Estimating the Elasticity of Turnover from Bunching: Preferential Tax Regimes for Solo Self-employed in Italy

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PRELIMINARY AND INCOMPLETE

Abstract

Turnover is a key indicator of economic activity, but we know little about how much entrepreneurs adjust it as a response to taxation. This is because business taxation is usually based on profits, rather than turnover. This paper exploits the notch created by the eligibility cut-off of the preferential (turnover) tax regime for solo self-employed in Italy to study turnover responses to taxation. I find that solo self-employed bunch below the turnover threshold to be eligible for the preferential scheme. Effects are different in different sectors, with professionals and business intermediaries showing the largest responses. I estimate the turnover tax elasticity by focusing on the (last) marginal buncher. To do so, I adapt the models of Kleven and Waseem (2013) and Harju et al. (2019) to derive a modified indifference condition that fits the institutional set-up.

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1 Introduction

Turnover is a key indicator of economic activity, but we know little about how much firms actually adjust it as a response to taxation. This is because business taxation is usually based on profits – for which there is plenty of evidence of bunching (Kleven 2016) – rather than turnover. This paper aims to fill this gap by investigating to what extent solo self-employed[1] adjust sales turnover due incentives of the tax system. I study responses to the notches created by the eligibility cut-offs of the preferential tax regimes for solo self-employed in Italy. Then, I exploit one specific notch to estimate the turnover tax elasticity. Since turnover is strictly related to output, after accounting for prices, analysing such responses is extremely important for both academic research and policy-makers.

The Italian tax system provides a suitable framework to address this question as tax liabilities for solo self-employed depend on the level of turnover. I exploit the notch created by the eligibility cut-off of the preferential turnover tax regime for solo self-employed to estimate the turnover tax elasticity. If turnover is below a certain threshold, Italian solo self-employed can opt out of the ordinary tax regime and choose to be taxed at a preferential rate. In addition to tax advantages, the preferential regimes also have simplified compliance procedures[2]. Conversely, if turnover is above the cut-off, higher average tax rates apply as the ordinary tax regime remains the only option. This creates a series of notches in the tax schedule for solo self-employed at different levels of turnover, depending on the sector and year being considered. I show that there is bunching below some of the statutory turnover-limits of the preferential regimes, as some solo self-employed choose to adjust their revenues and/or limit growth in sales to access tax advantages.

In the period 2012-2019, Italian solo self-employed could choose between the ordinary tax regime and (at least) one preferential tax scheme. The ordinary tax regime is moderately progressive. It includes personal income tax, social security contributions and VAT. Then, various preferential tax regimes have been introduced, exempting self-employed from VAT, and replacing the progressive personal income tax schedule with a proportional levy on taxable income. From 2012, the preferential profit scheme ("M-Regime")[3] featured a 5% rate on taxable income for those whose turnover was below €30,000. While this scheme was abolished in 2015, those who had chosen it were allowed to keep it as long as entry requirements were satisfied. The new preferential (turnover) tax scheme in place from 2015 – "the F-regime" [4] – kept the 5% rate only for new businesses (no more than 5 years old), but it raised the flat rate to 15% for others.

One key difference between these two preferential regimes (M & F regimes) is the

[1] Solo self-employed are self-employed individuals who work without collaborators or employees. The share of solo self-employed in self-employment is increasing in many OECD countries (Boeri et al. 2020).

[2] Similar regimes have been implemented in several developing countries (Best et al. 2015).

[3] "Regime dei Minimi".

[4] "Regime Forfettario".

tax base. While the M regime taxes profits, given by the difference between revenues and costs, the F regime defines the tax base as a sector-specific share of turnover, resulting in different tax incentives across sectors. I exploit this heterogeneity by studying each group separately and investigate which groups are more responsive.

I use administrative data from ISTAT[5] on all self-employed operating in Italy between 2012 and 2019. I consider the following three periods separately: 1) 2012-2014 when the M-regime was in place; 2) 2016-2018, when both the M & F regimes were in place; 3) 2019, when the new reform, announced in 2018, equalised the F-regime turnover-thresholds to €65,000 across sectors. While it's not possible to know the exact individual tax liabilities, I reconstruct how much each individual would pay in each regime given the current tax legislation. Then, I exploit the turnover responses to the €65K threshold of the F-regime in 2019 to estimate the turnover elasticity. To do that, I compute the implicit average tax rates on turnover, as the qualifying threshold for the F-regime refers to turnover.

This paper contributes to the literature in several ways. First, while the existing evidence of bunching largely focus on taxable income adjustments[6], this paper focuses on responses to taxation of sales turnover, that is a specific component of taxable income for self employed, and a key indicator of economic activity. I show that individual entrepreneurs in Italy adjust the level of revenues as a response to financial incentives of the tax system. Solo self-employed bunch below the turnover threshold, set by the tax code, to qualify for a preferential tax scheme, with preferential rates and simplified compliance procedures.

Turnover responses to taxation are studied by Harju et al. (2019) and Liu et al. (2021) in the context of VAT registration thresholds in Finland and UK respectively, and Aghion et al. (2022) who exploit the preferential regimes for self-employed in France. While all studies find bunching below the relevant threshold, different key findings can be highlighted. Harju et al. (2019) find that compliance costs due to VAT tax filing explain most of the observed bunching of small firms in Finland, so that the estimated elasticity of value added is quite low[7]. Then, Liu et al. (2021) find that bunching is more likely when firms have lower inputs-sales ratio, higher proportion of business-to-consumer sales, and lower mark-ups. Finally, Aghion et al. (2022) stresses the importance of tax simplicity and evasion responses that might explain observed responses in their case.

This paper differs from these studies in three ways. First, I investigate the responses at the threshold where there is an overall change of the taxation of solo self-employment income including, but not limited to, VAT. This seems to be a more suitable case to study how output responds to tax incentives, aside from compliance costs related to

[5]National Institute of Statistics, Italy.

[6]Saez (2010) for the US, Chetty et al. (2011) for Denmark, Kleven and Waseem (2013) for Pakistan, Bastani and Selin (2014) for Sweden, Adam et al. (2021) for the UK.

[7]This is motivated by the fact that VAT threshold in Finland is quite low (€8,500), so that the estimated compliance costs (€1,300) are relatively more important than the incentives generated by the VAT rate.

the tax system. Second, while Liu et al. (2021) study larger firms, compared to Harju et al. (2019), they don't provide an estimate of the elasticity of turnover. In this project, I adapt the models of Kleven and Waseem (2013) and Harju et al. (2019) to fit the institutional set-up and estimate the turnover elasticity. Third, our findings might be evidence of real responses as observed bunching is quite disperse and the relevant threshold for some taxpayers in Italy is higher than in France.

Lastly, this paper relates to the policy discussion regarding the opportunity of taxing different types of income differently by setting up preferential tax regimes for certain taxpayers. Adam and Miller (2021) discuss the different tax rules applying to wage-earners, self employed and business owners' income in the UK, and argue that preferential tax regimes could create inefficiency, unfairness, complexity and revenue losses for the government. This paper shows that this might also be the case in Italy: many solo self-employed declare revenues up to the eligibility thresholds for the preferential tax regime. If that is due to tax planning/evasion, then the preferential tax regime is eroding the tax base and therefore causing revenue losses for the Treasury. If bunching is due to self employed limiting their growth in sales, then the tax system is also encouraging businesses to remain small, which is potentially detrimental to economic growth.

2 Institutional Background and Data

2.1 Tax regimes for solo self-employed

In Italy, self-employed have two options for income taxation: i) the ordinary tax regime; ii) one of the existing preferential tax regimes. The first one includes social security contributions (see table 1), the progressive personal income tax schedule (see table 2), and VAT. Sellers charge VAT on their sales, remit it to the tax authorities every three months, and claim back the VAT paid on inputs of production. The standard VAT rate was 21% in 2012-2013, 22% from 2014 onwards, and it applies to most goods and services[8].

In the 2010's, two preferential tax schemes – alternative to the ordinary regime – were introduced, allowing solo self-employed[9] with turnover below a certain threshold to have tax advantages and simplified compliance procedures[10]. They provide lower income tax rates and/or a different tax base on which reduced rates apply. Moreover, a distinctive feature of these schemes is the exemption from VAT, meaning that the turnover cut-off to access these schemes coincides with the VAT registration threshold. Next, I describe two such schemes, alternative to the ordinary regime described above: 1) M-regime (2012-2015); 2) F-regime (from 2015 onwards).

[8] Italy has two reduced VAT rates: 4% for food and agricultural products; 10% for energy and gas used by households.

[9] Self-employed without collaborators.

[10] These include an exemption from filing VAT reports and bookkeeping for income tax purposes. However, entrepreneurs must keep all documents they receive and produce for their transactions.

Table 1: Social security contributions

		Contributions		Thresholds		
Year	Category	Variable	Fixed	Basic	Middle	Top
2012	Commerce	21.40%	€3,200	€14,930	€44,204	€96,149
-	Professionals	27.72 %	€0	-		-
2013	Commerce	21.84%	€3,360	€15,357	€45,531	€99,034
-	Professionals	27.72 %	€0	-		-
2014	Commerce	22.3%	€3,460	€15,516	€46,031	€100,123
-	Professionals	27.72 %	€0	-		-
2015	Commerce	22.7%	€3,540	€15,548	€46,123	€100,324
-	Professionals	27.72 %	€0	-		-
2016	Commerce	23.2%	€3,610	€15,548	€46,123	€100,324
-	Professionals	27.72 %	€0	-		-
2017	Commerce	23.6%	€3,680	€15,548	€46,123	€100,324
-	Professionals	25.72 %	€0	-		-
2018	Commerce	24%	€3,790	€15,710	€46,630	€101,427
-	Professionals	25.72 %	€0	-		-
2019	Commerce	24%	€3,830	€15,878	€47,143	€102,543
-	Professionals	25.72 %	€0	-		-

Notes: Commerce includes wholesale, retail trade and other self-employed. The contribution rate for Commerce applies between the basic and middle threshold, and then rises by 1 p.p. for any profit between the middle and top threshold. No contributions are due on profits exceeding the top threshold. For Professionals, there are no fixed contributions. The reported contribution rate applies all the way up to the top threshold.

Table 2: Ordinary regime: Income tax rates 2012-2019

	Personal Income Tax Rates				
	Starting	Basic	Middle	Higher	Top
Thresholds (€)	0	15,000	28,000	55,000	75,000
Tax rates	23%	27%	38%	41%	43%

Table 3: Tax credits: 2012-2019

	Tax credits	
Type	Brackets (€)	Amount (€)
Self-employment	$0 - 55{,}000$	$\frac{55{,}000-TP}{50{,}200} \times 1{,}104$
one child $<$ ($\geq$) 3 y.o		$\left[1 - \frac{TP}{95{,}000}\right] \times 1220\ (950)^a$
two children $<$ ($\geq$) 3 y.o		$\left[1 - \frac{TP}{110{,}000}\right] \times 1220\ (950)^a$
Non-working spouse	$0 - 15{,}000$	$800 - \frac{(110 \times TP)}{15{,}000}$
	$15{,}001 - 40{,}000$	690
	$40{,}001 - 80{,}000$	$\frac{(80{,}000-TP)}{40{,}000} \times 690$
Other		share of expenditure

Notes: Other includes the 19% tax credit for expenditures in healthcare services, gyms, university fees. This rises to 20% for high-efficiency refrigerators, 36% for renovations and 55% for energy-saving devices. Tax credits reduce the amount owed to the tax authorities.
[a] In 2012, the per-child amount was lower: €800 (€900) for $<$ ($\geq$) 3 y.o. child.
TP: Taxable Profits = Profits − social security contributions

Preferential profit tax scheme: M-regime

Between 2012 and 2015, solo self-employed with turnover below €30,000 could opt out of the ordinary regime and choose the M-regime. This scheme exempts entrepreneurs from VAT registration, annual VAT declaration to the tax authority, as well as record-keeping on clients, suppliers, purchases and payments. Then, the progressive PIT schedule is replaced by a proportional 5% tax rate on profits. Access to this scheme is limited to new businesses (no more than five years old) or until entrepreneurs are 35 years old. While the scheme was abolished in 2015, people already in and satisfying its requirements could keep it.

Although the M-regime has no tax credits, the lower statutory profit tax rate, compared to the ordinary regime, is enough to make this scheme advantageous for most taxpayers. Hence, it is safe to assume that any taxpayer meeting the entry criteria would be better off in the M-regime. As the turnover threshold of €30,000 is not related to any other tax policy in 2012-2014, any excess mass of taxpayers below that threshold can be safely explained by the tax incentive of this scheme.

Preferential turnover tax scheme: F-regime

In 2016, the F-regime replaces the M-regime as the main preferential tax scheme for solo self-employed. Table 4 shows the sector-specific turnover cut-offs that solo self-employed need not to go past if they want to choose this regime. The largest group of taxpayers – including lawyers, doctors, professors, architects and other professionals – faces the €30,000 threshold in 2016-2018. Then, in 2019, the cut-offs are equalised to 65K across sectors.

Table 4: F-regime rules by sector in 2016-2018 (2019)

Sector	Turnover cut-off (thousands €)	% of Taxable Turnover	Tax rate (%)
Real estate	25 (65)	86	15
Business Intermediaries	25 (65)	62	15
Professionals	30 (65)	78	15
"Other economic activities"	30 (65)	67	15
Food & beverage	45 (65)	40	15
Retail & accommodation	50 (65)	40	15

Note: the tax rate drops to 5% if the business is less than 5 years old. Turnover cut-offs in 2019 are in parentheses.

The new scheme exempts taxpayers from VAT and replaces the income tax schedule with a proportional tax rate (15% or 5% if the business is less than 5 years old). Moreover, it grants a 35% reduction in SSCs for artisan enterprises and shopkeepers, that are mostly part of the Retail & Accommodation sector. Hence, I take assume that all taxpayers in this sector apply for this tax relief. However, differently from the M and ordinary regime, the tax base is a pre-determined share of turnover, that is set by the tax code, that serves as a notional measure of profits on which tax rates apply. Notice that the sector-specific notional profit levels (share of taxable turnover) are used only for tax purposes. Taxpayers are not required to adjust profits to match them to access to the preferential tax scheme. The effective preferential tax rate on turnover is therefore given by the social security contribution rate plus the statutory tax rate multiplied by the share of taxable turnover (net of SSCs).

As the F and the ordinary regime have different tax bases, the incentives at the threshold will be heterogeneous across agents. Two main mechanisms can be distinguished. First, conditioning on the level of turnover, the incentive (to bunch) generated by the VAT exemption will be stronger for agents with higher value added[11]. Second, given the statutory tax rates in the F and ordinary regime, the incentive to bunch will depend on the difference between the notional profits (tax base in the F-regime) and the actual profits (tax base in the ordinary regime). Even if the statutory tax rate in the F-regime is quite low, compared to the ordinary regime, it's not certain any agent is better-off by bunching. An entrepreneur with relatively low (actual) profits might pay less in the ordinary regime, and given her preferences, non-bunching might turn out to be optimal. This implies that the F-regime threshold is a notch without a clear dominated region.

2.2 Data

This paper uses administrative data from the Italian National Institute of Statistics. It includes the universe of businesses operating in Italy in the period 2012-2019. The data

[11] This is the mechanism analysed by Harju et al. (2019) and Liu et al. (2021).

Table 5: Descriptive statistics, 2012 – 2019

	Self-employed statistics ($n = 14,466,976$)			
	Turnover	Inputs	Profits	Profit rate
Mean	37,668	14,101	20,180	0.56
Median	29,934	7012	16,887	0.67
sd	23,510	39,320	50,678	1.41

	Sector profit rate and shares of taxpayers					
	Professionals	Other Actvities	Real Estate	Retail & Accom.	Business Intermediaries	Food & Beverage
Mean	0.749	0.519	0.504	0.187	0.678	0.240
Median	0.780	0.633	0.621	0.23	0.713	0.263
sd	0.309	1.03	2.60	1.81	0.256	0.947
Sector shares	0.375	0.196	0.169	0.166	0.082	0.012

Note: The sample includes self-employed with turnover between €10,000 and €107,000. Taxpayers are categorized by Statistics Italy's industrial classification (2007).

contain information on annual revenues from sales, net of VAT, costs for intermediate inputs of production (like goods and services), personnel expenditures, and profits. The dataset also includes the number of people employed, the specific sector in which the entrepreneur operates, and whether the business is qualified as "artisan", and therefore eligible for the reduction in SSCs in the F-regime. For the purpose of this project, we restrict our sample to self-employed without collaborators and employees, as only these can qualify for preferential tax schemes in Italy. Table 5 shows some descriptive statistics for selected taxpayers with turnover between €10,000 and €107,000. We observe heterogeneous average profit rates across sectors, going from the highest for Professionals, to the lowest in the Retail & Accommodation industries[12]. Then, we also consider self-employed with collaborators to observe responses to the (different) personnel expenditure thresholds over the period.

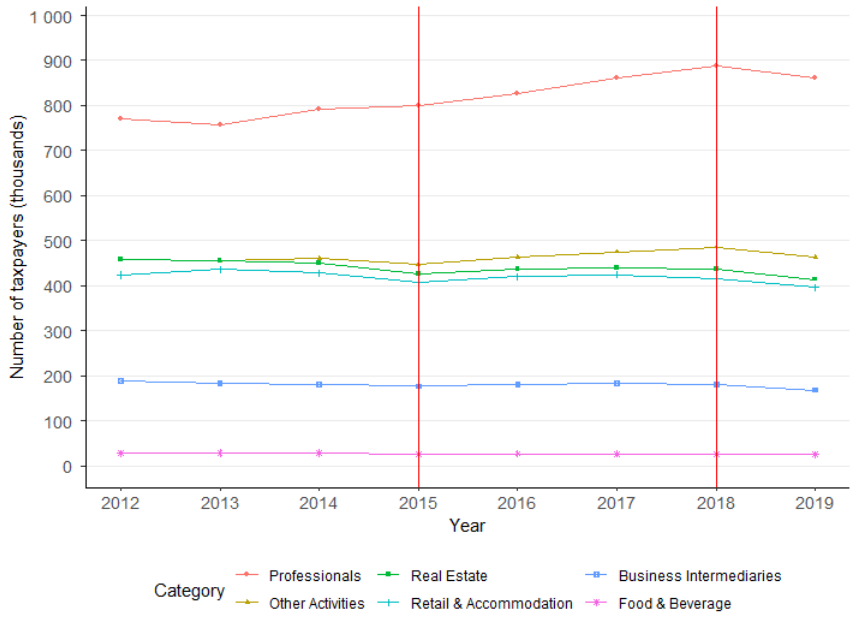
3 Bunching Estimation and Evidence

3.1 Behavioural response estimation: bunching method

The bunching method requires to estimate the counterfactual distribution, that is the distribution of turnover in absence of the notch, that will be compared with the empirical distribution. Following Chetty et al. (2011) and Kleven and Waseem (2013), I estimate the counterfactual distribution by fitting the observed distribution with a flexible polynomial, excluding an area around the threshold y^*. I group observations in bins denoted by j of size s in such a way that the the upper bound y_j of bin $(y_j - s, y_j]$ at the turnover threshold coincides with the threshold itself. Hence, all taxpayers bunching at

[12]For the preferential turnover regime, profit rate heterogeneity across sectors explains why different sectors have different shares of taxable turnover, that works as a notional profit level for each category of self-employed.

Figure 1: Number of solo self-employed by sector



the threshold y_j will be part of bin j. I run the following regression excluding the region $[y_L, y_H]$ around the threshold,

$$c_j = \sum_{i=0}^{p} \beta_i \cdot (y_j)^i + \sum_{i=y_L}^{y_U} \gamma_i \cdot \mathbf{1}[y_j = i] + \nu_j \tag{1}$$

where c_j is the number of taxpayers grouped in bin j, and y_j is the turnover level in bin j. In view of round-number bunching, I omit taxpayers declaring revenues that are multiples of €1K[13] for the benchmark estimation. Then, I extrapolate the fitted distribution to the cut-off using the fitted values of the regression $\hat{c}_j = \sum_{i=0}^{p} \hat{\beta}_i \cdot (y_j)^i$ for $[y_L, y_U]$. Excess bunching is defined as the difference between the observed and counterfactual density to the left of the threshold in $[y_L, y^*]$, that is $\hat{B} = \sum_{j=y_L}^{y^*} (c_j - \hat{c}_j)$. The lower bound of the excluded area y_L is chosen at the point where the turnover distribution begins to increase, i.e. when bunching behaviour starts. Then, the upper bound is chosen such that the estimated excess bunching to the left of the threshold $\hat{B}$ equals the estimated missing mass to the right of the threshold in $[y^*, y_H]$, that is $\hat{M} = \sum_{j>y^*}^{y_U} (\hat{c}_j - c_j)$.

In line with the bunching literature, I use a residual-based bootstrap procedure to compute the standard errors. A large number of turnover distributions are estimated by random resampling of residuals in (1), with which new estimates of the counterfactual distribution are obtained. The standard errors are defined as the standard deviation in the distribution of the estimate.

Following Kleven and Waseem (2013), I distinguish between the turnover response

[13] Including these observations would require to add round-number fixed effects to the regression for the counterfactual estimation.

conditional on bunching, and the actual turnover response given by heterogeneous tax incentives at the threshold. I refer to the first one as structural response – driven by structural elasticity e – and to the second as observed response, driven by the observed elasticity. The observed response includes those agents who optimally choose not to bunch given their particular incentive at the threshold, and are unresponsive to the notch. We focus on the structural response, and therefore structural elasticity, as we want to focus on those agents that have an incentive to bunch. Hence, denote by B excess bunching, and by $\beta(y)$ the share of agents at turnover y with sufficiently low profits π such that they are unresponsive to the notch. Then, excess bunching reads

$$B = \int_{y^*}^{y^*+\Delta y^*} (1-\beta(y))h_0(y)dy \approx (1-\beta)h_0\left(y^*\right)\Delta y^* \tag{2}$$

where the approximation assumes that the counterfactual density $h_0(y)$ and the share of non-bunchers β are roughly constant for $y \in (y^*, y^* + \Delta y_e^*)$. The term $(1-\beta)\Delta y^*$ is defined as the average turnover response attenuated by non-bunchers. Differently from Kleven and Waseem (2013), β represents the share of taxpayers that are unresponsive not because of frictions, but because of weaker (or even absent) tax incentives. For instance, consider agents in narrow range above the threshold where we can assume bunching or not only depends on tax liabilities above and below threshold[14]. Then, some taxpayers might not choose to bunch because they have very low profits and therefore very low tax liabilities in the profit tax regime above the threshold. Reworking (7) yields

$$\Delta y^*/y^* = \frac{B}{(1-\beta)h_0(y^*)y^*}$$

where y^* is expressed in binwidth units. We can compute the proportional behavioural response $\Delta y^*/y^*$ after estimating the counterfactual density $h_0(y)$.

3.2 Evidence of Turnover Responses

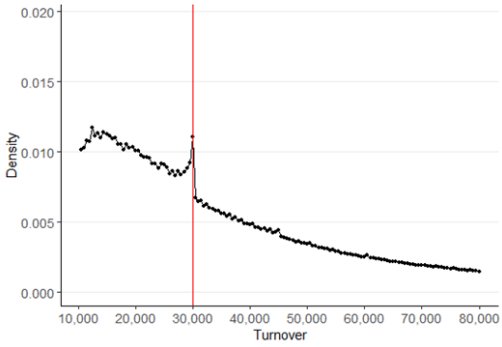
Figure 2 shows the turnover distribution in three periods: 2012-2014, 2016-2018 and 2019. In the first period (panel a), we can see bunching just below €30,000, that is the only relevant threshold for the preferential profit regime in 2012-2014. Then, panel (b) shows responses to the multiple sector-specific thresholds of the newly-introduced turnover (F) regime in 2016-2018. Notice that the spike below €30,000 gets bigger as that is also the valid threshold of the F regime for "Professionals" and "Other activities". Finally, panel (c) shows bunching below €30,000 and €65,000, that are the turnover cut-offs for, respectively, the preferential profit (M) and turnover (F) regimes in 2019.

Then, I focus on the €65,000 cut-off of the preferential turnover regime. Figure 3 shows the distributions of turnover of the different sectors. Figure 4 reports the values

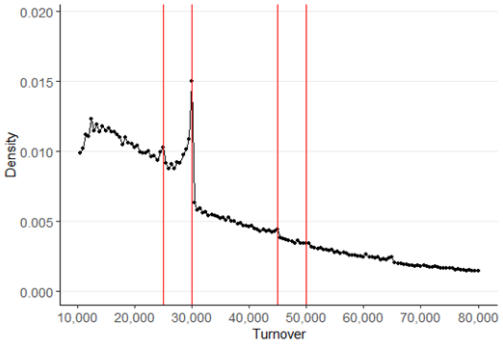
[14] As in this case bunching would require changing turnover marginally, we can abstract from their specific preferences

Figure 2: Bunching below the turnover thresholds to access the preferential regimes

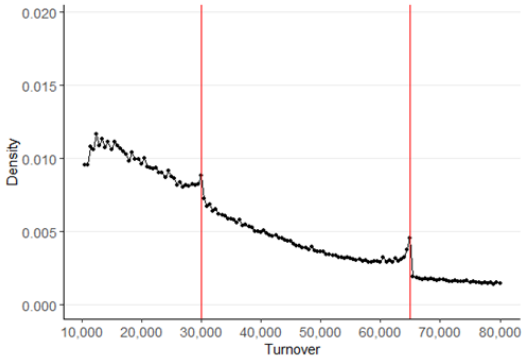
(a) 2012-2014: M regime



(b) 2016-2018: M & F regime



(c) 2019: M & F regime

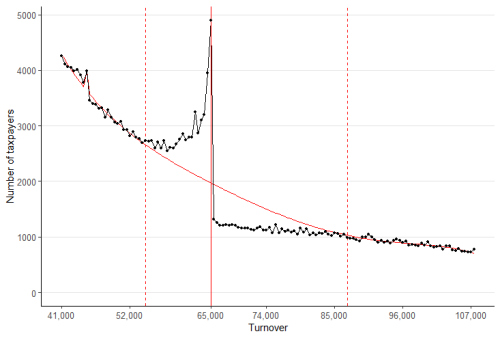


of the excess bunching coefficient b for all sectors. It is defined as the ratio between the excess mass of taxpayers to the left of the threshold and the value of the counterfactual distribution at the threshold, and serves as a measure of how strong bunching is. We can see there are heterogeneous responses across sectors, with Professionals showing the highest bunching coefficient.

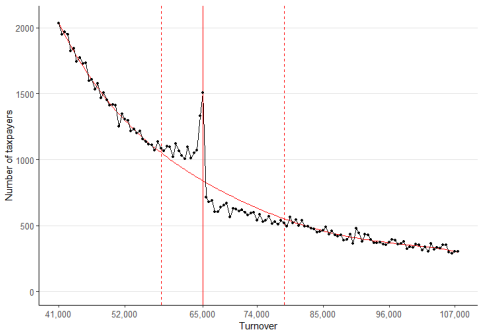
However, tax incentives are also different in different sectors so that the standard bunching coefficient alone cannot be used to compare responses across sectors. Without accounting for different tax incentives at the threshold, it is not possible to disentangle large responses *per se* from large responses due to large tax-rate-gaps across regimes. Therefore, I propose to normalise the standard bunching coefficient by the tax gap between the ordinary and preferential regime that the median taxpayer – in terms of profits – faces in each sector. For that, we need to know the whole tax incentive that the agent faces, including VAT incidence. These results are presented after the structural estimation section.

Figure 3: Bunching at the €65,000 threshold in 2019 to access the preferential turnover regime.

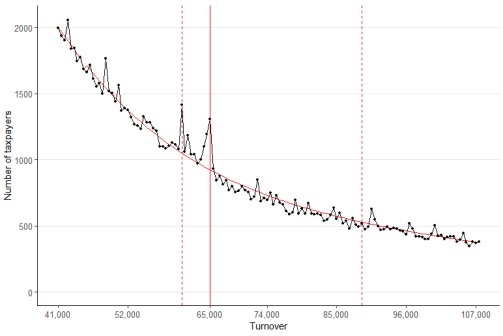
(a) Professionals



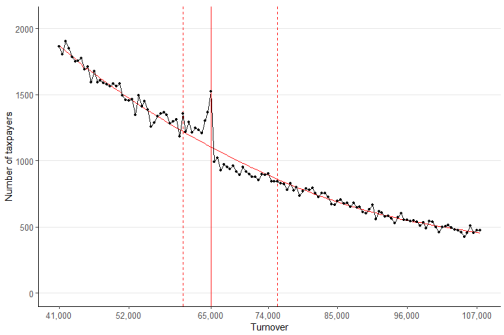
(b) Other Activities



(c) Construction & Real Estate



(d) Retail & Accommodation



(e) Business Intermediaries

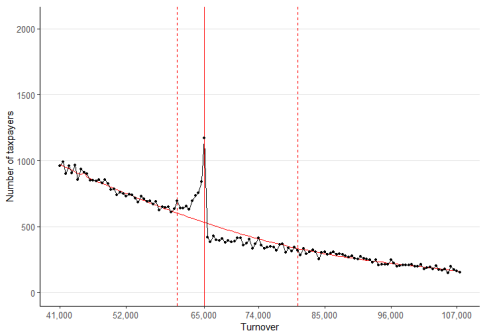
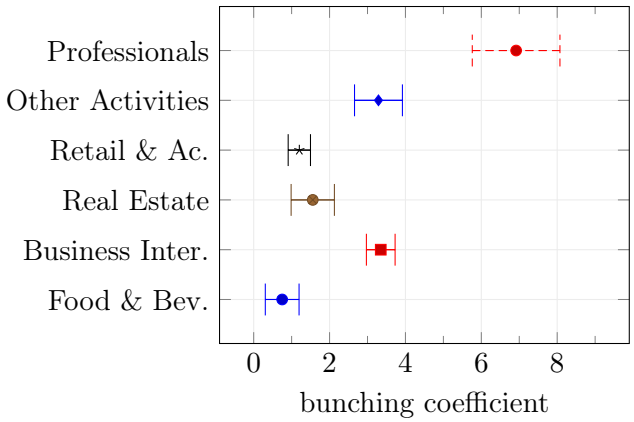


Figure 4: The bunching coefficient is given by the total excess mass below the turnover threshold divided by the counterfactual density at the threshold. 95% bootstrap confidence intervals (100 samples).



4 Theory

4.1 A frictionless model without extensive margin responses

This section describes the theoretical framework that will be used to estimate the elasticity of turnover with respect to net-of-turnover-tax rate. Building on Kleven and Waseem (2013) and Harju et al. (2019), I develop a model describing agent's behaviour around the turnover threshold of the preferential turnover tax (F) regime, in line with the evidence provided in section 3. Below (above) the threshold, agents are taxed on turnover (profits). This creates a non-standard notch in the tax schedule with a change of tax rate, tax base and tax liabilities.

Following the bunching literature (Kleven 2016), preferences are represented by a quasi-linear utility function (exp. 2). Turnover y generates disutility $\phi(y, n)$, that is increasing in turnover, but decreasing in the agent's ability n. The elasticity of turnover with respect to net-of-tax rate is denoted by e. The production costs of generating turnover y are given by $c_i = f_i + v_i(y)$, with fixed and variable costs, f_i and $v_i(y)$ respectively, that can be heterogeneous across agents. Each agent-type i is therefore identified by $\theta_i = \{n_i, c_i\}$, that includes ability n_i and the cost function c_i. Ability n governs how much one agent is willing to work, that is how much turnover one is willing to generate[15]. Therefore, ability n governs where in the turnover distribution that agent will be. Then, individual production costs c_i determine where in the profit distribution an agent is located, conditional on generating a certain level of turnover.

$$U = C - \phi(y, n) \tag{3}$$

$$\phi(y, n) = \frac{n}{1 + \frac{1}{e}} \left(\frac{y}{n}\right)^{1+\frac{1}{e}} \tag{4}$$

Agents maximise utility U by choosing how much to work, namely the level of turnover y, and face an upward notch at y^*. Below the cut-off y^*, agents have access to the preferential tax regime in which turnover is taxed proportionally at rate t_B. While entrepreneurs don't charge VAT to customers, they also cannot deduct VAT payments on inputs ($c_i\, t_V$). The effective tax on turnover in the preferential tax regime is therefore $t_P = t_B + t_V\,(c_i/y)$. Above the threshold, agents are taxed on their profits Π, and a different tax schedule applies: $t_A(\pi)$ is the implicit average turnover tax rate (IATTR), that is the equivalent proportional tax on turnover that the agent would pay, given the actual profit tax schedule for self-employed. Moreover, if VAT is not fully passed on to selling prices, revenues are scaled down by $1 + \alpha\, t_V$ where α captures the split of the tax incidence between consumers and sellers[16]. $\alpha = 0$ means VAT is fully passed on to

[15] We implicitly assume that the agent could always sell (earn) more if desired.

[16] Harju, Kosonen,and Nordström-Skans (2018) found evidence of VAT-non-neutrality among small

consumers, so that changes in VAT are irrelevant for the entrepreneur. The opposite case is $\alpha = 1$, when entrepreneurs bear the whole VAT burden.

$$C = \begin{cases} y\,(1 - t_B) - c_i(1 + t_V) & \text{if } y \leq y^* \\ y\left(\frac{1-t_A(\Pi)}{1+\alpha\, t_V}\right) - c_i & \text{if } y > y^* \end{cases}$$

I make the following assumptions: 1) smooth distributions of ability (n), turnover (y) and profits (π); 2) turnover can be changed by changing output that is always demanded; 3) no optimisation frictions (frictionless model). Also, extensive margin responses are ruled out at this stage.

Agent's optimisation

For an agent optimising to the left of the turnover cut-off ($y \leq y^*$), the FOC is given by $y^* = n\left[(1 - t_B) - c'(y)(1 + t_V)\right]^e$ where t_B is the preferential turnover tax rate and t_V is VAT. Provided that variable costs do not change much for those affected by the turnover threshold of the preferential regime, the FOC simplifies to

$$y^* = n\left[(1 - t_B)\right]^e \tag{5}$$

Then, to the right of the cut-off, ($y > y^*$), utility maximisation yields the following FOC

$$\left(\frac{1}{1+\alpha\, t_V}\right)\left[\underbrace{1 - t_A(\pi_i) - c'(y)}_{\text{Direct effect of changing } y} \underbrace{- y\, t'_A(\pi_i)\left(\frac{\partial \pi_i}{\partial y}\right)}_{\text{Indirect effect}}\right] = \left(\frac{y}{n_i}\right)^{\frac{1}{e}}$$

where $\frac{\partial \pi}{\partial y} = 1 - c'(y)$. Utility is raised by the net-of tax and net-of-marginal-costs part of additional turnover (direct effect). Then, changing turnover also varies profit π, and this affects tax liabilities, and therefore utility (indirect effect). The sign of the indirect effect depends on whether changing turnover at the margin increase or decrease profits. If profits go up (down), then the tax base is larger (smaller) and the tax liability increases (decreases), so that the indirect effect term is negative (positive). Provided that variable costs do not change much for those affected by the turnover threshold of the preferential regime, the FOC simplifies to

$$\left(\frac{1}{1+\alpha\, t_V}\right)\left[1 - t_A(\pi_i) - t'_A(\pi_i)y\right] = \left(\frac{y}{n_i}\right)^{\frac{1}{e}}. \tag{6}$$

Condition (6) implies that if two agents have equal turnover y at the optimum, but different profits, then the agent with higher profits π_i, and therefore higher tax liability $t(\pi_i)$, must also have higher ability n_i and/or higher elasticity e. By allowing an imperfect negative correlation between ability n and individual cost function c_i – therefore

restaurants in Finland and Sweden, as they did not alter prices after reductions in their VAT rate.

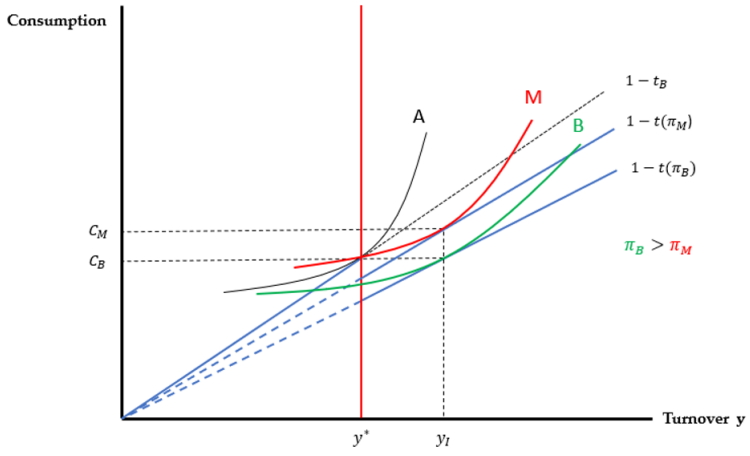
keeping n_i and c_i distinct – one can account for heterogeneous elasticity as well as heterogeneous profitability across agents, conditional on a certain level of turnover.

Heterogeneous Profitability and Incentives to bunch

Agents with different profits (costs) have different tax incentives at the threshold. Suppose for simplicity that two agents, M and B, have equal turnover and elasticity but B has higher profits – therefore lower costs c_i – than M. Hence, by condition (6), B has higher ability n than agent M. As earnings taxation above the threshold depends on profits, Figure 1 shows that agent B's consumption is lower than agent M's. Agent B is going to bunch to get a higher payoff, while agent M is just indifferent between bunching and remaining at the interior point $\bar{y}$ (marginal buncher). Any other agent with turnover $\bar{y}$, but with profits – and ability – lower than agent M is not going to bunch at the notch point y^*. This is driven by heterogeneous profitability across agents[17]. As tax liability above the threshold depends on profits, the implicit average turnover tax rate $t(\pi)$ varies across agents when profits (costs) are heterogeneous within the same turnover bin.

The multiplicity of budget sets above the threshold also implies that there can be multiple marginal bunchers at different levels of turnover. Hence, this notch does not create a clear dominated region. The decision to bunch will not just depend on preferences and turnover, but also on individual's profits conditional on turnover. For the purpose of the elasticity estimation, we consider the last marginal buncher, namely the marginal buncher with the highest pre-notch turnover y, for whom we can estimate the proportional turnover response $\Delta y^*/y^*$ using bunching below the cut-off y^*.

Figure 5: Optimisation with multiple notched budget sets



[17] If we allow for heterogeneous elasticity across agents, a similar story applies. Agent B would have a slightly higher ability (but lower than in the case of homogeneous elasticity) and higher elasticity than agent M and would be more likely to bunch.

4.2 Indifference condition

To estimate the elasticity of turnover, I exploit the indifference condition for the last marginal buncher, whose utility from bunching at the threshold is given by

$$U_{y^*} = (1 - t_B)y^* - c(y^*)(1 + t_V) - \frac{n}{1 + \frac{1}{e}} \left(\frac{y^*}{n}\right)^{1+\frac{1}{e}}$$

while at the best interior point, y_I (and profits π_I), the agent's utility reads

$$U_{y_I} = \left(\frac{1 - t(\pi_I)}{1 + \alpha\, t_V}\right) y_I - c(y_I) - \frac{n}{1 + \frac{1}{e}} \left(\frac{y_I}{n}\right)^{1+\frac{1}{e}}$$

With zero variable costs, U_{y_I} can be rewritten using the FOC from (2) with $c'(y) = 0$.

$$U_{y_I} = n \left(\frac{1 - t_A(\pi)}{1 + \alpha\, t_V}\right) \left(\frac{1 - t_A(\pi) - y_I t'_A(\pi)}{1 + \alpha\, t_V}\right)^e \left[1 - \frac{e}{1 + e} \left(\frac{1 - t_A(\pi) - y_I t'_A(\pi)}{1 - t_A}\right)\right] - c(y_I)$$

Using the agent's FOC in absence of the threshold, $y^* + \Delta y^* = n(1 - t_B)^e$, we derive the indifference condition $U_{y^*} = U_{y_I}$ for the last marginal buncher. Notice that with zero variable costs around the threshold, we have $c(y_I) = c(y^*)$, therefore giving the following indifference condition:

$$\frac{1}{1 + \Delta y^*/y^*} \left[1 - \frac{c\, t_V}{(1 - t_B)y^*}\right] - \frac{e}{e + 1} \left(\frac{1}{1 + \Delta y^*/y^*}\right)^{1+1/e}$$

$$- \left[\frac{1}{1 + \alpha\, t_V} \cdot \frac{1 - t_A}{1 - t_B}\right]^{1+e} \left(\frac{1 - t_A - y_I t'_A(\pi)}{1 - t_A}\right)^e \left[1 - \frac{e}{e + 1} \cdot \frac{1 - t_A - y_I t'_A(\pi)}{1 - t_A}\right] = 0. \qquad (7)$$

where $t'_A(\pi) = \frac{\partial t_A(\pi)}{\partial \pi}\big|_{\pi=\pi_I}$. As in Kleven and Waseem (2013), expression 7 characterises the relationship between the behavioural response of the marginal buncher $\Delta y^*/y^*$, the average net-of-tax-rate in the two regimes $\frac{1-t_A}{1-t_B}$, and the elasticity e. We also allow for imperfect VAT pass-through on selling prices, implying some of the VAT tax burden falls on entreprenuers, as in Harju, Matikka, Rauhanen (2019).

However, differently from Kleven and Waseem (2013), and Harju, Matikka, Rauhanen (2019), agents face two alternative regimes that have different tax bases and tax rates around the turnover threshold. Agents are taxed on turnover below the threshold, and on profits if they are above it. Thus, expression 7 also includes the effect that changing turnover has on tax liabilities above the threshold via changes in profits.

Model predictions: which agent-types bunch?

The newly developed theoretical framework allows to make predictions on the types of agent that are more likely to bunch. Figure 6 shows a stylized graph for the actual and counterfactual profit distributions, for a certain level of turnover above the turnover

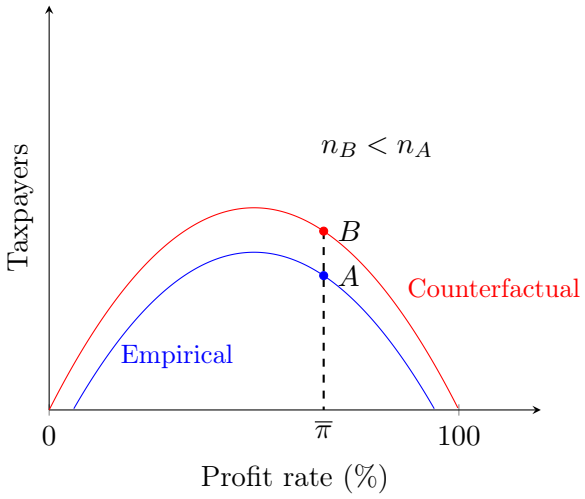


Figure 6: Stylized Profit distributions

threshold. The actual distribution is lower than the counterfactual meaning that some individuals have bunched, so that there are less people making that level of turnover compared to the counterfactual case. Suppose the turnover elasticity varies across agents, and that agent B has a higher elasticity than agent A, i.e. $e_B > e_A$. For agent B, the net payoff from bunching at the cut-off, that is utility from bunching $U^B_{y^*}$ minus utility from staying at the best interior point $U^B_{y_I}$, is positive. For agent A, the net pay-off is either zero (indifferent) or negative. Then, agent B will bunch, while agent A will remain at the best interior point y_I.

$$U^A_{y^*} - U^A_{y_I} \leq 0; \qquad U^B_{y^*} - U^B_{y_I} > 0$$

Suppose further that, in absence of the notch (counterfactual case), both agents would have produced the same output y and made same profit rate $\overline{\pi}$. By the FOC (6), agent A must have higher ability n than agent B, $n_A > n_B$. Hence, in this case, conditional on making equal turnover and profits, those who bunch will be lower ability individuals.

4.3 Elasticity estimation

Using the tax parameters and behavioural responses to the turnover regime's 65K threshold in 2019, I estimate the elasticity by solving the indifference condition (8) for 5 sectors: Professionals, Other Activities, Business Intermediaries, Construction & Real Estate, Retail and Accommodation. This results in a system of 5 equations, one indifference condition for each sector, and 6 unknowns, given by the VAT incidence parameters α_j in each group and the elasticity parameter. As an initial restriction, I set that all VAT incidence parameters must lie between zero and one. Then, I pick the group with the highest estimated VAT incidence parameter and set it to unity. This allows to select the highest possible VAT parameters during the simultaneous parameters' estimation, given our initial restriction, and therefore gives a lower bound estimate of the turnover

elasticity[18]. The group with the highest VAT incidence parameter is Retail and Accommodation. Therefore, I set $\alpha_{\text{Retail}} = 1$, meaning self-employed in this sector bear VAT entirely[19]. Hence, I estimate the elasticity parameter, equal for all sectors, and the VAT incidence parameters for the following sectors: Professionals, Other Activities, Business Intermediaries, Construction & Real Estate. such that all conditions are satisfied and $0 \leq \alpha_j \leq 1$ for any j.

$$\frac{1}{1+\Delta y^*/y^*}\left[1-\frac{c\,t_V}{(1-t_B)y^*}\right]-\frac{e}{e+1}\left(\frac{1}{1+\Delta y^*/y^*}\right)^{1+1/e}$$

$$-\left[\frac{1}{1+\alpha_j\,t_V}\cdot\frac{1-t_A}{1-t_B}\right]^{1+e}\left(\frac{1-t_A-y_I t'_A(\pi)}{1-t_A}\right)^{e}\left[1-\frac{e}{e+1}\cdot\frac{1-t_A-y_I t'_A(\pi)}{1-t_A}\right]=0. \tag{8}$$

4.4 Results

Table 6 presents the point estimates for the tax elasticity and VAT incidence parameters when, respectively, there are no compliance costs and in the case of compliance costs amounting to €1300, that is the estimate by Harju et al. (2019)[20].

	Compliance costs	
	zero	€1300
Turnover Elasticity	0.071	0.043
	VAT incidence parameters	
Retail & accommodation	1	1
Business intermediaries	0.773	0.803
Other activities	0.497	0.518
Professionals	0.358	0.402
Real estate	0.077	0.127

Table 6: Note: To obtain these estimates, I solve condition (8) by using the turnover response estimated by (4) and the observed values for $t_A(\pi), t_B, t_V, t'(\pi), y_I$ for the €65K threshold of the F-regime in 2019.

5 Concluding Remarks

This paper exploits the notches created by the eligibility cut-offs of the preferential tax regimes for solo self-employed in Italy to study turnover responses to taxation. I show that solo self-employed bunch below some of the turnover thresholds, set by the tax code, to qualify for a preferential tax scheme. Then, I adapt the models of Kleven and

[18] Choosing the highest VAT incidence parameters means that we consider the largest possible tax gaps, given our initial restriction. That delivers a lower bound estimate of the tax elasticity, given the estimated behaviour responses.

[19] There is empirical evidence that this is the case in Finland and Sweden: Harju, Kosonen, and Nordström-Skans (2018) found evidence of VAT-non-neutrality among small restaurants, as they did not alter prices after reductions in their VAT rate.

[20] I believe this estimate is relevant for this case too, as most simplifications of the preferential regime are representing by the VAT exemption, as in Harju et al. (2019)

Waseem (2013) and Harju et al. (2019) to derive a modified indifference condition that fits the institutional set-up and I use it to estimate the turnover tax elasticity. To do that, I exploit the behavioural responses to the turnover threshold of the preferential (turnover) regime in 2019.

6 Appendix

6.1 Derivation of the Indifference condition

For the last marginal buncher M, utility from bunching at the threshold is

$$U_{y^*} = (1 - t_B)y^* - c(y^*)(1 + t_V) - \frac{n}{1 + \frac{1}{e}} \left(\frac{y^*}{n}\right)^{1+\frac{1}{e}}$$

Then, at the best interior point, y_I, with profits π_I, the agent's utility reads

$$U_{y_I} = \left(\frac{1 - t(\pi_I)}{1 + \alpha\, t_V}\right) y_I - c(y_I) - \frac{n}{1 + \frac{1}{e}} \left(\frac{y_I}{n}\right)^{1+\frac{1}{e}}$$

Using the FOC, $\left(\frac{1}{1+\alpha\, t_V}\right)[1 - t_A(\pi) - t'_A(\pi)y] = (y/n)^{1/e}$, we can rewrite U_{y_I} as

$$U_{y_I} = n \left(\frac{1 - t_A(\pi)}{1 + \alpha\, t_V}\right) \left(\frac{1 - t_A(\pi) - y_I t'_A(\pi)}{1 + \alpha\, t_V}\right)^e \left[1 - \frac{e}{1 + e} \left(\frac{1 - t_A(\pi) - y_I t'_A(\pi)}{1 - t_A}\right)\right] - c(y_I)$$

We assume that variable costs are not crucial for the decision of bunching around the threshold, that is $c(y_I) = c(y^*)$ so that setting $U^*_y - U_{y_I} = 0$ gives

$$\begin{aligned} &(1 - t_B)y^* - c(y^*)\, t_V - n \cdot \frac{e}{1 + e} \left(\frac{y^*}{n}\right)^{1+\frac{1}{e}} \\ &-n \left(\frac{1 - t_A(\pi)}{1 + \alpha\, t_V}\right) \left(\frac{1 - t_A(\pi) - y_I t'_A(\pi)}{1 + \alpha\, t_V}\right)^e \left[1 - \frac{e}{1 + e} \left(\frac{1 - t_A(\pi) - y_I t'_A(\pi)}{1 - t_A}\right)\right] = 0 \end{aligned}$$

Divide all terms by n, and use the agent's FOC in absence of the threshold, $y^* + \Delta y^* = n(1 - t_B)^e$. Finally, after pre-multiplying the condition by $1/(1 - t_B)^{1+e}$ and collecting terms, we can rewrite the indifference condition as

$$\begin{aligned} &\frac{1}{1 + \Delta y^*/y^*} \left[1 - \frac{c\, t_V}{(1 - t_B)y^*}\right] - \frac{e}{e + 1} \left(\frac{1}{1 + \Delta y^*/y^*}\right)^{1+1/e} \\ &- \left[\frac{1}{1 + \alpha\, t_V} \cdot \frac{1 - t_A}{1 - t_B}\right]^{1+e} \left(\frac{1 - t_A - y_I t'_A(\pi)}{1 - t_A}\right)^e \left[1 - \frac{e}{e + 1} \cdot \frac{1 - t_A - y_I t'_A(\pi)}{1 - t_A}\right] = 0. \end{aligned}$$

where $t'_A(\pi) = \frac{\partial t_A(\pi)}{\partial \pi}\big|_{\pi=\pi_I}$ and $c = c(y^*)$.

6.2 Appendix A - Ordinary tax regime

The ordinary tax regime includes the progressive personal income tax (IRPEF) schedule, social security contributions (SSCs), and VAT.

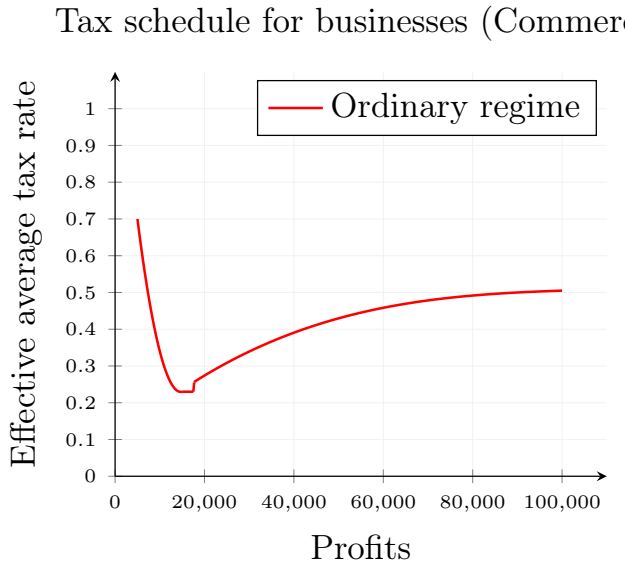


Figure 7: The ordinary regime includes income tax (IRPEF), social security contributions, deductions.

Table 7: Tax credits: 2012-2019

	Tax credits	
Type	Brackets	Amount
Self-employment	0 − €55,000	$\frac{55{,}000-TP}{50{,}200}\times$ €1,104
one child $<$ ($\geq$) 3 y.o		$\left(1-\frac{TP}{95{,}000}\right)\times$ €1220 (€950)[a]
two children $<$ ($\geq$) 3 y.o		$\left(1-\frac{TP}{110{,}000}\right)\times$ €1220 (€950)[a]
Non-working spouse	0 − €15,000	€800 − $\frac{(110\times TP)}{15{,}000}$
	€15,001 − €40,000	€690
	€40,001 − €80,000	$\frac{(80{,}000-TP)}{40{,}000}\times$ €690

[a] In 2012, the per-child amount was lower: €800 (€900) for $<$ ($\geq$) 3 y.o. child.
TP: Taxable Profits = Profits − social security contributions

6.3 Appendix - Heterogeneous elasticity

In the case o heterogeneous elasticity, excess bunching is defined as

$$B=\int_{e}\int_{y^*}^{y^*+\Delta y^*}(1-\beta(y))h_0(y)dyde\approx(1-\beta)h_0\left(y^*\right)\mathbb{E}[\Delta y_e^*] \tag{9}$$

where the approximation assumes that the counterfactual density $h_0(y)$ and the share of non-bunchers β are roughly constant for $y\in(y^*,y^*+\Delta y_e^*)$. The term $(1-\beta)\,\mathbb{E}[\Delta y_e^*]$ is defined as the average turnover response attenuated by non-bunchers. Differently from Kleven and Waseem (2013), β represents the share of taxpayers that are unresponsive not

because of frictions, but because of weaker (or even absent) tax incentives. Reworking (7) yields

$$\mathbb{E}[\Delta y_e^*]/y^* = \frac{B}{(1-\beta)h_0(y^*)y^*}$$

where y^* is expressed in binwidth units. We can compute this after estimating the counterfactual density $h_0(y)$.

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