Compliance costs vs. tax incentives: why small firms respond to size-based regulations?*

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Abstract

This paper studies the mechanisms behind the responses of small firms to size-dependent regulation. We exploit the value-added tax (VAT) exemption threshold in Finland. Both tax incentives (remitted VAT) and compliance costs (frequent filing of VAT reports, understanding the VAT system etc.) change at this sales-based threshold in a discontinuous manner. We utilize variation in both the VAT rate and reporting requirements to provide evidence that the large observed output response is caused by the compliance costs of VAT reporting rather than the level of the tax rate, highlighting the key role of compliance costs among small firms and entrepreneurs.

Keywords: compliance costs; value-added tax; firm behavior

JEL classification codes: D22; H25; H32; L11

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1 Introduction

Various size-dependent regulations and exemption thresholds are commonly applied to firms and entrepreneurs. As a prime example, these rules are apparent in many tax systems. The main issue with these types of regulations is that they create undesired incentives for firms to avoid exceeding the threshold, due to increased tax burden or reporting requirements above it. Various studies show that firms respond actively to these types of incentives (Best *et al.* 2015; Kleven and Waseem 2013; Garicano *et al.* 2016). However, particularly for small firms and entrepreneurs there is only limited evidence of the underlying drivers of responses, thus limiting the scope for applicable policy recommendations. Knowledge of the impact of regulation among these firms is increasingly important, as the emergence of small service sector firms and entrepreneurs in the gig economy (Uber/Lyft drivers, Airbnb suppliers etc.) is likely to continue (see, e.g. Katz and Grueger (2016), and Zervas *et al.* (2016)).

In this paper, we provide new micro-level empirical evidence of why small firms respond to size-based regulation. We focus on the role of compliance costs related to reporting practices and understanding the tax system in explaining observed responses. These types of costs are likely to be particularly relevant for entrepreneurs and small firms, potentially even more so than taxes paid. This is the first study that distinguishes between the compliance cost and tax rate responses of small firms utilizing quasi-experimental variation, providing estimates for both the amount of compliance costs of firms and the tax rate elasticity.

We exploit the value-added tax (VAT) threshold to provide evidence of the underlying mechanisms behind firm responses. The VAT is the most common consumption tax system in the world, and most VAT systems include various sales exemption thresholds for small firms.[1] In Finland, firms with annual sales less than 8,500 euros are not required to report and remit VAT. Therefore, both tax incentives (remitted VAT) and compliance costs (accounting costs and frequent filing of VAT reports, understanding the VAT system etc.) change at the threshold in a discontinuous manner, creating incentives for firms not to exceed it. Reforms in both the VAT rate and VAT reporting requirements provide us compelling variation to study whether the responses are caused by tax incentives or compliance costs.

We utilize high-quality administrative data on all Finnish firms and their owners for 2000–2015. We use the bunching methodology (Saez 2010; Kleven and Waseem 2013) to study firm responses to the VAT threshold. The bunching method utilizes the excess mass in the sales distribution at the threshold to infer the extent of the behavioral response caused by it. Using the bunching approach, we obtain visually clear and convincing reduced-form

[1] For example, in the EU countries, the VAT exemption thresholds vary between 0-100,000 euros. Half of the EU countries apply thresholds below 25,000 euros, including e.g. Germany, Belgium and Denmark.

evidence, and estimates that can deliver relevant behavioral parameters (Kleven 2016).

As our main result, we find that the large observed response to the VAT threshold is caused by the compliance costs of VAT reporting rather than the level of the tax rate. We utilize various sources of variation in tax incentives and compliance costs to distinguish between these mechanisms. Before 2004, the average VAT rate featured a sharp and discontinuous jump if a firm's sales exceeded the threshold, as firms above the threshold owed full VAT on all value added. In 2004, Finland introduced a VAT relief scheme in which the average tax rate increases only gradually above the threshold. This led to a drastic reduction in remitted VAT for small firms in the neighborhood of the threshold.

Compliance costs of VAT reporting reduced in Finland in 2010 in two ways. After 2010, small firms with annual sales below 25,000 euros are required to file a VAT report annually, in contrast to monthly reporting before 2010. In addition, VAT relief can be obtained by simply ticking a box in the regular VAT form, instead of filing a separate tax form before 2010.

Surprisingly, we do not find any significant changes in observed behavior after the drastic drop in the VAT rate at the threshold in 2004, nor between similar industries that faced different changes in VAT rates over time. In contrast, the excess mass below the threshold decreased sharply when compliance costs were reduced in 2010. In addition, we observe a sharp increase in voluntary VAT registration when compliance costs were reduced. Therefore, our results strongly indicate that compliance costs are the key factor in explaining the observed behavior.

Building up on Kleven and Waseem (2013), we develop a structural framework for entrepreneurs that accounts for both tax incentives and compliance costs. With this model, we can recover estimates of tax rate elasticity and compliance costs. Using the estimates of behavioral responses at the threshold we find that the tax elasticity estimate is very small, 0.016, and the amount of compliance costs is large, as much as 19% of the value added at the threshold (1,300 euros). This highlights the importance of taking compliance costs into account when analyzing the behavior of small firms and entrepreneurs, as their impact can be much larger than remitted taxes. From a broader policy perspective, our results imply that reducing compliance costs by, for example, simplifying or reducing reporting procedures can significantly alleviate the distortions caused by size-based regulation among small firms, in contrast to changes in tax rates.

In addition, we provide new evidence of the growth barriers of small firms. The VAT threshold could hinder the growth of small firms if they avoid exceeding the threshold for a prolonged period of time. We find that the threshold induces a negative growth effect, particularly among low-income service sector entrepreneurs. However, we find that this

effect almost vanished when compliance costs were reduced. Furthermore, we find no direct evidence of systematic misreporting of sales or inputs, or tax avoidance in terms of owners splitting larger firms into smaller entities. Therefore, we interpret that small firms mainly respond by scaling down real output and economic activity.

This paper contributes to several branches of literature. Our results add to the empirical literature examining the effects of different size-based rules and regulations on firm behavior. Best *et al.* (2015) observe that firms bunch sharply at the kink point that separates the turnover and profit tax regimes in Pakistan. They utilize variation in incentives over time and across firms to show that, unlike our results, the observed behavior is mainly driven by tax evasion in a developing country context. In addition, Kleven and Waseem (2013) find that the self-employed respond actively to the personal income tax notches in Pakistan. For larger firms, Garicano *et al.* (2016) and Gourio and Roys (2014) examine the effects of an employee threshold (50 pers.) in France above which many types of costs and regulations are increased and tightened (e.g. the payroll tax rate and firing costs). Both of these papers find that this threshold clearly affects the firm-size distribution and the productivity of firms. Almunia and Lopez-Rodriguez (2018) find that large firms avoid stricter enforcement by bunching just below a tax enforcement threshold in Spain. In contrast, they do not find any bunching at a corporate tax rate kink point, which provides suggestive evidence that firms respond more to regulatory thresholds compared to discontinuous changes in tax incentives.

Our paper also adds to the literature on compliance costs of taxes. For example, Chetty *et al.* (2009) show that the salience of sales tax rates is an important element in explaining behavioral responses among consumers. Benzarti (2017) studies the amount of hassle costs related to tax filing using register data on US income tax returns. He finds that these costs, approximately 650 US dollars on average, are much larger than previous estimates suggest. We contribute to this literature by showing that compliance costs are also highly relevant for small firms and entrepreneurs. In addition, we contribute to the emerging literature studying the mechanisms behind tax responsiveness of individuals and firms (see, e.g. Gelber *et al.* 2016, and Benzarti *et al.* (2017)).

Despite the widespread application of VAT thresholds, only a few previous papers study the effects of these thresholds. Keen and Mintz (2004) and Kanbur and Keen (2014) show that the optimal VAT threshold depends on, for example, administrative and compliance costs, and the extent to which firms respond to the threshold. We contribute to this literature by applying quasi-experimental estimates on behavioral responses to evaluate the optimal threshold. We find that the optimal VAT threshold in Finland is approximately 30,000 euros, which is three times larger than the current threshold.

The existing empirical literature has focused on VAT thresholds for larger firms. Onji

(2009) was the first to detect clear effects of a VAT threshold (approx. 3,3 million US dollars) on the distribution of firms in Japan, showing that large firms responded to the VAT threshold by splitting into smaller entities, which reflects clear tax avoidance behavior. Liu *et al.* (2017) show that firms in the UK bunch actively at the relatively large VAT threshold (100,000 euros), and discuss the mechanisms behind voluntary VAT registration. In contrast, Asatryan and Peichl (2016) find no responses to the VAT threshold in Armenia (150,000e), but find that firms respond to other regulative thresholds. We contribute to this literature by carefully examining the mechanisms behind the observed responses, and by analyzing the effects of the threshold among small firms.

This paper proceeds as follows: Section 2 describes the VAT threshold in Finland and the data we use. Section 3 presents the theoretical model and estimation strategy, and Section 4 presents the results. Section 5 concludes the study.

2 Institutions and data

2.1 Value-added taxation

Most developed countries use value-added tax (VAT) as their primary consumption tax system.[2] VAT is usually a broadly based tax assessed on the value added to goods and services. The VAT assessment process is the following: each trader in the chain of supply charges VAT on their sales. Individual firms are entitled to deduct the VAT paid on inputs from this amount. VAT is remitted to the tax authorities by the seller of the goods and services.

The standard VAT rate in Finland is 24% in 2018. The standard rate applies to most goods and services. Finland uses two reduced VAT rates: a 14% rate is applied to e.g. food and restaurant services, and 10% is applied to e.g. books and pharmaceuticals.[3] Some goods and services are exempt from VAT. These include financial and insurance activities, letting and operation of dwellings, education, health services and social work activities. Firms that

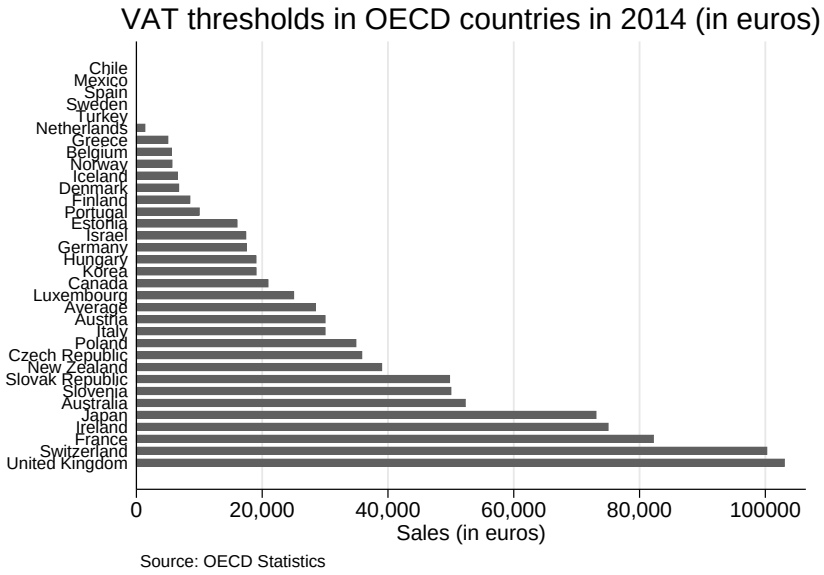
[2]VAT is an important source of tax revenue in many countries. In Finland, VAT accounts for approximately one third of all tax revenue. Among OECD countries, almost one fifth of tax revenue is collected from VAT.

[3]Until 2010, the standard VAT rate was 22% in Finland. The standard VAT rate was increased to 23% in 2010, and to 24% in 2013. The first reduced rate was 17% until 2009. It was decreased to 12% in 2009, and increased to 13% in 2010 and to 14% in 2013. The second reduced rate was 8% until 2010, and it was increased to 9% in 2010 and to 10% in 2013. Finland, as a member of the European Union (EU), applies the general EU VAT legislation (European Commission 2006a). All members of the EU apply a standard VAT rate of at least 15%. The EU allows member countries to use a maximum of two reduced VAT rates for specific products, services and labor-intensive industries, such as food, pharmaceuticals and hairdresser services (European Commission 2006b).

sell solely these goods or services are not liable to register for VAT in Finland.

2.2 VAT threshold

In many VAT systems, firms with annual sales below a certain predetermined threshold are not required to remit VAT and report sales and inputs subject to VAT to the tax authority. Figure 1 shows these annual sales thresholds in the OECD countries in 2014. The figure highlights that the thresholds vary considerably across countries. Some countries levy VAT on all sales without a specified VAT threshold (e.g. Sweden and Turkey), and some countries apply relatively high thresholds around 100,000 euros (e.g. Switzerland and the UK). A notable share of countries apply a relatively low threshold between 0-20,000 euros of annual sales, including e.g. Germany and Canada.



Notes: Figure presents the VAT thresholds applied in the OECD countries in 2014 (in euros). Data source: OECD Statistics.

Figure 1: Annual VAT exemption thresholds in OECD countries in 2014

In Finland, the VAT threshold for firms was 8,500 euros of annual sales in 1995–2015.[4] The threshold has remained constant from 1995 in nominal terms, although it was recently increased to 10,000 euros in 2016. Even though small firms below the threshold are exempt from VAT in Finland, they need to report their overall sales for income tax purposes. Therefore, we have reliable data on the annual sales of firms below the threshold, as this information is reported to the tax administration. The VAT threshold is not connected to

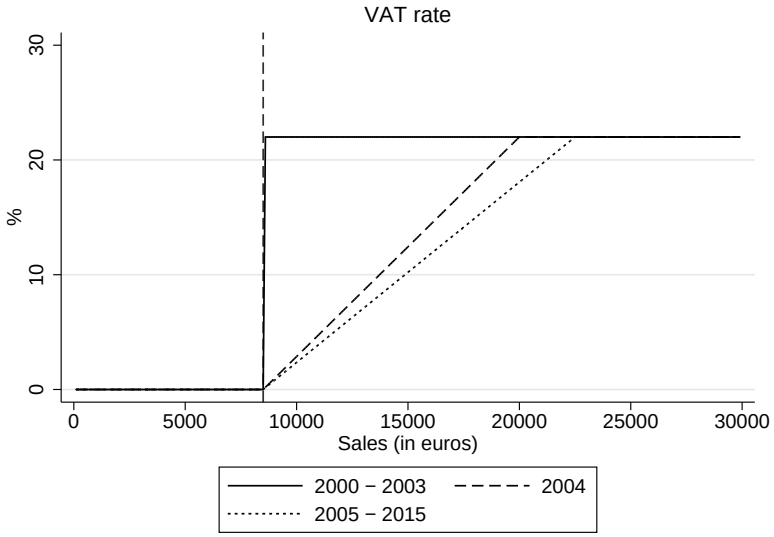
[4]Note that in January 2002, Finland replaced the Finnish mark with the euro as its official currency. Before 2002, the threshold was 50,000 Finnish marks, which was equivalent to 8,500 euros.

any other regulation, such as employer social security contribution rates or the right to claim individual-level unemployment benefits.

Below we describe the main details related to the VAT threshold in Finland. We focus on recent policy changes that affected both the size of tax incentives (remitted VAT) and compliance costs. We utilize this variation in our main analysis when studying the mechanisms behind observed firm behavior.

Tax incentives at the threshold. Before 2004, firms that exceeded the threshold owed VAT on all value added. This included value added on sales below the threshold. Therefore, exceeding the VAT threshold created a notable jump in VAT liability and the average VAT rate. In 2004, Finland changed its VAT system by introducing a VAT relief scheme. The VAT relief reduces remitted VAT such that the average VAT rate increases only gradually above the threshold, compared to a sharp discontinuous jump in the average VAT rate before. The VAT relief scheme was applied to firms with annual sales below 20,000 euros in 2004, and the relief was extended to firms with sales below 22,500 in 2005.

Figure 2 shows the VAT rates for different levels of sales. The figure illustrates the introduction of the VAT relief region in 2004 and the post-2005 schedule in comparison to the pre-2004 period for a firm that is subject to the standard VAT rate.



Notes: Figure shows the VAT rates for different levels of sales. The figure illustrates the introduction of the VAT relief region in 2004 and the post-2005 schedule in comparison to the pre-2004 period for a firm with positive value-added (sales>inputs) that is subject to the standard VAT rate of 22% (VAT rate in Finland in 2000–2010).

Figure 2: VAT rates for different levels of sales before and after the introduction of the VAT relief system in 2004

The figure shows that the pre-reform system created a salient *tax notch,* inducing a clear jump in the VAT rate from 0 to 22% at the threshold (the standard VAT rate in Finland was 22% until July 1st 2010). After the reform, the notch was replaced by a *tax kink*, implying a gradually increasing average VAT rate above the threshold. In terms of pure tax incentives, the reform induced a distinctive change at the threshold. In order to illustrate this, consider a firm with positive value-added (sales>inputs) that has annual sales of 10,000 euros, thus exceeding the VAT threshold by 1,500 euros. Before 2004, the average VAT rate on all value added for this firm was 22%. After 2004, the average VAT rate is around 2.5%, which is over eight times less than before the reform. However, as can be seen from the figure, the difference between the regimes decreases at larger sales levels, and disappears above the relief region.

Compliance costs. In addition to remitted VAT, firms face other costs when exceeding the threshold. We refer to these as *compliance costs*. These include reporting and accounting costs related to VAT reporting, and cognitive costs related to learning and understanding the VAT system.

Once a firm becomes liable for VAT, it needs to file periodic reports on sales and inputs subject to VAT. This procedure can be executed by the owner, or she can purchase an accounting service to conduct the VAT reporting for the firm. The reporting obligation covers sales and inputs at different VAT rates, and imports and exports. Also, the firm is legally required to separate the share of VAT from the selling price in all receipts and invoices, which further increases compliance costs. In addition, complex reporting procedures and detailed VAT rules can be difficult to learn and comprehend. Thus exceeding the threshold is likely to induce cognitive costs for the owners of small firms.

The compliance costs of VAT reporting changed in 2010. First, the frequency of required VAT reports was reduced. Before 2010, all firms needed to complete a VAT report on a monthly basis.[5] After 2010, firms with annual sales below 25,000 euros are required to report their VAT annually. Second, before 2010, firms needed to apply for the VAT relief using a separate tax form in order to be eligible for reduced VAT payments above the threshold (the VAT relief system is described above). From 2010 onward, firms can apply for VAT relief by simply ticking a box in the same periodic tax form they use to declare remitted VAT. This simplified procedure reduced the mechanical burden of filling out tax forms, and likely made the current VAT system more transparent. Overall, both of these reforms simultaneously reduced the compliance costs of VAT among small firms. We utilize this variation to study

[5]However, there were some minor exceptions to this rule. For example, for performing artists it was possible to declare VAT on a yearly basis.

whether reduced compliance costs affected the behavior of firms close to the threshold.

Voluntary registration. Firms that do not exceed the VAT threshold can voluntarily register and remit VAT. There are logical reasons for registering even when it is not necessary. First, a firm can only deduct the VAT from its inputs if it is registered, and thus voluntary registration could be relevant for businesses that have, for example, large start-up costs. Second, VAT registration can enhance the status of the firm and give the appearance that the firm is a large and trustworthy partner, and therefore increase business activity. Third, firms below the threshold that have a large share of business-to-business sales have an increased incentive to register, as the VAT rebate is only granted for inputs from VAT registered firms. Thus some VAT registered firms might prefer other VAT registered firms in business-to-business transactions. However, small firms and entrepreneurs tend to operate in the service sector where a large share of activity stems from customer sales, and thus business-to-business transactions are not likely to play a major role for these firms.

In contrast to non-registered firms, the VAT threshold induces smaller or no local changes in incentives for VAT registered firms. Before 2004, neither compliance costs nor tax incentives jumped at the threshold for voluntarily registered firms, as they were already reporting and remitting VAT. After 2004, the VAT relief applies to voluntary registered firms below the threshold. This implies a jump in the marginal VAT rate at the threshold for voluntarily registered firms, but no discontinuous change in compliance costs. Furthermore, the introduction of the VAT relief in 2004 and reduced compliance costs after 2010 both increased incentives for voluntary registration for firms below the threshold. In our empirical analysis, we utilize voluntarily registered firms to provide additional evidence of the mechanisms behind firm responses.

2.3 Data

Our data are from the Finnish Tax Administration and cover the period 2000–2015. The data contain all businesses that operate in Finland, including firms that are registered for VAT and firms that are not included in the VAT register. The data also include information on total sales for firms that are below the VAT threshold, as this information is required for income tax purposes. Thus this data enable us to analyze the effect of the VAT threshold on the distribution of sales.

The data include all information needed for tax purposes, such as sales, taxable profits, inputs, assets and the organizational form. In addition, we have data on other relevant firm-level variables, including the number of employees and the industry classification. Also,

we can link owner-level variables, such as personal taxable wage and capital income of the main owner, to the firm-level data. The owner-level data are available from 2002 onward.

In order to capture to overall distortive impact of the threshold, we include all firms, both non-registered and VAT registered firms, in our baseline analysis. We restrict the sample to include only firms with annual sales below 20,000 euros, since these firms can be thought of as being affected by the threshold. Furthermore, we exclude firms that are taxed on an assessment by the Finnish Tax Administration, as tax record information based on assessment does not provide explicit evidence of behavioral choices of firms in response to the VAT threshold. According to the Finnish Tax Administration, the most common reason for assessed taxation is that a firm has not returned its tax forms in time.[6]

Table 1 shows the descriptive statistics of small firms and their main owners. We can unsurprisingly observe that most of the firms in our sample do not have any employees, and have relatively low inputs and assets. Our measure of inputs comprise of all expenses except wages paid. This measure approximates VAT deductible inputs for firms both below and above the threshold. We use this measure as we do not directly observe VAT deductible inputs for firms below the threshold that are not registered for VAT. However, this measure potentially overestimates the level of taxable inputs as it captures also those inputs that are not necessarily VAT deductible (such as purchases that are not subject to VAT).

The relative average value added (sales-inputs) in our sample is large, indicating that the inputs-to-sales ratio is typically small. On average, the inputs-to-sales ratio is 0.22. This also implies that the effort of the entrepreneur has the largest contribution to the value added of the firm. In addition, the high value added relative to sales indicates that the tax incentives created by the VAT threshold are relevant for most small firms and their owners, as they are typically subject to considerable VAT payments relative to sales if the threshold is exceeded.

[6]Less than 1% of firms are taxed on an assessment each year.

	Firm-level statistics (n=893,894)						
	Sales	Inputs*	Value added^{+}	No. of empl.	Profits	Assets	
Mean	9,025	2,241	6,919	0.113	1,696	7,870	
sd	5,334	3,902	5,321	0.460	5,658	28,632	
	Sole proprietor	Corporation	Partnership				
Mean	0.682	0.241	0.077				
sd	0.466	0.428	0.266				
			By industry^				
	Commerce	Construction	Hospitality	Services	Other		
Mean	0.141	0.100	0.116	0.345	0.298		
sd	0.348	0.300	0.320	0.475	0.407		
	Owner-level statistics (n=679,328)$^{\otimes}$						
	Age	Women	Tot. Inc. (TI)$^{\#}$	TI <10k	TI 10-20k	TI 20-30k	TI > 30k
Mean	47	0.468	17,525	0.485	0.192	0.118	0.205
sd	13.6	0.499	32,746	0.500	0.404	0.323	0.404
	Full time$^{¤}$	Women		Men			
		Full time	Part time	Full time	Part time		
Mean	0.491	0.241	0.227	0.250	0.282		
sd	0.500	0.428	0.419	0.433	0.450		

Notes: Table presents the descriptive statistics. The sample includes firms with sales between 1,500–20,000 euros per year.
* Information from 2002 onward. Inputs are defined as all expenses except wages. $^{+}$Value added is defined as sales minus inputs.
^ Industries are categorized using Statistics Finland's Standard Industrial Classification (2008). 'Services' include professional, scientific, technical, administrative, support service, social work and other service activities. Transportation and storage are also included in 'Services'. 'Hospitality' refer to hotels and restaurants. 'Construction' includes construction and real estate activities. 'Commerce' includes wholesale and retail trade, and repair of motor vehicles and motorcycles. The category 'Other' includes agriculture, mining, manufacturing, waste management etc. Households acting as employers and extraterritorial organizations are also included in the 'Other' category.
$^{\otimes}$Owner-level information available from 2002 onward. $^{\#}$Personal total income (TI) = taxable gross earned income + taxable gross capital income. $^{¤}$Full-time=full-time entrepreneur if personal total income (capital income + earned income) < sales of the firm.

Table 1: Descriptive statistics, 2000–2015

The table shows that sole proprietorship is the most common organizational form among small firms in Finland, as almost 70% of small firms in our sample are sole proprietors. 24% of the firms in the sample are privately-held corporations, and 8% partnership firms. Overall, 90% of the firms are owned by a single entrepreneur. In addition, small firms represent a wide variety of different industries. However, a large share of firms (36%) operate in the service industry, which is a typical industry for single-owned firms and sole proprietors in Finland.

The lower panel of Table 1 describes the owner-level data. The average annual total income of the owner (the sum of taxable gross wage and gross capital income) is relatively low, approximately 17,500 euros. However, there is a lot of heterogeneity with respect to the income level. Roughly 50% of the owners in our sample have very low personal taxable income below 10,000 euros, 20% have personal income between 10,000–20,000 euros, and 30% of the owners have personal income above 20,000 euros.

In order to more specifically describe the role of the firm in generating income for the

entrepreneur, we define owners as 'full-time' entrepreneurs if the annual sales of the firm are larger than the total income of the owner. Most of the owners fulfill our suggestive definition of a full-time entrepreneur, as roughly 50% of all main owners in our sample have more annual sales in their firm than they have total personal gross income. Also, 'full-time' owners are distributed equally across genders. Therefore, the descriptive statistics suggest that part-time businesses do not comprise the majority of our sample, and despite the relatively low level of sales, many small firms are the main source of income for their owner.

3 Methodology

Building up on Kleven and Waseem (2013), we develop a simple model that describes how entrepreneurs and small firms respond to a size-based tax threshold. Our framework accounts for changes in both tax incentives and compliance costs, allowing us to recover estimates for both the tax rate elasticity and the amount of compliance costs. We discuss empirical estimation at the end of this section.

Exceeding the VAT threshold induces a discontinuous increase in both tax liability (remitted VAT) and compliance costs related to VAT reporting. Compliance costs include reporting inputs and sales to the tax administration and any other costs related to VAT registration, understanding the VAT rules etc. Therefore, the threshold creates *a notch* in entrepreneurs' choice set. Intuitively, if this notch affects the behavior of firms, we should find an excess mass of firms located just below the threshold in the sales distribution, capturing the output distortions created by the threshold.

Consider a large number of small firms (entrepreneurs/self-employed) that produce a single homogeneous good and sell all their products to consumers. Assume that the demand for the good is perfectly elastic and the producer price of the good is normalized to one. A small firm is managed by an entrepreneur of type a that captures his/her ability. Intermediate goods are needed as inputs to produce value added, $v = (1-\alpha)y$, $0 \leq \alpha < 1$, where α measures how much inputs are needed to produce one unit of sales revenue y. As is traditional in the bunching literature, we assume an iso-elastic disutility of generating output for an entrepreneur

$$\phi(y) = \frac{a}{1+1/e}\left(\frac{(1-\alpha)y}{a}\right)^{1+1/e}$$

where e is the elasticity of value added with respect to the net-of-VAT rate.

Entrepreneur maximizes quasi-linear utility $u(y) = c - \phi(y)$, where $c = (1-\alpha)y - T(y,\alpha) - \theta(y,\alpha)$, and $T(y,\alpha)$ denotes incurred VAT payments and $\theta(y,\alpha)$ compliance costs.

For simplicity, we abstract income taxes from the analysis because income tax rates do not change at the VAT threshold.

Our model is aimed to examine the incentives created by a VAT threshold that is typically applied to small firms. Therefore, we find the above stated assumptions to be realistic in this context. In our data set, firms that are affected by the VAT threshold are typically very small service sector firms with small inputs (α) relative to sales who sell their products directly to consumers. The average α is 0.2 for small firms with sales below 20,000 euros, implying that the VAT threshold induces significant tax incentives for these firms. In addition, these small firms are typically managed by a single entrepreneur (90% of the firms in our sample). These imply that both the ability and effort of the entrepreneur largely determine firm output, justifying the utility maximization model. Alternatively, we could model firm profit maximization with varying firm productivity levels and a specified production function, which would provide us with qualitatively similar results as this framework.

3.1 Tax notch

We begin by presenting the model within a tax notch system and apply it to a tax kink below. In the tax notch system before 2004, the firm owes full VAT on all value added when the threshold is exceeded. The utility of an entrepreneur below and above the VAT threshold y^* is

$$u(y) = \begin{cases} y - \alpha y - \alpha y t - \phi(y) = (1-\alpha)y(1 - \frac{\alpha t}{1-\alpha}) - \phi(y) & if\ y \leq y^* \\ y(\frac{1}{1+t} - \alpha) - \theta(1-\alpha)y - \phi(y) = (1-\alpha)y(1 - \frac{t}{(1-\alpha)(1+t)} - \theta) - \phi(y) & if\ y > y^* \end{cases}$$

where t denotes the VAT rate. Note that VAT paid from inputs is not deductible for firms below the threshold, denoted by the term $\alpha y t$ when $y \leq y^*$. Our assumption of perfectly elastic demand indicates that firms above the threshold ($y > y^*$) cannot pass VAT on to selling prices, and thus sales are scaled by $1/(1+t)$. Also, note that VAT paid on inputs is fully deductible when $y > y^*$.

As we are interested in local responses at the VAT threshold, we assume that compliance costs of VAT are a fixed share of value added, $0 \leq \theta \leq 1$. However, the model could be extended to a more general case where the amount of compliance costs decreases with y and increases with α. Another way of modeling compliance costs is to include a simple fixed compliance cost. We have also derived the model using fixed compliance costs, and the implications using this assumption are similar to those presented below.[7]

[7] One additional way of modeling compliance costs would be to include a combination of fixed and linear

After some rearranging, we get the following expression

$$u(y) = \begin{cases} (1-t^B)(1-\alpha)y - \phi(y) & if\ y \leq y^* \\ (1-t^A-\theta)(1-\alpha)y - \phi(y) & if\ y > y^* \end{cases} \quad (1)$$

where $t\frac{\alpha}{1-\alpha} = t^B$ and $\frac{t}{(1-\alpha)(1+t)} = t^A$ refer to effective tax rates below and above the threshold, and $t^B < t^A$ when $0 \leq \alpha < 1$. In the theoretical model, we assume that α and θ are constant parameters. We discuss the implications of heterogeneity in α and θ below in Section 3.4.

Equation (1) applies to firms who do not register voluntarily for VAT below the threshold. For these firms any benefits from voluntary VAT registration, such as the potential positive influence of registration status on business activity, are smaller than the costs of registration (remitted VAT and compliance costs). For voluntarily registered firms for whom the benefits of registration exceed its costs, the VAT threshold induces no local incentives in the tax notch regime. This is due to the fact that voluntarily registered firms need to remit VAT also below the threshold using the same VAT rate as above it, and by definition, registered firms have already incurred the compliance costs of VAT reporting. Thus neither remitted taxes nor compliance costs change at y^*.

Therefore, voluntary registration attenuates the overall distortions caused by the threshold. As there are small firms who voluntarily register for VAT (approx. 30% of firms below the threshold in our data in 2003–2004), we include all firms, both registered and non-registered, in our empirical analysis to capture the overall impact of the threshold, which stems from the behavioral responses of firms that are not voluntarily registered.

Maximizing utility below y^* in equation (1) yields $y(1-\alpha) = a(1-t^B)^e$. Assume that there is a smooth cumulative distribution of entrepreneurs with ability levels $F(a)$ and a corresponding density function $f(a)$. This implies that $F(y)=F\left(\frac{y(1-\alpha)}{(1-t^B)^e}\right)$ and $f(y)=f\left(\frac{y(1-\alpha)}{(1-t^B)^e}\right)\frac{(1-\alpha)}{(1-t^B)^e}$, and that absent any discontinuities at y^* there is a smooth sales distribution.

Bunching at the VAT threshold is illustrated in a budget set diagram in Figure 3. In the figure, ΔT represents the discontinuous jump in remitted VAT when the threshold is exceeded, and $\Delta\theta$ the amount of compliance costs. Entrepreneurs with sales originally below or directly at the threshold do not change their behavior, and thus Type N represents the lowest ability entrepreneur who locates at the threshold, with the ability level denoted by a^*. Type M represents the marginal buncher with sales $y^* + \triangle y_N^*$ in the absence of the threshold, corresponding to an ability level $a^* + \triangle a^*$. This entrepreneur is precisely indifferent between locating at y^* or y^B when the threshold is introduced. Thus there will be bunching at the threshold for entrepreneurs whose abilities lie in $(a^*, a^* + \triangle a^*]$.

cost parameters. However, this would make the mode more complicated and require additional assumptions in order to empirically estimate the amount of compliance costs.

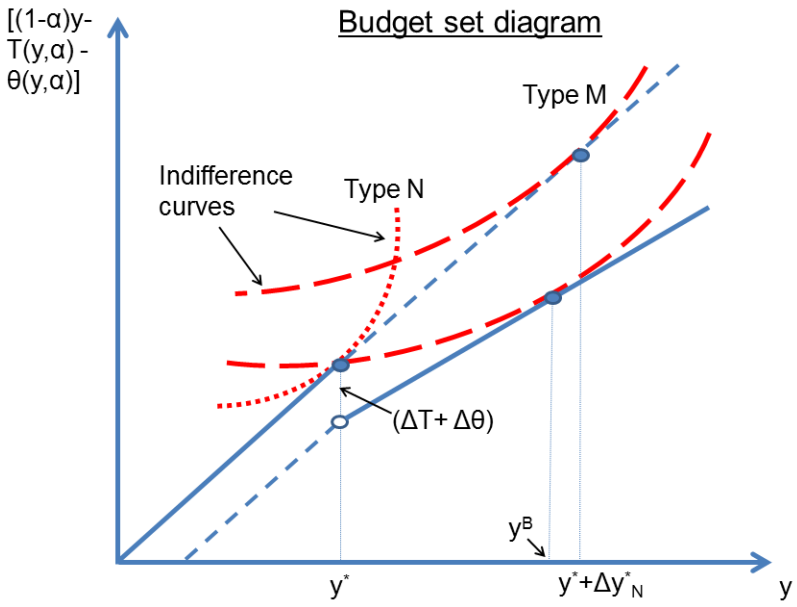


Figure 3: Bunching at the VAT threshold

Following Kleven and Waseem (2013), we can utilize the above indifference condition of the marginal buncher to derive an expression that links together tax rates, compliance costs, tax elasticity, and the behavioral response to the threshold. Using the observed parameters and estimates for behavioral responses, this will allow us to recover estimates for both the tax rate elasticity and the amount of compliance costs caused by the VAT threshold.

The indifference between the utilities of the marginal buncher M and the lowest ability entrepreneur N locating at y^* implies that $u^N = u^M$. First, the utility for entrepreneur of type N is

$$u^N = y^*(1-\alpha)(1-t^B) - \frac{a^* + \triangle a^*}{1+1/e}\left(\frac{y^*(1-\alpha)}{a^* + \triangle a^*}\right)^{1+1/e}$$

For type M, we have the following first order condition: $y^*(1-\alpha) = (a^* + \triangle a^*)(1-t^A-\theta)^e$. Thus we can write

$$u^M = (a^* + \triangle a^*)(1-t^A-\theta)^{e+1}\left(1 - \frac{e}{e+1}\right)$$

Setting $u^N = u^M$, we have

$$y^*(1-\alpha)(1-t^B) - \frac{a^* + \triangle a^*}{1+1/e}\left(\frac{y^*(1-\alpha)}{a^* + \triangle a^*}\right)^{1+1/e} = (a^* + \triangle a^*)(1-t^A-\theta)^{e+1}\left(1 - \frac{e}{e+1}\right)$$

Using $(y^* + \triangle y_N^*)(1-\alpha) = (a^* + \triangle a^*)(1-t^B)^e$ (the first-order condition of u^M in the absence of the threshold) and rearranging the terms, we obtain the following condition:

$$\frac{1}{1+\frac{\triangle y_N^*}{y^*}} - \frac{e}{e+1}\left(\frac{1}{1+\frac{\triangle y_N^*}{y^*}}\right)^{1+1/e} - \frac{1}{e+1}\left[\frac{1-t^A-\theta}{1-t^B}\right]^{e+1} = 0 \tag{2}$$

Similarly as in Kleven and Waseem (2013), the above formula offers a clear relationship between tax elasticity, behavioral response of the marginal buncher relative to the threshold $\frac{\triangle y_N^*}{y^*}$, and the tax rates below and above the threshold. However, in our setup we have three key features that are different in comparison to Kleven and Waseem (2013). First, on top of having a tax notch at the threshold we have compliance costs θ that create an additional incentive for entrepreneurs not to exceed the threshold. Second, not all of the output y is taxed in our setting, only value added. Third, the existence of voluntarily registered firms with no incentives to bunch attenuate the overall impact of the threshold. Our baseline empirical analysis includes both firms that are registered for VAT and firms that are not included in the VAT register, thus capturing the overall distortions caused by the threshold stemming from non-registered firms bunching at y^*.

3.2 Tax kink

In 2004, Finland introduced a VAT relief scheme where the VAT rate increases gradually above y^*. In this tax kink system, the utility of an entrepreneur is

$$u(y) = \begin{cases} (1-t^B)(1-\alpha)y - \phi(y) & if\ \text{y} \leq y^* \\ (1-t^A-\theta)(1-\alpha)y + (1-\alpha)y^*(1+t)t - \phi(y) & if\ \text{y} > y^* \end{cases} \tag{3}$$

Importantly, in the tax kink regime, the entrepreneur remits taxes on value added only above the sales threshold y^*, denoted by the VAT relief term $(1-\alpha)y^*(1+t)t$ when $y > y^*$. Therefore, tax incentives to bunch at the threshold are much smaller in this regime compared to the tax notch regime.

As above in the tax notch regime, we can write $u_k^N = u_k^M$, where subscript k refers to the tax kink regime. For u_k^N we now have

$$u_k^N = y^*(1-\alpha)(1-t^B) - \frac{a^* + \triangle a^*}{1+1/e}\left(\frac{y^*(1-\alpha)}{a^* + \triangle a^*}\right)^{1+1/e}$$

For u_k^M, we know from the first order conditions that $y^*(1-\alpha) = (a^* + \triangle a^*)(1-t^A-\theta)^e$, and thus we can write

$$u_k^M = (a^* + \triangle a^*)(1 - t^A - \theta)^{e+1}\left(\frac{1}{e+1}\right) + (1-\alpha)y^*(1+t)t$$

After setting $u_k^N = u_k^M$ and some rearranging, we have a following condition:

$$\frac{1}{1+\frac{\triangle y_K^*}{y^*}}\left(1 - \frac{t(1+t)}{(1-t^B)}\right) - \frac{e}{e+1}\left(\frac{1}{1+\frac{\triangle y_K^*}{y^*}}\right)^{1+1/e} - \frac{1}{e+1}\left(\frac{1-t^A-\theta}{1-t^B}\right)^{e+1} = 0 \qquad (4)$$

Three key features separate the kink regime from the notch regime (equation (2)). First, the term $\frac{t(1+t)}{(1-t^B)}$ scales down tax incentives at the threshold in the tax kink system, compared to the tax notch regime. Second, the behavioral response $\triangle y_K^*/y^*$ is different compared to the tax notch case. Everything else equal, the behavioral response in the tax notch system must be equal to or larger than in the tax kink system if tax incentives matter for these entrepreneurs, such that $\triangle y_N^*/y^* \geq \triangle y_K^*/y^*$. Note that this condition is true only if $\frac{t(1+t)}{1-t_B} \geq 0$, that is, if $\alpha \lesssim 0.82$. This implies that for firms with large taxable inputs relative to sales, there is no change in incentives after the VAT kink reform, and tax incentives to respond to the reform in general reduce when α gets larger.

Third, the VAT relief applies also to voluntarily registered firms below y^*. This implies that for these firms there is an increase in the marginal VAT rate at the threshold, but no discontinuous jump in compliance costs. In our empirical analysis, we therefore utilize the subgroup of voluntarily registered firms in the kink regime to obtain additional evidence of the impact of tax incentives at the threshold. In addition, the VAT relief also reduced the costs of voluntary registration. Therefore, if tax incentives matter, we should observe a sharp increase in voluntary registration after 2004, which we also test in our empirical analysis.

3.3 Compliance cost reduction

In 2010, compliance costs were reduced in two ways. First, small firms with annual sales below 25,000 euros are required to file their VAT report annually, in contrast to monthly reporting before 2010. Second, firms no longer needed to file a separate declaration form to apply for VAT relief. After 2010, just a simple tick in a box in the regular VAT form was required. This implies that the compliance costs above the threshold, $\widetilde{\theta}$, are now lower compared to those presented above, such that $\theta > \widetilde{\theta}$.

Replacing θ with $\widetilde{\theta}$ in equation (4), we get the following condition:

$$\frac{1}{1+\frac{\triangle y_C^*}{y*}}\left(1-\frac{t(1+t)}{(1-t^B)}\right)-\frac{e}{e+1}\left(\frac{1}{1+\frac{\triangle y_C^*}{y*}}\right)^{1+1/e}-\frac{1}{e+1}\left(\frac{1-t^A-\widetilde{\theta}}{1-t^B}\right)^{e+1}=0 \qquad (5)$$

In equation (5), the behavioral response $\triangle y_C^*/y^*$ is different compared to the previous conditions. Everything else equal, the behavioral response in the tax kink regime must be equal to or larger than in equation (5) if compliance costs are driving the behavioral response, implying that $\triangle y_K^*/y^* \geq \triangle y_C^*/y^*$. Furthermore, a reduction in compliance costs increased incentives for voluntary registration. Thus, we would expect to observe a sharp increase in voluntary VAT registration after 2010 if compliance costs are relevant for small firms.

3.4 Estimation

Clearly, none of the conditions (2), (4) and (5) have explicit analytical solutions for the tax elasticity and compliance costs. However, we can characterize a numerical solution by using observed values for α, t^B and t^A, and the estimates of the behavioral responses in each regime, $\triangle y_N^*/y^*$, $\triangle y_K^*/y^*$ and $\triangle y_C^*/y^*$. To obtain these estimates, we utilize the bunching method in each of the regimes separately.

The behavioral response caused by the VAT threshold is estimated by relating the observed excess mass below the threshold to the counterfactual density that would exist in the absence of the discontinuity at y^*. This bunching estimate includes responses to both tax incentives and compliance costs. Following the earlier bunching literature (Chetty *et al.* 2011; Kleven and Waseem 2013), the counterfactual density is estimated by fitting a flexible polynomial function to the observed distribution, excluding an area around y^* from the observed distribution.

First, we group firms into small sales bins of 100 euros, and then estimate a counterfactual density by regressing the following equation and excluding the region around the threshold $[y_L, y_H]$ from the regression

$$c_j = \sum_{i=0}^{p} \beta_i (y_j)^i + \sum_{i=y_L}^{y_H} \eta_i \cdot \mathbf{1}(y_j = i) + \sum_{r \in R} \varsigma_r \cdot \mathbf{1}(\frac{y_j}{r} \in \mathbb{N}) + \varepsilon_j \qquad (6)$$

where c_j is the count of firms in bin j, and y_j denotes the sales level in bin j. The order of the polynomial is denoted by p. Firms and entrepreneurs have a tendency to report revenue in convenient round numbers such as 5,000 and 10,000 euros (see, e.g. Kleven and Waseem (2013) and Devereux *et al.* (2014)). As this might affect the estimation of the counterfactual, we include a set of round number dummies to control for bunching at

integers, $\sum_{r \in R} \varsigma_r \cdot \mathbf{1}(\frac{y_j}{r} \in \mathbb{N})$, where R is a vector of annual gross sales in round thousands of euros, and $\mathbb{N}$ is the set of natural numbers.

The fitted values for the counterfactual density are thus given by $\hat{c}_j = \sum_{i=0}^{p} \beta_i (y_j)^i + \sum_{r \in R} \varsigma_r \cdot \mathbf{1}(\frac{y_j}{r} \in \mathbb{N})$. Utilizing the counterfactual estimate, the relative excess bunching is estimated by relating the actual number of firms close to the threshold within (y_L, y^*) to the counterfactual density in the same region:

$$\hat{b}(y^*) = \frac{\sum_{i=y_L}^{y^*} (c_j - \hat{c}_j)}{\sum_{i=y_L}^{y^*} \hat{c}_j / N_j} \tag{7}$$

where N_j is the number of bins within $[y_L, y^*]$.

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

We follow the approach of Kleven and Waseem (2013) to define the upper limit and the marginal buncher firm. We determine y_H such that the estimated excess mass, $\hat{b}_E(y^*) = (\sum_{i=y_L}^{y^*} c_j - \hat{c}_j)$, equals the estimated missing mass above the threshold, $\hat{b}_M(y^*) = (\sum_{i=y>y^*}^{y_H} \hat{c}_j - c_j)$, created by the firms above y^* in the counterfactual state that respond to the threshold. We apply this condition by starting from a small value of y_H and increasing it gradually until $\hat{b}_E(y^*) \approx \hat{b}_M(y^*)$. Importantly, this convergence condition defines the sales response of the marginal buncher. This implies that the estimated excess mass determines the response of the marginal buncher, linking together the sales response $\triangle y^*$ and the estimated upper limit y_H. As discussed above, we utilize the estimated $\triangle y^*$ in different regimes to evaluate compliance costs and tax rate elasticity.

Figure 4 illustrates the excess mass at the threshold in the hypothetical sales distribution created by bunching responses (solid line), compared to a smooth counterfactual sales distribution in the absence of the threshold (dashed line). Assuming heterogeneous preferences across entrepreneurs and no extensive margin responses, the observed density gradually approaches the counterfactual density above y^* (see Kleven (2016)). An important conceptual point is that the notch created by the VAT threshold does not create a clearly defined region of dominated choice just above the threshold where no entrepreneurs will ever locate, in contrast to an income tax notch often discussed in the bunching literature (Kleven 2016; Kleven and Waseem 2013). First, this stems from the fact that heterogeneity in inputs α

and compliance costs θ affects the size of incentives at the threshold. As there are firms with only small incentives not to exceed the threshold in all regimes, corresponding to firms with high values of α and low values of θ, we are likely to empirically observe a positive mass of firms also close to the threshold above it. Second, as discussed above, it is reasonable for some firms to register voluntarily for VAT if, for example, voluntary registration entails a large enough additional positive influence on business activity. These firms have no or smaller incentives to respond to the threshold, which is illustrated in Figure 4 as a positive density of firms just above y^*.

Figure 4: Bunching in the sales distribution

As is customary in the literature, we calculate standard errors for all the behavioral parameters using a residual-based bootstrap procedure. We generate a large number of sales distributions by randomly resampling the residuals from equation (6) with replacement, and generate a large number of new estimates of the counterfactual density based on the resampled distributions. The bootstrap procedure takes into account the iterative process to determine the marginal buncher firm. Based on the bootstrapped counterfactual densities, we evaluate variation in the estimates of interest. The standard errors for each estimate are defined as the standard deviation in the distribution of the estimate.

Finally, notches may create extensive margin responses, such as entry or exit of firms, that are not explicitly captured by the bunching method. We discuss the relevance of these types responses and their implications below in Section 4.6. However, estimated responses

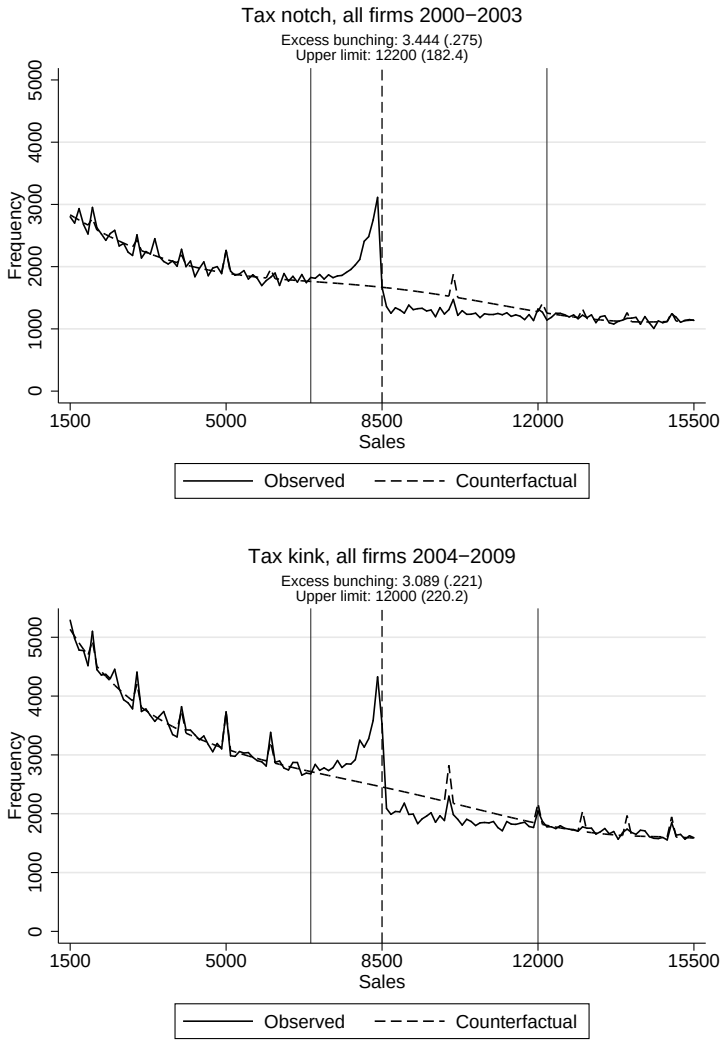
in different regimes using the bunching approach can deliver us compelling evidence of the underlying mechanisms behind firm behavior at the intensive margin, despite potential extensive margin responses.

4 Results

This section presents the results. We begin by studying whether tax incentives or compliance costs drive the overall behavioral response. In Section 4.2, we present and discuss the estimates on tax elasticity and compliance costs implied by the observed responses to the VAT threshold. We study heterogeneous responses in Section 4.3, and offer additional evidence of the mechanisms behind the response in Section 4.4. Section 4.5 characterizes the anatomy of bunching responses (real responses vs. evasion), and Section 4.6 discusses dynamic responses.

4.1 Tax incentives vs. compliance costs

Figure 5 shows the sales distributions for all firms (non-registered and VAT registered firms) around the tax notch regime in 2000–2003 and the tax kink regime in 2004–2009. The figures plot the observed sales distributions (solid line) and counterfactual distributions (dashed line) in bins of 100 euros in a range of +/– 7,000 euros from the threshold. The threshold is marked with a dashed vertical line. The excluded region $[y_L, y_H]$ in the estimation of the counterfactual is marked with solid vertical lines, and the counterfactual density is estimated using a 7th-order polynomial function.



Notes: Figure shows the sales distribution and the counterfactual distribution in bins of 100 euros, and the excess mass and upper limit estimates with bootstrapped standard errors from the tax notch (2000–2003) and tax kink (2004–2009) regimes.

Figure 5: Bunching at the tax notch (2000–2003) and tax kink (2004–2009)

The figure clearly shows that relative excess bunching at the threshold is visually clear, significant and similar in size both in the tax notch (3.444) and the tax kink regimes (3.089).[8]

[8]The sales distributions are rather smooth outside the bunching window $[y_L, y^*]$, with the exception of round-number bunching which can be seen as small spikes in the distributions at round numbers such as 5,000 and 10,000 euros. Bunching is still much more evident just below the VAT threshold than at any of the round numbers, implying apparent behavioral responses to the threshold. As discussed above, we take round-number bunching into account in the estimation of the counterfactual density. Figure A1 in the Online Appendix A shows the sales distribution around the VAT threshold for all firms in our estimation sample using pooled data from 2000–2015. Table A1 in Online Appendix A shows the results when we vary the choices of lower limit and the degree of polynomial. Overall, the conclusion of distinctive excess bunching is robust to different choices.

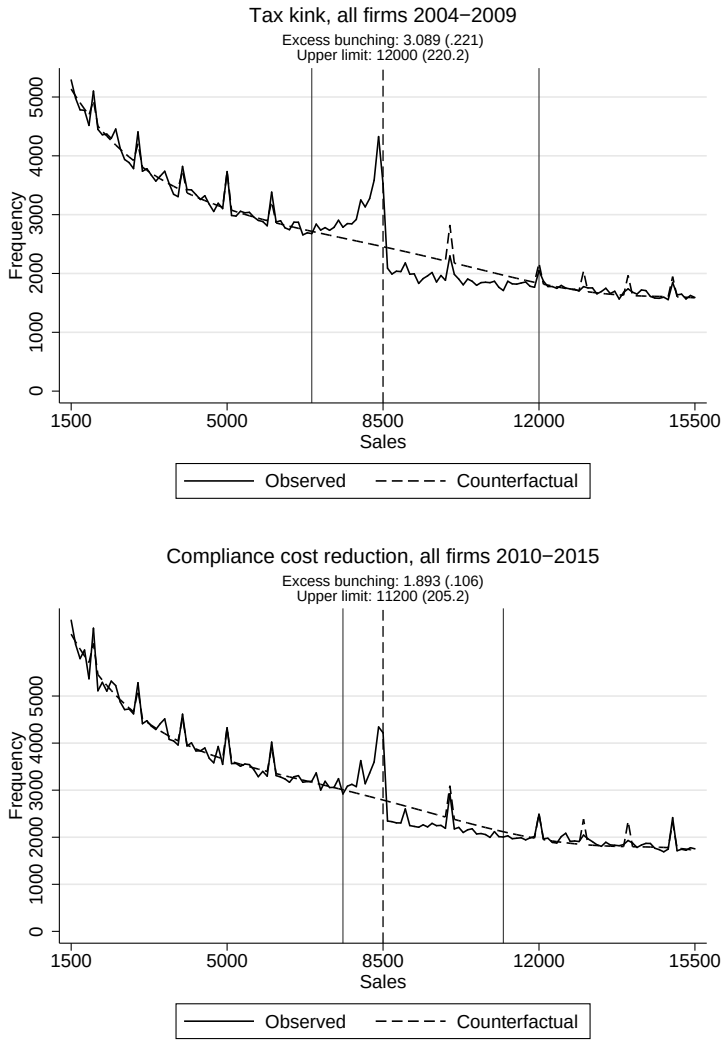
The estimate for the difference of the excess mass estimates between these regimes is small and not significantly different from zero, -0.355 (standard error 0.237).[9] Consequently, the upper limit estimates and thus the estimated sales responses of the marginal buncher are close to each other in both regimes, 3,700 and 3,500 euros from the threshold in tax notch and tax kink regimes, respectively. These findings indicate that despite the drastic drop in the VAT rate after 2004, we find no significant changes in the behavioral response to the VAT threshold.

Next, we study the effects of the compliance costs of VAT reporting. Figure 6 shows the sales distributions and excess mass estimates before (2004–2009) and after (2010–2015) the compliance cost reduction. Excess bunching is clearly observable in both periods. However, there is a visible and significant decrease in excess mass (from 3.089 to 1.893) and the marginal buncher response (from 3,500 to 2,700 euros) after the reform. The estimate for the difference in excess bunching between these regimes is notable and statistically significant (-1.196 (0.221)).[10] These results imply that the reductions in costs related to VAT reporting had a notable effect on behavior, in contrast to changes in tax incentives analyzed above.[11]

[9]The standard error for the difference in the estimates is calculated as follows: we first estimate a large number of excess mass estimates for both the tax notch and tax kink regimes using the bootstrap procedure explained in Section 3.4. After each round, we calculate the difference of the excess mass estimates, and then calculate the standard deviation of the average difference to examine whether or not the difference in excess bunching between the regimes is significantly different from zero.

[10]The standard error is calculated similarly as described in footnote 9.

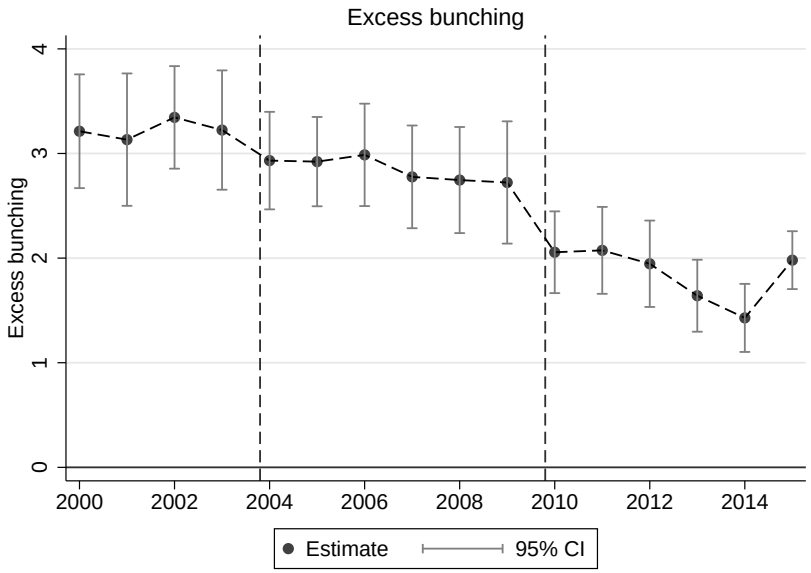
[11]In Online Appendix B, we provide additional bunching results using the distribution of small firms in labor-intensive industries in Sweden in 2006–2014 as a counterfactual for Finnish firms within the same industries in the same time period. There is no VAT threshold in Sweden, and thus Swedish firms represent a suggestive counterfactual when analyzing the effects of the Finnish VAT threshold. The distribution of Swedish firms around the threshold resembles the estimated counterfactual distributions derived in Figure 6, particularly in the neighborhood of the threshold. Using Swedish firms as a counterfactual provides similar results on the impact of compliance costs, thus further supporting the results in Figure 6.



Notes: Figure shows the sales distribution and the counterfactual distribution in bins of 100 euros, and the excess mass and upper limit estimates with bootstrapped standard errors before (2004–2009) and after (2010–2015) the reduction in compliance costs.

Figure 6: Bunching before (2004–2009) and after (2010–2015) the reduction in compliance costs

Figure 7 presents the excess bunching estimates over time in 2000–2015. The observed estimates do not significantly decrease when tax incentives change at the threshold from a tax notch to a tax kink. The estimates are just above 3 before 2004 and just below it after 2004, but there is no statistically significant change in the excess mass. However, right after the reduction in compliance costs in 2010, we observe a clear reduction in the amount of excess mass (from 3 to 2) for the whole post-2010 period. This summarizes that the bunching response is mainly driven by compliance costs, and not by the VAT rate.

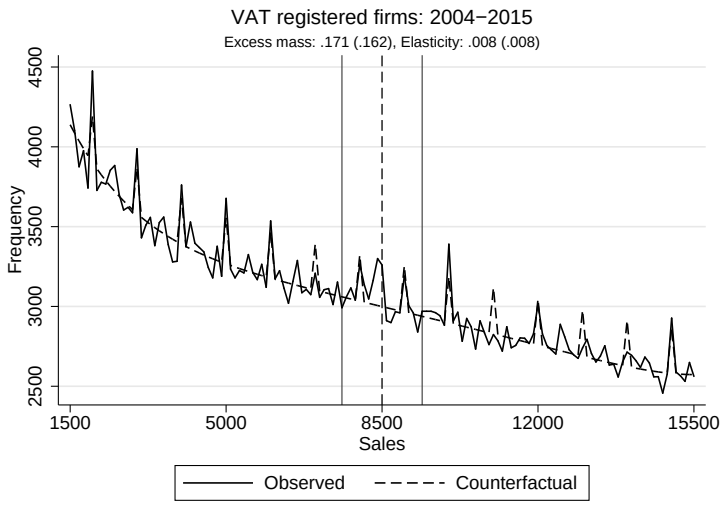


Notes: Figure presents the excess bunching estimates with bootstrapped 95% confidence intervals in each year in 2000–2015.

Figure 7: Excess bunching at the VAT threshold, 2000–2015

Furthermore, as discussed in Section 3, we can utilize voluntarily registered firms to obtain additional evidence on the impact of tax incentives and compliance costs. First, we study the behavior of voluntarily registered firms in the tax kink regime (2004–2015). These firms are eligible for a full VAT relief from 2004 onward, implying that remitted VAT is effectively zero even for voluntarily registered firms below the threshold. Therefore, as these firms are (voluntarily) subject to the compliance cost of reporting VAT, they only face changes in tax incentives at the threshold.

As the VAT threshold only creates changes in tax incentives for this selected group of firms, we estimate the excess mass and the tax elasticity following the procedures in the tax kink literature (see Saez 2010 and Chetty *et al.* 2011). We choose the lower and upper limits of the excluded region to be equally far away from the threshold (900 euros). Figure 8 shows that there is no visually or statistically significant excess bunching for voluntarily registered firms in 2004–2015. Also, the implied tax elasticity estimate is insignificant and very small. This result for a selected group of voluntarily registered firms adds an additional piece of evidence that tax incentives at the threshold have no significant effect on the behavior of small firms.

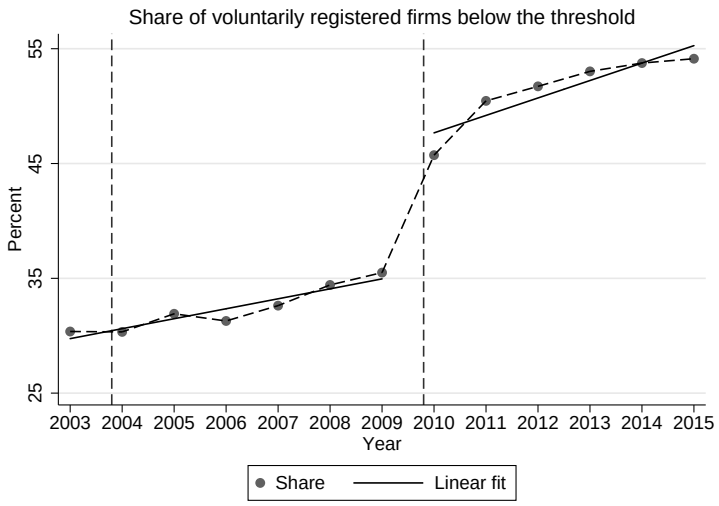


Notes: Figure shows the sales distribution and the counterfactual distribution in bins of 100 euros, and the excess mass estimate with bootstrapped standard error for VAT registered firms in 2004–2015.

Figure 8: Excess bunching for VAT registered firms, 2004–2015

Second, the tax kink reform in 2004 and the reduction in compliance costs in 2010 both reduced the costs of voluntary registration. Figure 9 shows the share of voluntarily registered firms below the threshold in 2003–2015.[12] We observe a sharp and distinctive jump in the share of voluntary registered firms from 35% to 45% right after the 2010 compliance cost reform. This indicates that a decrease in compliance costs increased voluntary registration among small firms. In comparison, there is no visible discontinuous change in the share of voluntarily registered firms right after the 2004 tax rate reform. This implies that exempting voluntarily registered firms from remitting VAT in 2004 did not significantly increase voluntary registration. These findings further underline the key role of compliance costs, and the negligible impact of remitted taxes.

[12]Unfortunately, we do not have detailed VAT register data before 2003, and thus we cannot present a longer time trend of the share of voluntary registered firms from before the 2004 tax reform.



Notes: Figure shows the share of voluntarily registered firms below the VAT threshold in 2003–2015.

Figure 9: Share of voluntarily registered firms below the threshold, 2003–2015

4.2 Estimates for tax elasticity and compliance costs

As explained in Section 3, we can characterize the tax rate elasticity and compliance costs of firms using the behavioral responses estimated in Figures 5 and 6. In order to recover the estimates, we solve conditions (2), (4) and (5) simultaneously by using observed average values for $\alpha = 0.2$, $t^A = 0.224$ and $t^B = 0.055$, and the estimates of the sales responses of marginal buncher in different regimes: $\triangle y_N^*/y^* \approx 43.5\%$, $\triangle y_K^*/y^* \approx 41.2\%$ and $\triangle y_C^*/y^* \approx 31.8\%$.[13] Solving the conditions numerically requires giving initial values for e, θ and $\tilde{\theta}$.

Table 2 presents the results. First, we find that the tax elasticity is very small, 0.016. This is completely in line with the observation that the drastic reduction in tax incentives is not followed by a reduction in overall sales responses. Second, we find that the compliance costs are large, approximately 19% of value added at the threshold before 2010, translating into annual compliance costs of approximately 1,300 euros. Third, we find that the compliance costs reduce by 5.6 percentage points to approximately 14% of the value added after, following the clear reduction in the excess mass and the sales response of the marginal buncher.[14]

[13] Observed value for α is calculated using the inputs-to-sales ratio of firms between the lower limit (y_L) and the threshold (y^*).

[14] Our setup allows us to recover an estimate for the level of compliance costs before and after 2010, but not a well-founded estimate for the compliance cost elasticity. This is due to the fact that the average monetary value for the reduction in compliance costs within the reform of 2010 cannot be unambiguously determined. Our estimate for the reduction in compliance costs after 2010 is ultimately based on the observed response of firms to this reform, which implies that dividing the estimated relative reduction in compliance costs by the observed relative change in firm behavior would not necessarily deliver us a meaningful estimate for the compliance cost elasticity.

(1) Tax elasticity (e)	(2) Compliance costs (θ) Pre-2010	(3) Compliance costs ($\tilde{\theta}$) Post-2010
0.016	0.194	0.138
(0.025)	(0.021)	(0.012)

Note: Table presents the estimates for tax elasticity and compliance costs before and after 2010. To obtain these estimates we solve all nonlinear conditions (2), (4) and (5) derived in Section 3 simultaneously by using observed values for α, t^A and t^B, and the estimates of the sales responses of marginal buncher in different regimes. The standard errors for these estimates are calculated by estimating a large number of sales response estimates (500) for each three regimes using the bootstrap procedure explained in Section 3.4. Then we use these estimates to solve the conditions simultaneously to obtain a large number of tax elasticity and compliance costs parameters for which we calculate the standard deviations that represent standard errors presented in parentheses in the table.

Table 2: Tax elasticity and compliance cost estimates

By distinguishing between tax rate elasticity and compliance costs using the parametric framework and quasi-experimental variation, we highlight that it is crucial to take compliance costs into account when analyzing the behavior of small firms, as the impact of compliance costs can be much larger than remitted taxes. Underlining the importance of our result, restricting our model such that compliance costs are ignored ($\theta = 0$), we estimate a tax elasticity of 0.55 which hugely overstates the importance of tax rates compared to the model where $\theta > 0$. Beyond the context of small firms and entrepreneurs, this shows that ignoring key determinants of potential responses can lead to false conclusions and policy recommendations.

Overall, our results highlight the key role of compliance costs in the behavior of small firms. As a broader conclusion, our results imply that reducing and simplifying reporting procedures are likely to decrease the welfare costs of size-based rules for small firms, in contrast to changes in tax rates.

Our estimate for compliance costs is somewhat larger than the typical survey-based evaluations of compliance costs for firms, ranging from approximately 600 to 800 euros (Crawford *et al.* (2010)). Our approach adds to this literature by estimating the significance and magnitude of compliance costs for entrepreneurs using quasi-experimental variation. Naturally, we acknowledge that our estimate of compliance costs is institution specific. However, we estimate compliance costs stemming from the VAT system, which is the most commonly applied consumption tax system in the world. VAT reporting procedures are typically similar across countries, particularly within the European Union. Therefore, in our view, this paper provides an applicable estimate of the magnitude of compliance costs of VAT for small firms.

Finally, we use our compliance cost estimate and the formula by Keen and Mintz (2004) to approximate the optimal VAT threshold. In a simple model without firm responses,

Keen and Mintz (2004) show that the formula for the optimal VAT exemption threshold (ET^*) is the following: $ET^* = (\gamma A + C)/((\gamma - 1)\tau N)$, where γ denotes the marginal cost of public funds, τ the VAT rate, N the ratio of value added to sales, A administrative costs and C compliance costs. First, we assume that the marginal cost of public funds is 1.3 (following the estimate of Kleven and Kreiner (2006) for Denmark). Then, using a VAT rate of 24% (standard VAT rate in Finland), a ratio of value added to sales of 80%, and an administrative cost of 260 euros per firm (following Crawford *et al.* (2010) and assuming that 20% of compliance costs represent the administrative costs of the tax administration), we approximate the optimal VAT threshold to be almost 30,000 euros. This estimate is clearly larger than the current VAT threshold of 10,000 euros in Finland.[15]

4.3 Heterogeneous responses to the threshold

The results above in Figures 5 and 6 showed the average responses to the VAT threshold for all small firms. However, it is likely that there is heterogeneity in responses between different types of firms and entrepreneurs, which could be relevant in terms of implications. In this section, we study responses separately for different types of firms and owners, and study the mechanisms (tax incentives vs. compliance costs) behind the responses for different subgroups.

Table 3 collects the excess mass estimates for different subgroups in different regimes (columns (1)–(3)), and the estimates for the differences in excess bunching between the regimes (columns (4)–(5)). First, we find significant excess mass estimates and observe visually clear bunching for most subgroups of firms and owners in all three regimes. This indicates that the overall response is not driven by certain specific groups of firms or owners responding very actively while other groups do not respond at all.

Differences in inputs (α) relative to sales produce a key source of heterogeneity in incentives to respond to the VAT threshold. In particular, firms with a smaller α face larger remitted VAT when exceeding the threshold compared to those with larger inputs. Also, VAT paid from inputs can only be deducted when the firm is registered to pay VAT, which increases incentives for voluntary registration and further reduces incentives not to exceed the threshold for firms with a large α (see Liu *et al.* (2017)).

However, for example, many small firms in the service sector have a low inputs-to-sales ratio.[16] Entrepreneurs operating in these sectors might differ from those running other similar-sized firms in other relevant aspects that could explain how they respond to the

[15] The VAT threshold in Finland was increased from 8,500 euros to 10,000 euros in the beginning of 2016.

[16] On average, α is 0.17 for service sector firms, 0.22 for hospitality, 0.37 for commerce, 0.24 for construction and 0.22 for other firms in our sample.

threshold. This implies that heterogeneity in α itself does not necessarily offer exogenous variation in incentives. In order to provide more compelling evidence, we utilize changes in tax incentives and compliance costs over time to analyze how different types of firms respond to changes in these incentives. As discussed above in Section 3, firms with a larger α had smaller incentives to respond to the reform of 2004, compared to firms with smaller inputs.

In Table 3, we provide the results separately for firms in different inputs-to-sales quartiles.[17] Overall, the results show that firms with a small α bunch more actively than those firms that have larger inputs relative to sales. However, excess mass estimates did not reduce for firms in the first and second quartile of inputs-to-sales ratio after the VAT rate reduction in 2004, even though these firms faced the largest changes in tax incentives due to the reform. In contrast, responses to the threshold reduced significantly for all groups when compliance costs were reduced in 2010. This evidence further strengthens the key role of compliance costs and the small impact of tax incentives, irrespective of the level of inputs.

Furthermore, we find no significant bunching in any regime when studying only VAT registered firms. Consequently, there are no significant changes in responses between the regimes either, which again underline the role of compliance costs in explaining the response, as compliance costs do not change at the threshold for voluntarily registered firms.[18]

[17] The average values for α in each quartile are the following: 1st quartile 0.02, 2nd quartile 0.22, 3rd quartile 0.49, and 4th quartile 0.86.

[18] In addition, due to the self-selection of voluntarily registered firms below the threshold, these firms have a larger average inputs-to-sales ratio of 0.63, compared to 0.22 for all small firms. This could also reduce the incentives to bunch among VAT registered firms after 2004, in comparison to other firms. However, the fact that voluntarily registered firms with no compliance cost incentives have a larger α is likely to also contribute to the relatively small excess mass for firms in the fourth quartile of inputs-to-sales ratio, compared to other quartiles where voluntary registration is less likely. In contrast to differences in inputs-to-sales ratios, other characteristics are very similar when comparing VAT registered firms below the threshold to all small firms in our baseline sample. For example, there are no relevant differences in the industry composition or total income of the owner.

Firm-level characteristics					
	Different regimes			Changes in excess bunching	
	(1)	(2)	(3)	(4)	(5)
	2000–2003	2004–2009	2010–2013	(04–09)–(00–03)	(10–13)–(04–09)
By inputs-to-sales ratio					
- 1st quartile	5.630 (.355)	5.130 (.373)	3.858 (.343)	-.500 (.516)	-1.272 (.509)
- 2nd quartile	4.070 (.293)	3.580 (.183)	1.835 (.127)	-.490 (.346)	-1.745 (.221)
- 3rd quartile	2.211 (.251)	1.826 (.139)	1.018 (.127)	-.385 (.287)	-.808 (.188)
- 4th quartile	1.584 (.268)	1.031 (.105)	.487 (.117)	-.553 (.293)	-.544 (.161)
VAT registered firms	.165 (.187)	.279 (.149)	.102 (.086)	.114 (.176)	-.172 (.076)
Sole proprietors	3.914 (.131)	3.456 (.149)	2.083 (.117)	-.458 (.202)	-1.373 (.189)
Partnership firms	3.211 (.393)	2.620 (.252)	1.720 (.200)	-.591 (.467)	-.900 (.312)
Corporations	2.568 (.271)	2.426 (.297)	1.661 (.285)	-.142 (.407)	-.765 (.423)
Services	4.561 (.203)	4.203 (.235)	2.421 (.203)	-.358 (.315)	-1.782 (.311)
Hospitality	3.952 (.237)	2.830 (.188)	2.015 (.173)	-1.122 (.298)	-.815 (2.53)
Commerce	2.827 (.191)	2.685 (.169)	1.710 (.179)	-.142 (.256)	-.975 (.253)
Construction	3.562 (.329)	3.546 (.335)	2.111 (.264)	-.016 (.472)	-1.435 (.432)
Other	2.919 (.162)	2.651 (.195)	1.369 (.192)	-.268 (.259)	-1.282 (.276)
Owner-level characteristics					
	Different regimes			Changes in excess bunching	
	(1)	(2)	(3)	(4)	(5)
	2000–2003	2004–2009	2010–2013	(04–09)–(00–03)	(10–13)–(04–09)
Women					
- Full time	5.320 (.212)	4.924 (.187)	2.930 (.158)	-.396 (.280)	-1.994 (.245)
- Part time	3.045 (.208)	2.209 (.166)	1.860 (.117)	-.836 (.273)	-.349 (.203)
Men					
- Full time	3.351 (.181)	4.161 (.214)	1.923 (.166)	.810 (.283)	-2.238 (.272)
- Part time	2.504 (.188)	2.222 (.172)	1.917 (.161)	-.282 (.255)	-.305 (.236)
Total inc. $<$ 10k	4.160 (.148)	4.318 (.171)	2.309 (.122)	.158 (.223)	-2.009 (.215)
Total inc. 10–20k	3.332 (.220)	2.297 (.165)	1.777 (.146)	-1.035 (.276)	-.520 (.214)
Total inc. 20–30k	2.496 (.267)	2.132 (.202)	1.762 (.148)	-.364 (.340)	-.370 (.249)
Total inc. $>$ 30k	2.431 (.233)	2.346 (.202)	2.100 (.153)	-.085 (.284)	-.246 (.232)

Notes: Table presents the excess mass estimates for different subgroups of firms and owners in different VAT threshold regimes in columns (1)–(3). Standard errors for these estimates are presented in parentheses. Columns (4) and (5) present the estimates for the differences in excess bunching within the groups between 2004-2009 and 2000-2003, and 2010-2015 and 2004-2009, respectively. The standard errors for these differences are calculated as follows: we first estimate a large number of excess mass estimates in both periods using the bootstrap procedure explained above. After each round, we calculate the difference of the excess mass estimates, and then calculate the standard deviation of the average difference. Full time=full-time entrepreneur if personal total income (capital income + earned income) $<$ sales of the firm, otherwise part-time.

Table 3: Excess bunching estimates for different types of owners and firms in different regimes.

In addition, we find that sole proprietors bunch more actively than partnership firms

and corporations, but the overall responses and the impact of reduced compliance costs are apparent among all organizational forms. Also, we find more prominent responses for service sector firms, but bunching is significant in all industry categories, implying that the results are not only driven by service sector firms. In terms of owner-level heterogeneity, we find that women appear to bunch more actively than men in all regimes. In particular, female owners classified as 'full-time' owners (personal taxable income $<$ sales of the firm) bunch very actively. Relatedly, we find that owners with low personal total income (earned income + capital income) bunch very actively, and in particular, respond distinctively to reduced compliance costs after 2010. We further discuss the implications of the threshold and heterogeneous responses in terms of firm growth in Section 4.6.

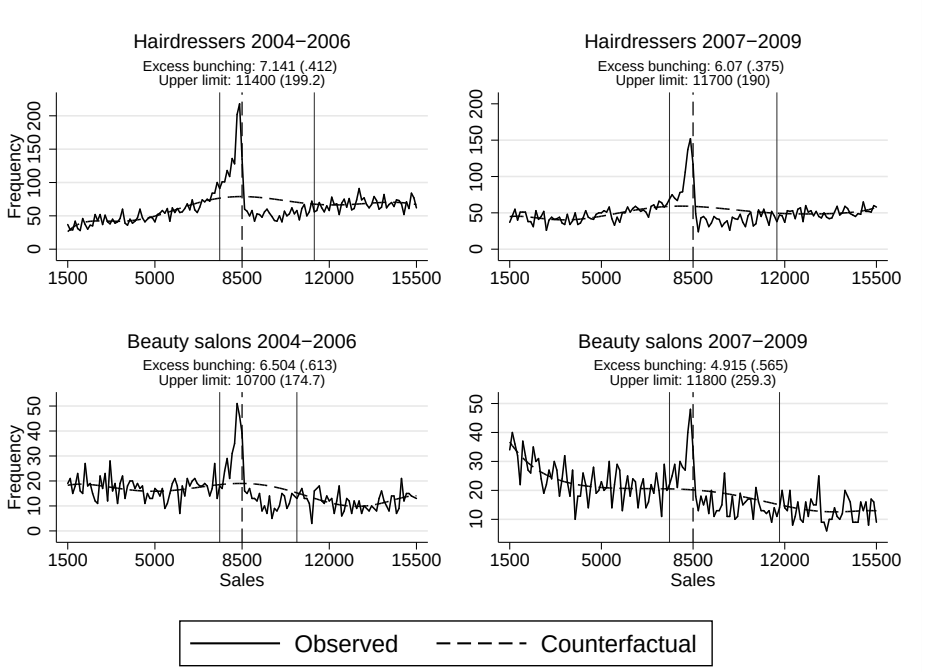
4.4 Additional evidence

To offer further evidence of the effects of tax incentives, we utilize an industry-specific VAT rate reduction. In Finland, the VAT rate for hairdressers and barbers was reduced from 22% to 8% in 2007–2011. Other similar types of services, such as beauty salons, were not subject to the reduced rate. Therefore, if tax incentives drive the response, we should observe a decline in excess bunching for hairdressers in 2007–2011, in comparison to beauty salons.[19]

Figure 10 shows the sales distributions in 200 euro bins around the VAT threshold for both hairdressers and beauty salons in 2004–2006 and 2007–2009. From the figure we can observe that hairdressers bunch very actively at the threshold both before and after the reform (upper graphs), but there is a slight decrease in the estimated excess mass after 2007. However, when compared to beauty salons, we observe a similar small decrease in excess bunching between the two periods (lower graphs). The estimate for the "difference-in-differences" in excess bunching over time between the two industries is small and not statistically different from zero (0.519 (0.997)).[20] This implies that these two sectors do not differ in terms of behavioral responses to the threshold, even though the VAT rate for hairdressers was 14 percentage points lower in the latter period.

[19] Kosonen (2015) studies the price and demand effects of this targeted VAT rate reduction for hairdressers using beauty salons as a comparison group.

[20] The standard error for the difference is calculated similarly as described in footnote 9 above.



Notes: Figure shows the sales distribution and the counterfactual distribution in bins of 200 euros, and the excess mass and upper limit estimates with bootstrapped standard errors for hairdressers/barbers and beauty salons before (2004–2006) and after (2007–2009) the VAT rate reduction from 22% to 8% for hairdressers.

Figure 10: Excess bunching for hairdressers/barbers and beauty salons, 2004–2006 and 2007–2009

This result provides further evidence that the change in the tax rate does not affect bunching behavior. It is important to note that potential issues related to understanding the changes in the overall VAT system within the VAT relief reform do not play a role in Figure 10. In 2004–2009, the overall VAT system was not changed, apart from the experiment with reduced rates for hairdresser services.

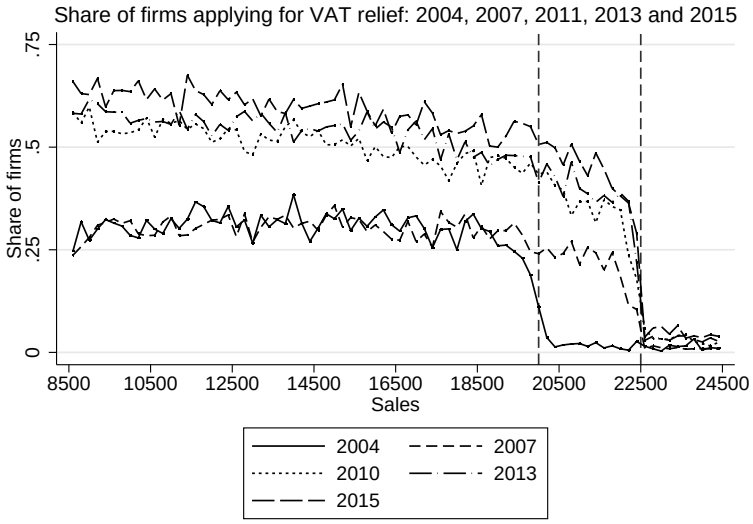
Next, we study the impact of compliance costs in more detail. Cognitive costs related to understanding the VAT rules and regulations could be an important part of compliance costs. One factor that might affect the reduction in excess bunching and the jump in voluntary registration after 2010 is the transparency and awareness of the VAT relief scheme. Simplifying and clarifying the procedure for applying for the relief in 2010 could thus also contribute to the observed changes in behavior.

We do not directly observe awareness of the VAT relief among entrepreneurs, but we do observe from the data whether a firm has applied for the relief. Thus we can characterize the general knowledge of VAT relief by studying how many firms above the threshold apply for the relief, and how this behavior was affected by the 2010 reform. However, the level of this "take-up rate" is likely not to give us accurate information about actual awareness

because firms might not apply for the relief if the perceived cost of applying exceeds the monetary benefit. This is particularly relevant for firms with a large inputs-to-sales ratio, as the relative effect of the relief on remitted VAT is smaller for them.

Figure 11 shows the take-up rates of the VAT relief within the VAT relief region in 2004, 2007, 2011, 2013 and 2015 in bins of 500 euros. The vertical axis denotes the share of firms that we observed applying for VAT relief. The dashed vertical lines at 20,000 and 22,500 euros denote the end of the relief region in 2004 and after 2005, respectively.

The figure shows that the take-up rate is around 30% just above the threshold in 2004 and 2007. This suggests that a notable fraction of firms did not apply for the relief. The take-up rate jumps to approximately 55–60% after 2010. This finding suggests that the awareness of threshold rules has a significant effect, implying that simplifying reporting requirements and increasing transparency of tax regulations is important in reducing the negative effects of size-based thresholds for small firms.



Notes: Figure shows the shares of firms that applied for the VAT relief in 500 euro bins before (2004 and 2007) and after (2011, 2013 and 2015) the simplification of the VAT relief application procedure in 2010. The dashed lines denote the end of the relief region in 2004 and after 2005, respectively.

Figure 11: Share of firms applying for VAT relief in 2004, 2007, 2011, 2013 and 2015

Finally, in addition to annual reporting for firms with sales below 25,000 euros, firms with sales between 25,000–50,000 are required to file VAT reports quarterly from 2010 onward, in contrast to monthly reporting before the reform. Figure A2 in Online Appendix A shows that there is no excess mass of firms below these new reporting thresholds at 25,000 and 50,000 euros after 2010. This suggests that altering the required reporting frequency for firms already reporting VAT is not likely to affect firm behavior. However, our main results

suggest that reducing the required reporting frequency is likely to be more relevant at the exemption threshold, as we observe a clear reduction in excess bunching when the reporting requirement was reduced from monthly to annual reporting.

4.5 Anatomy of the bunching response

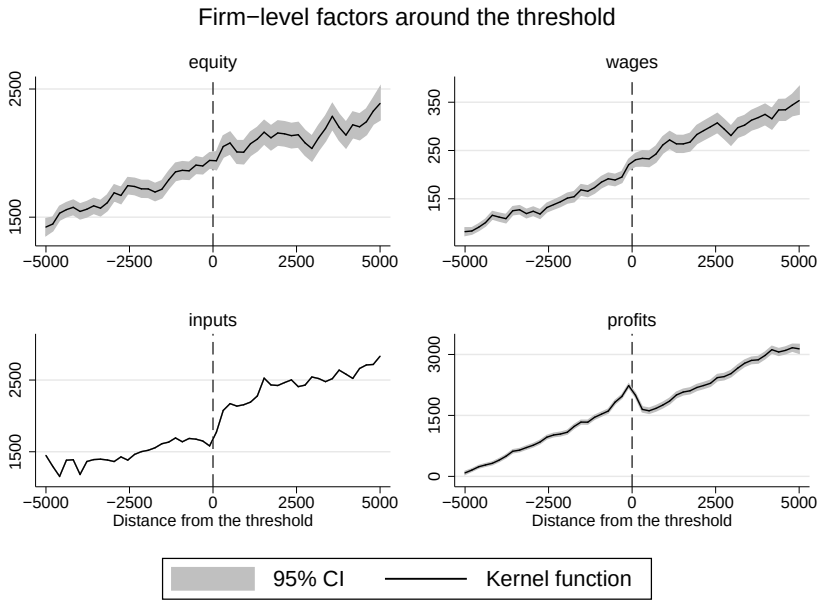
Regardless of whether firms avoid exceeding the VAT threshold because of tax incentives or compliance costs, it is relevant to know whether the effects are driven by real economic responses (e.g. scaling down real output) or evasion responses (e.g. misreporting of sales). The following three findings suggest that firms respond mainly within the real response margin. First, we find that bunching is scattered along a relatively wide income range (1,700–1,000 euros) below the threshold in all regimes, rather than sharp bunching exactly at the threshold. This observation is consistent with real responses, which are likely to be more uncertain and not perfectly controlled by the entrepreneur due to, for example, unpredictable demand-side effects, thus leading firms to respond already further below the threshold. In contrast, evasion and other pure reporting responses are inherently less uncertain and can be more easily adjusted at the end of the tax year. Supporting this statement, previous studies that find evasion or avoidance responses to dominate among firms and entrepreneurs typically observe very sharp bunching at various tax thresholds (Best *et al.* 2015; Kleven and Waseem 2013; Devereux *et al.* 2014; Saez 2010).

Second, in Figure 12 we examine how firm-level factors that firms are required to report to the tax administration, such as the level of equity, expenses and wages paid to employees, evolve around the VAT threshold. In the absence of evasion responses, production factors should develop smoothly around the VAT threshold as sales increase. Firms both below and above the threshold have clear incentives to report accrued input costs and wages, as they need to remit taxes on their profits (sales minus inputs and wages). Thus in terms of minimizing taxes, there are no incentives to underreport any accrued costs that are tax deductible. In contrast, if evasion through intentional underreporting of sales is the main explanation for how firms locate themselves below the VAT threshold, we should find that the level of reported expenses, wages and equity are larger in sales bins just below the threshold. Nevertheless, this analysis only illustrates the potential mechanisms behind the observed patterns of responses, rather than providing rigorous causal evidence of evasion.[21]

In the figure, the upper two graphs show that the levels of equity and total wages paid to employees increase smoothly as the sales of the firm increase. This implies that firms on both sides of the threshold are equal in size, which suggests that firms do not locate

[21] Almunia and Lopez-Rodriguez (2018) use a similar approach when characterizing the anatomy of the effect of a tax enforcement threshold for large firms in Spain.

themselves below the threshold by systematically underreporting their sales. The lower-left graph in Figure 12 shows that the level of inputs jumps significantly just above the threshold, indicating that, on average, firms just below the threshold incur less inputs to achieve a similar level of sales. However, this evidence does not point to active evasion responses below the threshold. In contrast, it suggests that firms just below the threshold have higher profit margins and productivity. The lower-right graph in Figure 12 also supports this view, showing that firm profits are higher just below the VAT threshold and decrease sharply right above the threshold. This is consistent with the finding in Table 3 that firms with higher value added and thus higher profit margins tend to bunch more actively. As more profitable firms bunch more actively, this selection is also likely to affect Figure 12. In addition, the result of larger profits below the threshold is consistent with our theoretical framework in the sense that firms just below the threshold do not need to remit VAT, and thus they have higher after-tax profits than similar firms with equal selling prices just above the threshold that are subject to VAT. Finally, Table A2 in Online Appendix A shows the numerical estimates for the discontinuities at the threshold. The numerical findings support the visual observations.



Notes: Figure presents local polynomial functions (Kernel) with 95% confidence intervals for different firm-level factors around the VAT threshold (denoted by zero) in 2002–2015. Bandwidth of 100 euros is used in the estimation.

Figure 12: Firm-level factors around the VAT threshold, 2002–2015

Third, Figure A3 in Online Appendix A shows that the average number of firms per owner is very close to one at the threshold, implying that avoidance via multiple firms that

all report sales below the threshold do not explain observed behavior. This finding is driven by the fact that most small firms in Finland are registered as sole proprietors (69% in our sample), and an entrepreneur cannot set up multiple firms registered as a sole proprietor in the Finnish business tax system.[22]

In summary, we find no direct evidence that active evasion responses explain the observed bunching behavior. This (indirectly) suggests that firms respond to the threshold mainly with a real economic decision, such as scaling down real output and activity when the level of sales approaches the VAT threshold. By utilizing similar types of empirical approaches as above, previous literature finds that evasion is an important factor in explaining observed responses to VAT threshold and other size-based rules among larger firms (see, e.g. Onji (2009), Liu *et al.* (2017), and Almunia and Lopez-Rodriguez (2018)). However, our findings suggest that small firms are not as able to utilize this behavioral margin compared to larger firms, implying that size-based thresholds could have more significant real economic consequences among smaller firms.

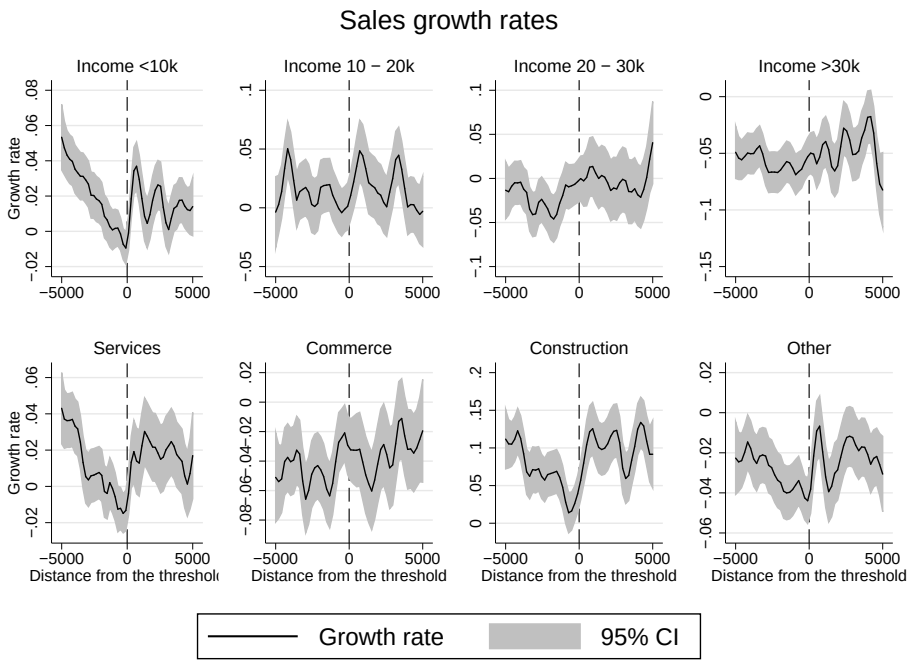
Nevertheless, as in other studies utilizing quasi-experimental variation, we do not directly observe intentional misreporting of overall business activity, such as operating fully or partly in the black market. Therefore, we are not able to provide conclusive evidence of the share of real responses and potential evasion responses. However, even though some proportion of the overall response of firms would comprise of evasion, it would not change our main implication. As evasion responses are likely to also entail non-negligible effects on efficiency, we find that reducing compliance costs is more effective in reducing distortions caused by size-based tax rules, compared to tax rate cuts.

4.6 Dynamic effects

Finally, we study the potential dynamic implications of the VAT threshold. Size-based thresholds typically create incentives for firms to stay small, potentially inducing negative effects on firm growth that further strengthen the distortions caused by the threshold. Figure 13 presents one-year logarithmic growth rates $(t-(t-1))$ of sales conditional on locating in 200 euro sales bins in the base year $t-1$ for owners in different income levels and for firms operating in different sectors. The figure shows that the average growth rate jumps significantly just above the threshold among owners with low personal income (earned + capital

[22]One further potential way to evade VAT and to avoid traceable marks on transactions is to accept only cash payments for transactions above the threshold. However, in 2000–2013, the prevalence of cash payments among consumers has reduced significantly. On average, under 1/4 of consumers use cash as their primary method of payment for daily consumer goods in 2006–2013 in Finland (source: Bank of Finland consumer survey 2015, results available in Finnish only). Therefore, a decision to accept only cash payments presumably reduces business activity, which undermines the potential benefits of evasion.

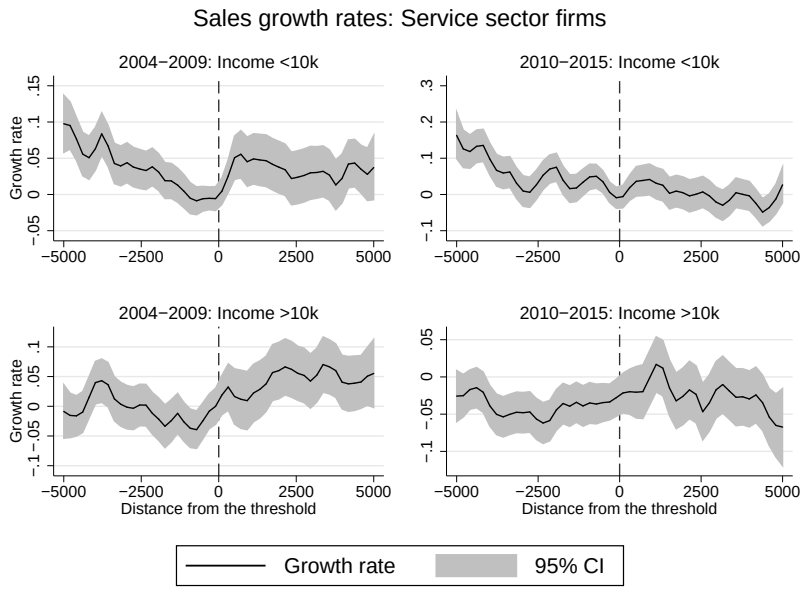
income $<$ 10,000 euros), suggesting that the VAT threshold has a negative impact on growth among these entrepreneurs. In contrast, average growth rates appear to be unaffected by the threshold among owners with larger income levels. In addition, the negative growth effects appear to be larger for firms operating in service and construction industries, compared to firms in commerce and other sectors.



Notes: Figure presents one-year logarithmic sales growth rates ($t - (t-1)$) with 95% confidence intervals conditional on locating in 200 euro sales bins in the base year $t-1$ for owners with different income levels and for firms operating in different industries. The VAT threshold is marked with zero in the figure.

Figure 13: Annual sales growth rates with 95% confidence intervals for different owners and firms, 2002–2015

This evidence suggests that the VAT threshold appears to reduce the growth rates of firms in service-oriented industries and among low-income owners, but this effect is not as significantly present for owners who have, for example, access to significant income outside the firm. Nevertheless, we do observe that high-income owners and firms in other industries also bunch below the threshold (see Table 3 above), but the threshold does not appear to induce any longer-term distortions to these types of firms. In addition, Figure A4 in Online Appendix A presents the persistence rates in different sales bins around the threshold for all firms. The figure shows notable average persistence in the bin just below the threshold, highlighting the overall negative impact of the threshold on growth.



Notes: Figure presents one-year logarithmic sales growth rates $(t-(t-1))$ with 95% confidence intervals conditional on locating in 200 euro sales bins in the base year $t-1$ for four groups of firms operating in the service sector: low-income owners (personal gross capital income + gross earned income $<$ 10,000 euros) before (2004–2009) and after (2010–2015) the reduction in compliance costs, and for owners with more than 10,000 euros of personal gross income in 2004–2009 and 2010–2015. The VAT threshold is marked with zero in the figure.

Figure 14: Annual sales growth rates of service sector firms, 2004–2009 and 2010–2015

Figure 14 describes the growth effects in more detail by characterizing sales growth rates in 200 euro bins around the threshold within the service sector for owners with different income levels. The left-hand side graphs show that before the compliance costs reform in 2010, the annual sales growth rate increased sharply above the threshold among low-income owners, and there is also visible but not as clear of a response for owners with personal income above 10,000 euros. However, the right-hand side graphs illustrate that the negative growth effect reduced significantly or even vanished after compliance costs were reduced in 2010 in both income groups. This suggests that a reduction in compliance costs decreased the negative implications of the threshold, particularly among low-income service sector entrepreneurs.

Moreover, Online Appendix B presents a comparative analysis of small firms in labor-intensive industries in Finland and Sweden, a neighboring country of Finland. There is no VAT threshold in Sweden, and thus Swedish firms represent a suggestive counterfactual when analyzing the growth effects of the Finnish threshold. Our main finding is that Finnish firms below the VAT threshold have significantly smaller growth rates than similar-sized Swedish firms, but differences in growth rates are no longer significant for firms above the VAT

relief region (Figure B2). These results further support the overall conclusion that the VAT threshold has considerable effects on growth, highlighting the detrimental dynamic effects of the threshold.

Finally, we find that the exit rates of firms increase above the threshold, which tentatively suggests that the threshold also affects the extensive margin decisions of entrepreneurs (see Figure B3 in Online Appendix B). This indicates that in addition to intensive margin responses captured by the bunching method, the VAT threshold entails additional distortions. However, estimated responses in different regimes using the bunching approach give us reliable evidence of the underlying mechanisms behind firm behavior at the intensive margin. As long as the mechanisms behind extensive margin responses are similar to those in the intensive margin, exit and entry decisions of firms do not affect our main conclusion that compliance costs drive the responses caused by the VAT threshold, not the VAT rate.

5 Conclusions

Our results offer compelling evidence that even considerable reductions in the VAT rate do not affect the extent of firms bunching just below the VAT threshold. Instead, we observe that a reduction in compliance costs related to VAT reporting decreased the amount of excess mass at the threshold. This implies that compliance costs drive the response rather than tax rate changes, providing new evidence of the underlying mechanisms behind the impact of size-based regulation for small firms and entrepreneurs.

From a broader perspective, our results indicate that reducing and simplifying reporting and other compliance procedures reduce the distortions caused by various size-based rules among small firms and entrepreneurs. These findings are increasingly relevant in terms of policy implications if the emergence of small service-sector firms and entrepreneurs in the gig economy, such as Uber/Lyft drivers, will further continue. In the case of the Finnish VAT threshold system, further avenues for reducing compliance costs include, for example, making the VAT relief fully automatic, and by merging VAT reporting forms with the annual income tax filing procedure. Nevertheless, reducing compliance costs of firms could in some cases increase the administrative burden of the tax authority, which implies that these types of reforms need to be carefully implemented in order to reduce overall costs and increase economic efficiency.

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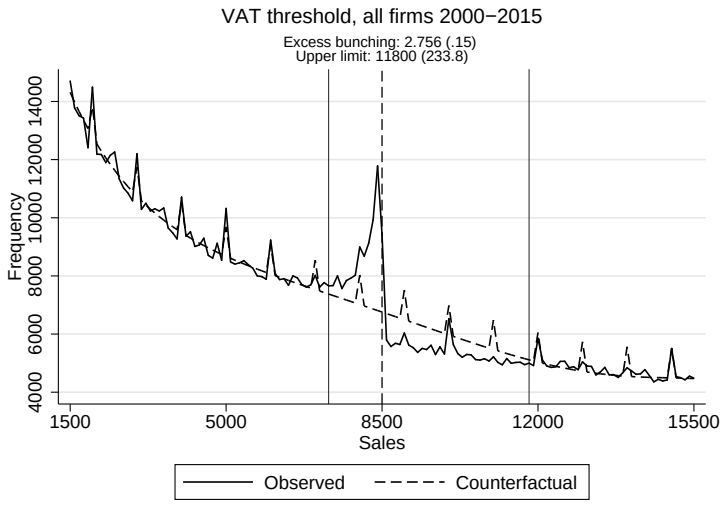
Online Appendix A

This Online Appendix A presents robustness checks and additional results for our empirical analysis presented in the main text of the article "Compliance costs vs. tax incentives: why small firms respond to size-based regulations?" (Harju, Matikka and Rauhanen, 2018).



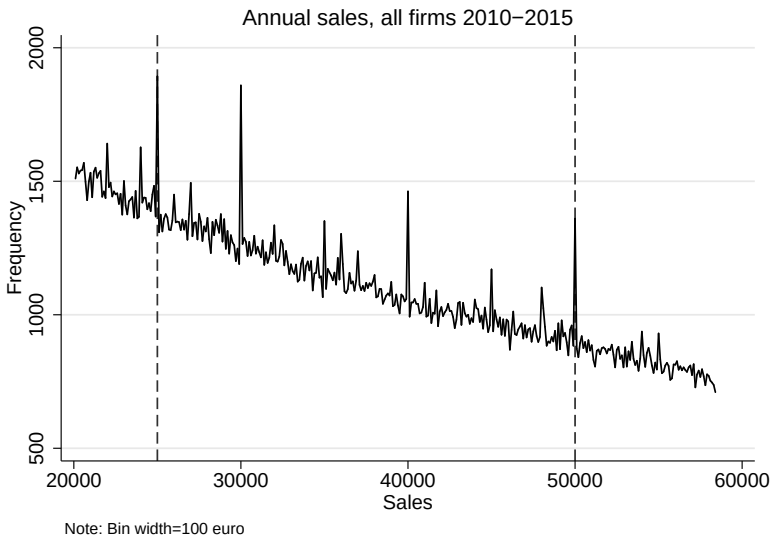
Notes: Figure shows the sales distribution and the counterfactual distribution in bins of 100 euros, and the excess mass and upper limit estimates with bootstrapped standard errors using pooled data from 2000–2015. The VAT threshold is marked with a dashed vertical line. The excluded region in the estimation of the counterfactual is marked with solid vertical lines.

Figure A1: Bunching at the VAT threshold, 2000–2015

	Order of polynomial (baseline=7)			
	4	6	8	10
Excess bunching	3.060	2.998	2.806	2.812
Std. error	(0.130)	(0.155)	(0.176)	(0.219)
	Bunching region (baseline=(-12 - 0))			
	-6 - 0	-9 - 0	-15 - 0	-18 - 0
Excess bunching	2.369	2.730	2.942	3.004
Std. error	(0.078)	(0.114)	(0.187)	(0.238)

Notes: Table shows the excess bunching estimates and standard errors for all firms in 2000–2015 with different assumptions on the order of polynomial and the bunching region. The baseline estimate is 2.756 (0.15). Varying the order of the polynomial from 4 to 10 provides statistically similar results. Decreasing the lower limit from -6 to -18 increases the excess bunching estimate, but estimates using smaller values than -12 provide statistically similar results.

Table A1: Robustness checks: order of the polynomial and the bunching region, 2000–2015



Notes: Figure shows the sales distribution in 200 euro bins around the 25,000 and 50,000 euro reporting thresholds, denoting the thresholds for quarterly and monthly VAT reporting from 2010 onward, respectively. No visible excess bunching is observed from the figure. The sharp spikes exactly at 25,000 and 50,000 euros are likely to be round-number effects, which are also detectable at other convenient round numbers such as 30,000 and 40,000 euros.

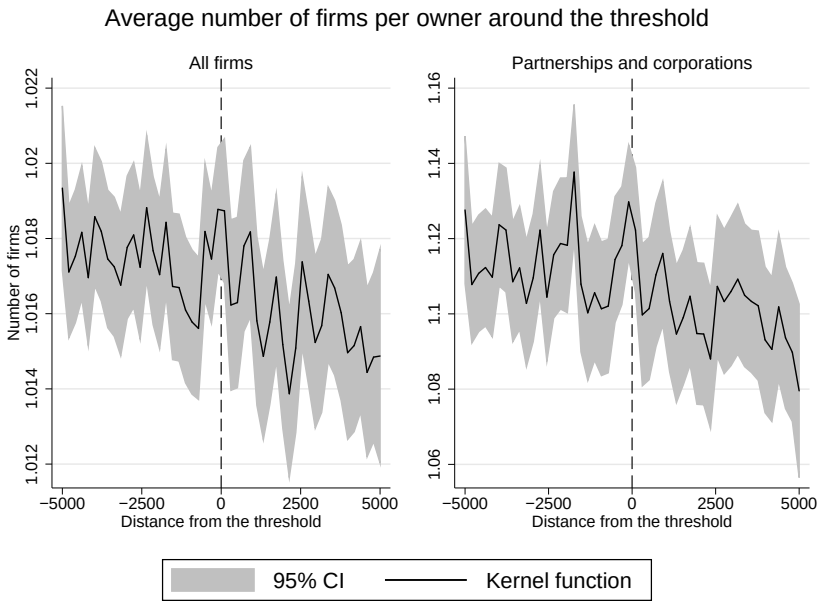
Figure A2: Annual sales of firms and VAT reporting thresholds: 25,000e (quarterly reporting) and 50,000e (monthly), 2010–2015

VARIABLES	Equity	Wages	Inputs	Profits
Estimate	-6.4	31.2	338.8	-325.8
Std. error	(58.7)	(13.6)	(7.0)	(52.7)
Observations	149,092	118,374	34,022	96,350
BW Loc. Poly. (h)	1564	1095	234.3	834.2
BW Bias (b)	2691	1805	545.5	2019

Notes: Table shows the estimates and standard errors for the discontinuities in firm-level factors around the VAT threshold displayed in Figure 12 in the main text. We follow the method presented in Calonico *et al.* (2014)[a] by implementing a local polynomial RD estimator with robust confidence intervals. We use a local linear regression with quadratic bias correction and a triangular kernel function to construct the estimator, and mean squared error optimal bandwidths. The level of equity is statistically insignificantly different on both sides of the threshold. For wages, we observe a statistically significant increase at the threshold, but the difference is very small (31 euros). In contrast, the level of inputs is clearly higher for firms above the threshold compared to firms below. Consistently, reported profits are also significantly lower for firms just above the threshold. These results are in line with the graphical findings in the main text.

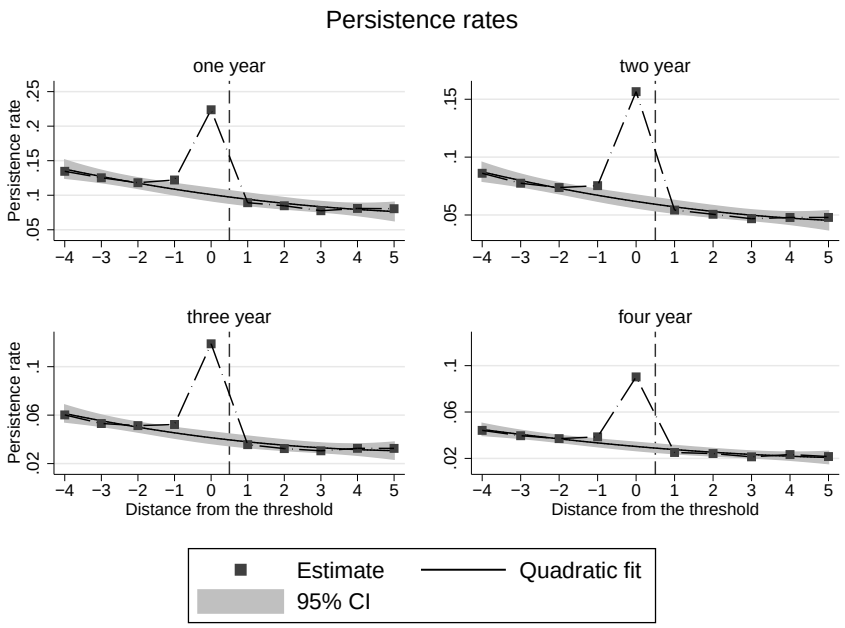
[a] Calonico, S., Cattaneo, M. and Titiunik, R. 2014. Robust nonparametric confidence intervals for regression discontinuity designs. *Econometrica,* 82(6): 2295–2326.

Table A2: Differences in firm-level factors at the VAT threshold calculated using the regression discontinuity approach, 2000–2015



Notes: Figure presents the average number of firms per individual owner around the VAT threshold with 95% confidence intervals in bins of 500 euros. The VAT threshold is marked with zero in the figure. First, the left-hand side of the figure shows that avoidance via multiple firms appears not to explain the observed behavior, as there is no statistically significant jump in the number of firms below the threshold. Second, the figure shows that having multiple firms is in general rare in the sample, as the number of firms per owner (denoted in the vertical axis) is very close to one in each bin. The right-hand side of the figure presents the number of firms per owner when excluding sole proprietors, because it is not possible for one owner to have multiple firms registered as sole proprietors. This graph indicates that the number of firms per owner just below the VAT threshold is slightly larger than above it. This suggests that at least some owners appear to set up multiple partnership firms or corporations in order to avoid VAT liability. Nevertheless, this finding does not in any way explain the overall bunching result, as a majority of the overall sample (69%) consist of sole proprietors, and the overall excess mass estimates are also smaller for both corporations and partnership firms, compared to sole proprietors (see Table 3 in the main text).

Figure A3: The average number of firms per owner around the VAT threshold, 2000–2015



Notes: Figure presents the persistence rates of firms in bins of 1,000 euros on both sides of the VAT threshold using data from 2000–2015. The persistence rate denotes the probability that a firm remains in the same sales bin from one year to another. The figure shows that persistence in the bin just below the threshold (denoted by 0) is notably larger than in other bins close to the threshold. Almost 25% of firms that located just below the threshold in the previous year also located in the same bin in the next year (upper-left panel). The persistence rates in other bins close to the threshold are clearly smaller, approximately 10%. The persistence rate just below the threshold seems to be larger than in other bins after multiple years, even after four years (lower-right panel). These results suggest that the VAT threshold significantly hinders the growth of small firms, and creates a barrier for firm growth.

Figure A4: Persistence rates in different bins around the VAT threshold after one, two, three and four years, 2000–2015

Online Appendix B

This Online Appendix B provides additional results for the article "Compliance costs vs. tax incentives: why small firms respond to size-based regulations?" (Harju, Matikka and Rauhanen, 2018).

We further study the effects of the VAT threshold by comparing Finnish firms to similar firms in Sweden, a neighboring country of Finland. There is no VAT threshold in Sweden, and thus Swedish firms represent an intuitive benchmark for analyzing the effects of the Finnish threshold. Despite the different VAT threshold policy, Finland and Sweden are very similar in terms of the VAT system (e.g. tax rates and reporting practices), the business tax structure and the overall institutional and cultural framework. To support this argument, Harju *et al.* (2015)[23] find that the overall economic development of firms in labor-intensive industries is very similar between Finland and Sweden.

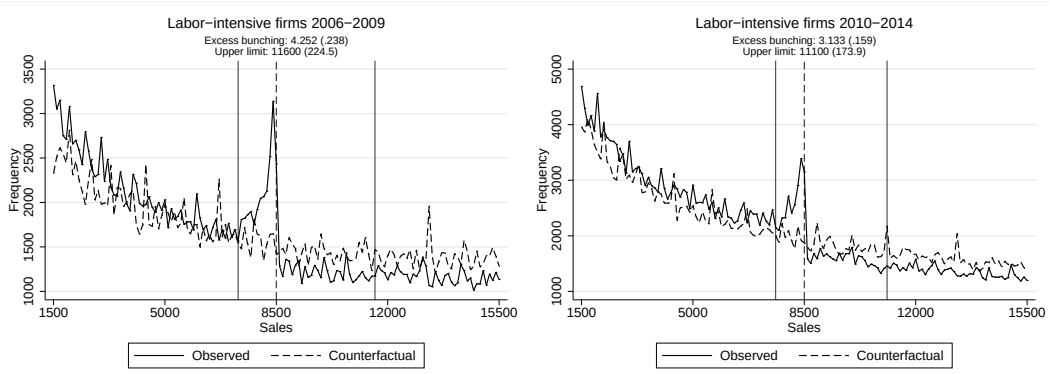
For Sweden, we have data on firms operating in labor-intensive industries in 2006–2014. Thus, in the following analysis, we restrict the data on Finnish firms to include only the same industries within the same period.[24]

Bunching and compliance costs. First, we estimate the excess mass of Finnish firms at the VAT threshold by using Swedish firms as a counterfactual. To do this, we first calculate the total number of firms within 100 euro bins before (2006-2009) and after (2010-2014) the compliance cost reform by country and divide this count by the total number of firms within the bunching window (VAT threshold +/- 7,000 euros). Then we multiply this share by 100,000 in both countries. Therefore, the frequencies in the figures below do not reflect the actual number of firms, but instead show the relative frequencies in both countries. In the estimations, we use the same procedure as in the main text but instead of estimating the counterfactual distribution using the observed distribution outside the excluded region, we directly use the observed relative Swedish firm distribution as a counterfactual when calculating the excess mass and marginal buncher.

Figure B1 shows the results. First, we find clear bunching of Finnish firms at the VAT threshold (vertical dashed line in the figures) also in the subsample that consists of firms operating in labor-intensive industries. In contrast, the sales distribution for Swedish firms is smooth around the Finnish threshold. We observe that excess bunching is very pronounced for Finnish firms, 4.252, before 2010 compared to the Swedish counterfactual. Similarly as in our baseline results, the amount of excess mass decreases significantly to 3.133 after the compliance cost reduction.

[23] Harju, J., Kosonen, T. and Nordström-Skans, O. 2015. Firm types, price setting strategies and consumption-tax incidence. CESifo Working Paper 5654.

[24] Data on Swedish firms is used with the permission of the Swedish Tax Agency. Labor-intensive industries cover mainly construction, cleaning and other personal services. In more detail, the data include Swedish and Finnish firms from the following two-digit industry codes: 41-43, 47, 50, 71, 74, 81, 84, 85, 88, 93, 95 and 96. More information on the composition of industry codes is available, for example, on Statistics Finland's website: http://www.stat.fi/meta/luokitukset/toimiala/001-2008/index_en.html (Accessed 19th of August, 2016).



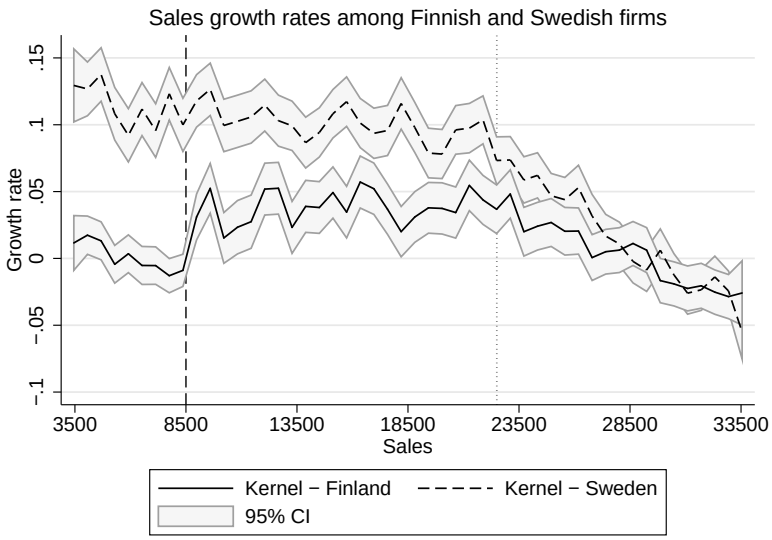
Notes: Figure shows the relative sales distributions in bins of 100 euros for Finnish (Observed) and Swedish (Counterfactual) firms in labor-intensive industries in 2006–2009 and 2010–2014. The Finnish VAT threshold is marked with a dashed vertical line. The excess mass and upper limit estimates are calculated using the Swedish firm distribution as a counterfactual. The estimation procedure is otherwise similar to that presented in Section 3.4 in the main text. Bootstrapped standard errors are in parentheses.

Figure B1: Bunching: using Swedish firms (no VAT threshold) as a counterfactual for Finnish firms, 2006–2009 and 2010–2014

In addition, the relative density of Finnish firms is slightly larger in the whole region below the threshold, and smaller above it. This suggests that the VAT threshold induces a negative growth effect, resulting in a larger relative frequency of firms below the threshold in Finland, in comparison to Sweden. We study this effect in more detail below.

Dynamic responses. Figure B2 shows the average annual growth rates in different parts of the sales distribution (in 200 euro bins) for Finnish and Swedish firms in 2006–2014. The following three points are clearly visible from the figure. First, below the VAT threshold (vertical dashed line), the average growth rate of Finnish firms is approximately zero, while comparable Swedish firms increased their annual sales by 10–15% on average. Second, above the threshold and below the upper limit of the VAT relief region (vertical dotted line), the growth rates are slightly smaller among Finnish firms compared to Swedish firms. Third, above the upper limit of the VAT relief region, the average growth rates are similar between the countries. These additional descriptive results suggest that the VAT threshold induces negative effects for the growth of small firms in Finland, in comparison to the Swedish system with no such sales-based regulations.

Extensive margin. The VAT threshold could also affect extensive margin decisions related to entry and exit of firms, which need to be considered when analyzing the overall distortions caused by this regulation. Figure B3 characterizes the effect of the threshold on entry and exit. The figure shows the relative exit rates around the threshold and the distributions of entering firms (at the time the firm is first observed in the data) in both Finland and Sweden. The upper-left graph suggests that the VAT threshold has an effect on exit decisions. It appears that the exit rates are

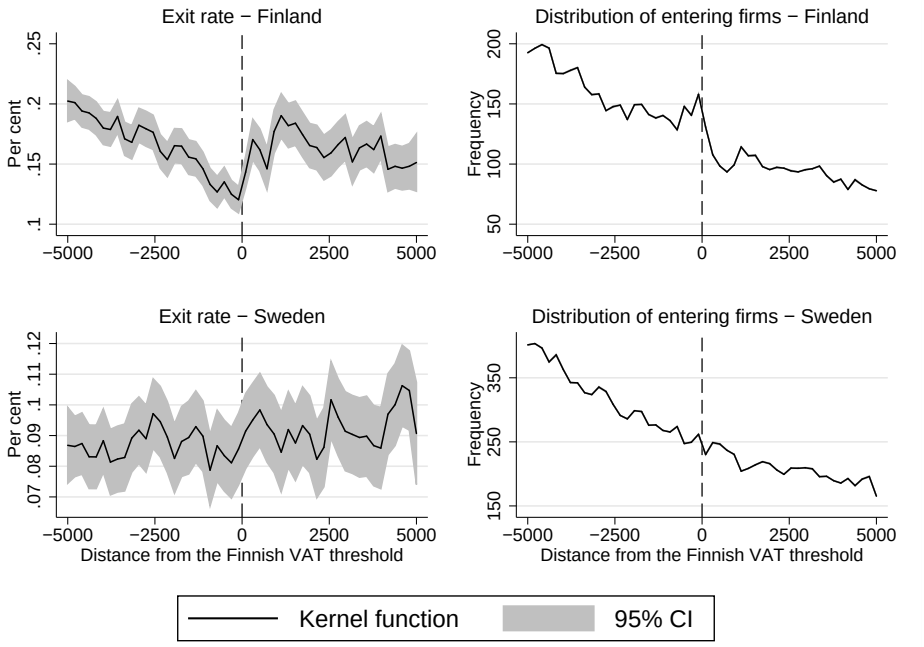


Notes: Figure presents one-year logarithmic sales growth rates ($t - (t-1)$) with 95% confidence intervals conditional on locating in 200 euro sales bins in the base year for Finnish and Swedish firms operating in labor intensive industries in 2006–2014.

Figure B2: Average annual growth rates in different sales bins (200 euros) for small firms in labor-intensive industries in Finland and Sweden, 2006–2014

larger for firms above the threshold than for firms below it in Finland. However, the exit rate drops just below the threshold, which is consistent with the observation in Figure A4 in Online Appendix A, showing that a large number of firms locate themselves below the threshold in many consecutive years. In comparison, exit rates do not feature such discontinuous changes in Sweden.

The upper-right graph of Figure B3 shows that entering firms also tend to locate themselves just below the threshold. This suggests that the threshold affects the distribution of both new and existing firms. In comparison, the distribution of entering firms declines smoothly with sales in Sweden.



Notes: Figure shows the exit rates of firms with 95% confidence intervals and the distributions of entering firms (first observation in the data) in bins of 200 euros around the Finnish VAT threshold (marked with 0 in the figure) for Finnish and Swedish firms in labor-intensive industries in 2006–2014.

Figure B3: Exit rates and distributions of entering firms, firms in labor-intensive industries in Finland and Sweden, 2006–2014

Overall, a comparison of Finnish and Swedish firms in labor-intensive industries supports the conclusion presented in the main text that the VAT threshold has significant effects on the behavior of Finnish firms. In addition, we find suggestive evidence that the growth effects and the impact on exit rates are non-trivial, suggesting that the threshold also affects both the behavior of firms over time and the extensive margin decisions of entrepreneurs.

This evidence suggests that the impact of the threshold estimated using the local bunching approach is likely to produce a lower bound estimate of the overall distortions created by the VAT threshold. Nevertheless, the evidence derived using reforms in both tax incentives and compliance costs show compelling evidence that compliance costs are the main driver of responses. As long as the mechanisms behind extensive margin responses are similar to those in the intensive margin, exit and entry decisions of firms and other growth effects do not affect our main conclusion that compliance costs drive the distortions caused by the VAT threshold.