Income Tax Incentives for Electronic Payments: Evidence from Greece's Electronic Consumption Tax Discount

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Abstract

How effective are features of the income tax in incentivising a change in behaviour? I study how Greek taxpayers respond to a novel policy, which conditions their personal tax allowance on electronic consumption, requiring specific amounts to be reached during the financial year. Aimed at incentivising a change from cash to electronic payments, the policy includes almost all taxpayers by default, generates monthly electronic spending information and pre-fills the annual amounts spent in tax returns. Using a unique administrative dataset of 50,000 randomly-drawn taxpayers, I document (a) strong responses to the policy during tax filing, with 92% reporting the required amounts to gain the full tax discount, (b) evidence of increased reported amounts if consumption is lower than required, (c) economically and statistically significant electronic consumption responses in some taxpayers as the end-of-year deadline approaches. Adjustment costs in the form of policy inattention, liquidity constraints and low perceived costs of audit can explain the mixed policy outcome. The results suggest that linking incentives to existing features of the income tax system can trigger large responses, but the overall effect depends on adjustment costs in the taxpayer population.

JEL Classification: H23, H24, H26.

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1 Introduction

The taxation literature is abundant with examples of how taxes on income are being used to encourage or discourage behaviour. For instance, income tax deductions offer incentives for saving, investment and charitable giving; child credit supports population growth and tackles income disparities; earned-income tax credit incentivises work and reduces poverty. Can income tax incentives be extended to address other objectives? And how effective are features of the income tax system in incentivising behavioural change?

This paper studies an extension of such incentives to the payments behaviour, using the introduction of the Electronic Consumption Tax Discount in Greece (or *ECTD* hereafter).[1] The policy attempts to induce third-party reporting information on a large scale, by conditioning the annual personal tax allowance on electronic consumption. Incentives encourage the use of electronic payments over cash to improve tax compliance. The paper presents evidence of how taxpayers respond; either by increasing electronic consumption or by reporting increased amounts during tax filing to gain the full tax allowance. Subsequently, the paper proposes an explanation of how adjustment costs, in the form of policy inattention, liquidity constraints and perceived costs of audit, shape the observed responses.

The ECTD forms part of third-party reporting policies, the role of which in improving tax compliance has generated a substantial body of empirical and theoretical work (Kopczuk and Slemrod, 2006; Kleven *et al.*, 2011; Kleven, 2016). In value-added taxes, most of these schemes attempt to address the "last mile" problem. Business-to-business transactions are self-enforcing since inputs to production can be tax exempt and firms have a direct economic benefit in requesting transaction receipts. The third-party information generated has been shown to facilitate enforcement (Pomeranz, 2015). However, the self-enforcement element breaks down in retail sales to the final consumer, as there are no incentives to report transactions (Slemrod, 2007).

Hitherto, governments have devised a variety of schemes to enhance incentives and create value in retail transactions, all of which have relied on active consumer participation. Tax lotteries have been a widely-used instrument in recent years as surveyed in Fooken *et al.* (2015). However, only a few schemes have been documented in economic literature. For instance, the Brazilian lottery in Naritomi (2019) has been shown to have a positive effect on tax compliance. Similarly, consumer VAT rebates in Costa Rica increase card transactions as shown in Brockmeyer and Somarriba (2021).

A noteworthy feature of ECTD, which distinguishes it from other third-party reporting policies, is the use of the income tax system as a means for incentivisation. Instead of relying on active participation, taxpayers are included by default through their personal tax allowance which is granted conditional on spending by electronic means (credit cards or electronic transfers). The scheme is also unique in the information technology system used for monitoring transactions. Aggregate amounts of electronic payments completed by all Greek taxpayers are transferred automatically every month from financial institutions to the tax authority. Tax ID and IBAN are then matched to provide an annual aggregation of electronic consumption, which appears directly in the tax returns of the following year. Using self-assessment, the taxpayers can accept or modify the pre-filled amounts and the reported electronic consumption amount is used to calculate the final tax bill.

To analyse how the scheme's incentives work and to motivate the empirical analysis, I embed the taxpayers' choice in a stylised model. Taxpayers can either increase electronic consumption or change the pre-filled information during tax filing, a process closely resembling how ECTD works. The tax discount they receive

[1] In Greece this policy became known as "electronic receipts". It was introduced in December 2016 with L.4446/2016 and implemented as of January 2017.

increases conditional on the level of electronic consumption during the financial year, up to a maximum amount (or *threshold* hereafter). The threshold is determined by the combination of taxable income and an exogenous percentage set by the government. Since thresholds are based on taxable income, they are taxpayer-specific and their task is to place an upper limit on the amount of tax discount that can be granted.

The model produces three testable predictions. Firstly, that reporting electronic consumption on or beyond the threshold (or *threshold-targeting* hereafter) is optimal. Through threshold-targeting taxpayers experience a positive income effect from maximising their tax discount, thereby avoiding an additional tax liability. The second and third predictions relate to how taxpayers choose to engage in threshold-targeting. For this the model defines a margin of responses; either increasing their electronic consumption during the year or changing the pre-filled information during tax filing.

All predictions are tested using a randomly-drawn administrative sample of 50,000 Greek taxpayers. The data include information on annual reported electronic consumption and monthly volumes of actual electronic consumption in 2017 and 2018, as transferred by financial institutions to the tax authority at the end of each month. By aggregating the monthly electronic consumption volumes, one can retrieve the annual aggregate amount for each taxpayer and evaluate the difference between what has been pre-filled in their tax returns versus what has been reported during tax filing. The data are complemented by tax returns information, including the taxable income declared by taxpayers, which allows for the calculation of their threshold values.

Consistent with the first prediction, I find evidence of threshold-targeting. A substantial visual mass of taxpayers (8%) report electronic consumption on or close to their threshold and the vast majority (84%) reports beyond their threshold, with only the remaining (8%) reporting less. Driven by tax discount maximisation, the distinct cutoff on and beyond threshold provides evidence of strong responses to the policy. At the same time, I document a mismatch between reported and pre-filled amounts, with less taxpayers concentrating on threshold (4%) and beyond threshold (69%), while a higher mass (27%) exhibits pre-filled amounts less than their threshold. Individuals with pre-filled amounts less than the threshold, increase their reported values during tax filing.

Further evidence of changes to pre-filled amounts are documented by (a) constructing within-taxpayer differences, which capture the amounts taxpayers actually spent versus the amounts reported in tax returns, and (b) by decomposing the sample to those below and above threshold at the end of the financial year. This analysis reveals the presence of rounding effects above threshold when below-threshold taxpayers report consumption. Visual excess mass is concentrated on multiples of fifty and hundred euros, indicating buoyancy of the pre-filled amounts.

Reporting higher amounts to gain the full tax discount is an unintended consequence of the policy. The implications of this result are even more important given the occupational type of taxpayers, who are predominantly wage-earners and pensioners, having traditionally lower evasion opportunities than the self-employed (Engström and Holmlund, 2009; Hurst *et al.*, 2014). Evidence of increases in the reported amounts by these occupational groups suggests that taxpayers react rationally to these opportunities, regardless of their occupational type.

To assess if taxpayers increase their electronic consumption in response to the policy, I use monthly event studies with the end-of-year deadline as a cutoff. The data include all months of 2017, in which the threshold is built, and 7 months of 2018. Taxpayers are then grouped in cohorts, based on the month their threshold was reached and an additional group with individuals who did not reach threshold. The evolution of electronic consumption in relation to the end-of-year deadline is assessed for each of these cohorts.

The ECTD affects electronic consumption in the following ways. Firstly, about half of the taxpayers in the regression sample reach their threshold by August 2017, 8 months after the policy's introduction. These individuals exhibit a moderate to high consumption pattern during the year, which enables them to achieve and surpass their threshold. Secondly, a significant mass of taxpayers who reach threshold in September, October, November and December exhibit end-of-year spikes in electronic consumption, up to 13% of annual income, as the deadline to build the threshold approaches. These cohorts have particularly low propensity of electronic consumption during the year, while the end of year spikes are inconsistent with their annual spending behaviour and seasonal spending fluctuations in other cohorts. Thirdly, there are evidence of spending becoming entrenched in the beginning of the new financial year in cohorts who experienced consumption spikes. Their electronic consumption increases and stabilises at about 5% of annual income every month as the new threshold-building attempt begins.

A final result in consumption responses regards individuals who remain below threshold and form about one-third of the regression sample. These individuals exhibit minimal consumption during the financial year and end up responding by changing their pre-filled information during tax filing. As the new financial year begins, their electronic consumption increases incrementally from 1% to 3.6% of annual income.

Overall, these results suggest a mixture of responses in both the reporting margin and electronic consumption margin. These responses have implications for the policy's effectiveness. Changing pre-filled amounts to gain the discount implies limited responses in electronic consumption and no generation of third-party reporting information. In addition, end-of-year consumption spikes might have welfare implications for liquidity constraint taxpayers. What determines the mixture of responses we observe? And why do they differ?

I propose an explanation for the observed pattern through adjustment costs in the form of policy inattention, liquidity constraints and perceived costs of audit, which seem to shape taxpayers' responses. Due to policy inattention, taxpayers spend lower amounts at the beginning of the year. As the end of year approaches, higher policy attention induces individuals to spend more to reach their threshold before the deadline. Taxpayers begin their threshold building attempt earlier during the new financial year after their last end-of-year experience. Additionally, responses might also depend on liquidity constraints: despite a higher policy attention, liquidity constraints might prevent some taxpayers from reaching their threshold. Lastly, for taxpayers who remain below threshold, changing their pre-filled amounts might be explained by relatively low perceived costs of audit and penalty. This seems to be a reasonably fitting explanation of the various adjustment costs that shape taxpayers' responses to the ECTD. While features of the income tax can exhacerbate a change in behaviour, the overall result depends on taxpayers' adjustment costs.

This paper relates to the third-party reporting literature at the consumer level. A handful of schemes have been analysed so far, notably Naritomi (2019) on the Brazilian lottery and Brockmeyer and Somarriba (2021) on Costa Rica's VAT rebates. The majority of studies in third-party reporting focuses on the role of information trail on firm behaviour (Almunia and Rodriguez, 2014; Pomeranz, 2015; Slemrod *et al.*, 2017; Waseem, 2020) and on reporting frictions that may inhibit the effectiveness of VAT policies (Carrillo *et al.*, 2017). This study is the first to present consumer level third-party reporting incentives through the income tax system.

The paper also contributes to a growing literature on the use of digitalisation to fight tax evasion (Gupta *et al.*, 2017; Haichao Fan and Wen, 2018; Bellon *et al.*, 2019). In particular, a number of studies have taken advantage of Greece as a testing ground, given the fast pace of reforms during the years of economic adjustment and an increasing digitalisation trend. Danchev *et al.* (2020) study the penetration of

electronic payments following capital controls in 2015 and Hondroyiannis and Papaoikonomou (2017) using macroeconomic data, estimate that 1% increase in card payments leads to 1% increase in VAT tax revenue. These estimates are in line with other studies at the EU level (Madzharova, 2020; Immordino and Russo, 2018).

Lastly, the analysis builds on closely-related studies on bunching (Kleven, 2016), that have documented responses at points of interest such as kinks (Saez, 2010; Chetty *et al.*, 2011; Bastani and Selin, 2014) and notches (Kleven and Waseem, 2013). In particular, tax reforms combined with the use of consumption expenditure provide a fertile ground to document such responses and related costs, as shown in Gorodnichenko *et al.* (2009). Also, recent studies have focused on how adjustment costs shape responses at these points (Chetty *et al.*, 2011; Adam *et al.*, 2020; Gelber *et al.*, 2020). I build on these findings, to analyse responses to thresholds and the role of adjustment costs.

The paper is organised as follows. Section 2 introduces the ECTD and provides a detailed description of its main elements. Section 3 develops a conceptual framework to analyse how it functions and derives testable predictions. Section 4 provides an empirical analysis, documenting threshold-targeting and responses in the reporting and electronic consumption margins. Section 5 interprets the findings and Section 6 concludes.

2 Institutional Background

Greece's attempt to increase tax revenue during the economic crisis in 2010 gave rise to a number of novel policies one of which was a requirement to collect a percentage of their total annual consumption in paper receipts in exchange for a personal tax allowance.[2] The policy aimed at incentivising taxpayers to demand paper receipts for their transactions, as a way to increase paper trail and fight tax evasion. Implementation of the policy relied on enforcement, as taxpayers had to present their paper receipts in case of an audit and were faced with additional tax bill if they failed to produced the required amounts.[3]

Paper receipt collection evolved drastically in 2017 to include only electronic payments, aided by the introduction of an information technology system by the tax authority, which linked individual taxpayer information to their bank accounts.[4] This formed part of a strategy to incentivise the use of electronic payments against the use of cash in the economy, and thereby generate third-party information on a large scale.[5] More specifically, financial institutions were obliged to send to the tax authority the aggregate amount

[2]The amount of paper receipts to be collected was set initially at 25% of annual income, and changed in the years that followed to 10%, increasing marginally on income. The policy evolved out of negotiations between Greece and its international lenders during the first economic adjustment programme in 2010. The IMF developed a policy position of expanding the Greek tax base to generate revenue, by lowering the tax allowance limit which stood at € 12,000 at the time, the existence of which resulted in a large number of taxpayers not having any income tax obligations. Given the political cost of lowering the limit, the counter-proposal of the Greek delegation was to link the annual income tax allowance to a level of paper receipts, thereby expanding the tax base by fighting tax evasion.

[3]Evaluation of the measure is absent in economic literature and in government's reports. However, it must have been very difficult to apply effectively on a large scale. Firstly, auditors had to check receipts one-by-one for millions of transactions, costing them time from other audits. Secondly, receipts could be transferable to other individuals. For example, tax accountants could keep a single file of receipts that could be used for any of their clients in case of an audit.

[4]Individuals declare their tax ID when opening a bank account and their IBAN number during tax filing, facilitating automatic matching.

[5]Other measures in the strategy included the compulsory introduction of point-of-sale machines in all firms (gradual roll-out from mid-2017 on-wards, based on occupation) and the introduction of a tax lottery using electronic transactions to generate eligible tickets (monthly draws began in October 2017)

of electronic transactions (but not single transactions) for all taxpayers at the end of the month. The tax authority could then aggregate the amount of electronic consumption completed by every taxpayer in the economy and check automatically if the required level was reached. Two new tax codes were introduced in tax returns (049 and 050 for taxpayer and spouse, respectively) with the pre-filled amounts of payments completed and allowing individuals to either confirm or modify the final amounts.

The policy links the personal tax allowance to electronic consumption as follows. Income is taxed progressively according to the tax brackets in Table **??** in Appendix A.1, and taxpayers receive a 22% tax discount on each euro spent by electronic consumption, up to a maximum amount (or *threshold*). Note that the discount is equivalent to the tax rate of the first income bracket, essentially making the amount of income spent up to the threshold, income-tax-free. This is equivalent to receiving a personal tax allowance, as long as the threshold amount is reached. The threshold and ECTD are taxpayer-specific, calculated as a percentage of declared taxable income, using Table 2.1.[6] It increases marginally on income up to € 160,000, thus higher incomes up to this level are incentivised to spend more by electronic means. This has been the main form of personal tax allowance in Greece since 2017.

Table 2.1 Threshold and ECTD

Income Bracket €	Marginal Rate %	Threshold Bracket €	ECTD €
0 - 10,000	10	0 - 1,000	0 - 220
10,001 - 30,000	15	1,000 - 4,000	220 - 880
30,001 - 160,000	20	4,000 - 30,000	880 - 6,600
160,000 <	0	30,000	6,600

ECTD-eligible taxpayers, are those receiving income from wages, pensions and agriculture, constituting the majority of the taxpayer population in Greece. The main exemptions are the self-employed, sole proprietors and business owners, taxpayers above the age of 70, individuals declaring null income, guaranteed minimum income receivers and residents in villages with less than 500 residents and islands with less than 3,100 residents (but which are not touristic locations). In addition, a special provision applies to joint-filing households.[7]

Consumption expenditures that count towards ECTD are those completed by electronic means (debit or credit cards and online banking) in Greece and in other EU countries. Non-consumption expenditure such as rents and mortgage payments, government payments (fines and taxes), buying vehicles (motorbikes, cars, boats), any kind of investment products (bonds or stocks) do not count towards the threshold. By excluding these categories, the policy aims at increasing electronic payments in everyday consumption transactions.

Reporting electronic consumption takes place in the annual tax returns, the filing of which is compulsory in Greece for all adults (even if declaring null income). Aggregation of payments happens during the financial

[6]For example, consider a taxpayer with taxable income of € 5,000 in 2017. The threshold corresponds to € 500 (10% of income) in electronic consumption, giving the taxpayer a tax discount of 22% per euro spent up to € 500. The maximum tax discount for the individual is € 110 (500x0.22). If the taxpayer spends less, the discount is reduced accordingly; for example if only € 250 is spent, the discount is € 55, and the taxpayer pays € 55 more in tax than if having received the full discount. Electronic consumption in excess of the threshold is not rewarded.

[7]All married individuals were obliged to file jointly in 2017. Each electronic consumption amount is declared individually in the tax returns (049 for husband and 050 for wife), but if the amount of one person is higher than the personal threshold while for the other person's amount is lower, the extra amount is taken into account when calculating the other person's tax obligation. For example, if an individual is 500 EUR below the personal threshold and the partner 500 EUR above the threshold, then the full tax discount applies.

year (January to December), followed by tax filing starting in April and ending in July the following year. During the tax year, financial institutions report monthly to the tax authority on the amount of electronic payments completed per taxpayer and the latter links the taxpayer's IBAN to their tax ID. The total annual amount of eligible electronic payments appears in dedicated fields during filing (codes 049-050) as shown in Figure A.2 in Appendix A.2. Before submitting the form, the taxpayers can observe what the tax authority has registered as electronic payments for the year, and they can edit the fields and declare a different amount, higher or lower, or accept the amount shown. Tax obligations are calculated once filing is completed, based, amongst others, on the declared amount of electronic payments, which is used to determine the final tax discount. Thus, the final amount of electronic payments declared has a direct and immediate effect on the taxpayer's overall tax obligation.

3 Conceptual Framework

3.1 Incentives for Electronic Consumption

In order to analyse the taxpayer behaviour, consider a static labour supply model with a choice for cash and electronic consumption.[8] Assume a quasi-linear, iso-elastic utility function, U, which depends positively on after-tax income c and negatively on before-tax income z, the former representing utility from consumption and the latter the effort from earning income. To analyse the choice between cash and electronic consumption, assume that labour income z is exogenous.

Utility from after-tax income c, is derived either from cash consumption, c_c, or electronic consumption, c_e; the two being perfect substitutes and utility strictly increasing in both c_c and c_e. In this benchmark model, switching between c_c and c_e is costless and either cash or electronic consumption yield the same level of utility.

The taxpayer chooses c_c, c_e to maximise U, subject to a linear budget constrain:

$$U(c_c, c_e, z) = c_c + c_e - z \tag{1}$$

$$s.t \;\; c_c + c_e = (1 - \widetilde{t})z - tF(z, a) + tc_e \tag{2}$$

where $(1 - \widetilde{t})z$ represents net-of-tax income, with $\widetilde{t}$ income tax rate. An additional tax $t \in (0, 1)$, is linked to electronic consumption conditional on function $F(z, a)$, which represents the taxpayer's threshold, determined by labour income z and an exogenous parameter $a \in (0, 1)$. Initially the threshold implies an additional tax obligation corresponding to a percentage of income, that can be nullified by increasing electronic consumption c_e (equivalent to receiving a tax discount).[9] In its simplest form, the threshold $F(z, a)$ is a percentage of labour income:

$$F(z, a) = za \tag{3}$$

[8] This modeling choice follows closely the elasticity of taxable income literature, as used in Feldstein (1999), Saez (2010) and as surveyed in Saez *et al.* (2012).

[9] In the ECTD, $F(z, a)$ is a piece-wise linear function, increasing on income as shown in Table 2.1. For simplicity, I model $F(z, a)$ to correspond to a mapping of electronic consumption that can be reached at every point of the before-tax income z.

Equation 3 defines the maximum tax discount that can be reached given income z. To avoid granting the tax discount beyond $F(z,a)$, I posit the following condition on t, where the marginal tax discount stops being granted when the threshold is reached:

$$t = 0 \quad if \quad c_e \geq F\left(z,a\right) \tag{4}$$

The model resembles how the ECTD works. The government sets exogenous policy parameters $\widetilde{t}$, t, rates a; i.e. the income tax rate, the tax discount rate and the percentage of electronic consumption conditional on income that determines the taxpayer's maximum discount threshold. Given an income z, the taxpayers choose electronic consumption, c_e, to maximise U. The tax discount increases on electronic consumption c_e, until the threshold $F(z,a)$ is reached. Any increase of c_e beyond $F(z,a)$ does not carry any additional discount.

Formally, the taxpayer's maximisation problem and first order condition become:

$$\underset{c_e}{argmax}\, U(c_e,z) = (1-\widetilde{t})z - tF(z,a) + tc_e - z \tag{5}$$

$$FOC: \frac{\partial U}{\partial c_e} = 0 \Longrightarrow t = 0 \tag{6}$$

Equation 6 implies that the maximising response of electronic consumption would be one that nullifies the additional tax. According to Equation 4, this takes place when the electronic consumption is equal or exceeds the threshold. In other words, the marginal benefit of increasing electronic consumption, which is the tax discount t, increases up to the point where additional electronic consumption yields no more benefits.

Proposition 1 (Threshold Targeting)**.** *Assume cash consumption and electronic consumption are perfect substitutes. For a given level of labour income $z > 0$, tax discount t and threshold defined by $F(z,a)$: $U\left(c_e,z\right)$ is maximised at $c_e \geq F\left(z,a\right)$.*[10]

Overall, the model predicts that taxpayers respond by shifting electronic consumption on or above their personal threshold. Increasing electronic consumption implies a positive income effect derived from maximising the tax discount.

3.2 Pre-filled Information and Adjustment Costs

The benchmark model can be extended to include the choice of changing pre-filled information during tax filing and adjustment costs. This choice resembles closely the ECDT's self-assessment process during tax returns; the tax authority pre-fills the amounts spent during the financial year and the taxpayer can either accept the amount or modify it before the tax obligations are determined.

Define c_r as any excess electronic consumption reported beyond the pre-filled electronic consumption, c_e. Changing the amounts may result in some costs, captured by function ψ, associated with a higher audit probability and penalty as is standard in the tax compliance literature (Allingham and Sandmo, 1972).

[10] Proof provided in Appendix A.3.

Assume also some costs of electronic consumption, captured by function ξ. Costs of electronic consumption include adjustment costs of behaviour from cash to electronic means.[11]

The utility function and budget constraint (in Equations 1 and 2) are then modified accordingly:

$$U(c_c, c_e, c_r, z) = c_c + c_e - \xi(c_e) - \psi(c_r) - z \tag{7}$$

$$s.t \;\; c_c + c_e = (1 - \widetilde{t})z - tF(z, a) + t(c_e + c_r) \tag{8}$$

Firstly, note that c_r does not enter the utility function directly, in contrast to c_c and c_e which represent actual consumption expenditure. Secondly, c_r can increase utility through the budget constraint by increasing the tax discount awarded in the case where electronic consumption, c_e, falls short of the threshold $F(z, a)$. As in the benchmark model, to avoid a tax subsidy if electronic consumption increases beyond the threshold, the condition of Equation 4 is modified accordingly to include the choice of increasing reported amounts:

$$t = 0 \;\; if \;\; c_e + c_r \geq F\left(z, a\right) \tag{9}$$

Equation 9 implies that a tax discount is awarded by either increasing electronic consumption or by increasing the reported amounts on or beyond $F(z, a)$ during tax filing. Any excess amount spent or reported is not rewarded beyond the threshold. The maximisation problem for the individual and the first order conditions become:

$$\underset{c_e, c_r}{argmax}\, U\left(c_e, c_r, z\right) = (1 - \widetilde{t})z - tF(z, a) + t(c_e + c_r) - \xi(c_e) - z \tag{10}$$

$$FOC\ 1 : \frac{\partial U}{\partial c_e} = 0 \Longrightarrow t = \xi'(c_e) \tag{11}$$

$$FOC\ 2 : \frac{\partial U}{\partial c_r} = 0 \Longrightarrow t = \psi'(c_r) \tag{12}$$

The first order conditions are similar to the benchmark model in Section 3.1, with the difference that a margin of responses is introduced between increasing electronic consumption or changing the pre-filled amounts when reporting. Firstly, note that in this extension of the model, it is still optimal for individuals to increase (electronic or reported) consumption on or above their threshold, by setting $t = 0$. By increasing c_e or c_r, the individual receives marginal benefit t (the tax discount) up to the threshold, $F(z, a)$. At maximum, one can combine Equations 11 and 12; the choice to either increasing consumption or changing pre-filled amounts depends on their marginal costs, $\psi'(c_r)$ and $\xi'(c_e)$.

Let electronic consumption costs be given by $\xi(c_e)$ and costs of changing pre-filled information by $\psi(c_r)$. Assume further a level of labour income $z > 0$, tax discount t and threshold defined by $F(z, a)$. Then, it can be shown:

Proposition 2 (Response Margin)**.** *$U\left(c_e, c_r, z\right)$ is maximised at $c_e + c_r \geq F\left(z, a\right)$, with the response margin depending on the marginal costs of c_e and c_r, satisfying $\xi'(c_e) = \psi'(c_r)$ at maximum.*[12]

[11] Both cost functions are assumed to be well-behaved. An explicit functional form of ψ and ξ is shown in Section 5.

[12] Proof provided in Appendix A.3.

Intuitively, Proposition 2 implies a response margin for individuals to reach their threshold $F(z, a)$ and maximise their tax discount. They can respond through the *electronic consumption margin*, by increasing electronic consumption during the financial year. If electronic consumption is below the threshold, they can respond through the *reporting margin* by changing their pre-filled information during tax filing.

The theoretical analysis provides a clear framework to explain how the ECTD works and to assess the margin of responses by taxpayers. Theoretical predictions can be summarised as follows:

1. *Threshold Targeting.* Taxpayers maximise utility by either increasing electronic consumption or reporting it on or above their threshold.

2. *Responses in the Reporting Margin.* If electronic consumption is less than the threshold, utility is maximised by changing pre-filled amounts up to the threshold, subject to marginal costs of doing so.

3. *Responses in the Electronic Consumption Margin.* Electronic consumption increases on or beyond the threshold, subject to the marginal costs of doing so.

4 Empirical Analysis

4.1 Data

I utilise a unique administrative dataset of 50,000 randomly-drawn taxpayers to study responses to the ECTD following the theoretical predictions of Section 3.[13] The data include aggregate monthly amounts of electronic consumption per taxpayer from all 12 months of 2017 and from the first 7 months of 2018, in the form that these were transferred from financial institutions to the tax authority (rounded to the nearest € 10). This enables us to examine monthly electronic spending that counts towards the taxpayers' threshold and which pre-fills the tax returns. Monthly electronic consumption data is matched at the taxpayer's level with information from tax returns (rounded to the nearest € 5).

The data include information for either a single individual or two individuals who file jointly in a household, corresponding to 31,409 and 18,591 observations, respectively. For each tax unit with a single individual, the tax return data contain the declared annual income, the declared amount of electronic payments and the postcode. In addition, I observe the occupational income source, being (a) from wages (b) from pensions (c) from self-employed or business activity and (d) from agricultural income. For joint-filing tax units, the data contain almost the same information as single-filers. I observe the declared annual income and declared electronic consumption for both individuals as well as their occupational income sources. However, I observe monthly electronic consumption payments for only one of the two individuals in a household, thus, limiting the analysis of any intra-household effects on electronic consumption. Sample statistics by primary income source are shown in Table A.2 in Appendix A.1.

A special category is also included in the sample, shown in the last row of Table A.2; individuals who have declared null income, representing 21.6% of the sample (10,815 individuals). This arises from a legal

[13]The data were provided by the Greek tax authority in October 2018 based on tax filings completed by July 30, 2018 (the last day of submission). The tax returns underwent a basic plausibility check and tax payment statements were issued by the tax authority in August 2018.

requirement of compulsory tax filing in Greece for all adults, even if the income is null. Thus, this group contains students above the age of 18 (for instance, in tertiary education), unemployed individuals, as well as tax units who conceal all of their income.[14] Declaring null income implies that these individuals do not face a requirement to reach a specific threshold of electronic payments (since the income is null, so is the threshold).

The sample utilised to examine taxpayer responses is restricted to include those eligible for ECTD. These are individuals who earn up to €160,000 and receive their primary income source from wages, pensions or agriculture (see Section 2). Business owners and the self-employed are exempt from the policy. To limit intra-household effects (transfers of income, electronic consumption and sharing of thresholds between spouses) the analysis excludes joint-filer. The null income category is also excluded as individuals do not abide to a specific threshold. Summary statistics are shown in the "ECTD" column of Table A.2. Overall, this subsample includes 20,676 taxpayers, 12,685 of which are wage-earners, 6,880 pensioners and 1,111 have income from agriculture.

4.2 Threshold Targeting

The data allow for the examination of threshold targeting and for a comparison between reported and pre-filled consumption information. Figure 4.1 depicts distributions of within-taxpayer threshold differences *vis-à-vis* reported electronic consumption (top graph) and pre-filled electronic consumption (bottom graph). The reference values at 0, indicate reported (top graph) and pre-filled (bottom graph) electronic consumption corresponding to the taxpayer's threshold, conditional on income. Values to the right of 0 represent over-reporting beyond threshold (top graph) and over-spending beyond threshold (bottom graph).

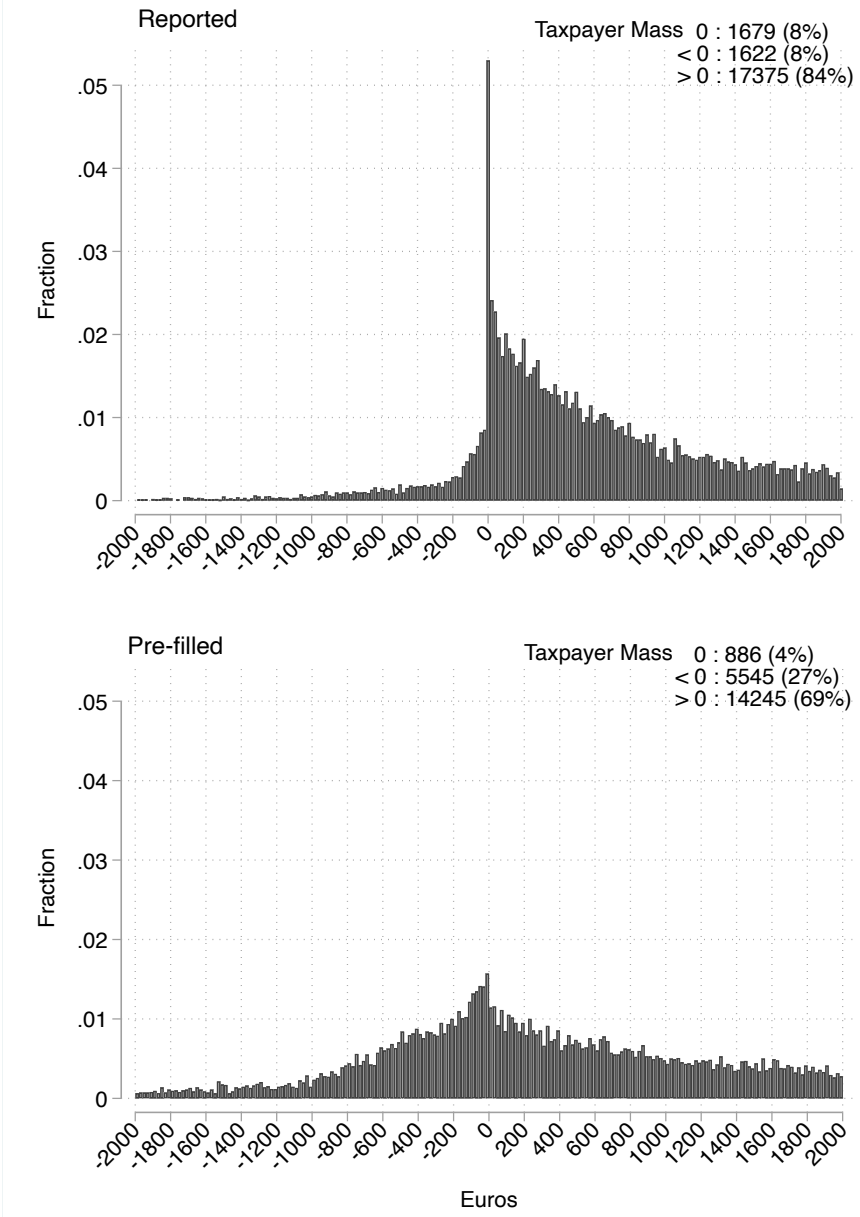
Firstly, threshold targeting is evident by the higher visual mass at the 0 value in both distributions. Figure 4.1 shows a spike in the reported electronic consumption distribution (top graph) and a smaller, yet significant, spike in the pre-filled electronic consumption distribution (bottom graph). The mass of the distribution around 0 ($\pm$ € 50), can provide a measure of taxpayer responsiveness to the threshold. Concentrated mass at 0 indicates that taxpayers know exactly what their threshold value is and respond precisely to match that value. When reporting electronic consumption, 8% of the sample report the exact required amount. The pre-filled electronic consumption amount is targeted by 4% of the taxpayers (using their monthly spending).

Secondly, the vast majority of taxpayers (84%) report more than their threshold. This indicates a strong response to the policy. When combined with taxpayers who concentrate responses at 0, almost all individuals (92%) declare electronic consumption on or above their threshold. A small number of individuals (8%) report less than their threshold, possibly due to policy inattention, honest reporting or being exempt from the threshold requirement (see Section 2 for exemptions).[15]

[14] Individuals in this group occupy a large proportion of the overall sample due the post-crisis recovery phase of the Greek economy in 2017. Firstly, annual youth unemployment stood at 43.5%, indicating a slow absorption rate of youth in the labour market and a large number of graduates declaring null income. Secondly, Greece experienced a very high unemployment rate of 21.5% in 2017. Thirdly, it is likely that more firms and workers shifted to the shadow economy during the crisis. These reasons can explain the high number of null-income declarations in the taxpayer population.

[15] This group is diverse and we cannot determine the precise reasons for responding below the threshold. It includes 753 wage-earners, 515 pensioners and 354 with agricultural income. Based on their postcode, they exhibit geographical dispersion, some of them reside in rural others in urban areas. Also, they do not belong to a particular decile of the income distribution.

Fig. 4.1 Threshold Targeting in Electronic Consumption



Notes: The figures present distributions of the cardinal difference of reported (top) and pre-filled (bottom) electronic consumption from taxpayers' threshold. The threshold value is derived from taxpayers declared income, by applying the scale in Table 2.1. The distance is measured in euros and both distributions are truncated at ± €2000 with bin width €20. The top graph shows reporting of electronic consumption with reference to each taxpayer's threshold. The 0-value indicates that electronic consumption reported in tax returns matches the threshold value. Positive (negative) differences indicate reporting above (below) threshold. The bottom graph shows the pre-filled consumption with reference to the taxpayer's threshold. The 0-value indicates that pre-filled electronic consumption matches the threshold value. Positive (negative) differences indicate over(under)-spending in reference to the threshold. The taxpayer mass at 0 measures the frequency (and percentage) of taxpayers at ± € 50 around 0 and the mass below (above) 0 is calculated from ± € 50. The sample used corresponds to the ECTD column in Table A.2.

Thirdly, an important insight of how taxpayers respond is given by the difference in the skewness of the two distributions. A broader version of the graphs (at ± €8,000 differences and €100 bin width) is shown in Figure A.1 in Appendix A.1. The taxpayers' pre-filled electronic consumption distribution (bottom graph) is more dispersed compared to the reported electronic consumption distribution (top graph). The latter displays a visible cutoff at 0 and with significant skewness at positive values to the right. While the distribution of pre-filled electronic consumption (bottom graph) is still skewed to the right with 73% of individuals spending on or above their threshold, this percentage increases to 92% when taxpayers report their electronic consumption. At the same time the mass below 0 falls from 27% in pre-filled consumption to 8% when reporting it. This provides some initial evidence of individuals increasing their pre-filled information during tax filing, which I explore in detail in Section 4.3.

Overall, the two distributions show that taxpayers respond strongly to the ECTD, targeting their threshold level or reporting above it. Spikes at thresholds of both graphs suggest that taxpayers use both margins of responses; either maximising their tax discount using electronic consumption or increasing the reported values tax filing. The pattern of behaviour provides support to the first theoretical prediction, showing clear evidence of threshold-targeting. In addition, taxpayers seem to behave rationally by maximising their utility through reporting electronic consumption on or above their thresholds. Decomposing further the responses in the two response margins, provides additional insights into how taxpayers respond to the policy.

4.3 Responses in the Reporting Margin

I examine changes to pre-filled electronic consumption information during tax filing, using within-taxpayer differences. These are calculated by subtracting the pre-filled consumption from the reported consumption for each individual, which reveals c_r; what has been reported by the individual over and above the pre-filled information indicated by the tax authority in the tax returns. A positive (negative) difference indicates over(under)-reporting of electronic consumption during tax filing. Conditional on their income and threshold, the value at 0 represent no change between the pre-filled and reported amounts. Thus, it serves as a measure of equivalence between the two.

The distribution of within-taxpayer differences is shown in Figure 4.2. The highest single-value mass (36%) is observed at or near 0 (± € 50), corresponding to pre-filled and reported being equivalent, whilst the majority of taxpayers are situated to the right of the distribution, indicating over-reporting of electronic consumption during tax filing. Over-reporting taxpayers constitute almost half (48%) of the sample.

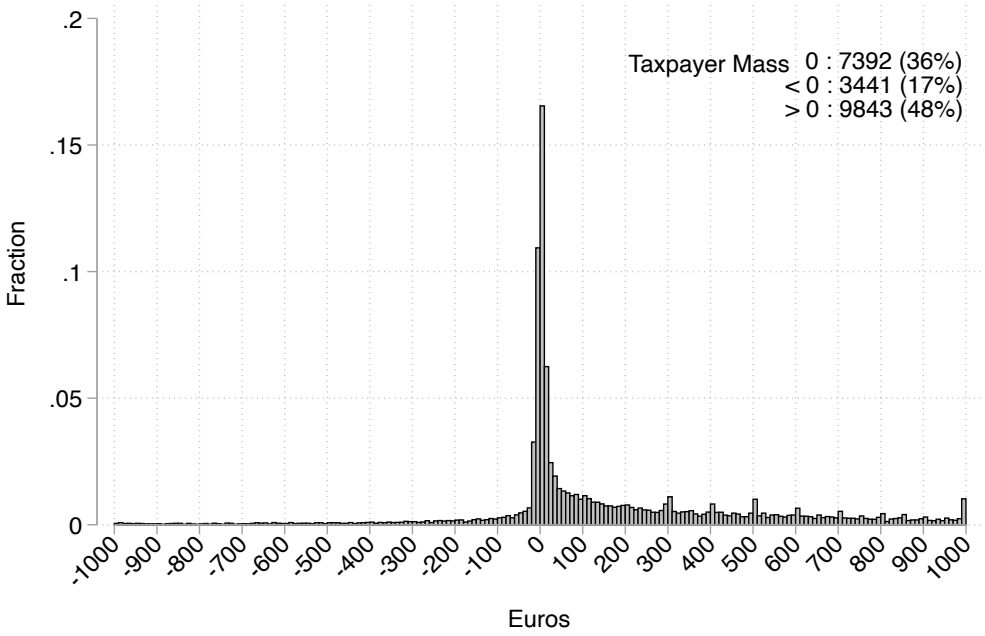
Adding to evidence of increased reporting during filing, Figure 4.2 documents spikes at positive round numbers of the distribution. A visually higher mass of responses is observed at every hundred euros to the right of the distribution. Spikes indicate that over-reporting does not occur as a result of reporting omissions in electronic consumption by financial institutions which the taxpayers attempt to amend, as this would had produced a smoother distribution. Instead, taxpayers over-report in multiples of hundreds beyond their pre-filled electronic consumption.

To investigate the mechanism that leads taxpayers to report more, consider the responses of those who ended up spending below (*below-threshold* hereafter) versus those spending above their threshold (*above-threhsold* hereafter).[16] Below-threshold taxpayers stand to gain from increasing their tax discount when they over-report on their pre-filled amounts, whilst for above-thresholds taxpayers over-reporting carries no

[16]Note that these are endogenously determined groups, making results from this comparison difficult to generalise.

additional benefit. Figure 4.3 shows distributions of within-individual differences for below-threshold (top graph) versus above-threshold taxpayers (bottom graph), composed of 6,051 and 14,625 taxpayers respectively.

Fig. 4.2 Within-Taxpayer Consumption Difference

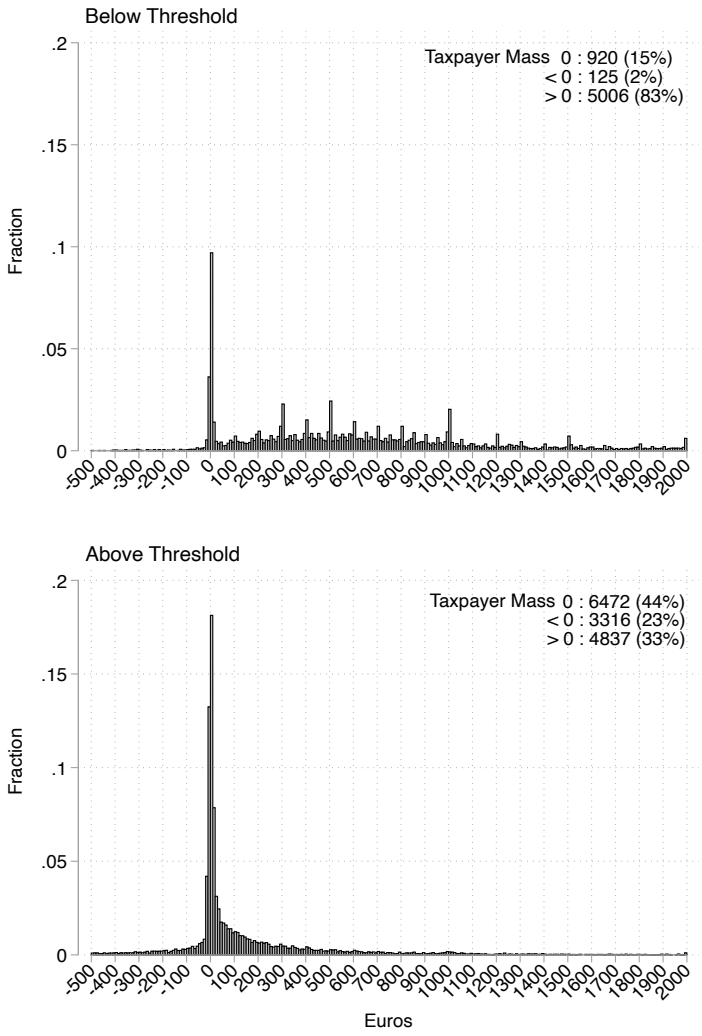


Notes: The figure presents the distribution of differences between reported and pre-filled consumption. The difference is calculated by subtracting pre-filled electronic consumption amounts from reported electronic consumption amounts for each taxpayer. A 0-value serves as a measure of no change, where reported consumption corresponds precisely to pre-filled consumption. Positive (negative) values indicate over(under)-reporting of pre-filled consumption in tax returns. The distribution is truncated at ± € 1000 and with bin width €10. The taxpayer mass at 0 measures the frequency (and percentage) of taxpayers at ± € 50 around 0 and the mass below (above) 0 is calculated from ± € 50. The sample used corresponds to the ECTD column in Table A.2.

Consider the below-threshold taxpayers (top graph). Conditional on their declared income and threshold, reporting equivalence between pre-filled and reported amounts (at the 0-value) is limited to 15% of taxpayers in this group, while 83% report a larger electronic consumption amount. By contrast, reporting equivalence for above-threshold taxpayers (bottom graph) stands at 44%. In the overall sample, 7,392 individuals report equal amounts and out of these, 6,472 belong to the above-threshold group and 920 to the below-threshold group. Similarly, there were 9,843 taxpayers reporting consumption above their threshold, 5,006 of which belong to the below-threshold group. The above-threshold distribution exhibits a skewness to the right indicating an overall tendency to over-report, but to a lesser extent when compared to the below-threshold distribution. The sub-samples are split to the left and right of 0, by 23% and 33% respectively in the above-threshold group and to 15% and 83% respectively in the below-threshold group.

Importantly, excess visual mass at round numbers (multiples of 50 and 100 euros) are present only in below-threshold responses, which can explain a similar pattern at round numbers observed in Figure 4.1. By contrast, mass at round numbers is absent from the above-threshold taxpayers' distribution.

Fig. 4.3 Within-Taxpayer Difference - Below/Above Threshold



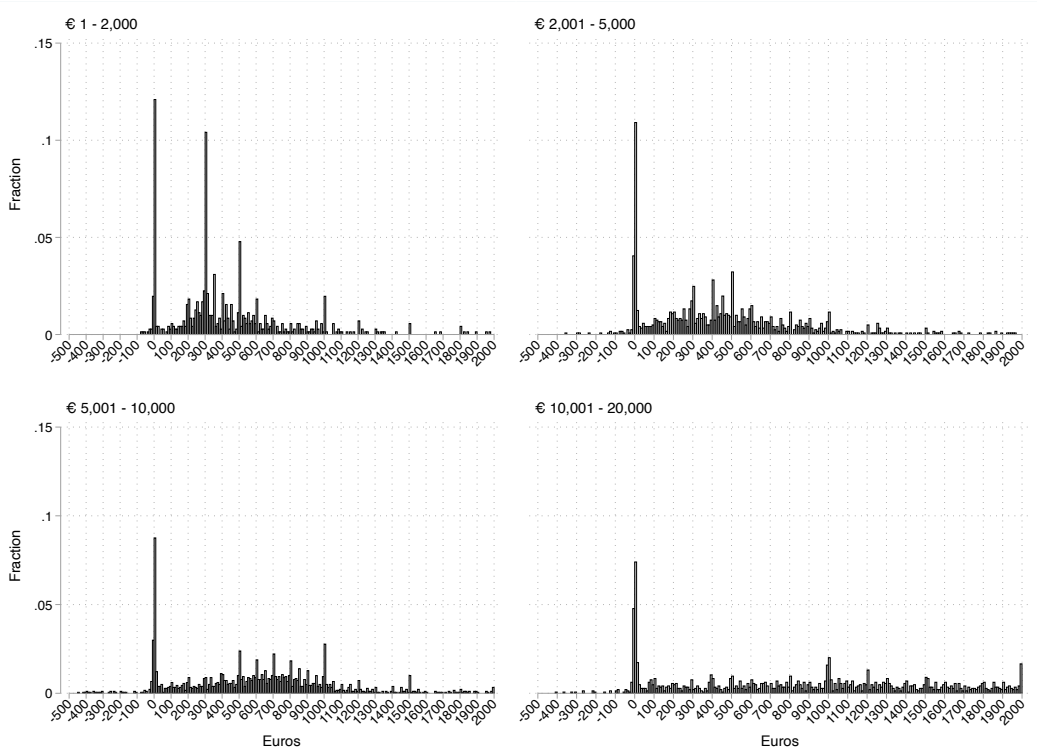
Notes: The figures presents the distribution of differences between reported and pre-filled consumption for individuals who spend less than their threshold (top graph) and more than their threshold (bottom graph). The difference is calculated by subtracting pre-filled electronic consumption from reported electronic consumption for each taxpayer. A 0-value serves as a measure no change, where reported consumption corresponds precisely to pre-filled consumption. Positive (negative) values indicate over(under)-reporting of pre-filled consumption in tax returns. The distributions are truncated at $-$ € 500 and $+$ € 2000 with bin width €10. The taxpayer mass at 0, measures the frequency (and percentage) of taxpayers at $\pm$ € 50 around 0 and the mass below (above) 0 is calculated from $\pm$ € 50.

Decomposing the below-threshold distribution in distinct income bands, provides further evidence of increases relative to the taxpayer's threshold. Figure 4.4 shows a breakdown in 4 income bands; € 1-2,000 (Group 1), € 2,001-5,000 (Group 2), € 5,001-10,000 (Group 3) and € 10,001-20,000 (Group 4). Out of 6,051

below-threshold taxpayers, these income groups include 5,749 observations with the rest being spread in higher income groups. Since the threshold is increasing in income (see Table 2.1), so is the excess visual mass in the 4 groups. For Group 1, that must satisfy a 10% of income threshold, over-reporting is more prominent at € 300. Such an amount satisfies their threshold level, even if they choose not to engage at all in electronic spending. As income increases in Group 2, so do threshold spikes at € 300, 400 and 500, corresponding to 10% threshold conditional on income. A similar pattern is observed also for Group 3 and 4, with the latter exhibiting the highest spikes at € 1,000, 1,200 and 2,000.

Overall, the within-taxpayer distributions provide strong evidence of responses in the reporting margin. The decomposition for above- and below-threshold individuals, identifies taxpayers who are more likely to increase their reported amounts beyond the pre-filled amounts. Reporting more is prominent in individuals who spent less than their threshold in electronic consumption. Such an increase would result in gaining the full tax discount and avoiding an additional tax liability. Excess mass at round numbers in distinct income groups, corresponding to their threshold values, provides evidence of the mechanism by which taxpayers respond: those who have not increased electronic consumption to reach their threshold, choose to increase their reported electronic consumption during tax filing.

Fig. 4.4 Within-Taxpayer Difference - Income Decomposition



Notes: The figures present distributions of differences between reported and pre-filled consumption for individuals who spend less than their threshold decomposed by income. The difference is calculated by subtracting pre-filled electronic consumption from reported electronic consumption for each taxpayer. A 0-value serves as a measure of no change, where reported consumption corresponds precisely to pre-filled consumption. Positive (negative) values indicate over(under)-reporting of pre-filled consumption in tax returns. The distributions are truncated at − € 500 and + € 2000 with bin width €10. The taxpayer mass at 0 measures the frequency (and percentage) of taxpayers at ± € 50 around 0 and the mass below (above) 0 is calculated from ± € 50.

4.4 Responses in the Electronic Consumption Margin

Having established that taxpayers respond strongly to the policy during tax filing, I turn to responses in their monthly electronic consumption. This is an important policy parameter, since the ECTD aims at increasing electronic spending and thereby generating third-party information. Recall that payments counting towards the threshold must take place during the financial year, which runs from January to December. Using monthly event studies with the end-of-year deadline as a before/after cut-off in 2017, this section documents increases in electronic consumption as the deadline approaches. The end-of-year increases appear to stabilise and become entrenched in the first half of 2018.

4.4.1 Empirical Strategy

To identify increases in consumption, I utilise variation in individuals who reach their thresholds in different months of the year. Overall, the dataset includes information on spending in 19 months; for 12 months in 2017 and for the first 7 months of 2018. Taxpayers are grouped in 12 cohorts based on the month their threshold was reached in 2017 (from February to December, including a group that did not reach threshold).[17] I analyse how their electronic consumption evolves in all months of the year, relative to the end-of-year deadline. Recall that once a taxpayer's electronic consumption has reached threshold, any additional consumption does not contribute to a tax discount. Reaching the threshold early in the year eliminates incentives to increase electronic consumption until the end of year. By contrast, for taxpayers who spent small amounts early in the year, incentives for spending are higher as the deadline approaches. Therefore, the initial hypothesis is that conditional on spending less than the threshold, the closer taxpayers are to the deadline, the larger the electronic consumption responses will be.

Importantly, note that monthly cohorts are not varied experimentally and are determined endogenously instead, based on the spending of individuals. A number of factors can affect the probability of a taxpayers belonging to a monthly cohort. Firstly, spending habits in electronic payments. Some individuals might have a higher propensity to use electronic payments than others. Those having high propensity can reach the threshold early in the year. Secondly, a large payment in a particular month, such a utility bill, which can eliminate the threshold requirement. Thirdly, other factors affecting electronic spending, such as the availability of point of sale machines and the social norms regarding electronic payments in the place of residence. Lack of exogenous variation limits our understanding on the precise mechanisms that might cause increases in consumption. However, the evidence remains suggestive on how electronic spending evolves in relation to the ECTD, given an end of year cut-off that has to be met for the tax discount to apply.

For estimating monthly event studies I follow three steps. Firstly, cohorts are established by identifying individuals above threshold in month m, who were below threshold in month $m-1$. This indicates the month at which an individual has passed the required threshold. Secondly, monthly consumption $C_{i,m}$ is parameterised by the taxpayer's annual declared income, Y_i, using:

$$\widetilde{C}_{i,m} = \frac{C_{i,m}}{Y_i} \times 100 \tag{13}$$

Transforming monthly electronic consumption in Equation 13 enables comparability across individuals. The dependent variable becomes monthly electronic consumption as a percentage of declared income. Thirdly, I

[17] A group for January is not included since two months are required to asses the monthly increase in electronic consumption.

consider changes in consumption before and after the end-of-year deadline using monthly event studies for each m-cohort. These are specified as follows:

$$\widetilde{C}_{i,m} = \alpha + \sum_{k=1}^{11} \beta_k (Lag\ k)_{i,m} + \sum_{j=1}^{7} \gamma_j (Lead\ j)_{i,m} + \varepsilon_{i,m} \tag{14}$$

where for i individual in month m, $Lag\ k$ are binary variables indicating consumption being k-months away from end-of-year deadline and $Lead\ j$ are binary variables indicating consumption j-months after the deadline. The event is considered to be end of December 2017.

4.4.2 Results

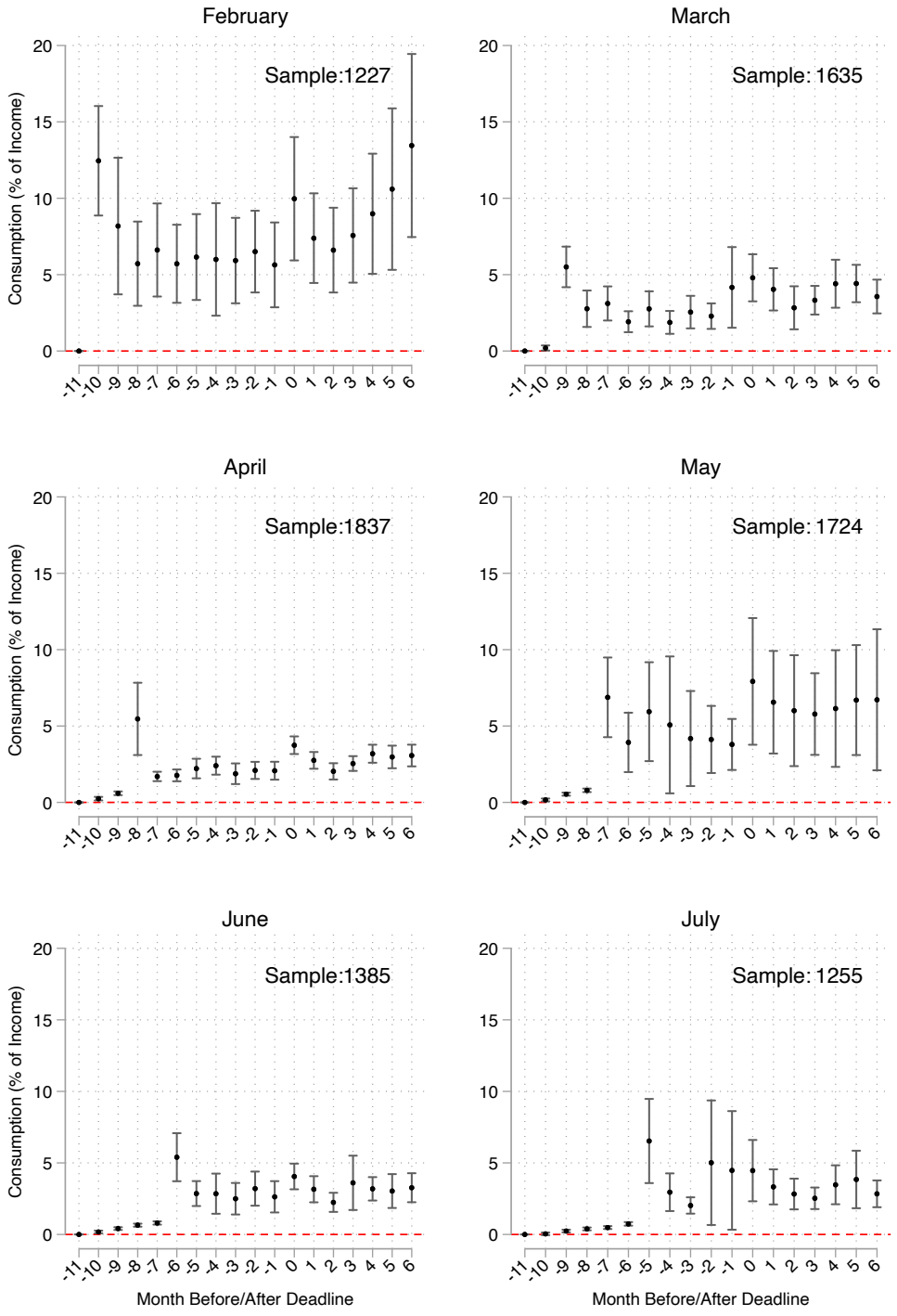
Results are presented in Figure 4.5 with regression estimates in Table A.3 in Appendix A.1. They show the evolution of consumption for individuals who have reached their threshold in each month of 2017 and, in addition, for those who have not reached their threshold. Months before or after, are in reference to December 2017 (the deadline for reaching the threshold) with the base month being January 2017. Spending in 2017 is represented by indicators -11 to -1 and in the first months of 2018 by indicators +1 to +6.

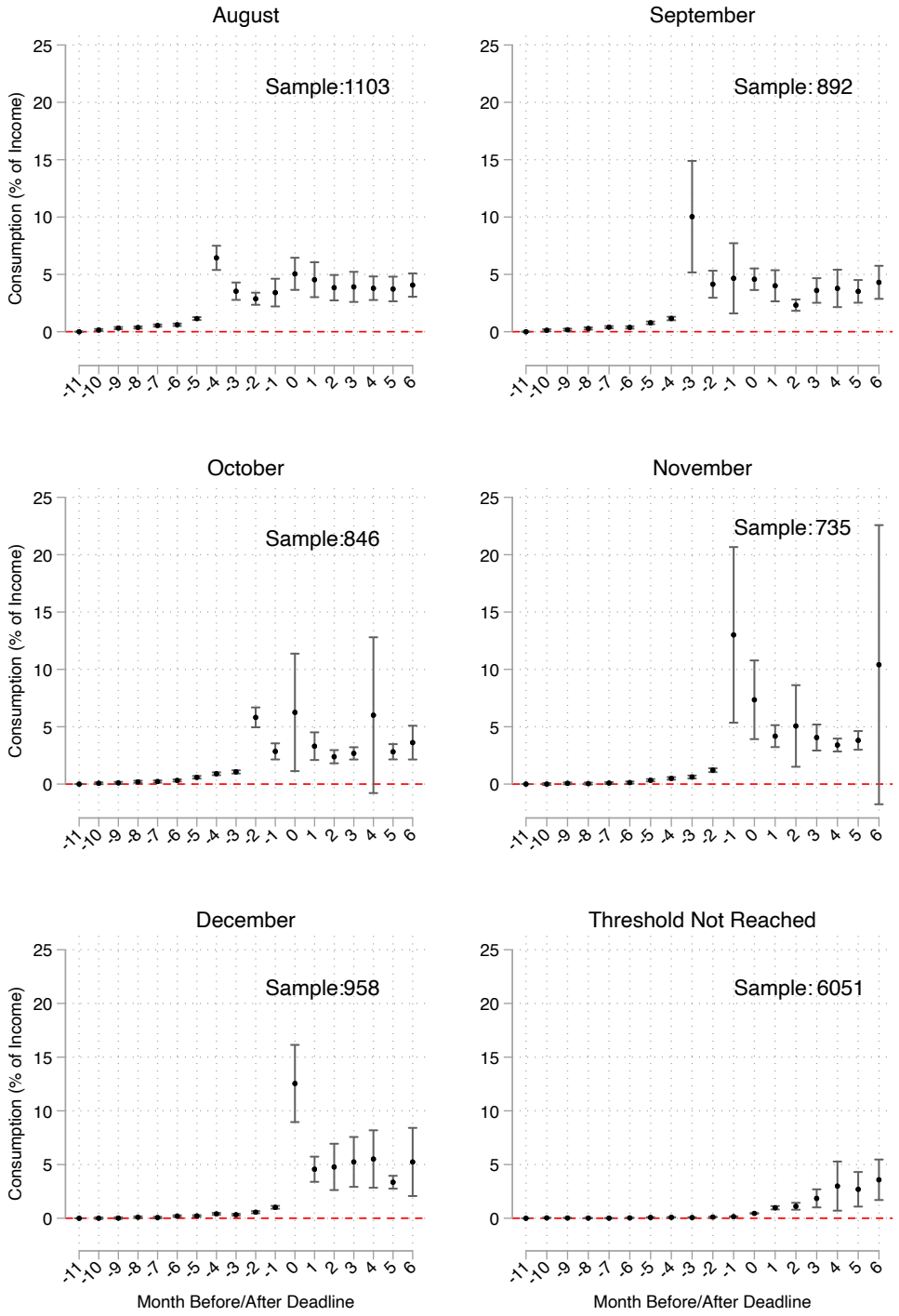
The following patterns can be observed. Firstly, note that about half of taxpayers reach their threshold in the first 8 months of the year (10,166 out of 19,648 in our sample). In September, October, November and December about 1,000 individuals each month reach their threshold, while 6,051 individuals do not reach threshold. Secondly, in most cohorts electronic consumption as a percentage of income fluctuates around 5% each month, with the exception of the February cohort, which exhibits a higher propensity to spend by electronic means. Thirdly, cohorts that reach threshold early in the year exhibit seasonal fluctuation with a small upward trend in electronic consumption.

Responses in electronic consumption are prominent in end-of-year cohorts. Taxpayers who reach their threshold in September, October, November and December, exhibit minimal spending during the year, whilst at the end of the year, these groups exhibit statistically and economically higher percentages in electronic consumption. In the November and December cohorts (with only two and one month respectively to reach threshold) monthly spending increases to 13% and 12.5% of annual income respectively, which is an economically large amount of spending relative to their income. This is in contrast to previous months of the year, in which consumption was close to 0% and exceeded 1% only once during the year. The increase goes beyond the seasonal increase exhibited by other cohorts, which is in the range of 0% to 6%, even with a higher propensity in using electronic payments. The large increases in end-of-year cohorts provide suggestive evidence of taxpayers increasing electronic spending to reach their threshold before the deadline.

Importantly, about a quarter of individuals in our sample that are subject to the policy do not reach their threshold. These individuals are more likely to increase their electronic consumption when reporting as was shown in Section 4.3. As can be observed in the "Threshold Not Reached" graph of Figure 4.5, responses in electronic consumption remain close to 0 during the year, with only marginal increases are observed at the end of year. However, the group exhibits an increase in electronic consumption during the new financial year starting from 1% in January 2018 and slowly increasing to 3.6% by June. This indicates that taxpayers who do not reach their threshold in 2017, increase payments gradually in 2018.

Fig. 4.5 Event Studies per Month of Reaching Threshold





Notes: The figures present monthly event studies for groups of taxpayers who have reached their threshold in particular months. The last graph includes individuals who have not reached their threshold. The dependent variable is monthly electronic consumption as a percentage of annual declared income. Point estimates in graphs follow the specification in Equation 14, which includes binary variables before and after the deadline in December 2017 and, in addition, individual fixed effects. Results are shown relative to -11 month from the deadline (February 2017). Detailed regression estimates are shown in Table A.3 in Appendix A.1. The sample number in each graph represents the number of individuals in our sample who have reached threshold on the specified month in 2017.

A similar behaviour during the new financial year can be observed in end-of-year cohorts who exhibit strong consumption responses at the end-of-year deadline in 2017. At the start of the new financial year electronic spending increases and remains stable at about 5% of income every month. This finding is shown in Figure 4.5 and provides evidence of electronic spending becoming entrenched once individuals experience an end-of-year deadline spike in consumption. Habit formation in the population or strategically spreading consumption earlier in the year to avoid an end-of-year spike can explain this pattern. Delayed responses in 2017, combined with higher consumption percentages in 2018 can also be a sign of policy inattention in 2017: individuals who noticed the policy late during the year responded by increasing consumption, whilst as the policy became salient, taxpayers increased monthly electronic consumption earlier in the year.

Overall, the results provide evidence that the policy affects the electronic consumption of about half of the taxpayers in our sample who are subject to the policy. Taxpayers who notice the policy close to the deadline and those with low propensity of electronic consumption, increase their spending at the end of year to about 13% of annual income and maintain a stable percentage around 5% every month during the new financial year. About one-third of taxpayers in our sample that are subject to the policy do not respond during the year and their electronic consumption remains below threshold. This group knows about the policy at the time of tax filing and resorts to changing the pre-filled information, increasing their reported electronic payments to gain the full tax discount. Finally, the remaining individuals reach their thresholds in the beginning to middle of the year, indicating that for part of the taxpayer population the thresholds are reachable and the policy is salient.

5 Interpretation

This paper has established three findings. First, the ECTD triggers strong responses in the taxpayer population, evidenced by their threshold-targeting behaviour. Taxpayers report on or beyond their threshold during tax filing. Second, about one-third of individuals subject to the policy do not increase their electronic consumption and they respond by changing the pre-filled amounts during tax filing. Responses in the reporting margin are strongest for individuals who failed to reach their threshold at the end of the year. Third, some taxpayers who exhibit low electronic spending during the year respond by increasing their electronic consumption sharply before the end-of-year deadline. Electronic consumption for these individuals becomes entrenched and increases during the new financial year. These evidence are consistent with the three theoretical predictions of Section 3; it is rational for taxpayers to target their threshold and they do so by either increasing electronic consumption or by changing the pre-filled information.

What could explain the pattern of behaviour we observe in the two margins of responses? For taxpayers with sharp consumption responses at the end of year one reason is policy inattention. Low salience of the policy during the first year of introduction might have resulted in late consumption responses. At the start of the new financial year, taxpayers increase consumption earlier, spreading payments to avoid end-of-year spikes. For below-threshold taxpayers the lack of consumption responses can be explained by a combination of factors. Policy inattention in their case can be extreme, hence noticing the policy after the financial year. However, the policy is salient at the time of tax filing (taxpayers respond to threshold when reporting takes place). Alternatively, the policy may be salient but these individuals may face liquidity constraints in increasing electronic consumption. Lastly, higher reported amounts can also signify perceived low costs of audit and penalties. If the tax authority's audit strategy is not credible enough, or if the expected costs of

evading are low, taxpayers might prefer to report higher amounts than increase their electronic consumption. An interplay of these factors can provide a fitting explanation of the observed pattern.

5.1 Marginal Cost Functions - Explicit Form

The taxpayers' choice between increasing electronic consumption or the reported amounts, can be expressed formally using the following explicit functional form for ψ and ξ, which can account for the facts that were documented in the empirical analysis. Firstly, consider the costs of increased reporting, $\psi(c_r)$, that were defined implicitly in Section 3.2. In the subjective sense of the individual, an increase of the reported amount of electronic consumption beyond the pre-filled amount is associated with increased risks of tax audit and penalty. Consider a function that captures these expected audit and penalty costs in the following form:

$$\psi(c_r) = \pi \rho c_r \tag{15}$$

where $\pi \in (0,1)$, represents a financial penalty proportional to the increase, c_r, and $\rho \in (0,1)$, a perceived probability of audit. Note that reporting the pre-filled amount ($c_r = 0$), does not imply any additional costs $\psi(c_r) = 0$, while increasing the reported amounts, increases the expected costs of audit and penalty

Secondly, consider a possible function for $\xi(c_e)$, arising from policy inattention as in Taubinsky and Rees-Jones (2017) and liquidity constraints. Suppose that electronic consumption c_e can be separated in 12 months represented by m, and define total electronic consumption in the year as the sum of these months $\sum_{m=1}^{12} c_{e,m}$. Policy inattention varies from month to month and can be defined in the cost function by a parameter $\theta_m \in (0, \infty)$, capturing policy inattention ($\theta_m > 1$) and excess attention ($\theta_m < 1$). The policy attention benchmark is given by $\theta_m = 1$.[18] In a similar fashion, to allow for liquidity constraints, the functional form should capture increasing costs of delaying electronic consumption at the end of year. I posit a factor $\delta^m \in (0, \infty)$ to account for the these costs, with liquidity constraints in reaching the threshold as months progress ($\delta^m > 1$) and excess liquidity at the end of the year ($\delta^m < 1$). At $\delta^m = 1$ month-to-month liquidity remains the same. The cost function can be written as:

$$\xi(c_e) = \sum_{m=1}^{12} \theta_m \delta^m c_{e,m} \tag{16}$$

Equation 16 can determine the timing of increased spending during the year. Higher attention(inattention) results in low(high) costs in a given month, and a higher(lower) preference to spend by electronic means. Similarly, higher(lower) liquidity constraints at the end of year, increase(decrease) the costs of electronic consumption.

Recall that the decision between increasing electronic consumption or the reported amounts depends on marginal costs (Proposition 2). Substituting the explicit form of the cost functions yields:

$$\pi \rho = \theta_m \delta^m |_m \tag{17}$$

[18] Note that policy inattention in a particular month results in high costs of electronic consumption, implying that taxpayers would prefer paying in cash. Increased policy attention in a particular month, lowers the costs of electronic consumption, making individuals more inclined to spend by electronic means (to reach their threshold).

Equation 17 provides an explicit form for the margin of responses, which maximises utility. In every month, m, the taxpayer weighs the marginal costs of increasing electronic consumption to the marginal cost of reporting higher amounts during tax filing.

This offers a concise framework to interpret the observed empirical evidence. Firstly, the expected costs of reporting higher amounts are fixed for all months and depend on the penalty and the perceived probability of audit. Secondly, policy inattention varies from month to month, starting high at the beginning of the year and decreasing at the end of the year, as the deadline approaches. Higher policy attention, implies lower costs of electronic consumption, leading to increased levels of electronic spending at the end of year. Thirdly, as policy attention increases, higher liquidity constraints at the end of year might prevent some taxpayers from reaching their threshold. Alternatively, below-threshold behaviour accompanied by changing of the pre-filled amounts during tax filing, can be explained by perceived audit and penalty costs being too low.

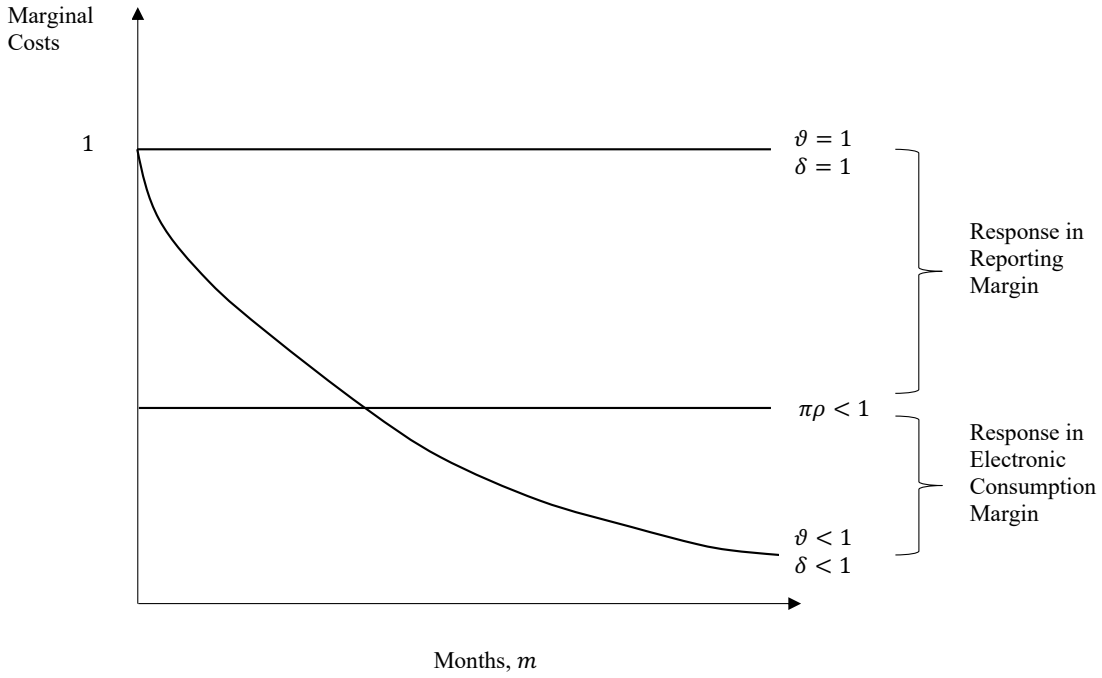
5.2 Diagrammatic Representation

Our understanding can be aided by a diagrammatic representation of the different cases. Consider the case where policy inattention is high in the beginning of the year ($\theta > 1$) and falls slowly as the deadline approaches ($\theta < 1$). In this first case, individuals do not face liquidity constraints in reaching their threshold ($\delta < 1$). The taxpayer's choice is illustrated in Figure 5.1, which graphs the marginal costs of increased reporting and electronic consumption against months, m.

Notice that the benchmark case for costs of electronic consumption is a horizontal line with $\theta = 1$ and $\delta = 1$, in all months of the year. The marginal costs of increased reporting are also represented by the straight $\pi\rho$-line, being fixed in all months. Since $\pi, \rho \in (0, 1)$, the marginal costs of reporting line is lower than the benchmark case of marginal costs of electronic consumption line. This means that without a higher policy attention, individuals will not increase electronic consumption and will prefer to increase the reported amounts instead. Higher policy attention is shown in the downward slopping curve, where θ decreases as months progress. At the point where the marginal costs of electronic consumption fall below the marginal costs of increased reporting, higher policy attention leads individuals to respond in the electronic consumption margin to reach their threshold. Compared to the empirical evidence, this corresponds to the sharp increase in electronic consumption observed in some cohorts as the end-of-year deadline approaches.

Consider now the case where policy inattention falls as months progress but individuals face liquidity constraints. This is shown in Figure 5.2, where the electronic consumption cost curve is still downward slopping ($\theta < 1$), but at a slower pace, indicated by the slope of the curve. High liquidity constraints ($\delta > 1$) increase the costs for taxpayers to respond in the electronic consumption margin. These costs are exacerbated at the end of the year and especially for the case where policy inattention is still high. The combination of high liquidity constraints and late policy attention, prevents some taxpayers from reaching their threshold using electronic consumption responses. These individuals resort to increasing their pre-filled electronic consumption amounts during tax filing.

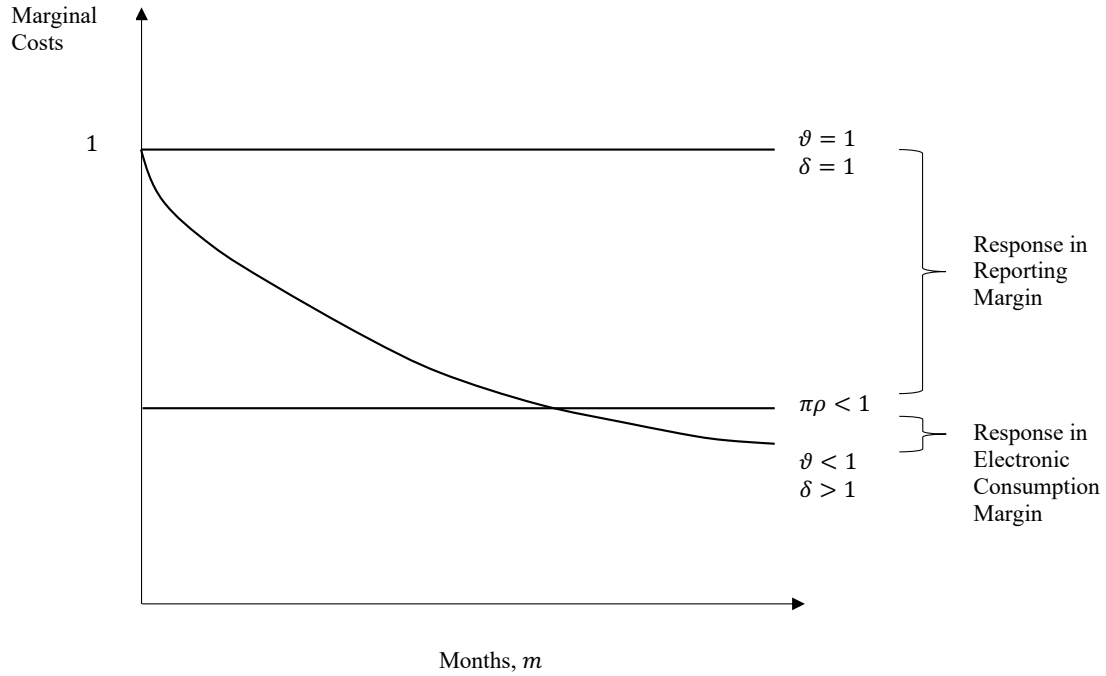
Fig. 5.1 Policy Attention without Liquidity Constraints



Notes: The diagram presents the taxpayer's choice of increasing electronic consumption or change their pre-filled amounts during reporting, based on the explicit definition of marginal costs in Equation 17. Marginal costs are drawn against months of the year to build the threshold (beginning of year on the left, to end of year on the right). The straight line at the top of the graph represents the benchmark case of responses in the electronic consumption margin. Policy inattention and liquidity constraints take the value of 1 and are therefore the same in all months. The downward slopping curve represents decreasing costs of electronic consumption, due to increasing policy attention $\theta < 1$ and decreasing liquidity constraints $\delta < 1$. The $\pi\rho$-line represents the marginal costs of reporting, being fixed in all months. In this case, lower marginal costs of electronic consumption than cost of reporting in particular months of the year, lead taxpayers to increase responses in the electronic consumption margin to reach their threshold. This is shown on the diagram, using the (relatively) large area of responses in electronic consumption margin.

Lastly, notice how perceived audit and penalty costs determine the choice of increasing the reported amounts. If the perceived probability of audit, ρ, is very low, due to the audit strategy being non-credible, or the penalty, π, is very small, the cost of reporting higher amounts falls, eliminating the need for electronic consumption responses to reach the threshold. This case can still occur if policy attention is high and liquidity constraints are low. Low perceived costs of audit and penalties, might explain the lack of consumption responses and the subsequent changes in the pre-filled information during tax filing. The different cases can explain the variety of taxpayer behaviour we observe in response to the policy.

Fig. 5.2 Policy Attention with Liquidity Constraints



Notes: The diagram presents the taxpayer's choice of increasing electronic consumption or increasing amounts during reporting, based on the explicit definition of marginal costs in Equation 17, when the liquidity constraints are high. Marginal costs are drawn against months of the year to build the threshold (beginning of year on the left, to end of year on the right). The straight line at the top of the graph represents the benchmark case of responses in the electronic consumption margin. Policy inattention and liquidity constraints take the value of 1 and are therefore the same in all months. The downward slopping curve represents decreasing costs of electronic consumption, due to increasing policy attention $\theta < 1$, which is offset by increasing liquidity constraints $\delta > 1$. The $\pi\rho$-line represents the marginal costs of reporting, being fixed in all months. Lower marginal costs of electronic consumption than cost of reporting in particular months of the year, lead taxpayers to increase responses in the electronic consumption margin to reach their threshold. In this case, responses in the electronic consumption margin are small, due to a combination of late policy attention during the year and high liquidity constraints. Higher marginal costs of electronic consumption than marginal costs of reporting, lead taxpayers to increase their pre-filled amounts during tax filing.

6 Conclusion

Features of the income tax system have been widely used as means for incentivising behavioural change. Since they apply to the majority of the taxpayer population, incentivisation is commonly broad, covering a large number of individuals. This paper has analysed a third-party reporting policy that conditions personal tax allowance on consumption by electronic means, thereby using a feature of the income tax system to incentivise a widespread change in payments behaviour. The analysis provided insights on how taxpayers change their behaviour when the policy is introduced and an explanation of how adjustment costs shape the variety of taxpayer responses.

By examining within-taxpayer differences between reported and pre-filled consumption, the paper produced evidence of threshold-targeting, indicating strong responses to the policy. About 92% of the sample report on

and beyond the required amounts to gain the tax discount. The findings support similar evidence of bunching at kink-points and cutoffs of the tax schedule (Kleven, 2016), and extend these to personal thresholds.

In addition, the analysis has documented evidence of increased reported amounts, in cases where electronic consumption is lower than required. Taxpayers who exhibit low propensity of electronic consumption during the financial year, end up changing their pre-filled information. This is an unintended consequence of the policy, which might be linked to tax evasion behaviour. The fact that these taxpayers are predominantly wage-earners and pensioners, suggests that individuals with traditionally low opportunities to evade, might not hesitate to do so when granted the opportunity. The implications for the evasion elasticity are likely to be large in this case, conditional on the opportunities granted by the institutional framework.

Inducing electronic consumption responses is the ultimate aim of the policy. The paper has provided evidence of how electronic consumption evolves during the financial year. Firstly, about half of the eligible population reaches threshold using electronic consumption by the third quarter of the financial year. Secondly, some taxpayers who exhibit low propensity of electronic consumption during the year, increase their responses as the end-of-year deadline approaches. Using monthly event studies, the paper has documented increases of up to 13% of annual income in the final months of the year. Thirdly, about a third of the eligible sample exhibits low electronic consumption and does not reach threshold. These individuals are more prone to increasing their electronic consumption amounts during tax filing. Fourthly, there are evidence of electronic consumption behaviour becoming entrenched as the new financial year begins, indicating an attempt by taxpayers to build their threshold earlier in the year.

The variety of responses we observe can be explained through adjustment costs, which seem to affect the policy's objectives. Similar studies on bunching document how adjustment costs determine responses (Chetty *et al.*, 2011; Adam *et al.*, 2020; Gelber *et al.*, 2020), and how these often related to the various elasticities (Piketty *et al.*, 2014). In the ECTD, the interplay of policy inattention, liquidity constraints and the perceived costs of audit are frictions that shape the final outcome and might dampen the policy's effect.

The scheme constitutes one of the first attempts by a tax administration to use features of the income tax as a way to change payments behaviour, and thereby induce third-party information at the final consumer level. Recent advances in information technology and an increasing digitalisation trend, are steering tax administrations towards using data that can monitor the entire volume of transactions, without the need for consumers to register their receipts (Gupta *et al.*, 2017). Nevertheless, the economic and welfare implications of this shift are yet to be fully grasped. Evidence in this paper, from threshold-targeting behaviour and related adjustment costs, suggest that when incentives for increasing electronic consumption are combined with key elements of the income tax system, they result in strong responses in the taxpayer population. In this regard, the results call for caution in the design characteristics of such policies, which remains an area of considerable government innovation.

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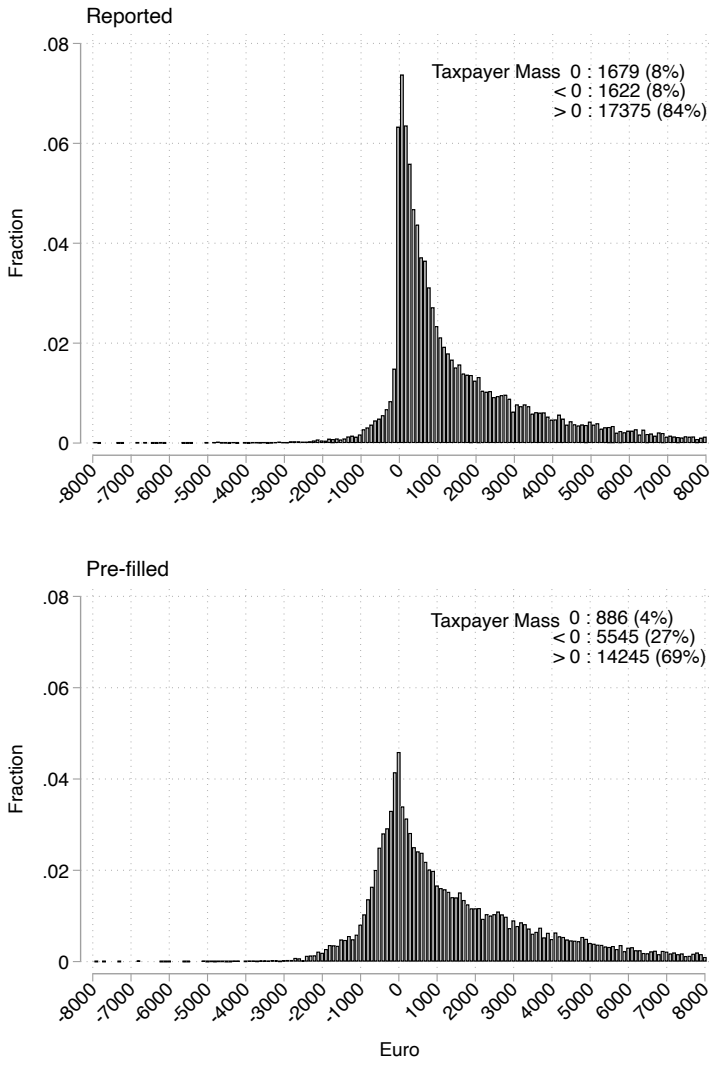
A Appendix

A.1 Additional Figures and Tables

Fig. A.1 Threshold Targeting - Truncation ± €8000



Notes: The figures present distributions of the cardinal difference of reported (top graph) and pre-filled (bottom graph) electronic consumption from taxpayers' threshold. The threshold value is derived from taxpayers declared income, by applying the scale in Table 2.1. The distance is measured in euros and both distributions are truncated at ± €8000 with bin width €100. The top graph shows reporting of electronic consumption with reference to each taxpayer's threshold. The 0-value indicates that electronic consumption is reported in tax returns matches the threshold value. Positive(negative) differences indicate reporting above(below) threshold. The bottom graph shows the pre-filled consumption with reference to the taxpayer's threshold. The 0-value indicates that pre-filled electronic consumption matches the threshold value. Positive (negative) differences indicate over(under)-spending in reference to the threshold. The taxpayer mass at 0, measures the frequency (and percentage) of taxpayers at ± € 50 around 0 and the mass below (above) 0 is calculated from ± € 50. The sample used corresponds to the ECTD column in Table A.2.

Table A.1 Income Tax in 2017

Income Bracket €	Marginal Tax %
0 - 20,000	22
20,001 - 30,000	29
30,001 - 40,000	37
40,000 <	45

Table A.2 Sample Statistics

	Sample Freq (Percent)	Single Filers Freq (Percent)	Joint Filers Freq (Percent)	ECTD Freq (Percent)
Primary Income Source:				
Self-Employed/Business	2,052	1,070	982	-
	(4.1)	(3.4)	(5.3)	-
Wage-Earner	22,335	12,691	9,644	12,685
	(44.7)	(40.4)	(51.9)	(25.4)
Pensioner	12,163	6,880	5,283	6,880
	(24.3)	(21.9)	(28.4)	(13.8)
Agricultural Income	2,635	1,123	1,512	1,111
	(5.3)	(3.6)	(8.1)	(2.2)
Null Income	10,815	9,645	1,170	-
	(21.6)	(30.7)	(6.3)	-
Total	50,000	31,409	18,591	20,676

Notes: The table presents the number of observations in the randomly-drawn sample from the Greek taxpayer population in 2017, decomposed by primary income source. There are four income categories and, in addition, a null income category. The null income includes individuals who declared null in their tax returns. Primary income is defined as the highest declared among the four income categories. The first column presents the overall sample. The second column presents single-individual tax units. The third column presents individuals who belong to a household comprising from two individuals and, thus file jointly (note that all such households were required by law to file jointly in 2017). Lastly, the forth column includes single-filers only, who are eligible for ECTD. This category excludes null income taxpayers and those that earning more than € 160,000, as well as, the self-employed and business income category.

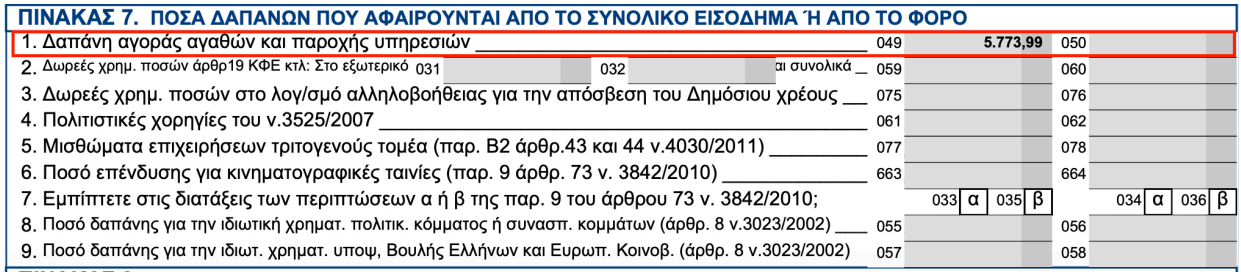
Table A.3 Event Studies - Monthly Consumption (% of Income)

Threshold Reached in:	(1) Not Reached	(2) February	(3) March	(4) April	(5) May	(6) June	(7) July	(8) August	(9) September	(10) October	(11) November	(12) December
Month to Deadline:												
-10	0.037***	12.454***	0.197**	0.247***	0.162***	0.175***	0.043	0.149***	0.129***	0.070	-0.000	0.007
	(0.012)	(1.827)	(0.086)	(0.059)	(0.048)	(0.048)	(0.047)	(0.045)	(0.048)	(0.044)	(0.043)	(0.037)
-9	0.027**	8.181***	5.505***	0.598***	0.542***	0.412***	0.240***	0.315***	0.175***	0.101**	0.062	0.020
	(0.011)	(2.280)	(0.677)	(0.061)	(0.052)	(0.049)	(0.047)	(0.048)	(0.046)	(0.045)	(0.042)	(0.037)
-8	0.018	5.717***	2.768***	5.467***	0.792***	0.651***	0.389***	0.370***	0.281***	0.199***	0.043	0.097**
	(0.011)	(1.405)	(0.608)	(1.206)	(0.058)	(0.054)	(0.051)	(0.047)	(0.051)	(0.049)	(0.043)	(0.040)
-7	0.010	6.613***	3.113***	1.699***	6.878***	0.803***	0.484***	0.539***	0.394***	0.222***	0.086**	0.066*
	(0.011)	(1.553)	(0.569)	(0.157)	(1.330)	(0.058)	(0.052)	(0.051)	(0.050)	(0.050)	(0.043)	(0.038)
-6	0.036***	5.710***	1.919***	1.770***	3.928***	5.400***	0.739***	0.608***	0.375***	0.314***	0.129***	0.200***
	(0.012)	(1.302)	(0.350)	(0.197)	(0.991)	(0.855)	(0.063)	(0.053)	(0.053)	(0.050)	(0.049)	(0.041)
-5	0.076***	6.151***	2.759***	2.216***	5.939***	2.858***	6.532***	1.144***	0.777***	0.590***	0.331***	0.216***
	(0.012)	(1.433)	(0.586)	(0.327)	(1.651)	(0.444)	(1.499)	(0.064)	(0.061)	(0.058)	(0.052)	(0.041)
-4	0.088***	5.996***	1.873***	2.405***	5.074**	2.850***	2.952***	6.442***	1.151***	0.901***	0.495***	0.410***
	(0.013)	(1.877)	(0.382)	(0.301)	(2.284)	(0.715)	(0.670)	(0.538)	(0.077)	(0.064)	(0.059)	(0.047)
-3	0.067***	5.921***	2.546***	1.877***	4.181***	2.498***	2.024***	3.532***	10.031***	1.061***	0.617***	0.331***
	(0.012)	(1.425)	(0.543)	(0.344)	(1.587)	(0.562)	(0.291)	(0.387)	(2.477)	(0.072)	(0.066)	(0.046)
-2	0.117***	6.508***	2.283***	2.096***	4.120***	3.203***	5.015**	2.875***	4.139***	5.815***	1.209***	0.568***
	(0.014)	(1.363)	(0.426)	(0.285)	(1.120)	(0.608)	(2.219)	(0.269)	(0.600)	(0.441)	(0.085)	(0.053)
-1	0.151***	5.639***	4.163***	2.075***	3.794***	2.632***	4.477**	3.411***	4.659***	2.848***	13.008***	1.020***
	(0.014)	(1.416)	(1.346)	(0.299)	(0.852)	(0.557)	(2.113)	(0.615)	(1.559)	(0.357)	(3.901)	(0.069)
Deadline - Dec 2017	0.457***	9.967***	4.794***	3.743***	7.921***	4.054***	4.460***	5.048***	4.577***	6.251**	7.348***	12.546***
	(0.019)	(2.058)	(0.786)	(0.294)	(2.114)	(0.458)	(1.092)	(0.714)	(0.480)	(2.608)	(1.748)	(1.831)
+1	0.978***	7.387***	4.037***	2.753***	6.559***	3.161***	3.326***	4.536***	4.005***	3.304***	4.179***	4.565***
	(0.080)	(1.495)	(0.706)	(0.280)	(1.712)	(0.465)	(0.625)	(0.776)	(0.691)	(0.614)	(0.486)	(0.597)
+2	1.118***	6.605***	2.829***	2.032***	6.005***	2.244***	2.827***	3.839***	2.318***	2.385***	5.064***	4.781***
	(0.163)	(1.414)	(0.718)	(0.272)	(1.851)	(0.341)	(0.548)	(0.566)	(0.251)	(0.293)	(1.812)	(1.098)
+3	1.854***	7.565***	3.325***	2.546***	5.784***	3.608***	2.526***	3.909***	3.595***	2.679***	4.059***	5.244***
	(0.429)	(1.574)	(0.478)	(0.246)	(1.363)	(0.968)	(0.384)	(0.669)	(0.546)	(0.272)	(0.577)	(1.182)
+4	2.994**	8.983***	4.404***	3.187***	6.143***	3.189***	3.471***	3.791***	3.777***	6.006*	3.404***	5.516***
	(1.166)	(2.005)	(0.801)	(0.301)	(1.947)	(0.418)	(0.693)	(0.524)	(0.831)	(3.460)	(0.287)	(1.363)
+5	2.697***	10.598***	4.418***	2.976***	6.699***	3.034***	3.844***	3.727***	3.520***	2.816***	3.809***	3.357***
	(0.821)	(2.694)	(0.625)	(0.378)	(1.835)	(0.603)	(1.024)	(0.547)	(0.504)	(0.339)	(0.415)	(0.305)
+6	3.584***	13.451***	3.566***	3.069***	6.717***	3.266***	2.841***	4.068***	4.307***	3.617***	10.409*	5.242***
	(0.962)	(3.054)	(0.563)	(0.363)	(2.354)	(0.516)	(0.477)	(0.518)	(0.734)	(0.749)	(6.199)	(1.616)
Constant	0.220	5.380***	3.565***	2.484***	1.825*	1.408***	1.190***	0.795***	0.640**	0.561	0.515	0.423
	(0.185)	(1.349)	(0.385)	(0.169)	(1.021)	(0.340)	(0.390)	(0.246)	(0.299)	(0.448)	(0.559)	(0.290)
Observations ($N \times T$)	108,918	22,086	29,430	33,066	31,032	24,930	22,590	19,854	16,056	15,228	13,230	17,244
Taxpayers (N)	6,051	1,227	1,635	1,837	1,724	1,385	1,255	1,103	892	846	735	958

Notes: The table presents monthly event studies for groups of taxpayers who have reached their threshold in particular months. Column (1) includes individuals who have not reached their threshold. The dependent variable is monthly electronic consumption as a percentage of annual declared income. The income has been declared by taxpayers in 2018 for the financial year 2017. Both the financial year and the deadline to build the threshold run from January to December every year. The regressions follow the specification in Equation 14, which includes binary variables before and after the deadline in December 2017 and, in addition, individual fixed effects. Results are shown relative to -11 month from the deadline (February 2017). January 2017 is excluded from the regression since two months are needed for assessing monthly spending. The sample excludes (a) joint-filers (to limit any intra-household consumption effects), (b) individuals who declare income from business and self-employed (c) individuals who declared 0 income (no threshold to follow). The results correspond to the graphs presented in Figure 4.5. Robust standard errors presented in parentheses, clustered at the individual's level.

A.2 ECTD Information

Fig. A.2 Tax Filing - Codes 049 and 050



ΠΙΝΑΚΑΣ 7. ΠΟΣΑ ΔΑΠΑΝΩΝ ΠΟΥ ΑΦΑΙΡΟΥΝΤΑΙ ΑΠΟ ΤΟ ΣΥΝΟΛΙΚΟ ΕΙΣΟΔΗΜΑ Ή ΑΠΟ ΤΟ ΦΟΡΟ										
1. Δαπάνη αγοράς αγαθών και παροχής υπηρεσιών	049	5.773,99					050			
2. Δωρεές χρημ. ποσών άρθρ19 ΚΦΕ κτλ: Στο εξωτερικό 031		032		αι συνολικά	059				060	
3. Δωρεές χρημ. ποσών στο λογ/σμό αλληλοβοήθειας για την απόσβεση του Δημόσιου χρέους	075						076			
4. Πολιτιστικές χορηγίες του ν.3525/2007	061						062			
5. Μισθώματα επιχειρήσεων τριτογενούς τομέα (παρ. Β2 άρθρ.43 και 44 ν.4030/2011)	077						078			
6. Ποσό επένδυσης για κινηματογραφικές ταινίες (παρ. 9 άρθρ. 73 ν. 3842/2010)	663						664			
7. Εμπίπτετε στις διατάξεις των περιπτώσεων α ή β της παρ. 9 του άρθρου 73 ν. 3842/2010;		033 α		035 β			034 α		036 β	
8. Ποσό δαπάνης για την ιδιωτική χρηματ. πολιτικ. κόμματος ή συνασπ. κομμάτων (άρθρ. 8 ν.3023/2002)	055						056			
9. Ποσό δαπάνης για την ιδιωτ. χρηματ. υποψ, Βουλής Ελλήνων και Ευρωπ. Κοινοβ. (άρθρ. 8 ν.3023/2002)	057						058			

Notes: The picture presents an example of how the aggregate amount of electronic consumption appeared in tax returns in 2017. Code 049 corresponds to the pre-filled information of annual electronic consumption, as sent by financial institutions to the tax authority. This is an example of a single-filing tax unit. For a joint-filing, an additional amount would appear in Code 050, for the spouses' spending. The individual can modify this amount before filing taxes, but the amount reported to the tax authority by financial institutions is salient to the taxpayer. The code name translates to "Consumption expenditure for goods and services".

A.3 Proofs

A.3.1 Proposition 1

The first part involves amounts of electronic consumption below threshold $F(z,a)$. Proof by contradiction. Suppose c_e^* is consumption below threshold, such that $c_e^* < F(z,a)$, and is a utility maximising point, such that $U(c_e^*, z) > U(c_e, z)$. Consider another consumption amount $c_e' > c_e^*$. Since $U(c_e, z)$ is increasing on c_e below the threshold, it must hold that $U(c_e', z) > U(c_e^*, z)$.

The second part involves amounts of consumption more than or equal to $F(z,a)$. Consider two consumption amounts $\tilde{c_e} > \hat{c_e} \geq F(z,a)$. Recall from Equation 4 that $t = 0$ if $c_e \geq F(z,a)$. Hence, $U(\tilde{c_e}, z) = U(\hat{c_e}, z)$. For any two electronic consumption points above threshold, the utility is the same. This completes the proof.

A.3.2 Proposition 2

The maximised response is proved in the same way as Proposition 1, for reporting and electronic consumption margins. What remains is to prove that the margin of responses depends on marginal costs.

Suppose $\xi'(c_e) > \psi'(c_r)$. Increasing c_r, increases utility U, until $t = 0$. At $t = 0$, $\psi'(c_r) = 0$. By Equation 9, $t = 0$ if $c_e + c_r \geq F(z,a)$, which is the utility maximising point.[19]

By symmetry, the same applies at $\xi'(c_e) < \psi'(c_r)$. Increasing c_r, increases U. At $t = 0$, $\xi'(c_r) = 0$. Therefore $t = 0$ is a utility maximising point, satisfying $\xi'(c_e) = \psi'(c_r)$. This completes the proof.

[19] In terms of the policy this means the following. If the marginal costs of changing the pre-filled amounts during reporting are lower than the costs of increasing electronic consumption to reach the threshold, the individual responds by increasing the reported values up to the threshold point, which gives maximum tax discount, and thus, maximum utility.