterfactual distribution of reported revenue in the absence of a turnover threshold, and compare it with the observed distribution. We estimate counterfactual density by fitting a flexible polynomial to the empirical density, excluding observations in a range $[z_L, z_U]$ around the threshold point z^*; a range that should correspond to the area affected by bunching responses, which is the area with excess bunching or missing mass. Dividing the data in small bins of width w, we estimate the polynomial regression

$$C_j = \sum_{i=0}^{q} \beta_i \cdot (Z_j)^i + \sum_{i=z_L}^{z_U} \gamma_i \cdot \mathbf{1}\left[Z_j = i\right] + \varepsilon_j \tag{9}$$

where C_j is the number of firms in revenue bin j, Z_j is revenue relative to the kink in 10,000 Birr intervals, q is the order of the polynomial, z_L and z_U are the lower and upper bound of the excluded interval (respectively), and the γ_i are intercept shifters for each of the bins in the excluded interval. Then, using the estimated coefficients from regression (9), we estimate the counterfactual distribution of reported revenue:

$$\hat{C}_j = \sum_{i=0}^{q} \hat{\beta}_i \cdot (Z_j)^i \tag{10}$$

We can estimate the excess bunching mass to the left of the threshold (B_n) and the missing mass to the right of the threshold (H_n) by comparing the counterfactual density to the observed distribution. Thus the excess mass to the left and the missing mass to the right are:

$$\hat{B}_n = \sum_{i=z_L}^{z_U} \left(C_j - \hat{C}_j\right) \qquad and \qquad \hat{H}_n = \sum_{i=z_L}^{z_U} \left(\hat{C}_j - C_j\right) \tag{11}$$

But for this estimation to be valid, the constraint that the area under the counterfactual must equal the area under the empirical distribution must hold. This is equivalent to saying that the missing mass (to the

left) created by bunching responses must be equal to the bunching mass (to the right). Hence the condition $\hat{B}_n = \hat{H}_n$ must hold, and thus the optimization requires us to define the excluded range $[z_L, z_U]$ such that this condition is satisfied. The lower bound z_L can be visually located and thus defined. But determining z_U is harder because the missing mass above a threshold is a more diffuse phenomenon occurring over a larger range, and hence the upper bound cannot be determined visually. To pin down z_L, we exploit the condition that $\hat{B}_n = \hat{H}_n$. An initial estimate of $\hat{C}_j$ starts with a low value of $z_L \simeq z*$; the upper bound is increased in small increments and the counterfactual reestimated every time until the bunching and missing mass converge:$\hat{B}_n = \hat{H}_n$. Now we can define our empirical estimate of b as the excess mass around the kink relative to the average density of the counterfactual earnings:

$$b = \frac{\hat{B}_n}{\left[\dfrac{1}{1 + (z_U - z_L)/w}\right] \sum_{j=z_L}^{z^*} \hat{\beta}_i \cdot (Z_j)^i} \tag{12}$$

where $\dfrac{1}{1 + (z_U - z_L)/w}$ is the number of excluded bins below the threshold.

The estimation procedure is done using the utility program in Chetty et al. (2011) (bunch_count.ado was written by Tore Olsen). Standard error for the estimate of excess mass $\hat{b}$ is caculated using a parametric bootstrap procedure. Before estimating the bunching, figures 1 and 2, visually suggest the existence of bunching after VAT law passed and a threshold was implemented.

5 Data

My analysis is based on firm level panel data from Ethiopia covering all regions of the country from 1996 to 2009. More precisely, the data is from Large and Medium Manufacturing Industries Survey conducted annually by Central Statistical Agency of Ethiopia. Manufacturing is defined, according to International Standard Industrial Classification as "the physical or chemical transformation of materials or components into new products, wether the work is driven by power driven machines or by hand, whether it is done in factory or in the worker's home, or whether the products are sold at wholesale or retail. The assembly of the components parts of manufacturing products is also considered as manufacturing activities." The scope of the LMMIS is confined to those manufacturing establishments which engage ten persons or above, use power driven machinery, and covers both private and public industries in all regions of the country, where establishments under the scope of the survey are found. The dataset contains an unbalanced panel of manufacturing firms at the 4-digit level. The data covers 44 industries with an average of 1000 firms per year with 623 in 1996 and 1,948 in 2009. The level of observation is at the firm level.

Firms pay mainly indirect taxes, and profit taxes. Before 2003, indirect taxes are sales taxes levied on turnover (revenue). After 2003, indirect taxes are value added taxes for VAT registered firms and turnover taxes for small firms. Profit taxes are tax levied on profit and are usually lower than the other taxes. Revenue is the firm's total sale value. The VAT registration threshold is based on turnover defined as revenue and is fixed at 500, 000 Birr. For registered firms, a 15% VAT tax is levied on locally produced goods at the manufacturing level or on imported goods. There is a refund for input taxes paid on raw materials used in the production of local goods, except for pure alcohol used as raw material. The tax is payable monthly and is due no later than the end of the following month. For non-registered firms, a 2% rate is levied on goods and servies rendered locally.

6 Results

We present the bunching estimates described in section 4. Remember the bunching estimate was defined as the ratio of excess bunching over the height of the counterfactual density at the VAT threshold: $b \approx d\bar{y}^S$.

We find evidence of firm bunching around the VAT revenue registration threshold. Figure 3 shows the counterfactual and empirical distributions of reported revenue overlaid. Revenue is normalized around 500000 Birr[1], which is the VAT revenue registration threshold. The figure shows spike around the threshold, illustrating a possible bunching. The number of bunching firms as computed from equation (11) is 134 (see Table 2). From our estimation procedure 4, we obtain a bunching estimate of $b = 4.80$ with a bootstrapped standard error of $b_{se} = 2.15$. The null hypothesis that there is no excess mass at the kink relative to the counterfactual distribution is rejected with a $p-value = 0.025$. Because the reported response is $b \times binwidth$, the bunching estimate implies that marginal bunching firms reduce their reported revenue by 48,000 Birr in response to the VAT registration threshold (bins were split into 10,000 Birr intervals). So some firms with revenue slightly above the threshold lower their revenue by about 9-10% to become VAT ineligible.

To check the robustness of our results, we also estimate potential firm bunching around the threshold before VAT was adopted. Figure 4 and Figure 5 shows the counterfactual and empirical distributions of reported revenue overlaid (excluding and including the year 2002). Both figures show negative bunching. From Table 2, we obtain a bunching estimate of $b = -1.88$ with a bootstrapped standard error of $b_{se} = 1.53$, $b = -0.76$ with a bootstrapped standard error of $b_{se} = 1.57$. The null hypothesis that there is no excess mass at the kink relative to the counterfactual distribution is not rejected in both cases. We find no bunching before 2003 when VAT was introduced, which suggest the VAT threshold created the bunching. Finally, when firms are divided into firms with high ratio and low ratio of inputs to revenue, we find a lower bunching estimate for high input firms (even though the estimates are not significant). These results suggest high input

[1]for estimation functionality, the normalization is around 510000Birr

firms have less incentive to bunch which is consistent with the fact that taxes on inputs are reimbursable under VAT. The existence of bunching shown above might be due to two non-exclusive factors: tax evasion and size efficiency.

On the one hand, the bunching might be to due to tax evasion because the low turnover tax might much more attractive than the VAT for firms just above the threshold. These type of firms weigh benefits of VAT from productive efficiency and lower inputs taxes against the low turnover tax after taking into account the potentially low evasion cost around the margin. On the other hand, because of market effects from the policy change, it is possible that firms around the threshold may optimally decrease their size. If firms maximize profits, then they optimally choose the level and mix of inputs, and the level of output to produce given market prices (assuming competition). If firm are registered can reclaim taxes paid inputs whereas if they are not they benefit from the low turnover tax on output. Therefore there might an equilibrium, where the optimal output is just below the VAT registration threshold. We believe the former reason is why firms bunch, but it is not in the scope of this paper to determine whether it is the case [2].

7 Conclusion

This lack of consensus on the optimal VAT threshold is due to fact that there is no unified theory or empirical results that suggest what the optimal level should be. Informing about firm behavior around the threshold is step forward in finding a solution to this problem because a key challenge in the implemention of value-added taxation is setting an appropriate threshold level of turnover at which firms are obliged to register for the tax. The main reason is a high threshold level lowers tax revenue while a low threshold imposes high compliance costs for both small firms and the government. This paper analyzes the behavior of Ethiopian manufacturing firms around the government implemented VAT threshold after the adoption of VAT in 2003. Using bunching estimation techniques, we show the existence of firm bunching around the threshold: marginal bunching firms lower reported revenue by 48,000 Birr in order to avoid registration. This suggested firm response to the threshold can help governments be more informed about how to choose an optimal VAT threshold.

The next step is to estimate elasticities of taxable income at the threshold and at different counterfactual thresholds. The goal is to elicit the size of the tradeoff for different threshold levels; this analysis will hopefully lead towards the empirical determination of the optimal VAT registration threshold under certain conditions.

[2] Ongoing project

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Table 1: VAT thresholds in selected countries

Table 1
VAT thresholds[a] in selected countries (in US$)

Albania	32 000
Austria	8300
Barbados	30 000
Benin	80 000
Burkina Faso	25 800 (services)
	86 000 (other)
Canada	25 000
China	121 000 (production)
	217 000 (distribution)
Cote d'Ivoire	50 000 (services)
	25 000 (other)
Croatia	8000
Denmark	1560
Egypt	16 000
France	17 800
Germany	60 000
Greece	900 (services)
	700 (other)
Indonesia	51 200 (services)
	103 000 (manufacturing)
	430 000 (retailers)
Italy	Nil[b]
Japan	269 000[c]
Latvia	18 000
New Zealand	15 000
Netherlands	Nil[d]
Niger	16 700 (other)
	50 000 (services)
Peru	Nil[e]
Senegal	180 000
Spain	Nil[f]
Singapore	710 000
Sweden	Nil[g]
Togo	40 000 (services)
	60 000 (other)
UK	82 800
Zambia	33 000

Sources: Miscellaneous tax guides; H.M. Customs & Excise (1998); OECD (1994); Oldman and Schenk (1995).

[a] Figures shown are levels of turnover at which registration is compulsory.

[b] Administrative simplifications are available, depending on turnover. In 1992, some reduction in liability (by a factor dependent on activity) was also available for those with turnover under L 18 million.

[c] Businesses with annual sales of less than 30 million yen are exempt; the liability of those with sales between 30 and 50 million yen is reduced by the fraction $(50 - Y)/20$, where Y denotes actual sales.

[d] Unincorporated firms whose liability is less than Gld 2173 are exempt. Liabilities between Gld 2173 and Gld 4150 are reduced by a proportion that decreases with the extent of that liability.

[e] A simplified system (replacing VAT and income tax) is available for those with turnover under US $4000.

[f] Those with turnover below 50 million Ptas are taxed under a presumptive scheme, liability depending on line of business, size of premises etc.

[g] Those with turnover below SKr 30 000 are exempt; those with turnover between SKr 30 000 and 1 million do not submit VAT returns but declare on their income tax returns.

Notes: Graph taken from Keen and Mintz (2004)

Table 2: Bunching Estimation

	Bunching Estimator ($\hat{b}$)	Number Bunchers (B)
Post VAT	4.80**	134
	(2.15)	
Pre-VAT	-0.76	-48
	(1.57)	
Pre-VAT	-1.88	-37
Excluding 2002	(1.53)	

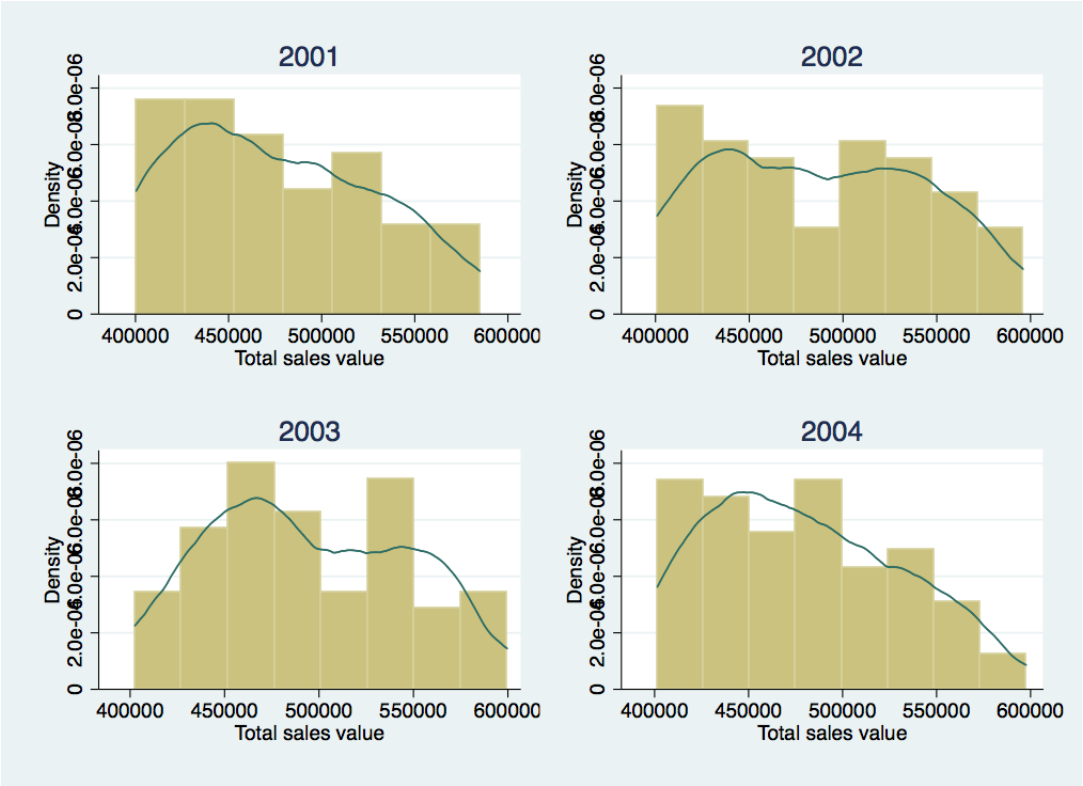
Notes: Table shows estimates of excess mass before and after the VAT policy. *** indicate significance at the 1% level, **at the 5% level, and * at the 10% level. Standard errors are in parenthesis. B is the number of bunching firms, and $\hat{b}$ is the bunching estimate. The results indicated the marginal bunching firm lowers reported revenue by 48000 Birr.

Table 3: Bunching Estimation

	Bunching Estimator ($\hat{b}$)	Number Bunchers (B)
Post VAT: Firms with Ratio	4.45	40
of Input to Revenue < 0.68	(5.08)	
Post VAT: Firms with Ratio	5.68	40
of Input to Revenue > 0.40	(5.99)	

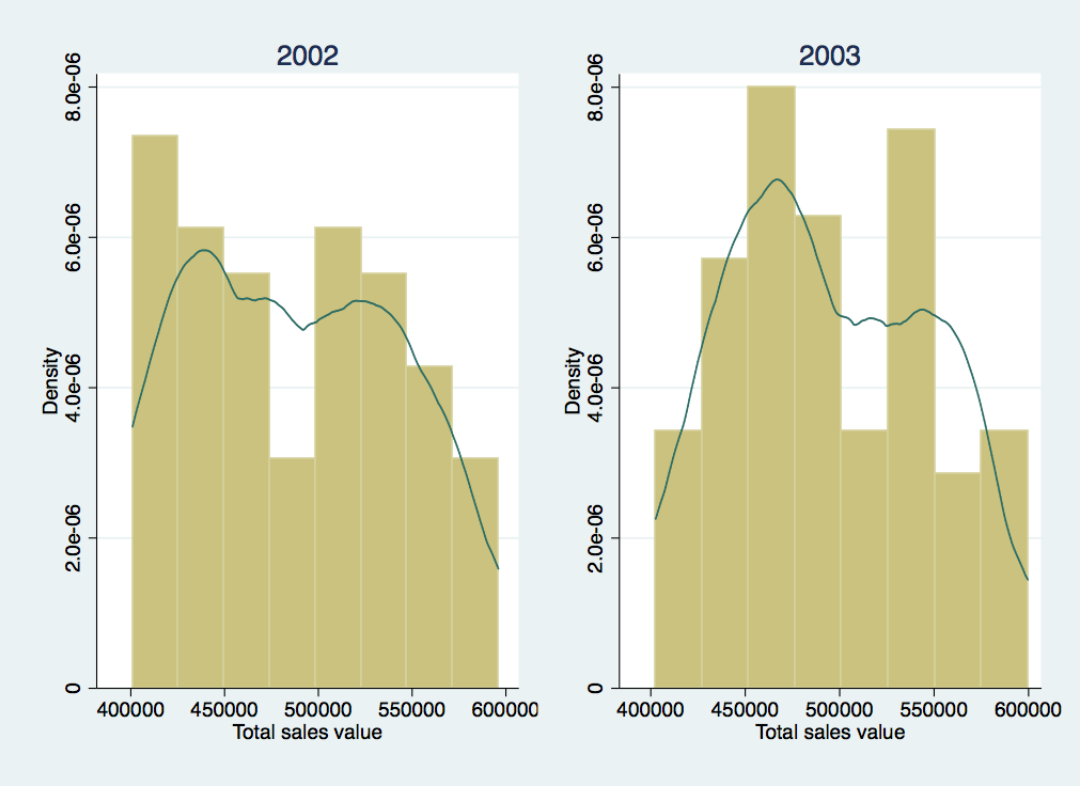
Notes: Table shows estimates of excess mass before and after the VAT policy. *** indicate significance at the 1% level, **at the 5% level, and * at the 10% level. Standard errors are in parenthesis. B is the number of bunching firms, and $\hat{b}$ is the bunching estimate. The estimates are not statistically significant.

Figure 1: Histogram Showing Density Around VAT Eligibility Threshold (500000 Birr)



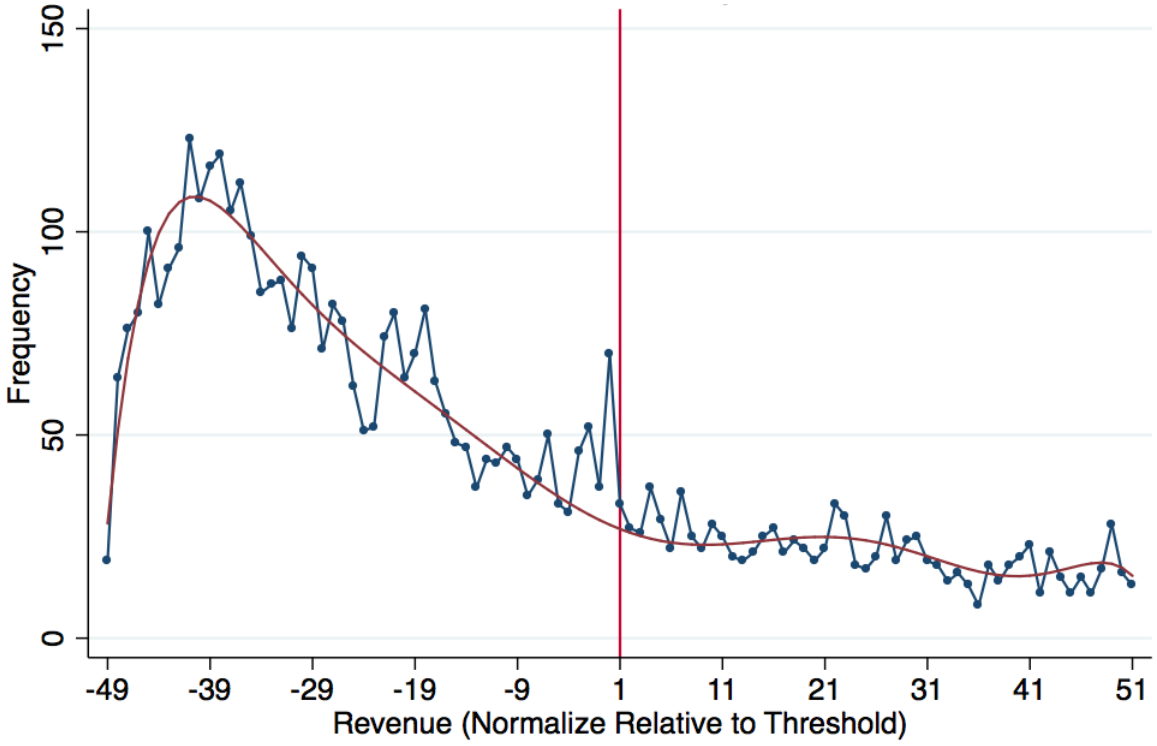
Notes: Histogram showing density around the 500000 Birr VAT eligibility threshold for year: 2001, 2002, 2003, 2004. VAT was implemented in January 2003.

Figure 2: Histogram Showing Density Around VAT Eligibility Threshold (500000 Birr) Right Before and After VAT Policy



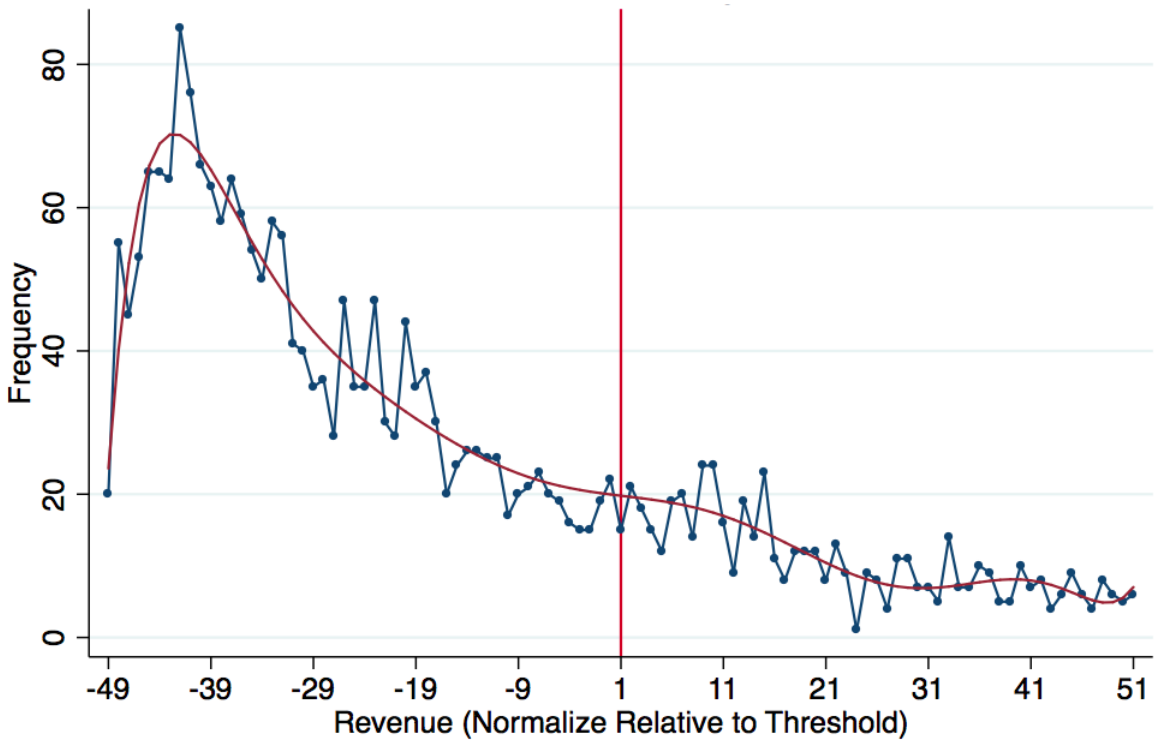
Notes: Histogram showing density around the 500000 Birr VAT eligibility threshold for year:2002, 2003. VAT was implemented in January 2003.

Figure 3: Comparing Empirical and Counterfactual Distributions of Reported Revenue After VAT Implementation



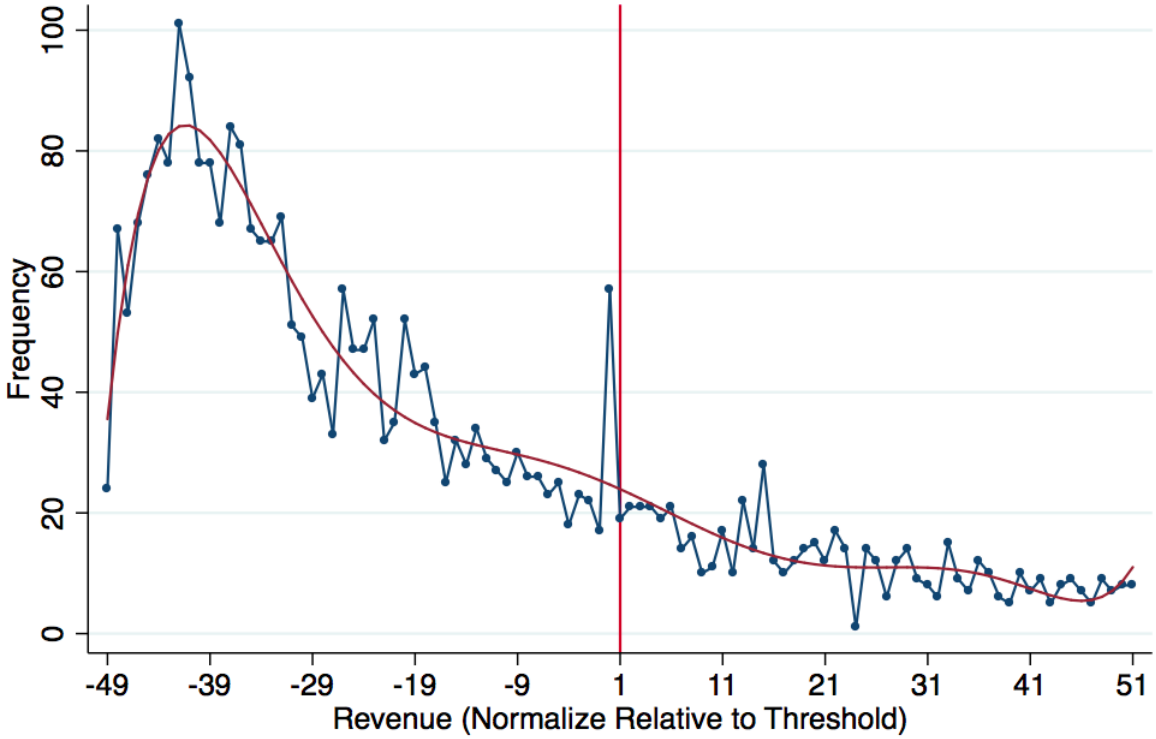
Notes: Graph comparing empirical and counterfactual distributions of reported revenue after VAT implementation. The counterfactual distribution is the smooth curve. The empirical distribution show bunching around the normalized VAT eligibility threshold. Revenue bins are in 10,000 Birr. The estimated excess mass is $b = 4.80$ with standard error $b_{se} = 2.15$. The results indicated the marginal bunching firm lowers reported revenue by 48000 Birr, which is about 9.6% of the VAT threshold revenue.

Figure 4: Comparing Empirical and Counterfactual Distributions of Reported Revenue Before VAT Implementation: Not including 2002



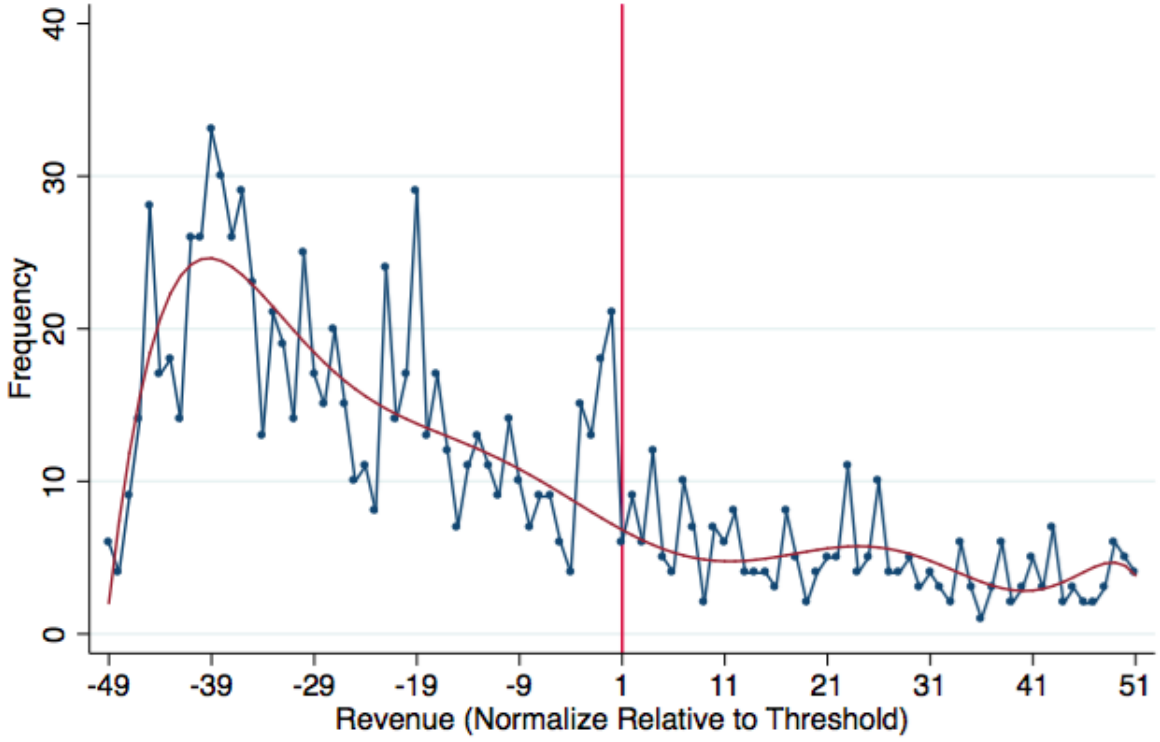
Notes: Graph comparing empirical and counterfactual distributions of reported revenue after VAT implementation. The counterfactual distribution is the smooth curve. The empirical distribution show bunching around the normalized VAT eligibility threshold. Revenue bins are in 10,000 Birr. The estimated excess mass is $b = -1.88$ with standard error $b_{se} = 1.53$. There is no evidence of bunching.

Figure 5: Comparing Empirical and Counterfactual Distributions of Reported Revenue Before VAT Implementation



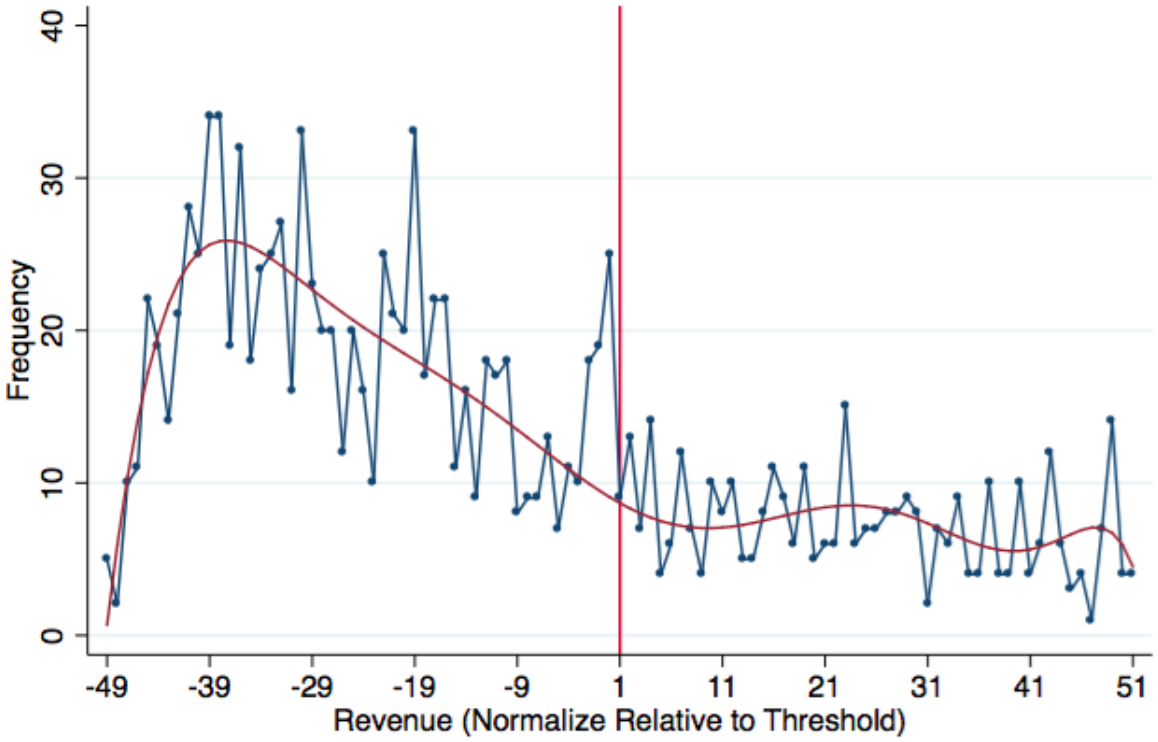
Notes: Graph comparing empirical and counterfactual distributions of reported revenue after VAT implementation. The counterfactual distribution is the smooth curve. The empirical distribution show bunching around the normalized VAT eligibility threshold. Revenue bins are in 10,000 Birr. The estimated excess mass is $b = -0.76$ with standard error $b_{se} = 1.57$. There is no evidence of bunching.

Figure 6: Post VAT Bunching: Firms with Ratio of Input to Revenue < 0.68



Notes: Graph comparing empirical and counterfactual distributions of reported revenue after VAT implementation. The counterfactual distribution is the smooth curve. The empirical distribution show bunching around the normalized VAT eligibility threshold. Revenue bins are in 10,000 Birr. The estimated excess mass is $b = 4.45$ with standard error $b_{se} = 5.08$.

Figure 7: Post VAT Bunching: Firms with Ratio of Input to Revenue > 0.40



Notes: Graph comparing empirical and counterfactual distributions of reported revenue after VAT implementation. The counterfactual distribution is the smooth curve. The empirical distribution show bunching around the normalized VAT eligibility threshold. Revenue bins are in 10,000 Birr. The estimated excess mass is $b = 5.68$ with standard error $b_{se} = 5.99$.