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The Elasticity of Taxable Income and Income-shifting Between Tax Bases: What is "Real" and What is Not?*

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Abstract

Previous literature shows that income taxation especially affects the behavior of business owners and entrepreneurs. However, it is still unclear how much of the response is due to changes in effort and other real economic activity, and how much is due to tax avoidance and tax evasion. This is important because the nature of the response largely affects the welfare implications and policy recommendations. In this paper we distinguish between real responses and tax-motivated income-shifting between tax bases using the widely-applied elasticity of taxable income (ETI) framework. We use extensive register-based panel data on both the owner and firm-level, which enable us to carefully distinguish between real effects and income-shifting among the owners of privately held corporations in Finland. Our results show that income-shifting accounts for over two thirds of the overall ETI. As the shifted income is also taxed, this significantly decreases the marginal excess burden of income taxation compared to the standard model in which the overall ETI defines the welfare loss. However, in addition to income-shifting effects, we find that dividend taxation significantly affects the real behavior of the owners.

JEL Classification Codes: H24; H25; H32

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1 Introduction

Income taxes are known to generate significant behavioral effects among business owners and entrepreneurs. However, the interpretation of the behavioral response is often difficult because business owners have many margins in which they can respond to taxes. In addition to real responses (labor supply, effort etc.), they have many opportunities to avoid taxes. Income-shifting between different tax bases is a common example of tax avoidance. In this study we focus on distinguishing between real responses and income-shifting. This is important because the nature of the response ultimately determines the welfare conclusions and policy recommendations (see e.g. Slemrod 1995, Piketty, Saez and Stantcheva 2013). Real responses stemming from deeper behavioral parameters such as labor-leisure preferences are

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not in direct government control. In contrast, income-shifting and other tax avoidance activities can be governed more easily by re-designing the tax system.

The elasticity of taxable income (ETI) framework is widely used when analyzing behavioral responses and the efficiency of income taxation. In addition to labor supply responses, the ETI captures other behavioral margins such as work effort, productivity, deduction behavior, tax avoidance and tax evasion. Much of the appeal towards estimating ETI is due to its conceptual simplicity and tight linkage to tax policy in practice. Under general conditions, the ETI quantifies the overall deadweight loss of income taxation (Feldstein 1995, 1999).

Income-shifting between differently taxed tax bases is one of the most relevant issues that might distort the ETI as a general measure of the excess burden among business owners. The ETI with respect to its own marginal tax rate does not account for the fact that other tax bases might have positive tax rates. This means that income-shifting across tax bases is not a full deadweight loss if the shifted income can also be taxed (Saez 2004, Chetty 2009b). In addition, a tax base may respond to changes in the tax rates of other tax bases even without a relevant change in its own marginal tax rate via the income-shifting channel.

The ETI is often estimated to be larger for business owners and high-income earners (see a survey by Saez, Slemrod and Giertz 2012). Thus these individuals seem to be more responsive to income tax rates than regular wage earners, which indicates larger welfare costs of income taxation among them. However, although some previous studies show that income-shifting is relevant for business owners (see e.g. Gordon and Slemrod 2000), it is still unclear how much of the overall response is due to changes in real economic activity, and how much is due to income-shifting.

Our contribution to the literature is to distinguish between real responses and income-shifting in the standard ETI framework. We build an empirical model which formalizes the analysis of ETI under income-shifting possibilities. We present the assumptions and data requirements needed to empirically estimate both real effects and income-shifting between tax bases. We show that adding the difference of the net-of-tax rates on available tax bases to the standard ETI model enables the identification of the average income-shifting effect and the average real response. We show that different empirical specifications lead to different interpretations of the estimated parameters. In conclusion, we discuss how the explicit inclusion of income-shifting affects the welfare analysis of income taxation.

In the empirical part, we analyze the ETI of the owners of privately held corporations in Finland. This subgroup of taxpayers has ample possibilities to affect their income composition within the Finnish dual income tax system, in which wages and dividends are taxed with separate tax rate schedules and tax rules. This type of environment with clear tax rate differences requires explicit modeling of income-shifting by adding the difference of wage and dividend tax rates into the model.

We use an individual-level panel data set of Finnish business owners. We link firm-level tax record information to the owner-level personal tax data, which is a novelty in the literature. With this data set we can define the marginal tax rates on both dividends and wages, which are needed when identifying income-shifting and real responses separately in the Finnish context. In addition, we are able to richly control for firm-level effects on the personal income trends of the owners. The comprehensive data set along with the dividend tax reform of 2005 in Finland creates an interesting opportunity to study the role of both income-shifting and real income creation.

Our results show that income-shifting responses are highly significant both statistically and economically. This result is very robust to specification. Over two thirds of the overall ETI among Finnish business owners is due to tax avoidance through income-shifting. However, income-shifting does not seem to be the whole story, as we also find positive real elasticity estimates for dividends. In addition, real responses are present even when analyzing broader firm-level income components, such as turnover and profits. These are less subject to tax avoidance than wages and dividends withdrawn from the firm. The tax elasticities of these components are also rarely analyzed in public finance literature.

In addition, we find that different tax bases and tax rates do not generate symmetric responses. Dividend taxes induce larger changes in both the income-shifting and the real margin. In contrast, wages are less responsive at the income-shifting margin, and not at all responsive at the real margin.

Our results imply that welfare calculations based on standard ETI analysis might be misleading for individuals with income-shifting incentives. In the case of Finnish business owners, the marginal excess burden of dividend taxes decreases from 0.9 to 0.4 when we account for the fact that the shifted income is also taxed. The income-shifting effect also affects policy recommendations. Even though dividends seem to be very responsive altogether, dividend taxes do not induce substantial changes in the real economy, at least on the short run.

The empirical ETI literature started building up after the path-breaking studies by Lindsey (1987) and Feldstein (1995). Feldstein (1995) estimates the taxable income elasticity to be large, ranging from 1-3 depending on income group. Many studies following Feldstein (1995) focus on improving the robustness and consistency of the elasticity estimation. Along with the refinements, the elasticity estimates have decreased markedly compared to the ones in Feldstein (1995). A wide range of studies report average elasticity estimates from 0 to 0.6. For example, the widely cited Gruber and Saez (2002) study find an ETI of 0.18 for mid-income earners and 0.57 for high-income earners. An extensive review of earlier empirical results can be found in the recent survey by Saez et al. (2012).

Recently, the literature has identified the behavioral response using the income distribution around the discontinuous kink points of the marginal income tax rate schedule. Saez (2010) shows that excess bunching around kink points is proportional to the local ETI at the kink. Many bunching papers show that the excess mass around kink points is larger for self-employed individuals (see Saez 2010, Chetty et al. 2011 and Bastani and Selin 2011). This indicates that the self-employed are more aware of the shape of the tax rate schedule and have more opportunities to adjust their behavior to it.

Related studies indicate that income-shifting is substantial for business owners. Gordon and Slemrod (2000) show evidence of active income-shifting between corporate and personal tax bases in the US during mid 1960s-mid 1990s. Devereux et al. (2012) show that income shifting between corporate and personal tax bases is also active in the UK. Goolsbee (2000) reports that a lot of the response to the 1993 income tax increase in the US was due to re-timing of executive compensations because the tax rate change was well anticipated before the actual implementation of the tax reform. Piketty et al. (2013) formulate a theoretical framework for analyzing tax avoidance effects as a part of the ETI of top income earners. By distinguishing between different forms of behavioral responses (tax avoidance, real responses and bargaining channels) they study the implications of optimal taxation at the upper end of the income distribution. They also provide empirical cross-country evidence which indicates that both real and avoidance responses are small while bargaining effects dominate.

In the Nordic countries, le Maire and Schjerning (2013) derive a dynamic extension to the bunching method and show that over half of the bunching effect among Danish entrepreneurs is due to intertemporal income-shifting. This suggests that the excess burden calculated by using the baseline bunching method overestimates the welfare effect. By using standard panel data ETI methods, Kleven and Schultz (2013) estimate cross-tax elasticities of taxable earned income and taxable capital income components within the Danish tax system. In general, they find small substitutability between earned and capital income, which supports the view that income-shifting effects exist.

In Finland, Harju and Matikka (2012) show that absent any real effects, income-shifting between tax bases is very active among the main owners of privately held corporations in Finland. Increased dividend tax rates after the 2005 dividend tax reform induced the owners to shift income from dividends to wages. This indicates that income-shifting is very responsive to tax incentives among Finnish corporate owners, and this might have notable effects on the welfare implications of income taxation. Pirttilä and Selin (2011) show evidence of responses to the dual income tax reform in Finland in 1993. They report that entrepreneurs and business owners increased their relative share of capital income when capital income tax rates were decreased.

The paper is organized as follows: Section 2 presents the theoretical model. Section 3 presents our empirical model. Section 4 describes the Finnish income tax system and recent tax reforms. Section 5 discusses identification issues, introduces the data and presents descriptive statistics. Section 6 presents the results. Section 7 discusses the main findings and implications.

2 Theoretical model

2.1 Taxable income model[1]

In the standard taxable income model by Feldstein (1999), an individual receives positive utility from consumption c and negative utility from creating taxable income z. Following Piketty et al. (2013), we assume a quasi-linear utility function of the form $u_i(c,z) = c - h_i(z)$, where $h_i(z)$ denotes the cost of effort to produce income via labor supply etc. The cost function is assumed to be convex and increasing in z. Utility is maximized under the budget constraint $c = z(1-\tau) + R$, where $(1-\tau)$ is the net-of-tax rate (one minus the marginal tax rate) on a linear segment of a non-linear tax schedule. R denotes virtual income.

Optimization of the utility function with respect to the budget constraint results that individuals will produce taxable income up to the point where $h_i'(z) = (1-\tau)$. Thus individual taxable income supply is a function of $(1-\tau)$.

[1] This subsection gives a very general description of the standard ETI framework. For more details, see Saez et al. (2012).

Next, consider a marginal decrease in $(1-\tau)$. Absent any income effects, increased marginal tax rate decreases taxable income. By using the standard definition of substitution elasticity and the taxable income supply function, the elasticity of taxable income (ETI) can be written as

$$e_z = \frac{(1-\tau)}{z}\frac{dz}{d(1-\tau)} \tag{1}$$

where e_z is the average ETI. In addition to changes in labor supply, e_z also covers changes in, for example, work effort and productivity. In addition, the average ETI covers tax avoidance and tax evasion.

The baseline intuition in the Feldstein (1999) model is that all behavioral responses affect the excess burden of income taxation. Individuals increase z until its marginal cost equals the net-of-tax rate, and the overall inefficiency can be summarized with the ETI. This requires that the marginal cost of effort, the marginal cost of tax avoidance and the marginal cost of tax evasion etc. all equal the net-of-tax rate. In other words, $h_i'(z) = (1-\tau)$ no matter how z is adjusted, and thus estimating e_z is all we need for welfare analysis.

2.2 Taxable income and income-shifting

Standard ETI in equation (1) implicitly takes into account any income-shifting to another tax base due to a change in $(1-\tau)$. However, among other previous papers that extend the ETI analysis to tax avoidance[2], we argue that more precise modeling of income-shifting is needed. This is essential especially if the ETI is analyzed among individuals who have easy access to differently taxed tax bases. Compared to the standard ETI analysis, income-shifting responses cannot be regarded as a full deadweight loss if the shifted income is also taxed.

Income-shifting can be very difficult for the average wage earner due to the lack of opportunities to alter the income composition. However, it can have major impact for individuals who indeed have these possibilities. In general, entrepreneurs and private business owners have more ways to affect the composition of their personal income. In particular, income-shifting opportunities are apparent within a dual income tax system where capital income and wage income are taxed differently with separate tax rules and regulations. In the Finnish dual income tax system, the most prominent income-shifting incentives lie between wage and dividend income of the owners of privately held corporations. We discuss the Finnish system in more detail in Section 4.

We present a static taxable income model for business owners with income-shifting opportunities. Our model is similar to the elasticity of taxable corporate income model by Devereux et al. (2012), and the Piketty et al. (2013) model with tax avoidance in the top income bracket[3].

We assume that there are two types of taxable income available, namely taxable wages z_W and taxable dividends z_D. We denote the total taxable income of the owner by $z_y = z_W + z_D$. More generally, taxable dividends can be thought of as taxable capital income, or as any other tax base in which the owner can legally report income (in addition to wage income). In many tax systems, business

[2] See for example Saez et al. (2012).

[3] Other previous papers also consider tax avoidance and income-shifting within the ETI framework, see e.g. Saez (2004) and Chetty (2009b).

owners and entrepreneurs have many different channels to withdraw income from the firm. Our model generalizes to any two differently taxed tax bases.

Wages are taxed at a tax rate τ_W and dividends are taxed at τ_D. The dual income tax system makes it possible to shift income (at a cost) between the two types of income. In general, the owner has an incentive to shift income form one tax base to the other if the tax rate schedules differ from each other[4]. Thus income-shifting describes the extent of changing the composition of income due to differences in τ_W and τ_D while keeping the level of total taxable income constant.

For simplicity and traceability, let us assume for now that $t_W > t_D$. This is usually the case in most dual income tax systems. We assume that both tax rates are exogenous.

The budget constraint can be written as

$$c = (1 - \tau_W)(1 - \alpha)z_y + (1 - \tau_D)\alpha z_y \tag{2}$$

where $0 \leq \alpha \leq 1$ and $(1 - \alpha)z_y = z_W$ is taxable wages denoted as a share of total taxable income. Similarly, $\alpha z_y = z_D$ is taxable dividends.

The utility function of an owner i is

$$u_i(c, z_y, \alpha) = c - \theta_i(z_y) - \phi_i(\alpha) \tag{3}$$

where $\theta_i(z_y)$ is the cost of effort to produce total taxable income, and $\phi_i(\alpha)$ is the cost of income-shifting between wages and dividends, i.e. changing the composition of total taxable income. We assume that both cost functions are convex and increasing in z_y and α, respectively.[5]

The owner chooses z_y and α to maximize utility, taking into account both the costs of real income creation and income-shifting. Utility maximization with respect to z_y and α gives the following first-order conditions:

$$(1 - \tau_W)(1 - \alpha) + (1 - \tau_D)\alpha = \theta_i^{'}(z_y) \tag{4}$$

and

$$(\tau_W - \tau_D)z_y = \phi_i^{'}(\alpha) \tag{5}$$

Equation (4) implies that total taxable income is an increasing function of the net-of-tax rates. Thus when α is fixed, both tax rates affect the total taxable income, as we have two separately taxed tax bases with no income shifting possibilities. Condition (5) implies that when keeping the amount of total taxable income (z_y) fixed, income-shifting is an increasing function of the tax rate difference. Thus the difference between the tax rates, $(\tau_W - \tau_D)$, determines the amount of income shifted from one tax base to another.

[4] Income-shifting from wages to dividends produces more total net income for the owner if $\tau_W > \tau_D$. Naturally, the opposite direction for income-shifting holds if $\tau_W < \tau_D$. If the tax rates are equal, we are back to the case of one common tax base.

[5] Alternatively, we could assume that both real wages and real dividends have separate convex cost functions that reflect true real wage and dividend income based on effort and the actual return on invested capital. This type of a model gives qualitatively similar results as the model with one cost function for all income.

Next we derive elasticities separately for both types of taxable income z_W and z_D. We assume there are no changes in the tax rate of the other tax base. The average net-of-tax rate elasticity for taxable wage income z_W is

$$\begin{aligned} e_{z_W} &= \frac{(1-\tau_W)}{z_W}\frac{\partial z_W}{\partial(1-\tau_W)} \\ &= \frac{(1-\tau_W)}{(1-\alpha)z_y}\frac{\partial z_y}{\partial(1-\tau_W)}(1-\alpha) + \frac{(1-\tau_W)}{(1-\alpha)z_y}\frac{\partial(1-\alpha)}{\partial(1-\tau_W)}z_y \\ &= e_W - e_{(1-\alpha)} \end{aligned} \tag{6}$$

where $e_W = dz_y/z_y * (1-\tau_W)/d(1-\tau_W)$, and $e_{(1-\alpha)} = d(1-\alpha)/(1-\alpha) * (1-\tau_W)/d((1-\tau_D)-(1-\tau_W))$. Equation (6) implies that we can distinguish the income-shifting effect $e_{(1-\alpha)}$ from the overall behavioral response e_{z_W}. The income-shifting elasticity measures how the wage tax base reacts to changes in the difference of the net-of-tax rates. We refer to the other component e_W as the real elasticity. It denotes how total income changes as wage tax rate changes. We discuss the limitations of interpreting e_W as an actual real effect in Section 3.

Similarly as above, we can express the average ETI of dividend income as

$$\begin{aligned} e_{z_d} &= \frac{(1-\tau_D)}{z_D}\frac{\partial z_D}{\partial(1-\tau_D)} \\ &= \frac{(1-\tau_D)}{\alpha z_y}\frac{\partial z_y}{\partial(1-\tau_D)}\alpha + \frac{(1-\tau_D)}{\alpha z_y}\frac{\partial \alpha}{\partial(1-\tau_D)}z_y \\ &= e_D + e_\alpha \end{aligned} \tag{7}$$

where $e_D = dz_y/z_y * (1-\tau_D)/d(1-\tau_D)$ is the real dividend elasticity, $e_\alpha = d\alpha/\alpha * (1-\tau_D)/d((1-\tau_D) - (1-\tau_W))$ is the income-shifting elasticity for dividends.

Altogether, equations (6) and (7) differ from (1) as they take income-shifting explicitly into account. As noted in Piketty et al. (2013), z_W and z_D are more responsive to changes in their own net-of-tax rates than in the standard ETI framework without income-shifting possibilities (or with arbitrarily large costs for income-shifting).

In the empirical part, we estimate the average elasticity of taxable income using the income-shifting framework above. In order to identify real elasticities and income-shifting effects separately, we use variation in both $(1-\tau_W)$ and $(1-\tau_D)$. If income-shifting is not important in practice, $e_{(1-\alpha)}$ and e_α should be small or insignificant. In the case that income-shifting matters, we empirically distinguish income-shifting from the overall response.

2.3 Welfare implications

In this section we describe how income-shifting affects the welfare interpretation of the ETI. We compare the marginal excess burden without income-shifting possibilities to a case where part of the behavioral response comes in the form of income-shifting. Our model for the marginal deadweight loss follows the one presented in Chetty (2009b).

We use the standard approach in the deadweight loss literature. We approximate the marginal excess burden by comparing behavioral responses caused by a tax rate change to a benchmark case which ignores the behavioral responses. The same follows from assuming that the tax revenue collected with wage and dividend taxes is returned to the owner as a lump sum transfer.

We use the following welfare function

$$w = \{(1-\tau_W)(1-\alpha)z_y + (1-\tau_D)\alpha z_y - \theta_i(z_y) - \phi_i(\alpha)\} + (1-\alpha)z_y\tau_W + \alpha z_y \tau_D \tag{8}$$

where individual utility is presented in curly brackets, and tax revenue collected by the government is denoted as the sum of the tax revenue from both tax bases. For simplicity, we again assume that $\tau_W > \tau_D$.

Let us first consider the standard ETI and deadweight loss analysis of wage taxation with respect to the wage tax base. This refers to the case in which $\alpha = 0$. Similar analysis can be carried out also for dividends, but for the sake of brevity we only show the equations for taxable wage income.

Consider a marginal increase in the wage tax rate, $d\tau_W$. As the owner is assumed to optimize her utility, we can use the envelope theorem and denote that the tax increase has only a first-order effect on individual utility. The first-order effects of the owner's utility and tax revenue of the government cancel each other out. Thus we can write the excess burden as

$$\frac{dw}{d\tau_W} = \tau_W \frac{\partial z_y}{\partial \tau_W} = z_y \frac{\tau_W}{(1-\tau_W)} e_{z_W} \tag{9}$$

where e_{z_W} denotes the overall elasticity of the wage tax base with respect to $(1-\tau_W)$. Thus e_{z_W} refers to the standard ETI in the Feldstein (1999) framework.

Next, consider a more general case where the owner can shift part of taxable wage income to the dividend tax base. This refers to the case where $0 \le \alpha \le 1$ and owners can adjust α. The deadweight loss can then be expressed as

$$\begin{aligned} \frac{dw}{d\tau_W} =& -z_y \frac{\partial \alpha}{\partial \tau_W}(\tau_W - \tau_D) + \frac{\partial z_y}{\partial \tau_W}((1-\alpha)\tau_W + \alpha\tau_D) \\ =& z_y \left[\frac{(1-\alpha)\tau_W + \alpha\tau_D}{(1-\tau_W)} e_W + (1-\alpha)\frac{(\tau_W - \tau_D)}{(1-\tau_W)} e_{(1-\alpha)} \right] \end{aligned} \tag{10}$$

where e_W denotes the real elasticity, and $e_{(1-\alpha)}$ is the income-shifting elasticity.

The key difference between equations (9) and (10) is the income-shifting response. Assume that we observe an overall decrease in taxable wage income due to an increase in the wage tax rate, $e_{z_W} > 0$. Assume further that part of this response comes in the form of income-shifting. If we ignore the income-shifting response and use equation (9) to assess the deadweight loss, the marginal excess burden is approximated to be too large when $0 < \tau_D < \tau_W < 1$ and $0 \le \alpha \le 1$.

The difference of the marginal excess burden between (9) and (10) depends on two factors: The difference of the net-of-tax rates $(\tau_W - \tau_D)$ and the size of the income-shifting response $e_{(1-\alpha)}$ in relation to the size of the overall behavioral response e_{z_W}. Large $e_{(1-\alpha)}$ implies that a large fraction of the response is due to income-shifting. With a given $e_{(1-\alpha)}$, small $((1-\tau_D)-(1-\tau_W))$ implies that income-shifting has only a small effect on efficiency. Thus, if there are large incentives for income-shifting, equation (10) highlights that it is important to estimate the elasticity for both the real component and the income-shifting component of the total elasticity.

Furthermore, it is worth noting that estimating the elasticity for a broader tax base affects the welfare conclusion. When estimating the elasticity of total taxable income $z_y = z_W + z_D$ with respect to $(1-\tau_W)$, income-shifting between the tax bases is equal to zero by definition, as income-shifting between tax bases does not by itself affect the amount of total taxable income in our model. We further discuss this and other data-related issues in the next Section.

However, the existence of income-shifting opportunities might affect the real component e_W, compared to a counterfactual in which there is no income-shifting possibilities. For example, a possibility to lower the overall tax payments by income-shifting might induce higher real effort and productivity. Theoretically, this refers to a model in which the cost functions $\theta_i(z_y)$ and $\phi_i(\alpha)$ are not separable, and separate parameters for income-shifting and real elasticity cannot be identified. Nevertheless, creating income-shifting opportunities might not be the optimal policy for the government, as income-shifting itself inflicts negative effects on welfare which might overcome the positive real effects.

Applying the envelope theorem in the welfare model assumes that individuals optimize such that the marginal cost of effort equals the associated net-of-tax rates (see the first-order conditions (4) and (5) from before). Thus equations (9) and (10) hold if individuals optimize as in the standard Feldstein (1999) framework. However, it is possible that the first-order conditions do not hold in practice, especially when income can be easily reported under different tax bases. Chetty (2009b) shows that the Feldstein (1999) formula for the deadweight loss does not hold if the marginal social cost of income-shifting does not equal the tax rate. More specifically, the welfare effect of income-shifting in equation (10) might be overestimated if the marginal resource cost of income-shifting is very small. In the case of income-shifting between tax bases with only real resource costs, this means that equation (10) does not hold if the real marginal cost of income-shifting is actually smaller than the difference of the two tax rates.

Intuitively, if income-shifting requires only a very small effort for the owner, the resulted loss in tax revenue due to the income-shifting effect is mainly transferring of resources from the government to business owners with only a negligible effect on efficiency. In addition, as noted by Chetty (2009b), at least part of the costs related to tax avoidance are plausibly transfers between different agents within the economy. For example, costs related to income-shifting might be payments to tax consultants, who usually report at least part if this original cost as their own taxable income. Thus transfers between different agents do not represent a full loss in efficiency. In the extreme, if income-shifting inflicts no real costs, the marginal excess burden reduces to the real effect of taxation, denoted by the first term on the right-hand side of equation (10). We further discuss this and the empirical magnitude of the deadweight loss among Finnish business owners in Section 7.

3 Empirical methodology

3.1 Empirical ETI model

A usual approach to estimate the ETI with individual-level panel data and tax reforms is to use a difference-in-differences approach and a first-differences estimator[6]. With these methods, time-invariant unobserved individual characteristics that affect income growth are canceled out. This is appealing as these characteristics (for example, innate ability) might be mechanically correlated with the marginal tax rate.

Following Saez et al. (2012), the baseline empirical ETI equation can be characterized as

$$ln(z)_{t,i} = e_z ln(1-\tau)_{t,i} + ln(\eta)_{t,i} + ln(\varepsilon)_{t,i} \tag{11}$$

where t is subscript for time and i denotes individual. z is taxable income, $(1-\tau)$ is the net-of-tax rate and e_z is the parameter of interest, the average elasticity of taxable income. η denotes potential income, i.e. income without taxes, and ε is the error term, including the transitory income component.

After taking first-differences, equation (11) can be expressed as

$$\triangle ln(z)_{t,i} = e_z \triangle ln(1-\tau)_{t,i} + \triangle ln(\eta)_{t,i} + \triangle ln(\varepsilon)_{t,i} \tag{12}$$

where $\triangle$ denotes the difference in the variables between time $t+k$ and t. In this specification, any time-invariant individual characteristics that affect $z_{t,i}$ are canceled out.

There are many issues that need to be taken into account when defining the actual empirically implementable version of equation (12). First of all, the net-of-tax rate and transitory income shocks are mechanically correlated within a progressive tax system. This means that a valid instrument for the net-of-tax rate is required in order to have a causal interpretation for e_z. Also, non-tax related changes in potential income need to be taken into account. In other words, differential income growth trends for different types of individuals need to be controlled for. This is usually done by adding a matrix of individual characteristics in base year t to the estimable equation. One common approach is to add taxable income spline variables for richer base-year controlling (see Gruber and Saez 2002).

3.2 ETI and income-shifting

The interpretation of the estimated ETI parameter might change if income-shifting possibilities exist. In this subsection we discuss this and specify ways of distinguishing income-shifting from the overall response using micro-level data. For now we assume that valid net-of-tax rate instruments exist, and that we can perfectly control for other individual characteristics that affect the growth of taxable income. These issues will be discussed in Section 6.

[6] For a more detailed discussion on empirical ETI estimation including cross sectional models, see Saez et al. (2012). We discuss the local estimation of ETI using distributions of taxable income and bunching around the kink points of the tax schedule in Section 6.2.

In order to identify different elasticity components, we need differential variation in marginal tax rates among otherwise similar individuals. This variation is needed for all relevant tax bases. In the Finnish case we need variation in both wage and dividend tax rates. Changes in income taxation for the owners of privately held corporations in Finland are described in detail in Section 4. Also, identification requires data which enable us to calculate the marginal tax rates for both tax bases for each individual. We discuss and present the data in Section 5.

By utilizing exogenous variation in both the net-of-tax rates of wages and dividends, we can write the estimable version of the elasticity of taxable wage income in equation (6) as

$$\triangle ln(z_W)_{t,i} = e_W \triangle ln(1-\tau_W)_{t,i} - e_{(1-\alpha)} \triangle (ln(1-\tau_D) - ln(1-\tau_W))_{t,i} + \triangle ln(\eta_W)_{t,i} + \triangle ln(\varepsilon)_{t,i} \quad (13)$$

where $(1-\tau_W)$ is the net-of-tax rate for taxable wage income and $(1-\tau_D)$ is the net-of-tax rate for dividend income. Now, equation (13) also includes the responsiveness of taxable wage income with respect to income-shifting incentives, namely $\triangle(ln(1-\tau_D) - ln(1-\tau_W))_{t,i}$. Regressing $\triangle ln(z_W)_{t,i}$ with both $\triangle ln(1-\tau_W)_{t,i}$ and $\triangle(ln(1-\tau_D)-ln(1-\tau_W))_{t,i}$ enables us to estimate separately both real elasticity e_W and the income-shifting component $e_{(1-\alpha)}$, along with the associated standard errors. Similar model can also be written for dividend income. For the sake of brevity, we only cover the wage income model in this Section.

The income-shifting effect can also be estimated by simply adding $\triangle ln(1-\tau_D)_{t,i}$ to the standard ETI model for taxable wages. After adding dividend tax rates we get the following expression

$$\triangle ln(z_W)_{t,i} = e_{z_W} \triangle ln(1-\tau_W)_{t,i} - e_{(1-\alpha)} \triangle ln(1-\tau_D)_{t,i} + \triangle ln(\eta_W)_{t,i} + \triangle ln(\varepsilon)_{t,i} \quad (14)$$

Importantly, adding $\triangle ln(1-\tau_D)_{t,i}$ to the baseline ETI model does not change the interpretation of the standard ETI parameter e_{z_W}, which captures *both* real responses and the income-shifting effect. If income-shifting behavior is significant, the estimated sum of these elasticity components might not be very informative. Standard ETI model alone or even conditional on net-of-tax rates of other tax bases might be misleading when assessing the welfare consequences of income taxation. However, in terms of identifying the income-shifting response, both (13) and (14) define the same response $e_{(1-\alpha)}$.

Another possibility to separate the income-shifting response is to study the elasticity of total taxable income $z_y = z_W + z_D$ with respect to the net-of-tax rate of wages. In the earlier literature this type of income has been in many cases referred to as broad income. The model for the total taxable income can be written as

$$\triangle ln(z_y)_{t,i} = e_W \triangle ln(1-\tau_W)_{t,i} + \triangle ln(\eta_y)_{t,i} + \triangle ln(\varepsilon)_{t,i} \quad (15)$$

The elasticity coefficient in equation (15) only includes the real response component, as any income-shifting gets canceled out by definition. In other words, if an increase in the wage tax rate induces only a pure income-shifting effect, total taxable income remains unchanged. Thus regressing $\triangle ln(z_y)_{t,i}$ with

$\triangle ln(1-\tau_W)_{t,i}$ allows us to identify the real elasticity component, which can then be compared with the taxable wage income elasticity in order to assess the relevance of income-shifting behavior.

Therefore, how well we can estimate both e_W and $e_{(1-\alpha)}$ depends on the data we have. We can outline real responses with total income data which include all relevant tax bases. In order to analyze both e_W and $e_{(1-\alpha)}$, we need information on the wage tax base separately. In addition, to analyze underlying differences in the responsiveness of wage and dividend tax bases, we need reliable data on the dividend tax base as well. As we meet all the conditions mentioned here with our data set, we can see how different specifications affect the estimates in our empirical analysis.

In the empirical analysis, we use broader income concepts than taxable wage and taxable dividend income to estimate the income-shifting model. In the Finnish context, taxable income is defined as gross income subject to taxation minus deductions and exemptions. Thus taxable income takes into account also changes in deduction behavior due to changes in tax rates. However, in this study we are particularly interested in estimating the effect of taxes on real behavior in contrast to income-shifting effects. Therefore, we use gross wage and dividend income subject to taxation as dependent variables when estimating the models. Gross income does not include the potential changes in deduction behavior.

Despite using changes in gross income as the left-hand side variable, interpreting e_W as a true real response in equations (13) and (15) includes an implicit assumption that income-shifting is the only possible margin for tax avoidance. In addition to tax deductions, there might be other possibilities to avoid taxes, and these might be included in the estimated e_W coefficient. For example, if tax rates increase, owners can increase their consumption within the firm (e.g. in the form of more office amenities). Owners can also increase fringe benefits, which are in many cases not fully included in gross income subject to taxation. Finally, owners might illegally evade taxes, for example, through intentional underreporting of income.

In order to assess the real component in a more diverse manner, we estimate the net-of-tax rate responses for more broadly defined income components at the firm-level. One example of this is net profits before wages. We define net profits as turnover plus other income of the firm minus all costs except wages. Compared to wages and dividends withdrawn from the firm, this type of income is not as easily manipulated with different tax avoidance measures. In addition to wages and dividends, net profits also includes retained profits. Intuitively, changes in net profits due to changes in net-of-tax rates reflect the real effort of the owner. We also estimate elasticities for the turnover of the firm. Turnover measures the overall sales revenue of the firm, which also reflects the real effort and productivity. Harju and Kosonen (2013) study tax responsiveness of turnover among the owners of unincorporated firms in Finland. They find small real responses for this group.

One of the most common examples of other tax avoidance channels affecting e_W is intertemporal or dynamic income-shifting. For example, one way to respond to a forthcoming tax increase is to pay out more income before the net-of-tax rate decreases (see Goolsbee 2000 and le Maire and Schjerning 2013). Especially dividend income can be rather easily shifted across periods using retained profits. In the Finnish context, Kari et al. (2008) show evidence that Finnish corporations did in fact anticipate the 2005 dividend tax reform by increasing dividend payments just before the abolition of the single taxation of dividends. Anticipation was feasible as the content of the reform was made public in advance already in late 2003. Mostly due to this anticipation possibility, our baseline empirical analysis utilizes a longer time period of 2002-2007. We further discuss the implications of other tax avoidance measures in Sections 6 and 7.

3.3 Estimable equation

We estimate different variations of the following equation using a two-stage least squares estimator:

$$\triangle lnTI_{t,i} = \alpha_0 + e\triangle ln(1-\tau^p)_{t,i} + \alpha_1 f(lnTI)_{t,i} + \alpha_2 B_{t,i} + \alpha_3 F_{t,i} + \triangle\varepsilon_{t,i} \tag{16}$$

In equation (16), $\triangle lnTI_{t,i}$ is the log change in gross income between t and $t+k$. The income concept varies across different specifications. In our baseline model, we analyze a single difference between 2002 and 2007. $\triangle ln(1-\tau^p)_{t,i}$ is the instrumented change in the log net-of-tax rate (we discuss the instruments in detail in Section 5). Thus e is the coefficient of interest, the average elasticity with respect to the net-of-tax rate. When studying the income-shifting responses, we add a difference of the log net-of-tax rates of wages and dividends into the estimable equation.

Following Gruber and Saez (2002), we add a 10-piece base-year income spline $f(lnTI)_{t,i}$ to the model. Base-year income controls for unobserved heterogeneity in income growth. We also control for observed individual effects with available background variables in the tax return data. Matrix $B_{t,i}$ includes age, age squared, ownership share of the firm, county and the sex of the owner. In addition, the extensive firm-level data allow us to control for firm-level effects. Firm-level base-year characteristics are denoted by the matrix $F_{t,i}$. Firm-level controls include total assets, turnover, profits, industry, number of employees and county.

We first analyze the responsiveness of wage income and dividend income subject to taxation with respect to own net-of-tax rates and income-shifting incentives. Thus in these cases we set $TI_{t,i} = (z_W)_{t,i}$ for wages and $TI_{t,i} = (z_D)_{t,i}$ for dividends. In addition to the two separate tax bases, we also regress the change in total income $TI_{t,i} = (z_W + z_D)_{t,i}$ with changes in the instrumented net-of-tax rates. We also estimate alternative models for real responses where we regress broader firm-level income components, such as turnover and net profits, with changes in the instrumented net-of-tax rates.

As a common procedure in the literature, we focus on the owners at the intensive margin whose firms are their primary source of income. In our baseline estimation, we limit the analysis to observations where base-year total income (wages + dividends) is above 25,000 €. In addition, individuals whose absolute change in total income between 2002 and 2007 is above 50,000 € are dropped from the sample in order to avoid necessarily high influence of outlier observations. All estimates are weighted by total income of the owner. When considering the welfare consequences of income taxation, income weighted uncompensated average ETI is the parameter of main interest (see Gruber and Saez (2002)). However, similarly as Gruber and Saez (2002), we censor the weights at 200,000 € in order to avoid giving unreasonably large weight to a few very high income individuals in the data.

In addition to first-differences estimation, we also use the distributions of z_W and z_D and the kink points in the marginal tax rate schedules to estimate the ETI. We discuss this bunching estimation and its implications in more detail in Section 6.2.

4 Finnish income tax system and recent tax reforms

We focus on analyzing the owners of privately held corporations in Finland. Privately held corporations are defined as corporations that are not listed on a public stock exchange (cf. public or listed corporations). In the Finnish tax system, dividends from listed and privately owned corporations are taxed at different tax rates and tax regulations. Also, the taxation of privately held corporations is different from other types of private businesses (e.g. sole proprietors and partnerships). We focus on the reforms that took place in 2002-2007, as we use the same time period in our baseline analysis.

Since 1993, Finland has applied the principle of Nordic-type dual income taxation where earned income (wages, pensions, fringe benefits etc.) and capital income (interest income, capital gains, dividends from listed corporations etc.) are taxed separately. Earned income is taxed with a progressive tax rate schedule whereas capital income tax rate is flat. As a typical feature of the Nordic dual income tax system, top marginal tax rate on earned income is much higher than the flat tax rate on capital income. The lower flat tax rate for capital income was motivated for various reasons, for example broadening the tax base, decreasing the scope for tax arbitrage, and increased global capital mobility which all argue in favor of taxing capital income more leniently.

Wage income of the owner is in general deductible from firm profits. Wages cannot be paid without a work contribution for the firm, or else wages may be considered as veiled distribution of profits. In addition, dividends can be paid only if the firm has distributable assets. These include for example accumulated profits and non-tied equity. Otherwise there are no significant legal limitations to in which form the owner can withdraw income from a privately held corporation[7].

As a whole, the Finnish income tax system follows the principle of individual taxation. Income of a spouse or other family members does not affect the marginal income tax rate of an individual. However, some tax deductions and received social security depend on the total income of the household.

4.1 Dividend taxation and the reform of 2005

The dual income tax system requires special rules for dividend taxation of the owners of privately held businesses. Otherwise there would be major incentives to shift income from heavily taxed wages to a more leniently taxed capital income tax base. In order to limit the scope of direct income-shifting, dividends are categorized into two parts according to the net assets (assets-liabilities) of the firm[8]:

[7] In contrast to wages and dividends, other alternatives to withdraw income from the firm are restricted. These include for example shareholder loans and share repurchases.

[8] The net assets of the firm are calculated using the asset and debt values in the year before. The individual net asset share of the owner is calculated based on the ownership share of the firm. Also, there are some individual adjustments to the net assets. For example, if the owner or her family members live in a dwelling which is owned by the firm, the value of this dwelling is not included in net assets when calculating the imputed return.

- The amount of dividends corresponding to the imputed 9% return on net assets of the firm are subject to a flat tax rate (26%[9]). The imputed "normal" rate of return on net assets is set by the government and it is the same for all owners and privately held corporations.
- Any dividends exceeding the imputed normal return are taxed progressively (max. tax rate 54%).

For example, with assets of 500,000 €, liabilities of 100,000 € and the rate of return set to 9%, the maximum amount of dividends taxed with the flat tax rate is 36,000 €. In other words, any dividends from the firm up to 36,000 € are taxed with the flat tax rate, and any dividend income *exceeding* this amount is taxed according to the progressive tax rate schedule. The taxation of dividends exceeding the imputed return is not similar with wage income. Dividends are subject to corporate taxes whereas wages are not. Also, some tax deductions are only allowed on wage income, whereas progressively taxed dividends are not subject to firm-level social security contributions.

A full imputation system of corporate taxes was in place until 2005. Within the full imputation system, corporate taxes paid on distributed dividends were credited back for the shareholder, which lead to an effective single taxation of dividend income. Thus, both flat-tax and progressively taxed dividend were only subject to individual-level taxes prior to 2005.

The reform of 2005 changed the whole principle of dividend taxation by switching the full imputation to a system with double taxation of dividend income. After the reform all dividends became subject to the 26% corporate tax rate. The splitting rule of dividend income into flat taxed and progressively taxed parts based on firm net assets was maintained. However, the imputed rate of return decreased a touch from the previous 9.6% to 9%.

Marginal tax rates on dividends (D)		
	Before	After
(I) D ≤ Imputed return and D ≤ 90,000e	29%	26%
(II) D ≤ Imputed return and D > 90,000e	29%	40.5%
(III) D > Imputed return		
min	0%	26%
max	55%	54%

Table 1: Marginal tax rates on dividends before and after the reform of 2005

In general, changes in the marginal tax rate (MTR) on dividends depend on the amount of dividends and the net assets of the firm. Table 1 presents the main changes in the MTR on dividends. The reform changed the MTR differently for different types of owners. The first type of owners (row (I) in Table 1) are those who have dividend income below the imputed return on net assets and below 90,000 euros. For these owners the effective flat tax rate for dividends decreased from 29% to 26%. Before the reform, dividends below the imputed return were not subject to the corporate tax rate, and taxed only with the

[9] All tax rates are from 2011 if not otherwise mentioned.

flat personal capital income tax rate of 29%. After the reform, these dividends are only subject to the 26% corporate tax rate, and not taxed in individual taxation.

The second type of owners (row (II)) are those who have dividend income below the imputed return on net assets and above 90,000 euros. For these owners the effective flat tax rate for dividends increased from 29% to 40.5%. Before the reform these dividends were taxed with the flat capital income tax rate. After the reform, 70% of dividends above 90,000 euros are regarded as taxable capital income in personal taxation, in addition to the flat corporate tax rate. This results in an effective MTR of 40.5% for these dividends.

The third type of owners (row (III)) are those who have dividend income above the imputed return on net assets. Before the reform, these dividends were only taxed as personal earned income, subject to a progressive tax rate schedule (0-55%). After the reform, 70% dividends above the imputed return are regarded as taxable earned income, in addition to the flat corporate tax rate of 26%. Thus the reform increased the MTR for small dividends above the imputed return, but changes in the MTR were small for large dividends above the imputed return.

All in all, owners with larger net assets were more likely faced with a decrease in the dividend tax rate, whereas owners with smaller net assets were more likely to face an increase in marginal dividend tax rates. Therefore, in the data we have otherwise similar owners who differ only in the net assets of the firm, and are thus faced with different changes in the marginal tax rate on dividends. This means that the change in the MTR of dividends is not directly related to the amount of dividend (or wage) income, which alleviates the usual identification issues in the literature. We discuss this in more detail in Section 5.1.

Figure 5 in the Appendix presents the effective marginal tax rates on dividends in 2002 and 2007 with two levels of net assets, 0 and 250,000 euros (approx. the mean net assets in the estimation sample before the reform). The Figure shows that most of the MTR increase is centered on low and mid-levels of dividends above the imputed return. Figure 5 also shows the 3 percentage point drop in the flat tax rate of dividends below the imputed return and 90,000 euros.

Finally, there are few important aspects of the reform that are also worth mentioning. First, the content of the 2005 tax reform was made public already in late 2003. Therefore, the years right before and right after the reform are not suitable for empirical analysis that aims at identifying longer run behavioral parameters[10]. Also, in 2005, special transition rules were applied which alleviated the partial double taxation of dividends.

Secondly, the main motivation behind the tax reform was not the economic and fiscal conditions in Finland. The pre-reform full imputation credit was given only to domestic shareholders whose firms operate in Finland. This violated European Union regulation of equal tax treatment of all EU citizens. Thus, Finnish legislators were more or less forced to change the tax system towards more unified treatment of both domestic and international shareholders. Therefore, the tax reform of 2005 can be considered exogenous from the point of view of domestic shareholders. Finally, despite the drastic change in the tax

[10]Kari, Karikallio and Pirttilä (2008) provide empirical evidence of notable anticipation effects right before and after the tax reform of 2005 for privately held corporations.

system, the tax base for dividends remained closely the same as before the reform.

4.2 Wage income taxation and variation in wage tax rates

In Finland there are three levels of wage income taxes: central government (or state level) income taxes, municipal income taxes and mandatory social security contributions. Central government income tax rate schedule is progressive, whereas municipal tax rates and social security contributions are proportional by nature. Nominal central government tax rate varies from 0 to 30%, depending on taxable income. The average nominal municipal tax rate is 19.16%. Municipal tax rates vary between different municipalities (16.25-21.5%)[11]. Social security contributions include for example unemployment insurance payments.

During 2002-2007, there was a general decline in central government income tax rates throughout the income distribution. Marginal tax rates decreased almost every year in most income classes within the central government taxation (for income above ca. 11,000 euros). In contrast, the average municipal income flat tax rate increased from 17.78% in 2002 to 18.45% in 2007.

Municipal tax rates have changed differently in different municipalities in different years. On average, every fifth municipality changed its tax rate in each year. Yearly municipal tax rate changes vary from -1 to +1.5 percentage points, which accounts for roughly 1-10% changes in the overall net-of-tax rate. Thus in the data we have owners whose marginal wage tax rate has changed in different directions in different years. Also, municipal tax rate changes are determined only by the municipality of residence, not individual level of wage or dividend income. Furthermore, the marginal wage tax rate of the owner is not determined by the municipality in which the firm is physically located or registered, since municipal taxation is residence-based.

Figure 6 in the Appendix describes the MTR on wage income. The left-hand side of the Figure illustrates the average marginal wage tax rates in 2002 and 2007, and shows that on average marginal tax rates decreased slightly throughout the income distribution. The right-hand side of Figure 6 shows the actual marginal tax rates calculated using our data set for the year 2007, highlighting the fact that individuals with the same income level face different marginal tax rates due to municipal-level tax rate differences. Thus owners with the same income level also face different changes in the MTR of wages via changes in municipal tax rates. This again improves the identification of the elasticity parameters.

We do not include mandatory pension and health insurance contributions as a direct tax on wages in this study. Insurance contributions of the owners of privately held corporations are not levied on actual wage income if the ownership share is above 50% and the shareholder holds an executive position in the firm. These owners are termed YEL owners. YEL owners report a self-selected YEL income from which the insurance payments are accumulated. The reported YEL income can be above or below the actual wages paid without implications or sanctions. However, there are both lower and upper limits for YEL income, which are both also independent of actual wage income. However, as insurance payments determine pensions after retirement as well as many income-bound social benefits, YEL owners have

[11] There are 336 municipalities in Finland (in 2012). Each democratically elected municipal council decides on the municipal tax rate on an annual basis. Municipalities can choose their tax rates relatively freely. However, certain legislative municipal-level duties need to be financed mainly by municipal taxes (e.g. basic health care and primary education).

incentives to report a realistic YEL income that reflects the actual income-earning potential.

In contrast, insurance contributions are based on actual wage income from the firm for owners whose ownership share is less than 50% (similarly as in the case of paid workers with no ownership share). These owners are termed TEL owners. Thus for TEL owners, insurance contributions increase or decrease one-to-one with wage income withdrawn from the firm. However, it is not clear whether insurance contributions are fully regarded as taxes, since owners directly benefit from them in the future. Nevertheless, it is plausible that insurance payments levied on actual wage income decrease the incentives to pay wages for TEL owners, compared to YEL owners whose insurance contributions do not (directly) depend on wages. We discuss how we apply this in our empirical analysis in Section 5.1.

Finally, pension contributions and other social security payments are fully deductible from taxable wage income in central government and municipal income taxation. Insurance contributions are not paid on dividend income. There were no relevant changes in TEL or YEL insurance payments in the time period we study. Average rate for TEL payments is 21.1% in both 2002 and 2007, and 20.8% in 2007 and 21.1% in 2002 for YEL payments. The YEL/TEL status cannot be freely chosen. Owners satisfying the YEL conditions in a given year cannot change their status to TEL owners, or vice versa.

4.3 Tax incentives for income-shifting

The Finnish dual income tax system creates noticeable income-shifting incentives for the owners of privately held corporations. As the tax rate schedules of wages and dividends differ from one another, owners can minimize income taxes by choosing an optimal combination of wages and dividends as their personal compensation from the firm. Thus with a given total income (wages + dividends), owners can shift their income between dividends and wages in order to maximize net income. Harju and Matikka (2012) show evidence that the owners of privately held corporations in Finland are active in minimizing tax payments through income-shifting between wages and dividends.

The 2005 tax reform affected the income-shifting incentives of many owners. In the light of our analysis, it is important that the reform changed the income-shifting incentives differently among the owners. Owners with different levels of firm net assets faced different changes in income-shifting incentives. Owners with high level of net assets faced only modest changes in their income-shifting incentives if dividend income was below the imputed return on net assets and 90,000 euros. For these dividends the marginal tax rate decreased by 3 percentage points, inducing a small change in incentives to increase dividend compensation at the expense of wages. Owners with relatively low net assets faced an increase in their dividend tax rates (on average), as progressively taxed dividends exceeding the imputed rate of return on net assets became double taxed. This also changed the relative difference between the marginal tax rates on wages and dividends. For many owners, the MTR on dividends became larger than the MTR on wages, inducing notable changes in the incentives to shift income. However, there is variation in incentives even among this group, since the MTR on dividends actually decreased slightly for large progressively taxed dividends (see Figure 5 in the Appendix).

Finally, Table 4 in the Appendix presents the marginal tax rates on wages and dividends with different levels of firm net assets. The Table highlights that owners with different net assets have different MTR on dividends, and faced different changes in the marginal tax rates and income-shifting incentives within the 2005 tax reform.[12]

5 Identification and data

5.1 Net-of-tax rate instruments

In a progressive income tax rate schedule, the marginal tax rate increases as taxable income increases. Therefore, an increase in taxable income mechanically decreases the net-of-tax rate, causing the tax rate variable to be endogenous in the empirical model. Thus a valid instrumental variable for the net-of-tax rate is required.

A common strategy in the ETI literature is to simulate predicted or synthetic tax rates and use them as instruments for the net-of-tax rate (see Gruber and Saez (2002)). Basic structure of the predicted net-of-tax rate (NTR) variable is the following: Take pre-reform income in base-year t and use it to predict the net-of-tax rates for $t + k$ by using the post-reform tax legislation in $t + k$. The predicted tax rate instrument is then the difference between the actual NTR in t and the NTR calculated with income in t and the tax law for $t + k$. The intuition behind this strategy is that the predicted NTR difference describes the change in the tax liability caused by the changes in tax legislation while ignoring any behavioral effects via taxable income responses. In this study we use the Gruber and Saez (2002) type predicted NTR instrument with a few modifications.

In general, predicted NTR instruments are better predictors of the exogenous tax rate variation within a single tax base and a single tax bracket of the progressive tax rate schedule. Intuitively, predicted NTR instruments perform better for changes in income that are relatively close to the original income level in the base period. However, available income-shifting opportunities might cause substantial changes in taxable income. In other words, income-shifting may lead to "jumping" across tax brackets. Therefore, the predicted net-of-tax rate instruments might be too weak if income-shifting is prevalent.

Thus, we might need additional instruments in order to more reliably estimate the ETI for individuals with income-shifting possibilities. The purpose of additional instruments is to capture the incentives to change the composition of income, which are not necessarily taken into account when using only the predicted NTR approach. The extensive individual and firm-level data set allows us to use the characteristics of the Finnish corporate tax system as potential instruments.

We use the pension insurance status of the owner as an additional instrument. The pension insurance status is mechanically defined based on the ownership share of the firm and the official working status of the owner in the firm. Individuals who work in their own firm in an executive position and own 50% or more of the firm alone or together with immediate family members are termed YEL owners. They can choose the amount of reported YEL income from which the mandatory insurance payments are levied on. In contrast, individuals who own less than 50% of the firm pay pension insurance payments based

[12] Harju and Matikka (2012) provides a more detailed discussion on the income-shifting incentives within the Finnish dual income tax system.

on the actual wages paid from the firm. These owners are called TEL owners. Insurance contributions of the owners are described in more detail in Section 4.2.

We use the TEL/YEL indicator in the base-year as an additional instrument in order to capture the incentives to shift income from dividends to wages (and vice versa). We assume that TEL owners who cannot choose the level of insurance payments would not increase their wage compensation after the reform as much as YEL owners for whom wages do not directly affect the level of the contribution. In other words, the YEL/TEL status affects the incentives to shift income from dividends to wages based on insurance payments, which are not captured by the predicted net-of-tax rate instrument. The exclusion restriction is that the YEL/TEL status is not itself correlated with transitory income shocks, conditional on various observed individual and firm-level characteristics.

We also need to address the development of net assets when defining the net-of-tax rate instrument for dividends. Net assets is the key factor determining the marginal tax rate on dividends (see Section 4). As shown in Tables 5 and 6 in the Appendix, net assets have in general increased both in the whole data set as well as in our estimation sample. Thus we need a counterfactual estimate for the net assets in $t+k$ when defining the NTR instrument for dividends. The counterfactual net assets takes into account the development of net assets which is not related to the tax reform of 2005. We predict the net assets after the reform for each owner using exogenous pre-reform characteristics in 2000-2003. We use the same exogenous individual and firm-level variables as in the baseline ETI regression. These variables include for example age, age squared, sex, turnover, total assets and industry and location dummies[13].

Another essential issue in estimating the ETI is variation in marginal tax rates. With both tax bases, changes in the marginal tax rates vary across the income distribution. In other words, there is differential tax rate variation among the owners in all income classes. This is important since non-tax related changes in income are potentially problematic when identifying the elasticity parameters (see Gruber and Saez (2002)). If the shape of the income distribution varies independently of tax reforms, the analysis of behavioral responses to tax changes might be biased if this variation cannot be properly taken into account. Non-tax related changes in the income distribution are especially problematic if the variation in the MTR is focused only on certain part of the income distribution, for example, the tax rates cuts or increases in the top income bracket. The fact that both dividend and wage tax rate variation occurs in all income classes alleviates the potential problems associated with these issues.

Furthermore, the fact that changes in both the MTR of wages and dividends are not direct functions of income improves the exogeneity of the instrument. As discussed in the recent ETI literature, there is no proof that the predicted NTR instrument is exogenous (Blomquist and Selin 2010, Weber 2011). In general, it is unlikely that the instrument is correlated similarly with both parts of the transitory income component ($\varepsilon_{t+k,i} - \varepsilon_{t,i}$) if the NTR is a direct function of income (even conditional on base-year income splines and other controls)[14]. This issues is less severe in our data, as the the level of the MTR

[13]The R-squared statistic for the net assets prediction using OLS is 0.73.

[14]Blomquist and Selin (2010) use income in the middle year of the difference ($(t+k+t)/2$) as the base period when imputing the predicted tax rates for both $t+k$ and t. Weber (2011) proposes an instrument which exploits years before k as the base period. Both of these approaches aim at reducing the covariance between the instrument and the transitory error component. However, both of these strategies provide more or less weaker instruments than the Gruber and Saez (2002) approach, which might also bias the estimated parameter of interest.

and changes in the MTR on both dividends and wages depend also on net assets and municipality of residence, respectively. Nevertheless, we discuss the implications of the possible endogeneity of the NTR instrument in Section 6.2.

5.2 Data

Our data are from the Finnish Tax Administration and include information on the financial statements and tax records of Finnish businesses. The data include tax record information on both the firm and its main owner. Another unique characteristic of the data is that it contain basically all Finnish businesses (all public and private corporations, partnerships, sole proprietors etc.). In this study we focus on the main owners of privately held corporations.

The data set contains all important tax information for our analysis, for example wages and dividends paid to the owner by the firm, and taxable income earned from other sources by the owner. These together with other tax record information enable us to precisely define the marginal tax rates for both relevant personal tax bases, wages and dividends. By linking the owner-level and the firm-level data together we can control for various individual and firm-level effects in the empirical estimation. This type of data are rarely used in the ETI analysis.

For this study we construct a balanced panel data for the years 2002-2007. The main owner data include only those individuals who received positive dividends from the firm during a tax year.

Tables 5 and 6 in the Appendix describes the data and the key variables we use from both 2002 and 2007. Table 5 shows the statistics for the whole data, and Table 6 for our baseline estimation sample. In general, wages have increased more than dividends. Total income of the owner has on average increased in the time period. A notable feature from the firm-level is that both total assets and net assets have increased considerably in the time period, whereas there is only a small average increase in the turnover of the firm.

5.3 Descriptive statistics

Figure 1 describes the means of wage, dividend and total income (wages+dividends) from 2000 to 2009 for the owners of privately held corporations. The Figure shows that mean wages, mean dividends and mean total taxable income all increased from 2000 to 2009. Importantly, the Figure indicates that the share of wage income relative to total income has increased from 2005 onwards. This suggests that the 2005 tax reform and the abolition of single taxation of dividends affected the combination of total income, which gives us preliminary evidence that income-shifting might be significant. Also, mean dividends increased in the two pre-reform years (2003 and 2004). This is consistent with the anticipation result reported by Kari et al. (2008). However, based on Figure 1, it remains unclear whether tax rate changes have also induced real responses.

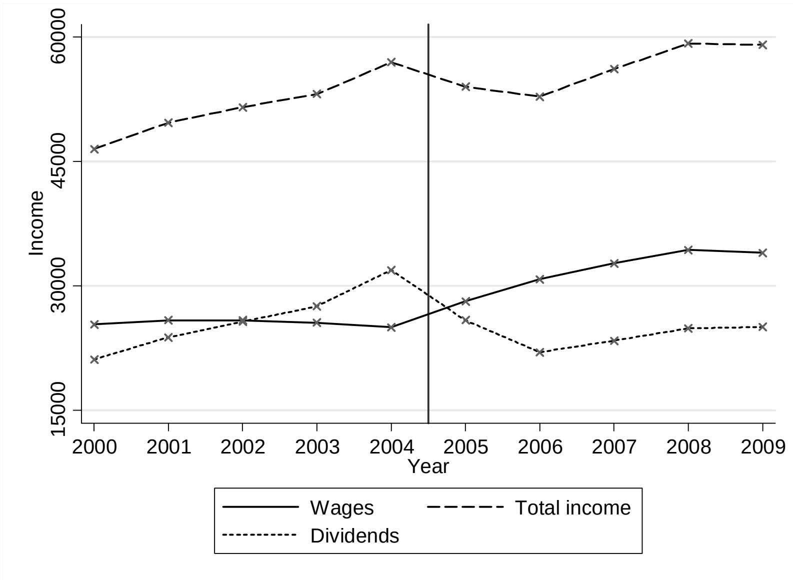


Figure 1: Means of wage, dividend and total income in 2000-2009 (in 2000 euros)

Figure 2 outlines how different tax incentives affect mean wages and mean dividends in 2000-2009. In the Figure, we roughly divide owners in two groups based on dividend income before the reform. The first group (I) consists of owners who had dividend income taxed at the progressive tax rate in 2000-2002. In other words, these owners had dividend income exceeding the imputed rate of return on net assets. On average, the double taxation rule increased marginal dividend tax rates for these dividends after 2005. This group refers to owners in row III in Table 1.

The second group (II) consists of owners who withdrew only flat taxed dividends below the imputed return in 2000-2002. For these dividends the effective marginal tax rates decreased by 3 percentage points. This group refers to owners in row I in Table 1.

Figure 2 shows that especially owners with progressively taxed dividends before the reform (I) increased their relative wage compensation after the reform. This was expected in the light of tax incentives, as these owners faced, on average, increased marginal dividend tax rates after the 2005 tax reform. In contrast, for those owners who withdrew only flat taxed dividends before the reform (II), income growth has mostly come in the form of dividends. Again, this is reasonable since the flat tax rate decreased in the 2005 reform. In addition, Figure 2 suggests that both groups also anticipated the abolition of the single tax system by increasing dividends just before the reform.[15]

However, real responses to tax changes might have also affected the development of wages and dividends in Figure 2. For example, in 2000-2009, both wages and dividends have increased for those owners who had only flat-tax dividends in 2000. Thus more detailed analysis on income-shifting and real effects is needed.

[15] In general, owners with large firm net assets faced no incentives to anticipate the reform. However, there was some uncertainty involved with the actual implementable dividend tax system, which might induce anticipation for this group as well. For more details, see Kari et al. (2008).

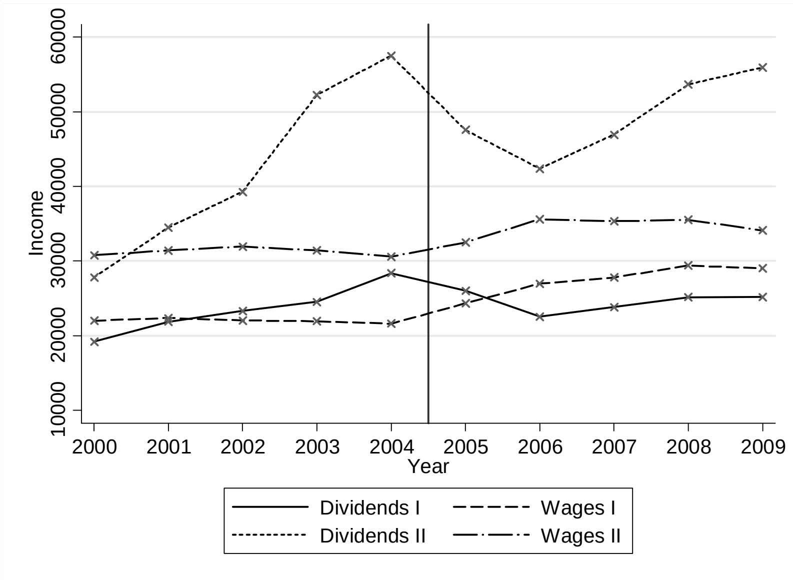


Figure 2: Means of wage and dividend income in 2000-2009 (in 2000 euros). For the owners with positive progressively taxed dividends in 2000-2002 (I), and the owners with only flat taxed dividends in 2000-2002 (II)

6 Results

6.1 Main results

ETI and income-shifting

Table 2 presents standard ETI estimates for wage income and dividend income (gross income subject to taxation). Columns (1)-(3) show the results for dividends, and columns (4)-(6) present wage income elasticities with the full set of control variables.

VARIABLES	(1) lnZ_D	(2) lnZ_D	(3) lnZ_D	(4) lnZ_W	(5) lnZ_W	(6) lnZ_W
$ln(1-t_W)$		-1.468***		0.042	0.316	-0.093
		(0.376)		(0.306)	(0.355)	(0.300)
$ln(1-t_D)$	1.649***	1.989***	0.521*		-0.409***	
	(0.123)	(0.163)	(0.297)		(0.139)	
$[ln(1-t_D)-ln(1-t_W)]$			1.468***			-0.409***
			(0.376)			(0.139)
Income spline	Yes	Yes	Yes	Yes	Yes	Yes
Base-year controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F-test for $ln(1-t_W)$		163.69		226.97	172.00	172.00
1st stage F-test for $ln(1-t_D)$	877.02	601.02	601.02		548.66	
1st stage F-test for $[ln(1-t_D)-ln(1-t_W)]$			334.74			333.09
Observations	14,003	14,003	14,003	12,135	12,135	12,135

Notes: Robust standard errors in parentheses. Estimates weighted by total income.*** p<0.01, ** p<0.05, * p<0.1

Table 2: ETI estimates for wages and dividends, 2002-2007

In sum, columns (1)-(3) show that income-shifting is very notable when analyzing the responsiveness of the dividend tax base. The standard ETI model in column (1) gives the average net-of-tax rate elasticity of over 1.6, which can be considered large. However, as income-shifting possibilities between dividends and wages are particularly relevant for the owners of privately held corporations in Finland, we need to add the net-of-tax rate of wages into the model in order to more rigorously analyze tax responsiveness.

Columns (2) and (3) imply that a significant part of the overall behavioral response of dividends is due to income-shifting between the tax bases. Column (2) shows that the cross elasticity of dividends with respect to the net-of-tax rate of wages is almost -1.5 and statistically significant. However, as discussed earlier in Section 3.2, simply adding the tax rate of another tax base in the ETI model does not change the basic interpretation of the own net-of-tax rate elasticity, which is the combination of both real and income-shifting responses.

Adding the difference of the instrumented net-of-tax rates to the model changes the interpretation, as now the own tax elasticity only includes the real response, which is estimated to be 0.52 and weakly significant. In terms of identification, models in columns (2) and (3) use the same tax rate variation which gives the exact same estimates for the income-shifting component. The main difference of the two approaches is the separate estimate for the real response component in column (3).

For wages, columns (4)-(6) show that the only statistically significant effect is the income-shifting response, which is estimated to be around -0.40. The own net-of-tax rate elasticity for wages is insignificant in every specification.

All in all, results in Table 2 show that income-shifting can have huge impact on the behavior of individuals with income-shifting possibilities. This result is in line with previous studies from both the US (e.g. Slemrod 1995, Gordon and Slemrod 2000, Saez 2004) and the Nordic Countries (e.g. Pirttilä and Selin 2011, le Maire and Schjerning 2013).

In addition, large income-shifting responses imply that the costs related to tax avoidance might be relatively low in the Finnish dual income tax system. This was also expected as there are only a few legal limitations to shift income in the Finnish system. Furthermore, costs and benefits might also partly explain the differences between wage and dividend tax elasticities. As shown by Chetty et al. (2011) and Kleven and Schultz (2013), larger changes in net-of-tax rates induce larger behavioral elasticities. This is consistent with the notion that small tax rate changes are attenuated by adjustment costs related to behavioral changes. As shown in Section 4, changes in wage taxation are smaller than changes in dividend tax rates, which might imply that the estimated real elasticity of wages would be smaller than the real elasticity of dividends.

However, there is no reason to assume that the elasticity estimates for wages and dividends should be the same in the first place. There might be underlying differences in how different tax bases react to tax rate changes (Piketty et al. 2013). Thus, based on Table 2, it might be that the dividend tax base is intrinsically more elastic than the wage tax base, which is important to take into account in welfare and policy implications.

Real response estimations

As discussed before in Section 3, the estimated real response components in Table 2 might not reflect the actual real effort or the productivity of the owner. Real responses in the ETI model might be "contaminated" with other tax avoidance measures, such as private consumption within the firm or fringe benefits. In order to assess the real component in a more diverse manner, we estimate the net-of-tax rate elasticities for income components that are broader than the separate tax bases for wages and dividends.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	$ln(Z_D + Z_W)$	$ln(Z_D + Z_W)$	*ln(net profit)*	*ln(net profit)*	*ln(turnover)*	*ln(turnover)*
$ln(1 - t_W)$		0.086		0.206		0.178
		(0.172)		(0.345)		(0.313)
$ln(1 - t_D)$	0.694***		0.335**		0.293*	
	(0.076)		(0.169)		(0.151)	
Income spline	Yes	Yes	Yes	Yes	Yes	Yes
Base-year controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F-test for $ln(1 - t_W)$		183.29		407.85		409.66
1st stage F-test for $ln(1 - t_D)$	805.69		850.48		791.86	
Observations	14,010	14,010	13,507	13,507	13,018	13,018

Notes: Robust standard errors in parentheses. Estimates weighted by total income.*** p<0.01, ** p<0.05, * p<0.1

Table 3: Real response estimations, 2002-2007

We begin by analyzing the elasticity of total income (wages + dividends). Conclusions based on the estimates in columns (1) and (2) in Table 3 are somewhat similar as before. Dividends seem to also affect the real behavior, whereas the real elasticity for wages is close to zero and very insignificant. The point estimate for dividend tax elasticity is 0.69, which can be considered relatively large.

However, there are still various ways in which the owners can affect the amount of reported total income subject to taxation. Therefore, we also estimate tax elasticities of firm-level income components that are less subject to tax avoidance.

First, we estimate the elasticity of net profits with respect to both net-of-tax rates. Net profits are defined as turnover plus other income of the firm minus all costs except wages. Thus net profits include for example sales, capital gains and irregular earnings. Importantly, net profits also include retained earnings which are not regarded as dividends or wages. Net profits are significantly responsive to dividend taxes, but the point estimate is half the size compared to the total income elasticity (column (3)). The point estimate for wage tax elasticity increases, but it is still statistically insignificant (column (4)). Columns (5) and (6) present the elasticity estimates for the turnover of the firm. The estimates are similar but somewhat smaller than before with net profits, which again indicates that dividend taxes affect the productivity of the firm in a statistically significant manner, and wage taxes do not.

Finally, it is worth noting that the size of the income component might also affect the estimates. As the underlying tax rate variation is the same in all specifications, broader tax bases have smaller elasticities if the absolute behavioral response is the same for different income components. Thus differences in the elasticity estimates for different income types might not be solely driven by differences in the opportunities to avoid taxes.

On the whole, the results imply that even though income-shifting between tax bases accounts for a large proportion of the elasticity for the owners, responses along the real margin might still be non-negligible at the same time. Thus for the policy maker, this requires weighting the possible advantages or disadvantages stemming from real responses with the costs of avoiding taxes by income-shifting.

6.2 Alternative specifications and robustness checks

Income distributions and bunching

We can also study the distributions of dividends and wages to analyze the responsiveness of the tax bases. Examining taxable income distributions near the kink points of the piecewise linear income tax schedule provides a visual and robust method to analyze local behavioral tax elasticities. A seminal contribution by Saez (2010) shows that under standard preferences, we should find individuals bunching around the marginal tax rate kink points if tax elasticity is significant. Thus if behavioral responses occur, we should observe an excess mass of individuals clustering at the point in the income distribution where the marginal tax rate exhibits a discontinuous jump.

Bunching analysis provides an alternative to the first-differences approach. With bunching methods we can estimate behavioral responses using cross sectional variation in tax rates. Thus we can apply a different identification strategy to estimate similar parameters. Also, using cross sectional identification avoids some of the critical issues in first-differences estimation and net-of-tax rate instruments, such as potential mean reversion. Overall, similar results from the bunching analysis would confirm our earlier conclusions based on panel data regressions.

The intuition behind the bunching analysis is the following: Consider a small increase in the marginal tax rate, $d\tau$, at a point $z = k$. Below the kink point k income is taxed with a tax rate τ_1, and above the kink point the tax rate is τ_2, such that $\tau_1 < \tau_2$. Assuming individuals with similar standard preferences as before in Section 2, we can denote the fraction of individuals bunching as $B(dz) = \int_k^{k+dz} h_0(z)dz$, where $h_0(z)$ is the pre-reform smooth density function of taxable income. Individuals located within the income interval $(k, k + dz)$ before the tax rate change bunch at k due to the introduction of the kink point. Individuals further up in the income distribution $z > k + dz$ or below k do not move to the kink point. The bunching approach implicitly assumes that individuals in the neighborhood of k are otherwise similar except that they face a different slope in the budget set.

Bunching at kink points can be used to derive the local elasticity of taxable income. Saez (2010) shows that the local ETI is proportional to the excess density mass around the kink point:

$$e \backsimeq \frac{B(dz)/h_0(k)}{k * ln((1-\tau_1)/(1-\tau_2))} \tag{17}$$

Intuitively, given the size of the change in the net-of-tax rate around the kink point $ln((1-\tau_1)/(1-\tau_2))$, the implied elasticity is larger the more bunching is observed at the kink. Also, with given excess bunching, the elasticity is smaller the bigger is the difference between the tax rates on both sides of the kink.

The challenge in equation (17) is estimating the size of excess bunching. Empirically, $b(k) = B(dz)/h_0(k)$ is estimated by comparing the actual density function around the kink point to a smooth counterfactual density. The counterfactual density function describes how the income distribution at the kink would have looked like without a change in the tax rate. Due to imperfect control and uncertainty about the exact amount of income in each year, the usual approach is to use a "bunching window" around k to estimate the excess mass (see Saez 2010 and Chetty et al. 2011). In other words, we compare the density of taxpayers within an income interval $(k-\delta, k+\delta)$ to an estimated counterfactual density within the same income range.

We use the approach of Chetty et al. (2011) and estimate the counterfactual density non-parametrically. We fit a flexible polynomial function to the observed density function, excluding the region around the kink point $[k-\delta, k+\delta]$ from the regression. First, we group individuals into small income bins, and estimate a regression of the following form

$$c_j = \sum_{i=0}^{p} \beta_i (z_j)^i + \sum_{i=k-\delta}^{k+\delta} \eta_i \cdot \mathbf{1}(z_j = i) + \varepsilon_j \tag{18}$$

where c_j is the count of individuals in bin j, and z_j denotes the income level in bin j. The order of polynomial is denoted by p.
The counterfactual density function is estimated by omitting the bunching window from the regression, $\hat{c}_j = \sum_{i=0}^{p} \beta_i (z_j)^i$. Thus we can express bunching around k as $\hat{B} = \sum_{i=k-\delta}^{k+\delta} c_j - \hat{c}_j$. However, as noted in Chetty et al. (2011), this simple calculation underestimates the counterfactual density. Individuals bunching at the kink come from the region on the right to the kink, which lowers the counterfactual density. We follow the iterative estimation procedure by Chetty et al. (2011) and shift the counterfactual density upwards such that it is equally large with the observed empirical distribution (for details, see Chetty et al. 2011).

Finally, the excess mass is calculated as

$$\hat{b}(k) = \frac{\hat{B}}{\sum_{i=k-\delta}^{k+\delta} \hat{c}_j / (2\delta + 1)} \tag{19}$$

Standard errors for $\hat{b}(k)$ are calculated using a bootstrap procedure (for details, see Chetty et al. 2011). As in the earlier literature, parameters δ and p are determined visually and based on the fit of the model. In general, our results are not very sensitive to the bunching window δ or the degree of polynomial p.

Figure 3 shows the distributions of dividend income around the kink point of flat taxed dividends in 2002 and 2007[16]. The Figure presents dividend income relative to the kink for each owner within +/- 5,000 € of the kink in bins of 100 €. Dividend income below the kink is taxed with the flat tax rate. Dividends exceeding the kink are taxed progressively. Thus for many owners the flat tax kink point induces large changes in the marginal tax rate on dividends. On average, increase in the marginal tax rate on dividends at the kink is 13 percentage points in 2002 and 19 percentage points in 2007.

[16] The computational return on net assets defines the location of the flat tax kink point for each owner. Before the reform of 2005, the computational normal return on net assets was effectively 9.6%, and after the reform 9%. For more details see Section 4.

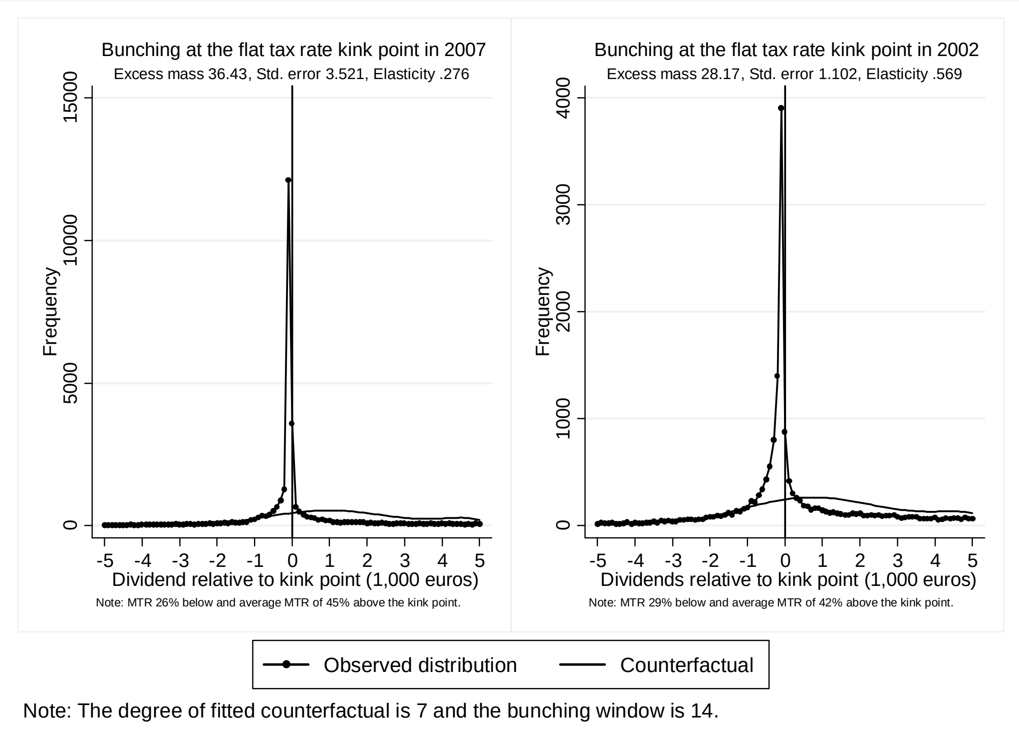


Figure 3: Dividend income distribution around the flat tax kink point, years 2007 (left) and 2002 (right)

Figure 3 indicates very clear bunching at the kink point. A very large proportion of owners locate very close or exactly at the kink point. This strongly supports the earlier conclusion that the owners are responsive to marginal tax rates on dividends, and that the dividend tax base is clearly responsive to its marginal tax rates.

There are a few aspects that are worth noting when interpreting Figure 3. First, the flat tax kink point is not the same for all owners in terms of euros, as the amount corresponding to the 9% imputed return on the net assets of the firm obviously varies among different owners. However, Figure 3 implies that the owners are very aware of their individual kink points, as there are no other explicit reason to locate at the kink except the discontinuous change in the tax rate. Secondly, the size of the change in the marginal tax rate on dividends at the kink point also varies among owners, as the marginal tax rate on dividends exceeding the kink depends on the total sum of progressively taxed income (wages, progressive dividends and other earned income from other sources).

We approximate the local ETI of dividend income at the kink point using the average marginal tax rate above the kink for the owners within the bunching window. We estimate the ETI to be 0.74 in 2002 and 0.51 in 2007. Both estimates are statistically significant.

How to interpret the ETI estimates from bunching analysis with regard to real effects and income-shifting? The counterfactual density is estimated based on the observed dividend income distribution around the kink point, and thus the bunching estimate identifies the effect of the increase in the marginal tax rate on dividend income only close the kink. Consequently, the bunching analysis provides a local alternative to estimate the overall response with respect to the own net-of-tax rate of the tax base. Thus the baseline bunching estimate for ETI does not implicitly allow us to estimate income-shifting between tax bases separately.

Furthermore, Figure 3 suggests that intertemporal income shifting might be relevant. Owners can minimize dividend taxes dynamically by not exceeding the flat tax kink point in any year. Owners can retain the extra dividends within the firm, and withdraw more flat tax dividends in later years. Notable incentives for such behavior exist, as retained profits increase the net assets value of the firm, which increases the maximum amount of flat taxed dividends in the next year. le Maire and Schjerning (2013) extend the bunching analysis to account for intertemporal income-shifting. They show that a significant part of the overall tax bunching among Danish entrepreneurs is due to intertemporal income-shifting.

We also do an indirect bunching analysis for wages. Figure 4 presents the distribution of all progressively taxed earned income relative to all kink points in the marginal tax rate schedule for 2002 and 2007 (+/- 5,000 € in bins of 100 €). It is not relevant to analyze only the distribution of wages from the firm, as also other progressively taxed income affects the location of the owner in the taxable income distribution. Thus the exact location in the taxable income distribution is what matters in terms of bunching. For simplicity, we only include owners who do not receive wages or other earned income outside the firm in Figure 4. However, the results are similar when we include all the owners in the data set.

From Figure 4 we can see that there is practically no excess bunching at the kink points of the earned income tax schedule. The only exception is the third kink point in 2002, where we find weakly significant excess bunching. This suggests that the owners do not react actively to marginal wage tax rates, which is in line with the low wage elasticity estimates presented before. Importantly, compared to the first-differences analysis, the cross-sectional bunching approach is not sensitive to the size of the change in the marginal tax rate between t and $t + k$. As changes in wage tax rates in time have been modest in 2002-2007, this might affect the results in Section 6.1. Nevertheless, both of these methods suggest low responsiveness of wage income to the marginal tax rate on wages.

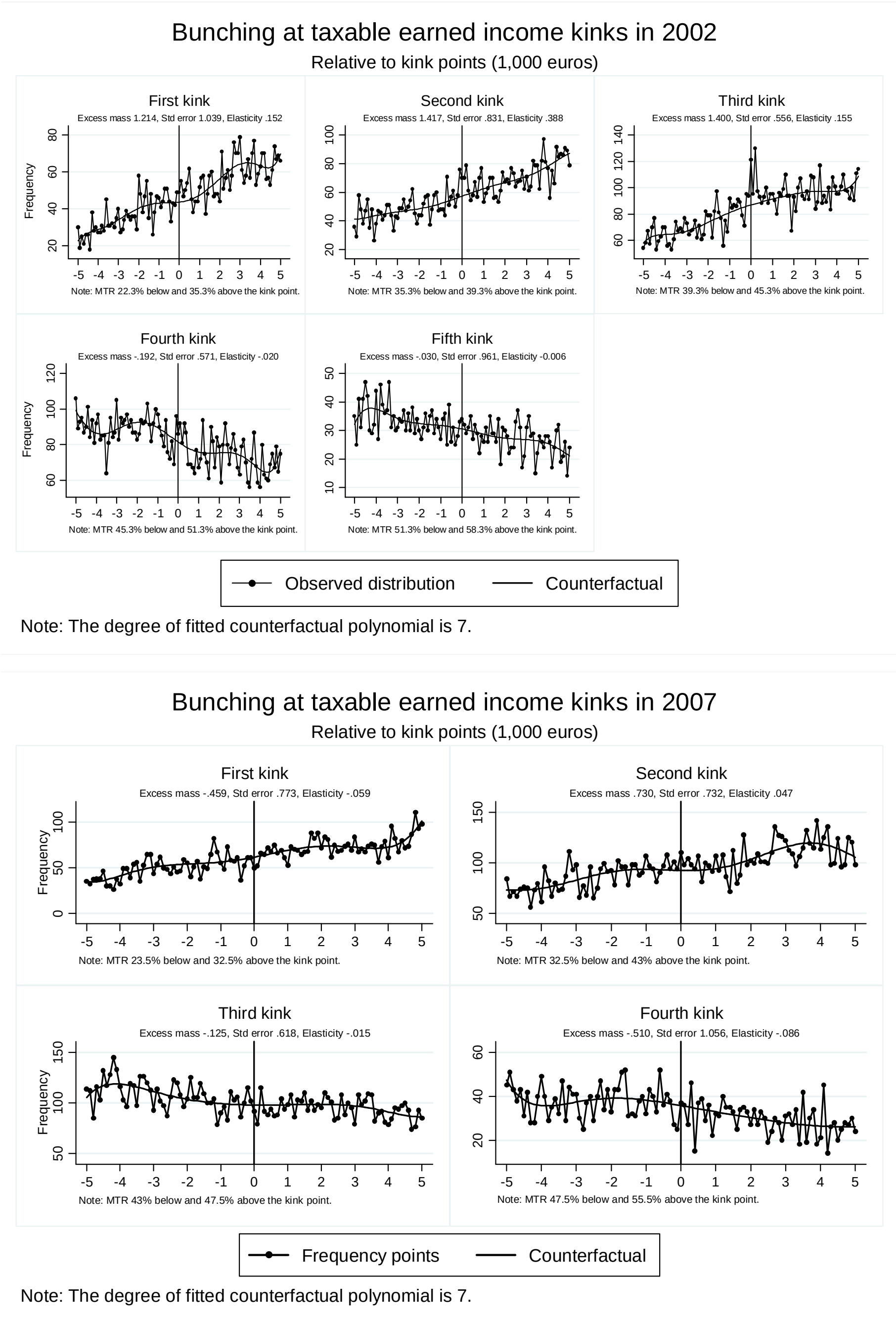


Figure 4: Taxable earned income distributions relative to all kink points, years 2002 (above) and 2007 (below)

Overall, the bunching analysis supports the result that dividends are more responsive to tax rates than wages. We find clear bunching at the flat tax kink point for dividends, whereas the earned income tax rate schedule seems not to induce notable behavioral responses. However, studying excess bunching of dividends and earned income does not give explicit information on the extent of static income shifting between the tax bases. Nevertheless, the bunching evidence shows that the owners are very aware of the flat tax kink point, which in its part suggests that the dividend kink also affects wage income and the overall composition of total income.

Robustness checks and sensitivity analysis

We estimate several different specifications of equation (16) to assess the robustness and sensitivity of our baseline results. The results for these estimations are presented in Tables 7 and 8 in the Appendix. In general, our results are relatively robust to changes in the empirical specification.

In column (1) of Table 7 we estimate the model for dividends, wages and the turnover of the firm without any control variables. The results without controls are approximately similar to those with controls. This tentatively indicates that the non-related changes in income, for example mean reversion, does not significantly bias the results, especially in the case of dividends and dividend taxes. This was also expected as dividend taxes are not solely determined by the amount of dividend income. The net assets of the firm largely affect the net-of-tax rate on dividend income. In other words, identification in the dividend model is not very sensitive to income trends stemming from other issues than tax rate changes. Also, the identifying wage tax rate variation is mostly not dependent on wage income of the owner, as municipal tax rate changes occur throughout the income distribution.[17]

Following Gruber and Saez (2002), our baseline estimates are weighted by total income. Column (2) in Table 7 shows the unweighted estimates, which are very similar to the weighted estimates. Columns (3)-(6) show the results with different variations of income cut-offs. All of these results are statistically equivalent to our baseline model. However, the point estimates vary somewhat depending on the income cut-offs.

Column (7) presents the OLS results, which indicate that the mechanical correlation between taxable income and the net-of-tax rates is notable. All of the OLS estimations give counterintuitive results. Column (8) shows the results from the reduced-form model, i.e. the regression of the change in income on the net-of-tax rate instrument and all controls. For dividend taxes, these results indicate that the predicted increase in net-of-tax rates based on pre-reform characteristics seem to decrease real dividends, and also significantly affect income-shifting. Thus these results are in line with the two-stage least squares model.

We also test how our modifications to the Gruber and Saez predicted NTR instrument affect our results. Including the YEL/TEL dummy variable as an additional instrument does not have a significant effect on the point estimates. However, it improves the precision of the estimation. The prediction of firm net assets based on pre-reform observed characteristics affects the main results for dividends, compared to a NTR instruments with fixed net assets from 2002. Without predicting the net assets, the F-test for the NTR instrument is very low. This indicates that the NTR instrument poorly predicts the changes in tax incentives without taking into account the exogenous growth of net assets, which largely affects the realized MTR of dividends. These results are available from the authors upon request.

Finally, Table 8 shows the results for longer run effects, namely for the years 2002-2008 and 2002-2009. In these estimations we use the same sample limitations as in our baseline model. The estimates suggest that the income-shifting effect somewhat decreases in the longer run. Otherwise the results for

[17] In addition, we also add 10-piece splines of firm-level variables as control variables in order to more rigorously control for the possibility that changes in individual income and firm-level characteristics are connected. This might be a concern since firm net assets, which also reflect the size of the firm, largely affect changes in the marginal tax rates on dividends. However, adding firm-level splines do not significantly affect the results. However, adding additional splines increase precision. These results are available from the authors upon request.

longer time periods are similar to those in our baseline model. This also indicates that anticipation to the 2005 tax reform does not significantly affect the results, as the estimates for longer time periods imply qualitatively similar results as our baseline model.

7 Discussion

In the previous literature, business owners and entrepreneurs are shown to actively respond to income taxes. However, it is not clear how much of this response is due to real behavior and how much is due to tax avoidance and evasion. In this paper we discuss how including income-shifting between tax bases to the widely-used elasticity of taxable income (ETI) framework affects the interpretation of the ETI as the overall measure of tax efficiency. We present and discuss the requirements and assumptions needed for the estimation of the ETI under income-shifting opportunities. We empirically distinguish between real responses and income-shifting between wages and dividends among the owners of privately held corporations in Finland using an extensive panel data on both the owner and firm-level.

As shown by Feldstein (1995, 1999), the ETI can be used to summarize the overall deadweight loss of income taxation. The source of the behavioral response is irrelevant as long as individuals optimize such that the marginal cost of "creating" taxable income through different margins equals the net-of-tax rate. However, tax avoidance through income-shifting might distort this line of thought for at least two reasons. Firstly, if part of the behavioral response is due to income-shifting between tax bases (or income-shifting in time), the shifted income is usually also taxed. Thus not all of the overall response is necessarily a full deadweight loss. Secondly, marginal real costs associated with income-shifting might be very low, which further decreases the efficiency loss. In the extreme case in which income-shifting induces no real costs at the margin, the tax revenue loss due to income-shifting is only re-allocation of resources between individuals and the government (Chetty 2009b).

In the empirical analysis, we use panel data and first-differences estimator to estimate both real responses and income-shifting responses. In order to estimate both of these margins separately, we need data which enable us to calculate the marginal tax rates for all relevant tax bases for each individual. Using these and individual variation in both marginal tax rates on wages and dividends in time, we can empirically identify average real responses and income-shifting responses for business owners. In order to examine real effects more reliably, we also estimate the model using broader income concepts at the firm-level, such as turnover.

Our results show that income-shifting accounts for a large proportion of the overall behavioral response among the owners of privately held businesses in Finland. Over two thirds of the overall response is due to income-shifting when studying the dividend tax base. For wages, the only significant response comes from the income-shifting margin. Overall, we find that dividend tax rates cause larger changes than wage taxes both at the income-shifting margin as well as the real margin.

What do these results imply in terms of the excess burden analysis? Using the welfare loss formulas (9) and (10) presented in Section 2.3, we can approximate the marginal excess burden both in the standard ETI framework and the income-shifting model. Following earlier literature, we approximate the marginal excess burden at the average point using the average marginal tax rates for dividend income and wage income (using post reform values).

Using the standard ETI framework and the point estimate for the average overall elasticity in column (1) of Table 2, we approximate the marginal excess burden of dividend taxation to be 0.93. When separating the income-shifting effect and using average estimates in column (3) of Table 2, the marginal excess burden decreases to 0.40. Thus the standard ETI analysis for the dividend tax base notably overestimates the deadweight loss. Simply taking into account the fact that the shifted income is also taxed significantly decreases the efficiency loss.

Similarly as the standard ETI model, our income-shifting model assumes that individuals optimize the amount of income shifted such that the marginal cost of income-shifting equals the difference of the tax rates on the two tax bases. As mentioned before, this condition might not hold in practice for many reasons. Thus it is reasonable to assume that the approximated welfare loss due to the estimated income-shifting effect represents the upper bound of the excess burden. In the extreme case of no deadweight loss of income-shifting, the marginal excess burden of dividend taxes reduces to the deadweight loss induced solely by the real behavioral effect. Using only the estimate for real responses in the dividend tax base model in column (3) in Table 2, we approximate the marginal deadweight loss to be 0.32. This can be seen as the lower bound for the marginal excess burden among Finnish business owners.

However, it is important to note that our estimate for the real response in the single tax base models might be upwards biased. When estimating the ETI model for dividends, the real response estimate might include other tax avoidance channels. For example, owners can also shift income intertemporally between different time periods. This type of behavior is tentatively supported by the bunching analysis, which indicates clear excess bunching at the distinctive dividend tax rate kink point in each year. In order to examine the real effects more diversely, we also use broader income concepts which are less subject to tax avoidance or evasion. The broader income concepts at the firm-level (e.g. turnover) also include retained earnings in addition to income withdrawn from the firm by the owner. However, also the more broader income concepts seem to be responsive to dividend taxes, which supports the view that real responses are non-negligible.

We find that the dividend tax base is more responsive to taxes than the wage tax base. Also, it seems that other income concepts are more responsive to dividend taxes compared to wage taxes. There are plausible explanations for these findings. Firstly, the variation in tax rates is larger for dividends, both over time as well as between the income tax brackets. Thus if there are underlying optimization frictions, the owners would respond more to larger changes in tax rates (see e.g. Chetty et al. 2011). Secondly, there might be notable differences in the salience of the two income tax bases and the types of taxes. Decisions on dividend distributions are usually made only once or a few times within a year. In contrast, wages are normally paid on monthly or weekly basis. The infrequent nature of the decision making process might make dividend income more responsive to taxes.

Also, the owners might be more aware of the dividend tax rate and the dividend tax rate kink points in the Finnish system, as long as they are aware of the net assets of their firm. In contrast, the effective marginal wage tax rate schedule including many deductions and tax credits might be less transparent.

This again implies that owners would be more responsive to dividend tax rates. Nevertheless, it could be that the return on invested income is inherently more responsive to taxes than the compensation for working, which would lead to larger dividend elasticities.

Finally, distinguishing between real responses and tax avoidance affects policy recommendations. In general, the government cannot easily affect the real response margin of the owners, as real responses reflect deeper behavioral parameters such as the opportunity cost of working (Piketty et al. 2013, Slemrod 1995). However, opportunities for tax avoidance and the income-shifting elasticity are in the control of the policy maker. Limiting the possibilities to avoid taxes or increasing the costs of tax avoidance in some other manner decreases income-shifting activity. In the extreme case, setting $\tau_D = \tau_W$ removes all income-shifting incentives, and the government can set their tax rates based on real responses alone (assuming no other means of tax avoidance or evasion).

However, there are also reasons not to set equal tax rates. Within a simple Ramsey-framework, it would be optimal to tax less the tax base with the larger elasticity (Piketty et al. 2013). Based on our results, this would mean that the optimal policy is to set $\tau_D < \tau_W$, at least in the absence of income-shifting possibilities. Also, our framework and empirical results measure only short or medium run outcomes. It could be that lower dividend taxes increase entrepreneurial activity in the long run. Thus the policy maker needs to balance between the inefficiency and revenue losses induced by income-shifting and possible efficiency gains created by setting a lower dividend tax rate.

References

[1] Bastani, S. and H. Selin. (2011). Bunching and non-bunching at kink points of the Swedish tax schedule. Uppsala Center for Fiscal Studies Working Paper 2011:12, University of Uppsala.

[2] Blomquist, S. and H. Selin. (2010). Hourly wage rate and taxable labor income responsiveness to changes in marginal tax rates. Journal of Public Economics, 94: 878–889.

[3] Chetty, R. (2012). Bounds on elasticities with optimization frictions: A synthesis of micro and macro evidence on labor supply. Econometrica, 80(3): 969–1018.

[4] Chetty, R. (2009a). Sufficient statistics for welfare analysis: A bridge between structural and reduced-form methods. Annual Review of Economics, 1: 415–488.

[5] Chetty, R. (2009b). Is the taxable income elasticity sufficient to calculate the deadweight loss? The implications of evasion and avoidance. American Economic Journal : Economic Policy, 1(2): 31–52.

[6] Chetty, R., J. Friedman, T. Olsen and L. Pistaferri. (2011). Adjustment costs, firm responses, and micro vs. macro labor supply elasticities: Evidence from Danish tax records. Quarterly Journal of Economics, 126(2): 749-804.

[7] Devereux, M., L. Liu and S. Loretz. (2012). The elasticity of corporate taxable income: New evidence from UK tax records. Oxford University Center for Business Taxation Working Paper 12/23.

[8] Feldstein, M. (1999). Tax avoidance and the deadweight loss of the income tax. Review of Economics and Statistics, 81: 674–680.

[9] Feldstein, M. (1995). The effect of marginal tax rates on taxable income: A panel study of the 1986 Tax Reform Act. Journal of Political Economy, 103: 551–572.

[10] Goolsbee, A. (2000). What happens when you tax the rich? Evidence from executive compensation. Journal of Political Economy, 108: 352–378.

[11] Gordon, R. and J. Slemrod. (2000). Are 'real' responses to taxes simply income shifting between corporate and personal tax bases?, in J. Slemrod (ed.), Does Atlas Shrug? The Economic Consequences of Taxing the Rich, New York: Russell Sage Foundation and Harvard University Press, 2000: 240–280.

[12] Gruber, J. and E. Saez. (2002). The elasticity of taxable income: evidence and implications. Journal of Public Economics, 84: 1–32.

[13] Harju, J. and T. Kosonen. (2013). The impact of tax incentives on the economic activity of entrepreneurs. CESifo Working Paper Series 4259.

[14] Harju, J. and T. Matikka. (2012). Entrepreneurs and income-shifting: Empirical evidence from a Finnish tax reform. Government Institute for Economic Research Working Papers 43.

[15] Kari, S., H. Karikallio and J. Pirttilä. (2008). Anticipating tax changes: Evidence from the Finnish corporate income tax reform of 2005. Fiscal Studies 29.

[16] Kleven, H. and E. Schultz. (2013). Estimating taxable income responses using Danish tax reforms. Forthcoming American Economic Journal: Economic Policy.

[17] Lindsay, L. (1987). Individual taxpayer response to tax cuts: 1982-1984, with implications for the revenue maximizing tax rate. Journal of Public Economics, 33: 173–206.

[18] le Maire, D. and B. Schjerning., (2013). Tax bunching, income shifting and self-employment. Journal of Public Economics, 107: 1–18.

[19] Piketty, T., E. Saez and S. Stantcheva (2013). Optimal taxation of top labor incomes: A tale of three elasticities. Forthcoming American Economic Journal: Economic Policy.

[20] Pirttilä, J. and H. Selin. (2011). Income shifting within a dual income tax system. Evidence from the Finnish tax reform of 1993. Scandinavian Journal of Economics, 113(1), 120–144.

[21] Saez, E. (2010). Do taxpayers bunch at kink points? American Economic Journal: Economic Policy, 2(3).

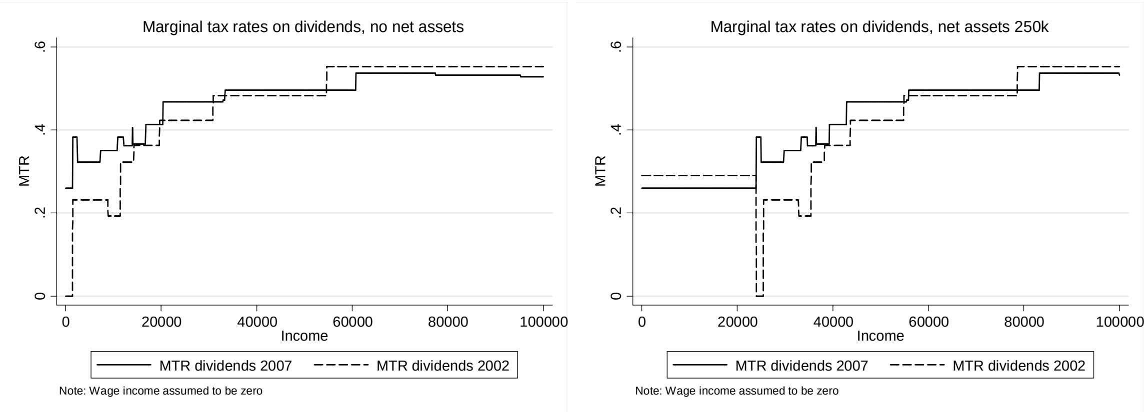
[22] Saez, E. (2004). Reported income and marginal tax rates, 1960-2000: Evidence and policy implications. NBER Working Paper 10273.

[23] Saez, E., J. Slemrod and S. Giertz. (2012). The elasticity of taxable income with respect to marginal tax rates: A critical review. Journal of Economic Literature, 50(1): 3–50.

[24] Slemrod, J. (1995). Income creation or income shifting? Behavioral responses to the Tax Reform Act of 1986. American Economic Review Papers and Proceedings, 85(2): 175–180.

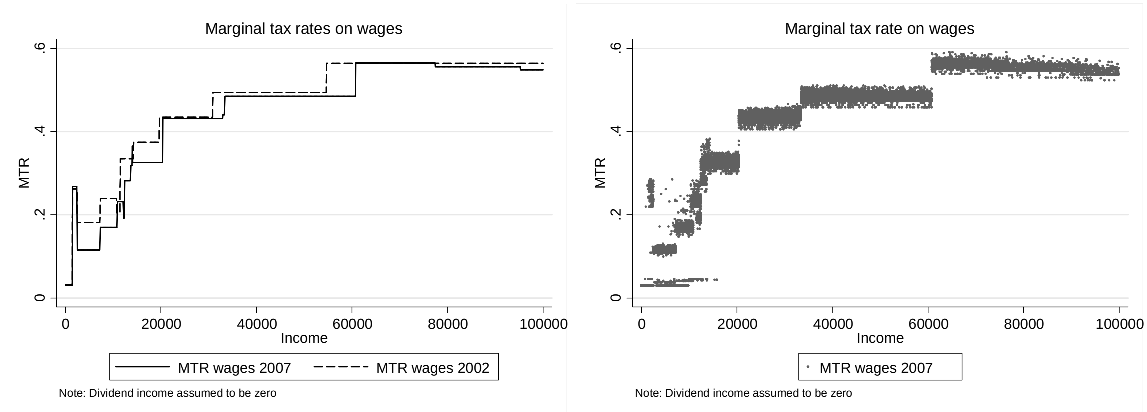
[25] Weber, C. (2011). Obtaining a consistent estimate of the elasticity of taxable income using difference-in-differences. Working Paper.

Appendix



Note: MTR on dividends includes corporate taxes paid on withdrawn dividends (after 2005) and all automatic deductions and allowances on dividend income. Progressively taxed dividends include central government taxes and average municipal taxes.

Figure 5: Average marginal tax rates on dividends in 2002 and 2007. No net assets (left-hand side), net assets of 250,000 euros (right-hand side)



Note: Left-hand side: Average MTR includes central government taxes, average municipal taxes and all automatic tax deductions and exemptions. MTR also includes social security contributions levied on wage income as well as firm-level social security contributions.

Right-hand side: MTR includes central government taxes, individual municipal taxes and individual tax deductions and exemptions. MTR also includes social security contributions levied on wage income as well as firm-level social security contributions.

Figure 6: Average marginal tax rates on wages in 2002 and 2007 (left-hand side). Marginal tax rates on wages in 2007, including individual variation in the municipal tax rate (right-hand side)

	MTR on wages		MTR on dividends (no net assets)		MTR on dividends (net assets 250k)		MTR on dividends (net assets 1000k)		MTR on dividends (net assets 5000k)	
Income	*2002*	*2007*	*2002*	*2007*	*2002*	*2007*	*2002*	*2007*	*2002*	*2007*
5,000	18.1	11.6	23.1	32.3	29.0	26.0	29.0	26.0	29.0	26.0
10,000	23.9	17.0	19.3	35.1	29.0	26.0	29.0	26.0	29.0	26.0
15,000	37.4	32.6	36.3	36.6	29.0	26.0	29.0	26.0	29.0	26.0
20,000	43.4	32.6	42.3	41.3	29.0	26.0	29.0	26.0	29.0	26.0
25,000	43.4	43.1	42.3	46.7	0	32.3	29.0	26.0	29.0	26.0
30,000	43.4	43.1	42.3	46.7	23.1	35.1	29.0	26.0	29.0	26.0
35,000	49.4	48.5	48.3	49.5	19.3	36.2	29.0	26.0	29.0	26.0
40,000	49.4	48.5	48.3	49.5	36.3	41.3	29.0	26.0	29.0	26.0
45,000	49.4	48.5	48.3	49.5	42.3	46.7	29.0	26.0	29.0	26.0
50,000	49.4	48.5	48.3	49.5	42.3	46.7	29.0	26.0	29.0	26.0
55,000	56.4	48.5	55.3	49.5	48.3	46.7	29.0	26.0	29.0	26.0
60,000	56.4	48.5	55.3	49.5	48.3	49.5	29.0	26.0	29.0	26.0
65,000	56.4	56.5	55.3	53.7	.48.3	49.5	29.0	26.0	29.0	26.0
70,000	56.4	56.5	55.3	53.7	48.3	49.5	29.0	26.0	29.0	26.0
75,000	56.4	56.5	55.3	53.7	48.3	49.5	29.0	26.0	29.0	26.0
80,000	56.4	55.6	55.3	53.2	55.3	49.5	29.0	26.0	29.0	26.0
85,000	56.4	55.6	55.3	53.2	55.3	53.7	29.0	26.0	29.0	26.0
90,000	56.4	55.6	55.3	53.2	55.3	53.7	29.0	32.3	29.0	40.5
95,000	56.4	55.6	55.3	53.2	55.28	53.7	29.0	35.1	29.0	40.5
100,000	56.4	54.8	55.3	52.8	55.3	53.2	23.1	36.2	29.0	40.5

Notes:

MTR on wages is calculated with dividend income equal to zero, and vice versa. MTR on wages include average municipal taxes, central government income taxes, automatic tax deductions and tax credits and average firm-level social security contributions (3%). MTR on wages does not include pension and health insurance contributions or any deductions based on insurance contributions. MTR on dividends includes corporate taxes on withdrawn dividends (after 2005). MTR on dividends include all automatic tax deductions and tax credits. MTR on progressively taxed dividends include average municipal taxes and central government income taxes. Marginal tax rates are calculated using Stata and JUTTA microsimulation model.

Table 4: Marginal tax rates (MTR) on wages and dividends with different levels of firm net assets, 2002 and 2007 (in nominal euros)

	2002				2007			
Variable	Mean	Median	SD	N	Mean	Median	SD	N
Wages	25,862	21,306	34,688	39,101	30,780	25,615	40,964	52,028
Dividends	25,696	8,750	101,722	39,104	22,015	7,523	83,456	52,045
Total income	51,560	35,242	110,046	39,101	52,800	38,458	95,633	52,028
MTR dividends	0.38	0.37	0.11	39,104	0.36	0.26	0.11	52,045
MTR wages	0.47	0.51	0.11	39,104	0.42	0.47	0.13	52,045
YEL	0.35	0	0.48	39,104	0.54	1	0.50	52,045
Ownership share	0.80	0.70	0.35	39,104	0.73	0.80	0.27	52,045
Male	0.82	1	0.38	39,104	0.82	1	0.38	52,045
Age	48.47	49	10.46	39,104	50.42	51	10.78	52,045
Turnover	1,022,725	232,099	5,847,782	39,104	1,064,023	224,399	8,153,712	52,045
Total assets	697,755	167,336	4,410,689	39,104	855,857	196,591	6,140,952	52,045
Net assets	431,001	93,075	3,836,671	39,104	524,072	108,413	4,034,409	52,045
No. employees	10.74	3	47.76	39,104	9.74	3	51.52	52,045

Table 5: Descriptive statistics, data (in 2002 euros)

	2002				2007			
Variable	Mean	Median	SD	N	Mean	Median	SD	N
Wages	27,300	25,000	21,207	14,012	28,992	26,546	24,237	14,010
Dividends	21,028	11,301	32,882	14,012	22,251	11,878	33,858	14,010
Total income	48,328	40,738	38,152	14,012	51,243	44,050	41,118	14,010
MTR dividends	0.40	.42	0.10	14,012	0.37	0.26	0.11	14,010
MTR wages	0.48	0.51	0.09	14,012	0.43	0.47	0.12	14,010
YEL	0.62	1	0.49	14,012	0.62	1	0.49	14,010
Ownership share	0.77	0.80	1.02	14,012	0.76	0.85	0.26	14,010
Male	0.84	1	0.37	14,012	0.84	1	0.37	14,010
Age	47.4	48	9.27	14,012	52.4	53	9.27	14,010
Turnover	764,175	265,622	2,652,496	14,012	852,451	267,531	2,732,651	14,010
Total assets	453,071	190,734	1,686,930	14,012	650,201	250,470	2,612,920	14,010
Net assets	268,107	113,133	837,228	14,012	399,598	154,933	1,634,324	14,010
No. employees	8.94	4	21.31	14,012	8.84	3	23.21	14,010

Table 6: Descriptive statistics, baseline estimation sample (in 2002 euros)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	No controls	No weights	Small inc limit	Large inc limit	Small △inc limit	Large △inc limit	OLS	Reduced-form
VARIABLES	lnZ_D	lnZ_D	lnZ_D	lnZ_D	lnZ_D	lnZ_D	lnZ_D	lnZ_D
$ln(1-t_D)$	0.595*	0.542*	0.860***	0.436	0.753**	0.581**	-1.291***	0.389**
	(0.317)	(0.290)	(0.259)	(0.331)	(0.307)	(0.293)	(0.048)	(0.152)
$[ln(1-t_D)-ln(1-t_W)]$	1.722***	1.481***	1.359***	1.364***	1.059***	1.535***	0.0399	0.312**
	(0.399)	(0.369)	(0.333)	(0.418)	(0.397)	(0.369)	(0.045)	(0.150)
Observations	14,003	14,003	16,935	9,888	10,988	14,879	14,003	14,003
VARIABLES	lnZ_W	lnZ_W	lnZ_W	lnZ_W	lnZ_W	lnZ_W	lnZ_W	lnZ_W
$ln(1-t_W)$	-0.274	-0.123	-0.193	-0.158	-0.315	0.0110	-2.117***	-0.162
	(0.308)	(0.299)	(0.273)	(0.347)	(0.296)	(0.298)	(0.074)	(0.184)
$[ln(1-t_D)-ln(1-t_W)]$	-0.691***	-0.420***	-0.423***	-0.391***	-0.594***	-0.328**	0.653***	-0.144***
	(0.162)	(0.141)	(0.136)	(0.149)	(0.143)	(0.138)	(0.034)	(0.047)
Observations	12,135	12,135	14,342	8,535	9,611	12,870	12,135	12,135
VARIABLES	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*
$ln(1-t_D)$	0.357**	0.291*	0.297**	0.411**	0.217	0.281*	-0.254***	0.114*
	(0.160)	(0.149)	(0.143)	(0.171)	(0.169)	(0.146)	(0.045)	(0.060)
Observations	13,018	13,018	15,720	9,134	10,252	13,817	13,018	13,018
VARIABLES	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*	*ln(turnover)*
$ln(1-t_w)$	0.148	0.156	0.266	0.136	0.460	0.0423	-0.658***	0.108
	(0.329)	(0.306)	(0.272)	(0.360)	(0.337)	(0.305)	(0.067)	(0.189)
Observations	13,018	13,018	15,720	9,134	10,252	13,817	13,018	13,018

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Small income limit (column(3)) = 10,000 € of total income in base-year. Large income limit (4) = 40,000 € of total income in base-year. Small limit in change of income (5) = 25,000 €. Large limit in change of income (6) = 75,000 €.

Table 7: Robustness checks: Different specifications, 2002-2007

Years 2002-2008								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	lnZ_D	lnZ_W	$lnTI$	$lnTI$	*ln(turnover)*	*ln(turnover)*	*ln(net profit)*	*ln(net profit)*
$ln(1-t_w)$		-0.043		-0.015	0.110		0.295	
		(0.261)		(0.157)	(0.294)		(0.342)	
$ln(1-t_D)$	0.625**		0.687***			0.207		0.178
	(0.250)		(0.083)			(0.161)		(0.182)
$[ln(1-t_D)-ln(1-t_W)]$	1.408***	-0.359**						
	(0.315)	(0.149)						
Observations	12,859	11,012	12,867	12,867	11,840	11,840	12,373	12,373
Years 2002-2009								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	lnZ_D	lnZ_W	$lnTI$	$lnTI$	*ln(turnover)*	*ln(turnover)*	*ln(net profit)*	*ln(net profit)*
$ln(1-t_w)$		0.283		-0.128	0.228		0.215	
		(0.292)		(0.163)	(0.309)		(0.362)	
$ln(1-t_D)$	0.396*		0.487***			0.329*		0.339*
	(0.225)		(0.081)			(0.170)		(0.195)
$[ln(1-t_D)-ln(1-t_W)]$	0.831***	-0.402**						
	(0.292)	(0.156)						
Observations	11,843	9,933	11,851	11,851	10,712	10,712	11,325	11,325

Notes: Robust standard errors in parentheses. Estimates weighted by total income. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 8: Robustness checks: Years 2002-2008 and 2002-2009

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