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VATT INSTITUTE FOR ECONOMIC RESEARCH

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Valtion taloudellinen tutkimuskeskus
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Abstract

Previous literature shows that income taxation significantly affects the behavior of high-income earners and business owners. However, it is still unclear how much of the response is due to changes in real economic activity, and how much is caused by tax avoidance. In this paper we distinguish between real responses and income-shifting between tax bases. We show that separating income-shifting responses can largely affect the welfare analysis of income taxation. In our empirical example we find that income-shifting accounts for a majority of the overall elasticity of taxable income among Finnish business owners and significantly decreases the marginal excess burden.

Key words: elasticity of taxable income, tax avoidance, income-shifting, real responses

JEL classification numbers: H24, H25, H32

Tiivistelmä

Tässä artikkelissa tarkastellaan tuloverotuksen vaikutusta yrittäjien taloudellisiin päätöksiin. Aiemman tutkimuskirjallisuuden perusteella verotus vaikuttaa erityisesti yrittäjien käyttäytymiseen. On kuitenkin epäselvää, kuinka suuri osuus käyttäytymisvaikutuksesta aiheutuu reaalitaloudellisista päätöksistä ja kuinka suuri osa johtuu verosuunnittelusta. Tämä erottelu on hyvin tärkeää, sillä eri käyttäytymiskanavat vaikuttavat siihen, miten verotuksen vaikutusta tulkitaan. Reaalitaloudelliset vaikutukset, kuten esimerkiksi muutokset yrityksen tuotannossa ja yrittäjien kokonaistuloissa, vaikuttavat talouskasvuun ja yhteiskunnan hyvinvointiin. Sitä vastoin verosuunnittelu ei merkittävästi lisää taloudellista aktiviteettia. Verosuunnittelusta aiheutuvat vaikutukset rajoittuvat esimerkiksi yrityksen sisäisiin ratkaisuihin verorasituksen vähentämiseksi. Tämä vähentää kerättyjä verotuloja, muttei vaikuta reaalitaloudellisen toiminnan laajuuteen.

Tässä artikkelissa erotellaan tuloverotuksen aiheuttamat reaaliset käyttäytymisvaikutukset verosuunnittelun vaikutuksista. Empiirisessä osiossa tutkimme suomalaisten listaamattomien osakeyhtiöiden omistajia. Näillä omistajayrittäjillä on merkittävät taloudelliset kannustimet järjestää yrityksestä nostamansa palkka- ja osinkotulot siten, että osinko- ja palkkatulosta maksettavat tuloverot ovat yhteensä mahdollisimman pienet. Tämä tulonmuunto palkka- ja osinkotulojen välillä on yksi keskeisimmistä verosuunnittelukanavista niille yrittäjille, jotka voivat nostaa yrityksestään sekä palkka- että osinkotuloja.

Tulostemme perusteella yli kaksi kolmasosaa koko tuloverotuksen aiheuttamasta käyttäytymisvaikutuksesta on verosuunnittelua. Vaikka verotus aiheuttaa merkittäviä muutoksia yrittäjien tuloissa, valtaosa tästä muutoksesta on selitettävissä tulonmuuntona palkka- ja osinkotulojen välillä. On kuitenkin huomionarvoista, että tulostemme mukaan osinkoverotus vaikuttaa myös yrittäjien reaalitaloudellisiin päätöksiin. Käyttäytymismuutokset eivät siis rajoitu pelkästään verosuunnitteluun ja osinkoverotuksella voidaan vaikuttaa kohtalaisesti myös yrittäjien kokonaistuloihin ja yrityksen tuotantoon.

Asiasanat: Verosuunnittelu, tulonmuunto, reaaliset vaikutukset

JEL-luokittelu: H24, H25, H32

Contents

1 Introduction

Income taxes are known to generate significant behavioral effects among high-income earners and business owners. Previous literature concurs that the elasticity of taxable income (ETI) is considerable for these individuals (see a comprehensive survey on ETI by Saez, Slemrod and Giertz 2012). However, the interpretation of the overall behavioral response is often difficult because business owners and high-income earners have many margins in which they can respond to taxes. In addition to real responses (labor supply, effort etc.), many tax systems include a range of opportunities to legally avoid taxes. Although previous research shows that tax avoidance is a significant behavioral margin for these groups (see e.g. Slemrod and Gillitzer 2014), it is still unclear how much of the overall response is due to changes in real economic activity, and how much is due to avoidance.

Income-shifting is one of the most relevant tax avoidance channels for business owners and high-income earners (see e.g. Gordon and Slemrod 2000, Goolsbee 2000, Kreiner et al. 2014). Distinguishing between real responses and income-shifting between different tax bases is important because the nature of the response largely affects the welfare conclusions and policy recommendations (Slemrod 1995, Piketty, Saez and Stantcheva 2014). Traditionally, ETI quantifies the excess burden of the income tax (Feldstein 1995, 1999). However, income-shifting between tax bases might overstate ETI as a measure of welfare losses among high-income earners and business owners. Standard ETI does not account for the fact that other tax bases might have positive tax rates. Thus income-shifting is not a full deadweight loss if the shifted income is also taxed (Saez 2004). In addition, it is plausible that income-shifting responses inflict smaller welfare losses compared to similar real economic responses (Chetty 2009). This could further decrease the evaluated excess burden, which further highlights the importance of separating real responses and income-shifting.

Our main contribution to the literature is to distinguish between real responses and income-shifting responses. Based on previous theoretical literature (e.g. Piketty et al. 2014), we present a model that enables us to empirically separate the income-shifting response from the overall ETI. We compare the excess burden in the standard ETI model with a model that distinguishes between income-shifting and real responses. We illustrate that separating the income-shifting response can have a substantial effect on evaluated welfare loss and policy recommendations.

To our knowledge, this paper is the first to explicitly estimate both real elasticity and income-shifting between different tax bases using a well-defined empirical model, and individual-level panel data and tax reforms. In our empirical example, we estimate both real responses and income-shifting responses for the owners of privately held corporations in Finland. This group faces large incentives and ample possibilities to shift income between different tax bases, which makes them a particularly suitable group for analyzing both income-shifting and real responses. In the Finnish tax system, the owners of privately held corporations can withdraw income from their firm as a combination of wages and dividends, which are taxed with separate tax rate schedules and tax rules. There are only a few minor legal limitations on whether income is withdrawn as wages or dividends, and explicit tax rate differences induce clear incentives for tax-motivated income-shifting.

We use extensive panel data of all Finnish business owners. We link firm-level tax record information to the owner-level personal tax data, which is a novelty in the ETI literature. With this data set we are able to richly control for firm-level characteristics that might affect the personal income trends of the owners. The comprehensive data 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. In general, the reform tightened dividend taxation. However, the reform changed dividend tax rates differently for different types of owners, which provides suitable identifying variation to estimate ETI among Finnish business owners.

Our results show that income-shifting responses are highly significant both statistically and economically. Income-shifting responses account for a majority of the overall response among Finnish business owners. Furthermore, we show compelling graphical evidence that tax incentives induce clear behavioral responses, and that income-shifting effects are apparent. In addition, income trends are parallel in a group that faced a dividend tax increase and a group that faced no changes or a small dividend tax decrease before the reform of 2005. This highlights that the typical threats to identification in ETI estimation stemming from non-tax-related changes in income are not a particular issue in our empirical example.

Applying the estimated elasticities of income-shifting and real responses, we show that separating the income-shifting response largely affects the extent of the excess burden among Finnish business owners. For example, 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. If we assume that income-shifting responses do not induce welfare effects the estimate further decreases to 0.3. These imply that large observed overall

ETI does not necessarily indicate substantial welfare losses.

Our paper relates to the emerging literature on the composition of behavioral responses to tax rate changes. Piketty et al. (2014) formulate a theoretical framework for analyzing tax avoidance effects as a part of the ETI of high-income earners. By distinguishing between different forms of behavioral responses (tax avoidance, real responses and bargaining channels), they study the implications of optimal income taxation at the upper end of the income distribution. They also provide empirical cross-country evidence which indicates that both the real and avoidance responses are small while bargaining effects dominate. le Maire and Schjerning (2013) and Kreiner, Leth-Petersen and Skov (2015, 2014) show that intertemporal income-shifting accounts for a significant share of the observed short-run ETI among self-employed and top income earners in Denmark. These results imply that changes in real economic activity are small or close to zero even though the observed overall ETI is significant, especially among the self-employed.

In addition, other previous studies from different countries indicate that income-shifting between tax bases is substantial for high-income earners and business owners. For example, Gordon and Slemrod (2000) show evidence of active income-shifting between corporate and personal tax bases in the US. Devereux et al. (2014) show that income-shifting between corporate and personal tax bases is also active in the UK. In addition, Sivadasan and Slemrod (2008) find significant income-shifting responses for partners in partnership firms in India, and Romanov (2006) finds income-shifting between personal and corporate tax bases among high-income self-employed professionals in Israel. In Sweden, Alstadsæter and Jacob (2012) show that income-shifting is active among Swedish corporate owners. In Finland, Harju and Matikka (2014) show that absent any real effects, income-shifting between tax bases is active among the main owners of privately held corporations in Finland. Also, Pirttilä and Selin (2011) show that entrepreneurs and business owners increased their relative share of capital income when capital income tax rates were decreased.

Finally, recent literature has identified ETI using income distributions 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 studies show that the excess mass around kink points is particularly large for self-employed individuals (see Saez 2010, le Maire and Schjerning 2013, Chetty et al. 2011, Bastani and Selin 2014). As an additional analysis, we estimate the local tax responsiveness of Finnish business owners using the bunching method. We find that business owners bunch actively at the dividend income tax rate kink point, which supports our main results.

This paper is organized as follows: Section 2 presents the conceptual framework. Section 3 describes the Finnish income tax system and recent tax reforms. Section 4 discusses empirical estimation and identification issues, introduces the data and presents the descriptive statistics. Section 5 presents the main results, alternative specifications and robustness checks. Section 6 discusses the main findings and implications.

2 Conceptual framework

2.1 Standard ETI model

We begin with the standard elasticity of taxable income (ETI) model with a single tax base. Following Piketty et al. (2014), we assume a quasi-linear utility function of the form $u_i(c, z) = c - h_i(z)$, where c is consumption, z is taxable income, and $h_i(z)$ denotes the cost of effort to produce income for individual i. 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 rate schedule. R denotes virtual income.

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

Next, consider a marginal change in the net-of-tax rate, $d(1-\tau)$. Then the elasticity of taxable income 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 covers changes in, for example, work effort and productivity. In addition, the average ETI covers tax avoidance and tax evasion.

The intuition behind the standard ETI model is that all behavioral responses affect the excess burden of income taxation (Feldstein 1999). Individuals increase z until its marginal cost equals the tax rate, and thus the overall inefficiency can be summarized with ETI. 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.

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

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

$$\triangle ln(z)_{t,i} = e_z \triangle ln(1-\tau)_{t,i} + \triangle ln(\eta)_{t,i} + \triangle ln(\varepsilon)_{t,i} \tag{2}$$

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

Many issues need to be taken into account when empirically estimating equation (2). First, we need exogenous variation for $\triangle ln(1-\tau)_{t,i}$ to identify ETI. Second, the net-of-tax rate and the transitory income component are mechanically correlated within a progressive tax system, as a positive income shock results in a lower net-of-tax rate. This means that a valid instrument for the net-of-tax rate is required in order to have a causal interpretation for e_z. Third, non-tax-related changes in potential income also need to be taken into account. In other words, potential differential income growth trends for different types of individuals need to be controlled for. We discuss these issues in more detail in Section 4.

2.2 ETI and income-shifting

It is important to explicitly include income-shifting in the model when analyzing ETI among individuals with income-shifting opportunities. Especially, business owners have many different channels to withdraw income from their firm, for example, by reporting part of their personal taxable income as corporate profits, or vice versa. 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. (2014), and the Piketty et al. (2014) ETI model with tax avoidance in the top income bracket.[1]

We assume that there are two personal tax bases available, taxable wages z_W and taxable dividends z_D. We denote the total taxable income of the owner by $z_y = z_W + z_D$.

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

This setup generalizes to any two differently taxed tax bases in which an individual can report income.

Wages are taxed at a tax rate τ_W, and dividends are taxed at τ_D.[2] It is possible for the owner to legally shift income between the two types of income. This income-shifting behavior 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. Intuitively, 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 standard ETI model.

For simplicity, let us assume that $\tau_W > \tau_D$ and that both tax rates are exogenous. The budget constraint can be written as

$$c = (1 - \tau_W)(1 - \alpha)z_y + (1 - \tau_D)\alpha z_y \tag{3}$$

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

The utility function of an owner i is

$$u_i(c, z_y, \alpha) = c - \theta_i(z_y) - \phi_i(\alpha) \tag{4}$$

where $\theta_i(z_y)$ is the cost of effort to produce total taxable income. $\phi_i(\alpha)$ is the cost of income-shifting between wages and dividends, i.e. changing the composition of total taxable income. We assume that the cost of income-shifting depends on the share of total income reported as dividends. Following Piketty et al. (2014), in order to simplify the model we assume that the costs functions are separable.

Costs of income-shifting include, for example, the opportunity cost of time or payments to tax consultants. Income-shifting costs can also be affected by the number of owners in the firm, as it might be more burdensome to alter the composition of total income with multiple owners. In addition, tax-motivated income-shifting can be considered socially less acceptable.

We assume that both cost functions are convex and increasing in z_y and α, respectively. Alternatively, we could assume that both real wages and real dividends have separate convex cost functions that reflect real wage and real dividend income based on labor supply and effort, and the actual return on invested capital. This type of model gives qualitatively similar results as the model with one cost function for all income. In addition, we could assume a distribution of income-shifting costs $f(\phi_i)$, where ϕ_i is

[2] τ_D includes all corporate taxes paid on distributed dividends.

an individual-specific fixed income-shifting cost which does not depend on α. However, this does not change the welfare conclusions based on estimated average elasticities (see Section 2.3).

The owner chooses z_y and α to maximize utility, which gives the following first-order conditions:

$$(1-\tau_W)(1-\alpha)+(1-\tau_D)\alpha=\theta_i^{'}(z_y) \tag{5}$$

and

$$(\tau_W-\tau_D)z_y=\phi_i^{'}(\alpha) \tag{6}$$

Equation (5) implies that when α is fixed, total taxable income is an increasing function of the net-of-tax rates. Equation (6) 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.

Next, we derive elasticities separately for both tax bases. Following Piketty et al. (2014) and Devereux et al. (2014), keeping $(1-\tau_D)$ constant the average net-of-tax rate elasticity for wage income is

$$\begin{aligned} e_{z_W} &= \frac{(1-\tau_W)}{z_W}\frac{\partial z_W}{\partial(1-\tau_W)} \\ &= \frac{(1-\tau_W)}{(1-\alpha)z_y}\frac{\partial z_y}{\partial(1-\tau_W)}(1-\alpha)+\frac{(1-\tau_W)}{(1-\alpha)z_y}\frac{\partial(1-\alpha)}{\partial(1-\tau_W)}z_y \\ &= e_W-e_{(1-\alpha)} \end{aligned} \tag{7}$$

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 (7) implies that we can distinguish the income-shifting effect from the overall behavioral response e_{z_W}. The income-shifting elasticity $e_{(1-\alpha)}$ 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 the wage tax rate changes, describing changes in real economic activity.

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

$$
\begin{aligned}
e_{z_d} &= \frac{(1-\tau_D)}{z_D}\frac{\partial z_D}{\partial(1-\tau_D)} \\
&= \frac{(1-\tau_D)}{\alpha z_y}\frac{\partial z_y}{\partial(1-\tau_D)}\alpha + \frac{(1-\tau_D)}{\alpha z_y}\frac{\partial \alpha}{\partial(1-\tau_D)}z_y \\
&= e_D + e_\alpha
\end{aligned} \tag{8}
$$

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

Next, we present the empirical ETI model with income-shifting. Based on equation (7), we can write the estimable version of the elasticity of wage income as

$$
\begin{aligned}
\triangle ln(z_W)_{t,i} &= e_W \triangle ln(1-\tau_W)_{t,i} - e_{(1-\alpha)}\triangle(ln(1-\tau_D) - ln(1-\tau_W))_{t,i} \\
&\quad + \triangle ln(\eta_W)_{t,i} + \triangle ln(\varepsilon)_{t,i}
\end{aligned} \tag{9}
$$

Compared to the standard ETI model, equation (9) includes the responsiveness of taxable wage income with respect to income-shifting incentives. 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 the real elasticity e_W and the income-shifting component $e_{(1-\alpha)}$, along with the associated standard errors. A similar model can also be written for dividend income. For the sake of brevity, we only present the wage income model.

To empirically identify elasticities e_W and $e_{(1-\alpha)}$, we need to assume that real responses and income-shifting responses are separable. This means that $\triangle(ln(1-\tau_D) - ln(1-\tau_W))_{t,i}$ itself or the existence of income-shifting possibilities do not affect real responses and thus the amount of total income withdrawn from the firm. Consequently, income-shifting between tax bases is solely determined by changes in the difference of the net-of-tax rates. Without this assumption it is not possible to separate income-shifting responses from the overall elasticity. Similar assumption is required in separating different elasticities in previous studies (see e.g. Piketty et al. 2014 and le Maire and Schjerning 2013). In general, the separability assumption is realistic when studying the effects of changes in tax rates within a tax system that offers income-shifting opportunities both before and after changes in incentives. In our empirical example we study behavioral responses of Finnish business owners in exactly this type of an environment. Sections 3 and 4 describe the institutions in more detail.

In our empirical example, it is possible that e_W does not capture all potential real effects among business owners. However, we can take many of these issues into account in our analysis. First, we want to exclude all forms of tax avoidance when estimating e_W. Therefore we use gross wage and gross dividend income subject to taxation as dependent variables when estimating our baseline model. These income measures do not include potential changes in deduction behavior, which presumably also include changes in tax avoidance activity (see Doerrenberg et al. 2014). In addition, if personal income tax rates increase, owners could increase their consumption within the firm (for example in the form of more office amenities or fringe benefits), which is not shown as changes in income withdrawn from the firm. Also, if tax rates differ over time, income can be shifted across periods using retained earnings (see e.g. le Maire and Schjerning 2013). In order to capture these issues, we estimate the net-of-tax rate elasticity of the turnover of the firm as an additional analysis. Turnover is less subject to tax avoidance compared to income withdrawn from the firm, and it also includes retained earnings and other income not withdrawn from the firm in the current period.[3]

Finally, changes in net-of-tax rates might also affect illegal tax evasion, for example in the form of intentional underreporting of income. In our model we do not separate potential evasion responses, and these are thus included in the estimated real response component e_W. More generally, in addition to changes in labor supply and effort, real responses of business owners might include other types of behavioral margins. For example, a decrease in the personal income tax rate might increase various types of investments in the firm, which might (eventually) increase the total income of the owner.[4] Overall, as in the standard ETI model, responses along different types of margins of real responses are all reflected in e_W.

2.3 Welfare implications

Next, we compare the marginal excess burden in the standard ETI model with a model that includes income-shifting. Following Chetty (2009), we approximate the marginal excess burden by comparing behavioral responses caused by a tax rate change to a benchmark case which ignores behavioral responses. The same follows from assuming that tax revenue collected from wage and dividend taxes is returned to the owner as a lump-sum transfer.

We use the following welfare function

[3] Harju and Kosonen (2013) study the tax responsiveness of turnover among the owners of unincorporated firms in Finland. They find small real responses for this group.

[4] In the ETI model of wage earners investments are generally considered to include investments in human capital such as education choices and other career considerations. With business owners it is reasonable to include physical firm-level investments as well.

$$w = \{(1-\tau_W)(1-\alpha)z_y + (1-\tau_D)\alpha z_y - \theta_i(z_y) - \phi_i(\alpha)\} + (1-\alpha)z_y\tau_W + \alpha z_y\tau_D \quad (10)$$

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

Let us first consider the standard ETI framework for wage income without income-shifting opportunities. Conceptually this refers to the simplified case where $\alpha = 0$ in equation (10). The same analysis can be carried out 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 the tax revenue of the government cancel each other out. Thus we can write the excess burden as

$$\frac{dw}{d\tau_W} = \tau_W \frac{\partial z_y}{\partial \tau_W} = z_y \frac{\tau_W}{(1-\tau_W)} e_{z_W} \quad (11)$$

where e_{z_W} denotes the standard ETI. Intuitively, e_{z_W} includes all margins of behavioral responses, and thus defines the scope of the marginal excess burden of the wage income tax.

Next, consider a more general case where $0 \leq \alpha \leq 1$, and the owner can adjust α. The excess burden is expressed as

$$\begin{aligned}\frac{dw}{d\tau_W} =& \frac{\partial z_y}{\partial \tau_W}\left((1-\alpha)\tau_W + \alpha\tau_D\right) + z_y \frac{\partial(1-\alpha)}{\partial \tau_W}(\tau_W - \tau_D) \\ =& z_y \left[\frac{(1-\alpha)\tau_W + \alpha\tau_D}{(1-\tau_W)} e_W + (1-\alpha)\frac{(\tau_W - \tau_D)}{(1-\tau_W)} e_{(1-\alpha)}\right] \quad (12)\end{aligned}$$

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

The size of the marginal excess burden in equation (12) depends on the following factors: (1) the size of the income-shifting elasticity ($e_{(1-\alpha)}$), (2) the size of the real elasticity (e_W), (3) the difference of the net-of-tax rates ($\tau_W - \tau_D$), (4) the relative size of the tax bases (α) and (5) the level of both marginal tax rates (τ_W, τ_D). Intuitively, a large $e_{(1-\alpha)}$ relative to e_W implies that a large fraction of the overall response is due to income-shifting. For a given $e_{(1-\alpha)}$, a small ($\tau_W - \tau_D$) implies that income-shifting has only a small effect on efficiency, and vice versa. In addition, the relative size of the tax bases further scales the significance of the income-shifting response.

The key difference between equations (11) and (12) 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, $e_{(1-\alpha)} > 0$, and part of the response is due to changes in real economic behavior, $e_W > 0$. If we ignore the income-shifting response and use the standard equation (11) to assess the marginal excess burden, it is approximated to be too large when $0 < \tau_D < \tau_W < 1$ and $0 \leq \alpha \leq 1$.

Equation (12) shows that income-shifting and real responses have different welfare consequences even within the standard ETI framework when the shifted income is also taxed. Thus if there are large incentives for income-shifting, equation (12) highlights that it is important to estimate elasticities for both the real component and the income-shifting component in order to more accurately analyze the excess burden.

In addition, it is plausible that equation (12) overestimates the welfare effect of income-shifting. As noted by Chetty (2009), a notable share of costs related to income-shifting might be payments to tax consultants, who usually report at least part of this original cost as their own taxable income. Thus the income-shifting costs could include transfers between different agents in the economy, and this fiscal externality is not taken into account in the standard framework. In the extreme, if income-shifting inflicts no real resource costs, the marginal excess burden reduces to the real effect of taxation, denoted by the first term on the right-hand side of equation (12). Therefore, even if we assume that income-shifting itself does not inflict welfare costs, it is still important to separate income-shifting elasticity from the overall ETI to more rigorously study welfare consequences of income taxation.

3 The Finnish income tax system and recent tax reforms

In our empirical example we analyze 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 under different tax regulations. Also, taxation of privately held corporations is different from that of other types of private businesses (sole proprietors and partnerships).

Within the Finnish tax system, wage income and dividend income from privately held corporations are taxed with separate tax rules and tax rates. This creates notable incentives to arrange the income composition between wages and dividends in such a way that minimizes tax payments. Owners of these firms can relatively freely choose the income composition, and thus income-shifting between these tax bases is in general legitimate. For example, reporting more dividend income at the expense of wages induces no fines or penalties. Therefore, the owners of privately held corporations provide a suitable and illustrative example group to analyze both income-shifting and real responses.

However, there are a few minor legal limitations on whether income is withdrawn as wages or dividends from a privately held corporation in Finland. Wages cannot be paid without a work contribution for the firm, or else wages may be considered as veiled distribution of profits. Dividends can be paid only if the firm has distributable assets (for example accumulated profits and non-tied equity). In contrast to wages and dividends, other alternatives for withdrawing income from the firm are restricted. These include, for example, shareholder loans and share repurchases.[5]

Next, we describe recent changes in dividend and wage tax rates in Finland for the owners of privately held corporations. We focus on tax reforms that occurred in 2002-2007, as we use this time period in our baseline analysis.

3.1 Dividend taxation and the dividend tax reform of 2005

Dividend taxation. The Finnish tax system includes specific rules for dividend taxation of the owners of privately held businesses. Dividends are categorized into two parts according to the net assets (assets-liabilities)[6] of the firm:

- The amount of dividends corresponding to an imputed 9% return on the net assets of the firm are subject to a flat tax rate (26% in 2007). The imputed rate of return on net assets is set by the government, and it is the same for all owners.
- Any dividends exceeding the imputed return are taxed progressively (highest rate 56% in 2007).

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

[6]The net assets of the firm are calculated using the asset and debt values in the year before. The 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.

For example, with net assets of 400,000 € and the imputed rate of return set at 9%, the maximum amount of dividends taxed at the flat tax rate is 36,000 € (0.09*400,000=36,000). In other words, any dividends from the firm up to 36,000 € are taxed at the flat tax rate. Any dividend income *exceeding* this amount is taxed according to the progressive tax rate schedule.

Dividend tax reform of 2005. In general, the reform of 2005 tightened the taxation of dividend income. Before 2005, a full imputation system of corporate taxes was in place, and dividends were taxed only once at the individual-level. In 2005, the full imputation system was replaced by *partial* double taxation of dividends, in which dividends are in general taxed both at the firm and individual-level.

In more detail, the reform changed the marginal tax rates (MTR) differently for different types of owners. In general, changes in the MTR on dividends depend both on the amount of dividends and the net assets of the firm. Table 1 presents the main changes in the MTR on dividends for different types of owners. MTR on dividends includes both individual taxes and corporate taxes paid on withdrawn dividends.

Effective marginal tax rates on dividends (z_D)		
	Before the reform (2002)	After the reform (2007)
Type (I): $z_D \leq$ imputed return and $z_D \leq$ 90,000€	29%	26%
Type (II): $z_D \leq$ imputed return and $z_D >$ 90,000€	29%	40.5%
Type (III): $z_D >$ imputed return		
min	0%	26%
max	55%	54%

Table 1: Effective marginal tax rates on dividends before (2002) and after (2007) the reform of 2005 for different types of owners

The first type of owners (Type (I)) in Table 1 are those who have dividend income below the 9% imputed return on net assets and below 90,000 €. For these owners the effective flat tax rate on dividends decreased from 29% to 26%. Before the reform, dividends below the imputed return were not subject to the corporate tax rate, and were taxed only at the flat personal capital income tax rate of 29%. After the reform, these dividends are only subject to the 26% corporate tax rate, and are not taxed at all in individual taxation. In other words, dividend income below imputed return and 90,000 € remained single taxed at a flat tax rate.

Type (II) owners are those who have dividend income below the imputed return on net assets and above 90,000 €. Before the reform, these dividends were taxed at the flat capital income tax rate. After the reform, 70% of dividends above 90,000 € are regarded as taxable capital income in personal taxation (28%), in addition to the flat corporate tax rate of 26%. This results in an effective flat tax rate of 40.5%[7] for these dividends after the reform, compared to 29% before the reform.

Type (III) owners 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% of dividends above the imputed return are regarded as taxable earned income, in addition to the flat corporate tax rate of 26%. Therefore, the reform significantly increased the MTR on small dividends exceeding the imputed return, but the changes in the MTR were smaller for large dividends above the imputed return on net assets.

Figure 3 in Appendix A presents the effective marginal tax rates on dividends in 2002 and 2007 with two levels of net assets, 0 and 250,000 € (approximately the average net assets in the estimation sample before the reform). The Figure shows that most of the MTR increases occur on low and middle dividend income that exceeds the imputed return. Also, the Figure shows the 3 percentage point drop in the flat tax rate on dividends below the imputed return and 90,000 €.

In summary, owners with larger firm-level net assets were more likely to face a decrease in their dividend tax rate. In contrast, owners with smaller net assets were more likely to face an increase in their marginal dividend tax rate. Therefore, otherwise similar owners who differ only in the net assets of the firm were faced with different changes in their marginal tax rate on dividends.

Finally, the main motivation behind the reform of 2005 was not the economic and fiscal conditions in Finland. The pre-reform full imputation credit was granted only to domestic shareholders whose firms operate in Finland. This violated European Union rules on the 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 domestic and international shareholders. Therefore, the tax reform of 2005 can be considered exogenous from the point of view of domestic shareholders.

In addition, the formal proposition of the reform was introduced already in late 2003. Thus it was possible for owners to anticipate the reform. We discuss the implications of possible anticipation effects in more detail in Section 4.

[7] The effective MTR in this case is calculated as 26% + 0.7*(1-0.26)*28% = 40.5%.

3.2 Wage income taxation and variation in wage tax rates

In Finland, wage income is taxed on a progressive tax rate schedule. There are three levels of wage income taxes: central government (or state-level) income taxes, municipal income taxes and mandatory social security contributions. The central government income tax rate schedule is progressive, whereas municipal tax rates and social security contributions are proportional by nature. Municipal tax rates vary between different municipalities.[8] Social security contributions include, for example, unemployment insurance payments. In our baseline analysis we exclude employer pension and health insurance contributions.

During 2002-2007, there was a general decline in central government income tax rates, and thus marginal tax rates decreased in most income classes. Marginal tax rates declined more for low and middle wage income, whereas marginal tax rates decreased only slightly or remained unchanged for higher wage levels. This creates variation in marginal wage tax rates between different types of owners.

Furthermore, municipal tax rates have changed differently within 2002-2007, which creates additional variation in marginal wage tax rates. Because different municipalities have changed their tax rates differently, the marginal wage tax rates of owners with similar income levels have changed differently. Also, the municipal tax rate is flat, and thus municipal tax rate changes are determined only by the municipality of residence, not by the income level of an individual owner. 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. On average, the municipal tax rate increased from 17.8% in 2002 to 18.5% in 2007.

Figure 4 in Appendix A describes the MTR on wage income. The left-hand side of the Figure shows that average marginal wage tax rates decreased throughout the income distribution in 2002-2007, and that the largest changes in average marginal tax rates occurred at low wage income levels. The right-hand side of Figure 4 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. In addition, owners with the same income level face different changes in the MTR on wages due to different changes in municipal tax rates.

Finally, Table 3 in Appendix A presents the marginal tax rates on wages and div-

[8]There were 416 municipalities in Finland in 2007. Each democratically elected municipal council decides on the municipal tax rate on an annual basis. Municipalities can choose their tax rates freely. However, certain legislative municipal-level duties need to be financed mainly by municipal taxes (e.g. basic health care and primary education).

idends at 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 marginal tax rates and income-shifting incentives from the 2005 dividend tax reform.

4 Identification and data

4.1 Estimable equation

Equation (13) presents our baseline estimable equation for wage income.

$$\begin{aligned} \triangle ln(z_W)_{t,i} &= \alpha_0 + e_W \triangle ln(1-\tau_W)_{t,i} - e_{(1-\alpha)} \triangle (ln(1-\tau_D) - ln(1-\tau_W))_{t,i} \\ &\quad + \alpha_1 f(ln(z_W))_{t,i} + \alpha_2 B_{t,i} + \alpha_3 F_{t,i} + \triangle \varepsilon_{t,i} \end{aligned} \tag{13}$$

We estimate the model using a two-stage least squares estimator. $\triangle ln(z_W)_{t,i}$ is the log change in wage income between t and $t+k$. $ln(1-\tau_W)_{t,i}$ is the instrumented net-of-tax rate on wages, and $(ln(1-\tau_D) - ln(1-\tau_W))_{t,i}$ is the difference of the instrumented net-of-tax rates on dividends and wages. Thus e_W is the average real elasticity, and $e_{(1-\alpha)}$ is the income-shifting elasticity. We estimate a similar equation also for dividends.

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

In our baseline model, we analyze a single difference between 2002 and 2007. We choose this time window in order to avoid potential anticipation effects of the 2005 tax reform. Formal propositions for the dividend tax reform of 2005 were published by the Finnish Government in late 2003. Also, in 2005, special transition rules were applied. Therefore, the years right before and right after the reform are not suitable for empirical analysis that aims at identifying longer-run behavioral parameters (see Kreiner et al. 2014 and 2015). Thus, in our empirical analysis, we exclude the years 2003-2006 from the regression. In Section 5.2, we perform several robustness checks on the length of the difference, including a pooled regression model with multiple differences.

As is common procedure in the ETI literature, we focus on intensive margin responses. 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 unnecessarily high influence by outlier observations. We perform robustness checks on these sample restrictions in Section 5.2.

4.2 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 (NTR) (see Gruber and Saez 2002). The basic structure of the predicted 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 defined as the difference between the actual NTR in t and the NTR calculated with income in t and the tax law for $t + k$. Intuitively, the predicted NTR instrument describes the change in tax liability caused by changes in tax legislation, ignoring any behavioral effects via taxable income responses.

We use the Gruber and Saez-type predicted NTR instrument in our baseline analysis. This instrument is often used in previous ETI studies (see Saez et al. 2012). However, when studying Finnish business owners, we need to slightly modify the net-of-tax rate instrument. We need to address the development of net assets when defining the net-of-tax rate instrument for dividends. Net assets is a key factor in determining the marginal tax rate on dividends (see Section 3). Average net assets increase in time both in the whole data set and our estimation sample (See Tables 4 and 5 in Appendix A). Thus we need an estimate for net assets in $t+k$ when defining the NTR instrument for dividends. Without predicting the net assets, the predicted dividend tax rate change is incorrectly measured for a large number of owners, and the instrument is too weak and thus invalid.

We predict firm 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, owner-level age, age squared, gender, and firm-level turnover, total assets and industry and location dummies. The R-squared statistic for the net assets prediction using OLS is 0.73.

An essential issue in identifying ETI is the variation in marginal tax rates. Non-tax-related changes in income are potentially problematic when identifying the elasticity parameters (see Saez et al. 2012). If the shape of the income distribution varies independently of tax reforms, the analysis of behavioral responses to tax rate 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 MTR is focused only on a certain part of the income distribution, for example the tax rate 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 in our empirical example.

More specifically, as discussed in the recent ETI literature, there is no proof that the predicted NTR instrument is exogenous in all cases (see Weber 2014). Especially, if changes in tax rates are focused on a single part of the income distribution (for example high-income earners), it is unlikely that the instrument is correlated similarly with both parts of the transitory income component ($\varepsilon_{t+k,i} - \varepsilon_{t,i}$). However, this is arguably less of an issue in our empirical example, as changes in the MTR occur across the income distribution. In addition, the MTR on both dividends and wages also depend on net assets and the municipality of residence, respectively. To study how the choice of the instrument affects our estimates, we use alternative instruments to estimate the model in Section 5.2. Furthermore, we use the bunching method to estimate the standard ETI without relying on instrumented net-of-tax rates as the source of exogenous variation.

4.3 Data and descriptive statistics

Our data are from the Finnish Tax Administration, and include information on the financial statements and tax records of Finnish businesses and their owners. The data include firm and owner-level tax record information from the year 2000 onward. The data include 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 main owner data include only those individuals who received positive dividends from their firm during a tax year.

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

Tables 4 and 5 in Appendix A describe the data and the key variables we use from both 2002 and 2007. Table 4 shows the statistics for the whole data, and Table 5 for our baseline estimation sample. Owner-level data show that the tax bases of wages and dividends are of the same magnitude, but the wage tax base is somewhat larger in our estimation sample in year 2002. In addition, dividends have larger variation than wages. Firm-level data show that Finnish privately held corporations are relatively small on average, especially in terms of employees (median number of employees is 4 in 2002). However, there is considerable variation in terms of the size of the firm.

Figure 1 describes the means of wage, dividend and total income (wages+dividends) from 2000 to 2009 for all owners of privately held corporations. Wages, dividends and total taxable income all increased from 2000 to 2009. The Figure indicates that the share of wage income relative to total income has increased from 2005 onwards. This suggests that the tax reform of 2005 and the increase in dividend tax rates affected the composition of total income, which gives us preliminary evidence that income-shifting might be significant. However, based on Figure 1, it remains unclear whether the tax rate changes also induced real responses.

In addition, Figure 1 shows that mean dividends increased in the year before 2005, and decreased right after the implementation of the reform. Plans to the change the dividend tax system were officially published already in late 2003. Thus it seems that owners anticipated the reform by increasing dividend payments before the reform. We discuss this issue in more detail below.

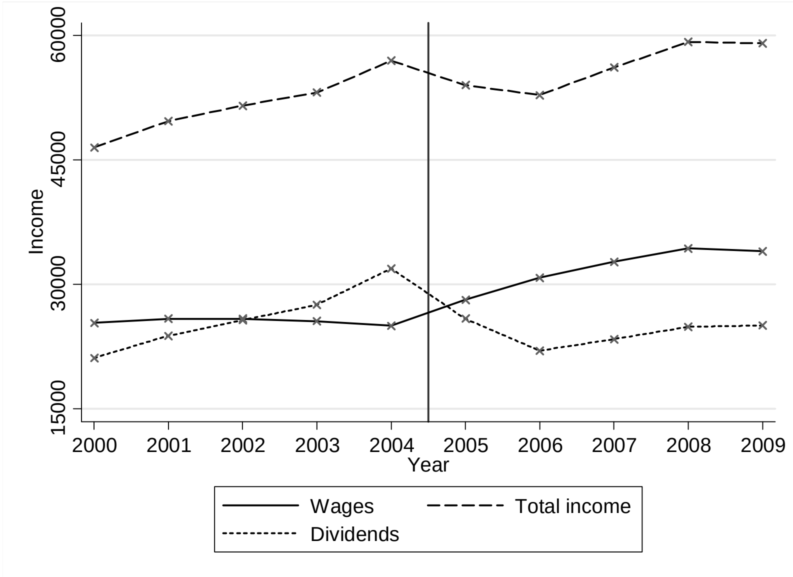


Figure 1: Means of wage, dividend and total income withdrawn from the firm in 2000-2009, whole data (in 2000 euros)

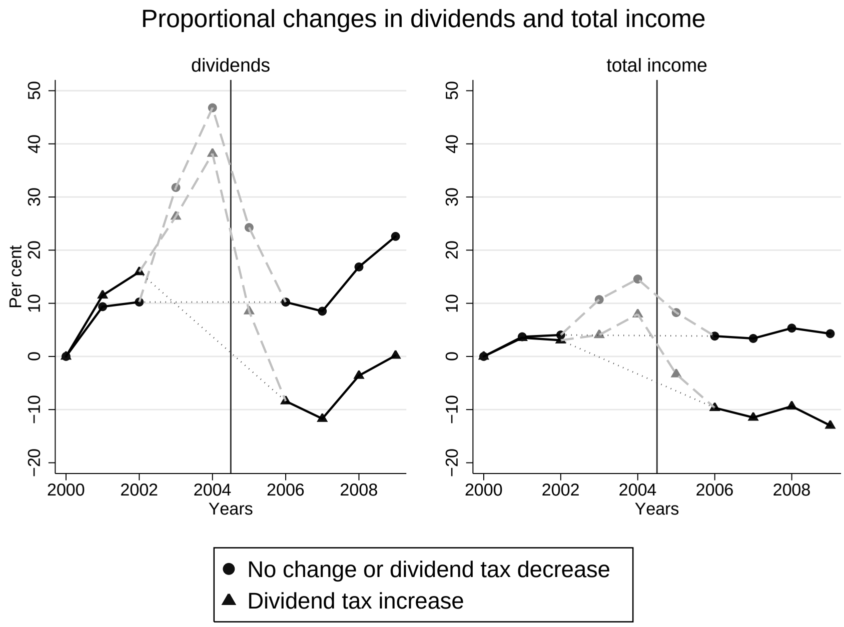
Next, we describe how tax incentives affect income withdrawn from the firm. Figure 2 shows the proportional changes in dividends (left-hand side) and total income (right-hand side) for two groups: those who faced a modest dividend tax decrease or no changes in the dividend tax rate, and those who faced a dividend tax increase. These groups are defined based on the *predicted changes in marginal tax rates* between 2002-2007, calculated using the income information in 2002. The predicted tax rate changes are defined similarly as the net-of-tax rate instruments (see Section 4.2 above). Owners with no changes in the dividend tax rate include those with a predicted change below 7.5% in the tax rate on dividends (in either direction). Owners with a dividend tax increase include owners with a positive change above 7.5%, and owners with a dividend tax decrease include owners with a negative change below 7.5% in the predicted marginal tax rate on dividends.

Figure 2 highlights the following issues: First, dividends and total income increased very similarly in both groups before 2003. This similarity of pre-reform trends provides strong visual evidence which supports that our estimation results are not biased by differential non-tax related changes in income. This is a crucial assumption when identifying ETI (see Kleven and Schultz 2014).

Second, when comparing dividends in the pre-reform (2000-2002) and post-reform (2006-2009) periods, we can see from Figure 2 that dividends decreased among owners who faced a predicted dividend tax increase. In comparison, dividends increased among owners with no tax rate changes or a dividend tax decrease. This indicates that owners responded to the dividend tax reform according to changes in tax incentives. In addition, compared to owners with no tax changes or a dividend tax decrease, owners with a dividend tax increase decreased their total income after the reform. This implies that the dividend tax reform also affected the total income withdrawn from the firm, which alludes to changes in real economic behavior.

In the Figure, the light-gray dashed lines denote the potential anticipation period (2003-2005). A tax committee appointed by the government published a report in 2002 which proposed a full double taxation of dividends. This proposal would have increased dividend taxes among almost all owners. However, the official government proposal published in late 2003 introduced only partial double taxation of dividend income, which increased dividend taxes only for part of the owners. Furthermore, special transition rules were applied in 2005 which reduced the double taxation of dividends.

Figure 2 shows that both groups increased dividends before the reform in 2003 and 2004. Increase in dividends in 2003 in both groups is feasible based on the double taxation proposal in the committee report published in 2002. In 2004, larger dividend payments among the group that faced a dividend tax increase is consistent with anticipation incentives. However, based on the official proposal published in 2003, the group that faced a modest predicted dividend tax decrease or no changes in the dividend tax rate should have not increased dividends in 2004 based on pure tax incentives. Nevertheless, there are logical reasons to explain this behavior. First, approximately 2/3 of firms decided on the amount of dividend distributions for 2004 before the publication of the official proposal in late 2003. Thus an average increase in dividends for all owners is in line with anticipation incentives based on the 2002 committee report. Second, heated public discussion on dividend taxation and the change in the composition of the government after the parliament election in 2003 potentially induced additional uncertainty on the implementation of the dividend tax reform of 2005.



Notes: Figure shows proportional changes in dividends and total income (wages+dividends) over time for our baseline estimation sample. The group with no change or a dividend tax decrease includes owners with no changes in the predicted dividend tax rate (changes below 7.5% in either direction) between 2002-2007, and owners with a predicted decrease in the dividend tax rate below 7.5%. The group with a dividend tax increase includes owners with a predicted increase in the dividend tax rate above 7.5%. The predicted changes in tax rates are calculated similarly as the net-of-tax rate instruments in Section 4.2.

Figure 2: Proportional changes in dividends and total income for owners with different predicted changes in the dividend tax rate

Figure 5 in Appendix A presents similar graphical evidence for wage income. Figure 5 shows the proportional changes in wages (left-hand side) and total income (right-hand side) for those who faced a wage tax increase or no changes in the wage tax rate, and those who faced a wage tax decrease. As before, the groups are defined based on the predicted wage tax rate change between 2002-2007. Owners with no changes in the wage tax rate include those with a change below 7.5% in the predicted tax rate on wages (in either direction). Owners with a wage tax increase include owners with a predicted positive change above 7.5%, and owners with a wage tax decrease include owners with a negative change below 7.5% in the predicted wage tax rate.

First, Figure 5 shows that wages and total income increased very similarly in both groups before 2003, which is essential for identification. This again implies evidence of common income development before the large change in dividend tax rates. Second, wage income decreased in the anticipation period in both groups. This suggests that increased dividends before the reform were at least partly offset by lowering wage payments, indicating active income-shifting among the owners. Third, comparing pre-reform and post-reform periods, the Figure shows no differential changes in wages or total income between the groups. This indicates that wage tax rate changes do not induce significant changes in the wage tax base and total income.

Figure 6 in Appendix A presents graphical evidence of how dividends and wages respond to changes in income-shifting incentives for two groups: those who faced no changes or a decrease in the difference of wage and dividend tax rates ($\tau_W - \tau_D$) and those who faced an increase in the difference of the tax rates. Again, the groups are defined based on predicted tax rate changes. Owners with no changes in tax incentives include those with a change below 10% in the tax rate difference (in either direction). Owners with an increase in the difference include owners with a positive change above 10%, and owners with a decrease include owners with a negative change below 10% in ($\tau_W - \tau_D$).

Figure 6 again shows similar income trends before the dividend tax reform in both groups. When comparing pre-reform and post-reform periods, the Figure shows clear evidence that tax bases respond to income-shifting incentives. For dividends, the owners who faced an increase in ($\tau_W - \tau_D$) decreased their dividend payments compared to other owners. To highlight the income-shifting effect, the same owners mutually increased their wage payments relative to owners with a decrease or no changes in ($\tau_W - \tau_D$).

5 Results

5.1 Main results

Table 2 presents the baseline ETI estimates for wage income and dividend income for a single difference between 2002-2007 using equation (13). Columns (1)-(2) show the results for dividends, and columns (3)-(4) present wage income elasticities with the full set of control variables.

VARIABLES	(1) lnZ_D	(2) lnZ_D	(3) lnZ_W	(4) lnZ_W
$ln(1-t_D)$	1.709***	0.615**		
	(0.125)	(0.292)		
$ln(1-t_W)$			-0.159	-0.279
			(0.313)	(0.306)
$[ln(1-t_D)-ln(1-t_W)]$		1.432***		-0.366***
		(0.370)		(0.141)
1st stage F-test for $ln(1-t_D)$	1,766.65	907.76		
1st stage F-test for $ln(1-t_W)$			391.19	227.62
1st stage F-test for $[ln(1-t_D)-ln(1-t_W)]$		504.02		487.66
Observations	14,006	14,006	12,137	12,137

Notes: Heteroscedasticity-consistent standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Equation (13) estimated using a single difference between 2002-2007 and the baseline estimation sample (see Section 4.1). All columns include income splines, and owner and firm-level base-year controls. Table includes the first-stage F-tests for all the instruments used in columns (1)-(4).

Table 2: ETI estimates for wages and dividends

For dividends (z_D), the standard ETI model in column (1) gives average net-of-tax rate elasticity of 1.7, which can be considered large. In order to separate the income-shifting component from the overall ETI, we add the difference of the net-of-tax rates on dividends and wages to the model. The results show that a significant part of the overall response of dividends is due to income-shifting between the tax bases. Column (2) shows that the average income-shifting elasticity ($e_{(1-\alpha)}$ in equation (13)) is 1.4 and statistically significant. The estimate for the real response component (e_W in equation (13)) is 0.6 and weakly significant. This suggests that income-shifting does not fully explain the changes in the dividend tax base.

For wages (z_W), the standard ETI estimate in column (3) is not statistically different from zero. In column (4), we include the difference of the net-of-tax rates to the model. The results show that the income-shifting elasticity is -0.4 and statistically significant. However, the real response component is statistically insignificant. These results imply that the wage tax base is only responsive to income-shifting incentives.[9]

What do the results imply in terms of the excess burden analysis? Applying the welfare loss formulas (11) and (12) presented in Section 2.3, we can approximate the marginal excess burden both in the standard ETI framework and the income-shifting model. We approximate the marginal excess burden using elasticities in Table 2, and

[9] All F-test statistics are very large, which implies that the instruments are strong. The difference between the number of observations in columns (1)-(2) and (3)-(4) is due to fact that some of the owners do not withdraw wage income from the firm. As a robustness check we also estimate the wage income model including owners with zero wages (see Table 8 in Appendix A). Including these owners do not affect the results.

the average marginal tax rates on dividend income and wage income using post-reform values for the whole data set (see Table 4 in Appendix A).

Using the standard ETI framework and the point estimate for the average overall dividend elasticity in column (1) of Table 2, we approximate the marginal excess burden of dividend taxation to be around 0.9. When separating the income-shifting effect and using the average estimates in column (2) of Table 2, the marginal excess burden halves to 0.4. Thus the standard ETI analysis for the dividend tax base notably overestimates the deadweight loss, and simply taking into account the fact that the shifted income is also taxed significantly decreases the evaluated efficiency loss. Furthermore, if we assume that income-shifting is purely transferring resources in the economy with zero social costs, the marginal excess burden of dividend taxes reduces to the welfare loss induced solely by the real response component. Using the estimate for real responses in the dividend tax base model in column (2) of Table 2, we approximate the marginal deadweight loss to be around 0.3 which is three times smaller than in the standard ETI model.

For wages, zero real responses imply that potential welfare losses are induced only by income-shifting responses (column (4)). In addition, if we assume that income-shifting does not affect excess burden, the welfare effects for the wage tax base are negligible. Therefore, in our empirical example, the only non-negligible welfare effects stem from dividend taxes and the dividend tax base.

Furthermore, an important observation that emerges from the results is that the dividend tax base seems to be more responsive to tax rate changes than the wage tax base, both at real and income-shifting margins. In theory, we have no explicit reason to assume symmetric real responses between different tax bases or tax rates (Piketty et al. 2014). First, the return on invested income (dividends) could be inherently more elastic than the compensation for working (wages). This would imply that dividends are simply more responsive to tax rate changes than wages. In addition, there are few practical differences between the two tax bases. Decisions on dividend distributions are usually made only once or a few times within a year. In contrast, wages are normally paid on a monthly or weekly basis. The more infrequent nature of the decision-making process might make dividend income more responsive to taxes.

The results in Table 2 also indicate that owners respond to the dividend tax rate, but do not respond to the wage tax rate. First, dividends respond actively to changes in the dividend tax rate (column (1)). However, column (2) shows that a large part of the overall effect comes from income-shifting between dividends and wages. Instead, column (3) shows that changes in the wage tax rate do not significantly affect the wage tax base. However, column (4) shows that income-shifting incentives significantly affect the wage tax base, which implies that changes in the dividend tax rate affect the size of the wage tax base through the income-shifting channel.

In our empirical setting, there are also institutional and practical reasons explaining different responses to different tax rates. First, within the time period we study, the variation in marginal tax rates is larger for dividends, both over time and between income tax brackets. If there are underlying optimization frictions, the owners would respond more to larger changes in tax rates (see Chetty 2012 and Kleven and Schultz 2014), and thus respond more to dividend tax rate changes. Second, the owners might be more aware of their dividend tax rates, 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. Previous literature suggests that individuals respond more actively to more salient taxes (Chetty et al. 2009). As an additional analysis in Section 5.2, we use cross-sectional variation and the bunching method as an alternative identification approach, and show that owners respond actively to dividend taxes but do not respond to wage taxes, which support the results in Table 2.

In addition, Table 2 shows that income-shifting elasticities are clearly significant for both tax bases, which implies that income-shifting is an important behavioral margin explaining observed changes in both tax bases. However, the estimated elasticity coefficients differ from each other. In contrast to real responses, we have no clear reason to assume asymmetric income-shifting responses between the two tax bases. However, it is difficult to comprehensively compare the estimated coefficients from different tax bases with each other. First, in our estimation sample the wage tax base is 30% larger than the dividend tax base in the base year (see Table 5 in Appendix A). This explains part of the observed asymmetry between the income-shifting elasticity coefficients. Taking the difference of the size of the tax bases into account decreases the income-shifting elasticity for the dividend tax base to approximately 1. Second, the relatively large variation in the income-shifting elasticity for the dividend tax base makes the comparison of the point estimates more difficult, especially after taking into account the different sizes of the tax bases. Third, in our example, we have arguably less exogenous variation in the wage tax rate compared to the dividend tax rate. This could potentially further complicate the empirical comparison. Related to this, we study the robustness of the results in terms of instruments and other model specifications in Section 5.2.

In summary, the results in Table 2 show that income-shifting largely explains the behavioral responses of business owners in Finland. Income-shifting elasticity is notable and statistically significant for both tax bases, and accounts for a remarkable share of the overall response. In the Finnish context, the large income-shifting response is not surprising. Among business owners, income-shifting between wages and dividends is relatively unlimited and straightforward, which implies that the costs of income-shifting are arguably small. In addition, evidence from other countries also point to large income-shifting responses among similar types of individuals with income-shifting possibilities, see for example Slemrod (1995), Gordon and Slemrod (2000) and Saez (2004) for the US, Devereux et al. (2014) for the UK, and le Maire and Schjerning (2013) and Kreiner et al. (2014) for Denmark.

Finally, the results highlight that the distinction between income-shifting and real elasticity components can have substantial effect on the evaluated excess burden of income taxation. In general, separating different tax avoidance responses from the overall ETI of high-income earners or business owners can largely affect policy conclusions. Our approach is applicable for many existing income tax systems. For example, the Tax Reform Act of 1986 in the US drastically decreased marginal personal tax rates of high-income earners, and induced notable incentives to shift income from the corporate tax base to the personal tax base. Previous studies show that the overall ETI is relatively large among high-income earners in the US, implying notable welfare losses (see for example Saez et al. 2012). Nevertheless, with separate real and income-shifting elasticities, we could better understand the welfare effects of reducing personal income tax rates among top income earners in the US.

5.2 Additional analysis and robustness checks

As a first additional analysis, we study bunching at the kink points of the dividend and wage tax rate schedules. The bunching method provides a visual and robust method to analyze ETI. If individuals respond to tax rates, we should observe individuals bunching at the kink points of the piecewise linear income tax rate schedule. Empirical estimates of excess bunching can be used to evaluate ETI locally at the kink points (Saez 2010). The bunching method provides a local alternative to our baseline model, and allows us to estimate behavioral responses using cross-sectional variation in tax rates. This avoids some of the critical issues in first-differences estimation and net-of-tax rate instruments, such as non-tax-related changes in income over time. We describe the bunching method in more detail in Appendix B.

The bunching method identifies the effect of the increase in the marginal tax rate close to the kink, not taking into account potential changes in behavior elsewhere in the income distribution or in other tax bases. Therefore, the standard bunching approach does not enable us to identify separate estimates for real and income-shifting responses. Nevertheless, similar overall behavioral responses from the bunching analysis would support our main results based on panel data regressions.

Figure 7 in Appendix B shows the distributions of dividend income around the kink point of flat-taxed dividends in 2002 and 2007. Dividend income below this kink is taxed at 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, the increase in the marginal tax rate on dividends at the kink is 13 percentage points in 2002, and 19 percentage points in 2007.

The Figure indicates clear bunching at the flat-tax kink point. A large proportion of the owners are located very close to or exactly at the kink point. This strongly supports the earlier conclusion that owners are responsive to marginal tax rates on dividends, and that the dividend tax base is clearly responsive to the marginal tax rate on dividends. We approximate the local ETI of dividend income at the kink point using the average marginal tax rate above the kink for owners within the bunching window. We estimate the ETI to be around 0.9 and statistically significant both in 2002 and 2007.

Figure 8 in Appendix B presents the distributions of wage income (earned income) relative to different kink points in the marginal wage tax rate schedule for 2002 and 2007. The Figure shows that there is no statistically significant excess bunching at the kink points. The evidence from the wage tax rate kink points suggests that owners do not react actively to marginal wage tax rates, which is in line with negligible wage elasticity estimates presented before. 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 over time have been modest in 2002-2007, this might affect the results in Section 5.1. Nevertheless, both of these methods suggest low responsiveness of wage income to the marginal tax rate on wages.

In summary, 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 wage tax rate schedule appears not to induce any behavioral responses. However, studying excess bunching does not give explicit information on the extent of income-shifting between the tax bases. Nevertheless, given the ample possibilities to shift income between wages and dividends in this context, it is very probable that part of the observed excess bunching is due to income-shifting between the tax bases, as highlighted in our baseline panel data analysis.

As discussed in Section 2.2, studying only wage and dividend tax bases might underestimate potential effects of income taxes on real economic behavior of business owners. Therefore, as a second additional analysis, we study the responsiveness of firm turnover to changes in individual income tax rates. In contrast to income withdrawn from the firm, changes in turnover also capture potential changes in within-firm consumption such as fringe benefits, and changes in retained earnings and other income not withdrawn from the firm in the current period. We interpret average changes in turnover to reflect the real effort of the owner, as the firms in our estimation sample are relatively small in terms of the number of employees (median no. of employees is 3 in 2007). Thus the owner typically contributes significantly to the overall output of the firm. In addition, elasticities of these types of firm-level income components with respect to owner-level tax rates are rarely analyzed in public finance literature (see Harju and Kosonen 2013).

Table 6 in Appendix A presents the results for the turnover estimation. The results show that wage tax rate has no effect on turnover, which supports the earlier conclusion that wage taxation has a negligible effect on real economic behavior in our example. The point estimate for the dividend net-of-tax rate implies a positive relation to real economic behavior, but the estimate is only weakly significant (p-value 0.109). Nevertheless, this result is broadly in line with the notion that dividend taxes could also have a real economic effect on the behavior of business owners.[10]

Next, we study the robustness of our baseline results with respect to the length of the difference and the net-of-tax rate instruments. First, columns (1) and (2) of Table 7 in Appendix A show the results for a regression that uses pooled seven-year differences (2000-2007, 2001-2008 and 2002-2009) to estimate our baseline equation (13). A pooled regression approach allows us to better control for potential observed heterogeneity in income growth between different types of owners. In this specification, real responses are insignificant both for dividends and wages. Furthermore, the point estimate for the income-shifting component in the dividend model is somewhat smaller (1.03) than in our baseline model, but it is still notable and highly significant. The point estimate for income-shifting in the wage model remains practically unchanged (-0.39). This suggests

[10] It is worth noting that the size of the income component might also affect the interpretation of the estimates. As the underlying tax rate variation is the same as before, broader income components have smaller elasticities if the absolute behavioral response is the same for different income components. Therefore, it is presumable to receive smaller point estimates for the turnover of the firm than for different types of income withdrawn from the firm, such as wages and dividends.

that part of the difference between the income-shifting elasticity estimates in the baseline wage and dividend models could be accounted for by taking potential heterogeneity in income growth more rigorously into account.

Second, columns (3)-(6) of Table 7 in Appendix A present the results for 6-year and 7-year single differences. The results for 2002-2008 are very similar to our baseline model. However, for 2002-2009, the point estimates in the dividend model somewhat decrease, but not in a statistically significant manner. Overall, the estimates for longer time periods imply qualitatively very similar results as our baseline model, and thus support the view that income-shifting is the principal behavioral margin for the owners of privately held corporations in Finland.

As discussed in Section 4.2, the commonly applied Gruber-Saez net-of-tax rate instrument is not necessarily exogenous (see Weber 2014). Since the instrument is a function of base-year income, it is unlikely that the instrument is uncorrelated with the transitory income component $(\varepsilon_{t+k,i} - \varepsilon_{t,i})$. This issue is pronounced if tax rate variation occurs only at certain income levels, as it is likely that transitory income shocks differ between individuals at different income levels in the base-year. In our empirical example, endogeneity of the instrument could be a particular concern in the wage income model, as part of the wage tax rate variation come from changes in central government income tax rates that are a function of taxable income in the base-year.

First, we derive the net-of-tax rate instrument using lagged income in period $t-1$. As shown in Weber (2014), using income lagged for one or more periods when predicting changes in the net-of-tax rates reduces the potential endogeneity of the net-of-tax rate instrument. However, the disadvantage is that this type of strategy typically generates weaker instruments, which might decrease the validity of the instrument.

Columns (7) and (8) of Table 7 in Appendix A show the results for our baseline model when using the Weber instrument. The results highlight that the strength of this instrument is a major concern in our empirical setup, as the first stage F-test statistics decrease significantly and are all below 20. It is reasonable that lagged instruments perform worse particularly for business owners, as yearly income tend to fluctuate more among them compared to regular wage earners. Nevertheless, given the weakness of the instrument, the point estimates still suggest that income-shifting is the main source of behavioral responses. Compared to our baseline results, the income-shifting elasticity is very similar in both the wage and dividend tax base, but the estimates are very imprecise.

Second, we use changes in the proportional municipal tax rate as an instrument for the overall changes in the progressive marginal wage tax rates of the owners. The municipal tax rate is flat, and therefore not determined by individual income. This provides the basis for the exogeneity of this instrument and justifies the use of this part of the variation as exogenous changes in tax rates in the ETI model. Matikka (2014) discusses the pros and cons of this approach and applies changes in municipal tax rates as instruments when estimating ETI for the overall population in Finland.

Columns (9) and (10) of Table 7 in Appendix A show the results when using the municipal tax rate instrument. In general, the estimates are much more imprecise than in our baseline model. First, changes in municipal tax rates are on average rather small (see Section 3.2), which tends to increase imprecision. Second, in our context, the share of tax rate variation captured by the municipality instrument decreases along with a longer length of the difference, and our baseline five-year difference is too long in order to get more precise results when using this instrument. Third, our data do not include municipal-level characteristics, which might not only decrease standard errors but also further validate the exogeneity of municipal-level changes as individual-level instruments (see Matikka 2014). Nevertheless, the results point to similar conclusions as before, but the only statistically significant effect comes from the income-shifting response in the wage tax base model.

Overall, despite the obvious issues related to alternative instruments, the results when using different instruments still suggest that income-shifting is the principle source of responses. Furthermore, potentially more exogenous instruments for the wage tax rate tend to increase the income-shifting elasticity in the wage income model, which tentatively suggests that at least part of the observed asymmetry between the income-shifting elasticities of the two tax bases in our baseline model could come from the shortage of exogenous variation in the wage tax rate.

In addition, we estimate several different specifications of our baseline estimable equation (13) in order to assess the robustness and sensitivity of the results. The results for these estimations are presented in Table 8 in Appendix A. In general, our main conclusions are robust to changes in the empirical specification.

In column (1) of Table 8 we estimate the baseline models without any control variables. The results without controls are approximately similar to those with controls in the dividend model. This indirectly indicates that (observed) non-tax-related changes in income do not significantly affect the results. In other words, identification appears not be sensitive to the selected individual and firm-level controls.[11] However, the estimates

[11]As an additional robustness check, we add 10-piece splines of firm-level income and asset variables

in the wage income model are more sensitive to added controls. This suggests that it is important to control for non-tax-related changes in wage income using available firm and owner-level characteristics.

Columns (2)-(5) of Table 8 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, which suggests that there is some heterogeneity in responses.

Column (6) of Table 8 presents our baseline estimates weighted by total income withdrawn from the firm by the owner. In many ETI studies, estimates are weighted by income to reflect the relative contribution to tax revenue (Gruber and Saez 2002). The results show that weighted estimates are very similar to the unweighted baseline estimates in our empirical example.

In our baseline analysis, we do not include firm-level mandatory pension insurance contributions in the wage tax rate. Column (7) of Table 8 presents the results when mandatory firm-level pension insurance contributions are included. There is only small variation in contribution rates over time and between different owners. Therefore, including pension contributions mainly affect the level of the wage tax rate. The results show that including pension insurance contributions have no effect on the coefficients in the wage income model. However, for dividends, including pension contributions appears to increase the relative share of real elasticity from the overall response, but the difference is not statistically significant compared to our baseline model.

Our data only include owners with positive dividend income. Thus in the data there are some owners with no wage income withdrawn from the firm. Column (8) of Table 8 estimates the wage income model including owners with zero wages by replacing zero wages with annual wages equal to 1 euro. Including owners with zero wages do not affect the results.[12]

Finally, columns (9) and (10) of Table 8 present the OLS and reduced-form results, respectively. OLS results indicate that the negative mechanical correlation between income and the net-of-tax rates is notable, as the OLS estimations give counterintuitive

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 because firm net assets, which also reflect the size of the firm, greatly affect changes in the marginal tax rates on dividends. However, adding firm-level splines does not significantly affect the results. Nevertheless, adding additional splines increases precision.

[12]In general, the owners who do not pay any dividends and are thus not included in our data might respond differently to tax incentives than the owners who pay dividends. Therefore, our results might not fully reflect the average responses of all Finnish business owners. For example, it is plausible that owners not paying any dividends are less active in income-shifting, especially before the reform of 2005 when there was in general larger incentives to pay dividends.

results with large negative own net-of-tax rate elasticities. Reduced-form results imply that the predicted changes in net-of-tax rates based on pre-reform characteristics affect income-shifting behavior in both the wage and dividend income models and real economic responses in the dividend model. Thus these results are in line with the baseline two-stage least squares model.

6 Discussion

In this paper we distinguish between real responses and tax-motivated income-shifting between tax bases. We present a model that enables us to separate the income-shifting response from the overall ETI. We show that separating income-shifting responses can have substantial effect on welfare analysis and policy conclusions. This type of approach is applicable for many existing tax systems which include opportunities to shift income between different tax bases.

As an empirical example, we analyze real responses and income-shifting between wages and dividends among the owners of privately held corporations in Finland. Ample possibilities for income-shifting together with differential variation in tax incentives make this group an interesting example to study the effects of both real income creation and income-shifting. Our results show that income-shifting is clearly significant and accounts for a large proportion of the overall behavioral response among Finnish business owners. Using the estimated elasticities, we show that the evaluated excess burden of dividend taxation is approximately three times smaller when we separate the income-shifting response.

Our results emphasize that it is crucial to distinguish between different behavioral margins when analyzing the effects of income taxes among high-income earners and business owners, as large observed overall responses do not necessarily yield large efficiency effects. Furthermore, separating different types of responses have implications for practical tax policy. Real responses stemming from deeper behavioral parameters such as labor-leisure preferences are not under direct government control (Piketty et al. 2014). In contrast, income-shifting can be governed more easily by re-designing the details of the tax system. Therefore, for example, limiting the legal possibilities to shift income arguably decreases the overall ETI among individuals with income-shifting possibilities. However, compared to real economic responses, decreasing the income-shifting elasticity has a notably smaller effect on excess burden.

Finally, it could be that the opportunity to decrease the overall personal tax burden through income-shifting between different tax bases increases the economic activity of high-income earners and business owners in the long run. If this type of effect exists, the policy maker would need to balance between tax revenue losses induced by income-shifting and the long-run efficiency gains induced by setting differential tax rates and allowing for income-shifting. In future research, it would be important to gain knowledge of the potential profound effect of income-shifting on real economic activity in order to comprehensively understand the welfare effects of income tax systems.

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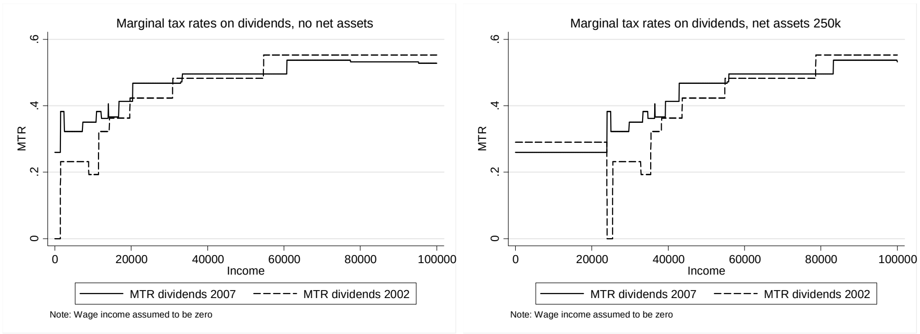
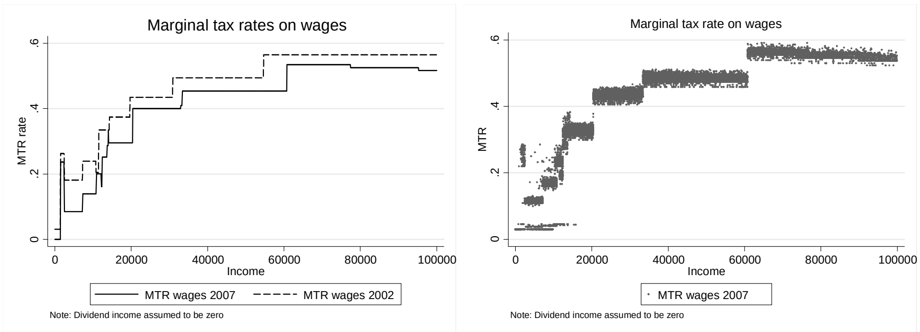
Appendix A



Notes: Figure shows the marginal tax rates (MTR) on dividends for a single owner of a privately held corporation with no firm-level net assets (left-hand side), and with net assets of 250,000 euros (right-hand side) for years 2002 and 2007. For simplicity, wage income is assumed to be zero. MTR on dividends includes corporate taxes paid on withdrawn dividends (after 2005) and all automatic deductions and allowances on dividend income. Dividends exceeding the imputed return on net assets include central government taxes and average municipal taxes.

Figure 3: Average marginal tax rates on dividends in 2002 and 2007. No net assets (left-hand side), net assets of 250,000 € (right-hand side)



Notes:
Left-hand side: Figure shows the average marginal tax rates (MTR) on wage income in 2002 and 2007 for an owner of a privately held corporation. For simplicity, dividend income is assumed zero. 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 and firm-level social security contributions. MTR on wages does not include pension and health insurance contributions or any deductions based on insurance contributions. Right-hand side: Figure shows the marginal tax rates (MTR) on wage income including individual municipal tax rates from the whole data. For simplicity, dividend income is assumed zero. MTR includes central government taxes, individual municipal taxes and individual tax deductions and exemptions. MTR also includes social security contributions levied on wage income and firm-level social security contributions. MTR on wages does not include pension and health insurance contributions or any deductions based on insurance contributions.

Figure 4: 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 1,000k)		MTR on dividends (net assets 5,000k)	
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	55.3	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: Table presents the marginal tax rates (MTR) on wages and dividends in 2002 and 2007 for a single owner of a privately held corporation with different values of firm net assets (0, 250,000, 1,000,000 and 5,000,000 euros). 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 include corporate taxes on withdrawn dividends (after 2005). MTR on dividends include all automatic tax deductions and tax credits. MTR on dividends exceeding the imputed return on net assets include average municipal taxes and central government income taxes.

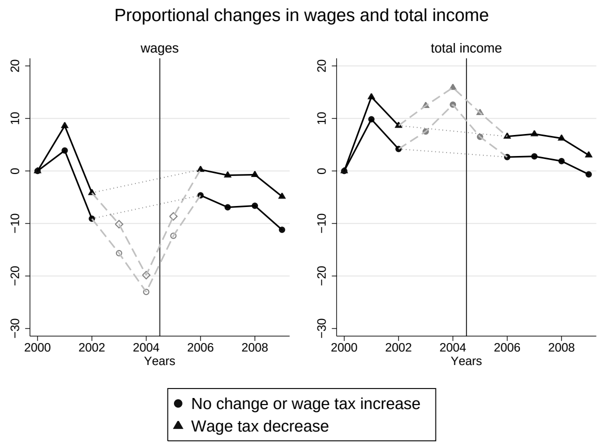
Table 3: Marginal tax rates (MTR) on wages and dividends with different levels of firm net assets, 2002 and 2007 (in nominal euros)

	2002				2007			
	Owner-level characteristics							
Variable	Mean	Median	SD	N	Mean	Median	SD	N
Wages	25,860	21,305	34,687	39,104	30,779	25,615	40,962	52,045
Dividends	25,696	8,750	101,722	39,104	22,015	7,523	83,456	52,045
Total income	51,556	35,242	110,043	39,104	52,798	38,458	95,632	52,045
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
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
	Firm-level characteristics							
Variable	Mean	Median	SD	N	Mean	Median	SD	N
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. of employees	10.74	3	47.76	39,104	9.74	3	51.52	52,045

Table 4: Descriptive statistics, whole data (in 2002 euros)

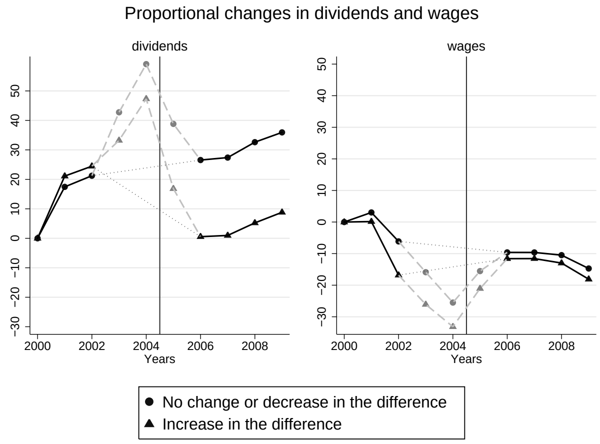
	2002				2007			
	Owner-level characteristics							
Variable	Mean	Median	SD	N	Mean	Median	SD	N
Wages	27,302	25,000	21,208	14,010	28,992	26,546	24,237	14,010
Dividends	21,026	11,301	32,882	14,010	22,251	11,878	33,858	14,010
Total income	48,328	40,738	38,153	14,010	51,243	44,050	41,118	14,010
MTR dividends	0.40	.42	0.10	14,010	0.37	0.26	0.11	14,010
MTR wages	0.48	0.51	0.09	14,010	0.43	0.47	0.12	14,010
Ownership share	0.77	0.80	1.02	14,010	0.76	0.85	0.26	14,010
Male	0.84	1	0.37	14,010	0.84	1	0.37	14,010
Age	47.4	48	9.28	14,010	52.4	53	9.27	14,010
	Firm-level characteristics							
Variable	Mean	Median	SD	N	Mean	Median	SD	N
Turnover	764,243	265,622	2,652,620	14,010	852,451	267,531	2,732,651	14,010
Total assets	453,014	190,734	1,686,850	14,010	650,201	250,470	2,612,920	14,010
Net assets	268,201	113,133	837,243	14,010	399,598	154,933	1,634,324	14,010
No. of employees	8.91	4	21.32	14,010	8.84	3	23.21	14,010

Table 5: Descriptive statistics, baseline estimation sample (in 2002 euros)



Notes: Figure shows the proportional changes in wages and total income (wages+dividends) over time for our baseline estimation sample. The group with no change or a wage tax increase includes owners with no changes in the predicted wage tax rate (changes below 7.5% in either direction) between 2002-2007, and owners with a predicted increase in the wage tax rate above 7.5%. The group with a wage tax decrease includes owners with a predicted decrease in the wage tax rate below 7.5%. The predicted changes in tax rates are calculated similarly as the net-of-tax rate instruments in Section 4.2.

Figure 5: Proportional changes in wages and total income for owners with different predicted changes in the wage tax rate



Notes: Figure shows the proportional changes in dividends and wages over time for our baseline estimation sample. The group with no change or a decrease in the difference of the tax rates ($\tau_W - \tau_D$) includes owners with changes below 10% in either direction between 2002-2007, and owners with a predicted decrease in the difference below 10%. The group with an increase in ($\tau_W - \tau_D$) includes owners with a predicted increase in the tax rate difference above 10%. The predicted changes in tax rates are calculated similarly as the net-of-tax rate instruments in Section 4.2.

Figure 6: Proportional changes in dividends and wages for owners with different predicted changes in the difference of the marginal tax rates on wages and dividends

VARIABLES	*ln(turnover)*
$ln(1-t_W)$	-0.062
	(0.378)
$ln(1-t_D)$	0.303
	(0.189)
1st stage F-test for $ln(1-t_W)$	245.27
1st stage F-test for $ln(1-t_D)$	859.46
Observations	13,021

Notes: Heteroscedasticity-consistent standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Equation (13) estimated using our baseline estimation sample of owners and a single difference between 2002-2007, and log changes in firm-level turnover as the dependent variable. Explanatory variables are log changes in instrumented net-of-tax rates on wages and dividends. Control variables are the same as in the baseline equation, and include income splines, owner-level base-year controls and firm-level base year controls.

Table 6: Alternative real response estimation: The elasticity of the turnover of the firm with respect to changes in net-of-tax rates on wages and dividends

	Different time periods						Instruments			
	Pooled 7-year differences		2002-2008		2002-2009		Weber		Municipal	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	lnZ_D	lnZ_w	lnZ_D	lnZ_w	lnZ_D	lnZ_W	lnZ_w	lnZ_D	lnZ_w	lnZ_D
$ln(1-t_W)$		-0.344		-0.207		0.134	-1.300		-0.999	
		(0.227)		(0.272)		(0.306)	(1.444)		(1.379)	
$ln(1-t_D)$	0.234		0.770***		0.473**			1.526		0.142
	(0.182)		(0.259)		(0.228)			(1.314)		(1.738)
$[ln(1-t_D)-ln(1-t_W)]$	1.033***	-0.393***	1.416***	-0.304**	0.818***	-0.373**	-2.424*	2.296	-1.006***	1.991
	(0.213)	(0.099)	(0.332)	(0.150)	(0.295)	(0.159)	(1.252)	(2.052)	(0.373)	(2.257)
1st stage F-test for $ln(1-t_W)$		446.94		262.53		231.31	13.54		70.24	
1st stage F-test for $ln(1-t_D)$	2143.97		895.76		1041.57			20.06		933.52
1st stage F-test for $[ln(1-t_D)-ln(1-t_W)]$	1369.28	1265.19	472.86	462.10	509.36	501.39	8.89	7.75	443.17	468.36
Observations	27,423	24,375	13,001	11,150	11,974	10,064	8,274	9,370	11,919	13,754

Notes: Heteroscedasticity-consistent standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Table presents the estimation results for our baseline model using different time periods and alternative net-of-tax rate instruments.
Columns (1)-(2): Equation (13) estimated using our baseline estimation sample of owners and pooled data of three seven-year differences: 2000-2007, 2001-2008 and 2002-2009. Control variables are the same as in the baseline equation, and include income splines, owner-level base-year controls and firm-level base year controls.
Columns (3)-(6): Equation (13) estimated using our baseline estimation sample of owners and a single difference of 2002-2008 and 2002-2009, respectively. Control variables are the same as in the baseline equation, and include income splines, owner-level base-year controls and firm-level base year controls.
Columns (7)-(8): Equation (13) estimated using our baseline estimation sample of owners and a single difference of 2002-2007, and an alternative net-of-tax rate instrument proposed by Weber (2014). The instrumented net-of-tax rates for each owner are derived using lagged income variables in 2001. Control variables include lagged income-splines, owner-level base-year controls and firm-level base year controls.
Columns (9)-(10): Equation (13) estimated using our baseline estimation sample of owners and a single difference of 2002-2007, and using changes in flat municipal tax rates as the net-of-tax rate instrument for the wage tax rate. Control variables include income splines, owner-level base-year controls and firm-level base year controls.

Table 7: Robustness checks: Different time periods and alternative net-of-tax rate instruments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	No controls	Small inc limit	Large inc limit	Small $\triangle$inc limit	Large $\triangle$inc limit	Weights	Pension contributions	Zeros included	OLS	Reduced-form
Variable	lnZ_D	lnZ_D	lnZ_D	lnZ_D	lnZ_D	lnZ_D	lnZ_D		lnZ_D	lnZ_D
$ln(1-t_D)$	0.628**	0.960***	0.590*	0.710**	0.732**	0.572*	0.853***		-1.301***	0.405***
	(0.319)	(0.253)	(0.325)	(0.304)	(0.289)	(0.298)	(0.192)		(0.048)	(0.152)
$[ln(1-t_D) -$	1.729***	1.309***	1.267***	1.209***	1.428***	1.450***	1.186***		0.0410	0.305**
$ln(1-t_W)]$										
	(0.402)	(0.326)	(0.411)	(0.395)	(0.365)	(0.377)	(0.228)		(0.046)	(0.150)
Observations	14,006	16,938	9,891	10,991	14,882	14,006	13,999		14,006	14,006
Variable	lnZ_W	lnZ_W	lnZ_W	lnZ_W	lnZ_W	lnZ_W	lnZ_W	lnZ_W	lnZ_W	lnZ_W
$ln(1-t_W)$	-1.109***	-0.450*	-0.260	-0.390	-0.216	-0.238	-0.395*	-0.0341	-2.121***	-0.184
	(0.323)	(0.273)	(0.357)	(0.306)	(0.302)	(0.307)	(0.206)	(0.248)	(0.074)	(0.186)
$[ln(1-t_D) -$	-0.539***	-0.357***	-0.374**	-0.585***	-0.271*	-0.360***	-0.337***	-0.364***	0.652***	-0.148***
$ln(1-t_W)]$										
	(0.160)	(0.137)	(0.152)	(0.148)	(0.139)	(0.139)	(0.130)	(0.135)	(0.034)	(0.047)
Observations	12,137	14,344	8,537	9,613	12,872	12,137	12,132	14,006	12,137	12,137

Notes: Heteroscedasticity-consistent standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table presents the estimation results for our baseline model using different specifications and sample restrictions.

Column (1): Equation (13) estimated using our baseline estimation sample of owners and a single difference of 2002-2007 without any control variables.

Columns (2)-(5): Equation (13) estimated using a single difference of 2002-2007 and different sample limitations: Small income limit (column(2)) = 10,000 € of total income in the base-year. Large income limit (column (3)) = 40,000 € of total income in base-year. Small limit in change of income between 2002-2007 (column (4)) = 25,000 €. Large limit in change of income between 2002-2007 (column (5)) = 75,000 €. Control variables in columns (2)-(5) are the same as in the baseline equation, and include income splines, owner-level base-year controls and firm-level base year controls

Column (6): Equation (13) estimated using our baseline estimation sample of owners and a single difference of 2002-2007. Owner-level total income is used to weight the estimates. Control variables are the same as in the baseline equation, and include income splines, owner-level base-year controls and firm-level base year controls.

Column (7): Equation (13) estimated using our baseline estimation sample of owners and a single difference of 2002-2007. Firm-level pension insurance contributions are included in the wage tax rate. The average firm-level pension insurance rate was approximately 21% in both 2002 and 2007. Control variables are the same as in the baseline equation, and include income splines, owner-level base-year controls and firm-level base year controls.

Column (8): Equation (13) estimated for the wage tax base using a single difference of 2002-2007 and our baseline estimation sample including owners with zero wages in either 2002 or 2007 or both. Observations for zero wages are replaced with a wage income equal to 1 euro. Control variables are the same as in the baseline equation, and include income splines, owner-level base-year controls and firm-level base year controls.

Column (9): Equation (13) estimated using our baseline estimation sample of owners and a single difference of 2002-2007 using OLS estimator without instrumented net-of-tax rates. Control variables are the same as in the baseline equation, and include income splines, owner-level base-year controls and firm-level base year controls.

Column (10): Equation (13) estimated using our baseline estimation sample of owners and a single difference of 2002-2007 by regressing log changes in wages and dividends with log changes in predicted net-of-tax rate variables. Control variables are the same as in the baseline equation, and include income splines, owner-level base-year controls and firm-level base year controls.

Table 8: Robustness checks: Different specifications

Appendix B

Bunching at kink points

Following Saez (2010), consider a small increase in the marginal tax rate, $d\tau$, at a point $z = k$. Below the kink point k taxable income z is taxed at 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 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. Saez (2010) shows that the local ETI is proportional to the excess density mass around the kink point

$$e \backsimeq \frac{b(k)}{k * ln((1-\tau_1)/(1-\tau_2))} \tag{14}$$

where $b(k) = B(dz)/h_0(k)$ is the excess mass at k.

Empirically, the excess mass at the kink point is estimated by comparing the actual density around the kink point to a smooth counterfactual density. The counterfactual density describes how the income distribution at the kink would have looked 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. To do this, 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

$$c_j = \sum_{i=0}^{p} \beta_i (z_j)^i + \sum_{i=k-\delta}^{k+\delta} \eta_i \cdot \mathbf{1}(z_j = i) + \varepsilon_j \tag{15}$$

where c_j is the count of individuals in bin j, and z_j denotes the income level in bin j. The order of the 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 $\hat{B} = \sum_{i=k-\delta}^{k+\delta} (c_j - \hat{c}_j)$.

Finally, the excess mass is calculated as

$$\hat{b}(k) = \frac{\hat{B}}{\sum_{i=k-\delta}^{k+\delta} \hat{c}_j/(2\delta + 1)} \tag{16}$$

As in earlier literature, parameters δ and p are determined visually and based on the fit of the model. We use a seventh-order polynomial and a bunching window of +/-700 € from the kink point in our baseline estimations. Our conclusions are not sensitive to the choice of the bunching window δ or the degree of the polynomial p.

As in Chetty et al. (2011), standard errors for $\hat{b}(k)$ are calculated using a bootstrap procedure where we generate a large number of income distributions by randomly resampling the residuals from equation (15). The standard errors are defined as the standard deviation in the distribution of $\hat{b}(k)$.

Figure 7 shows the distributions of dividend income around the kink point of flat-taxed dividends in 2002 and 2007. 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 at 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, the increase in the MTR on dividends at the kink is 13 percentage points in 2002, and 19 percentage points in 2007. A large proportion of the owners are located very close to or exactly at the kink point. We approximate the local ETI of dividend income at the kink point using the average marginal tax rate above the kink for owners within the bunching window. We estimate the ETI to be 0.9 and statistically significant both in 2002 and 2007.

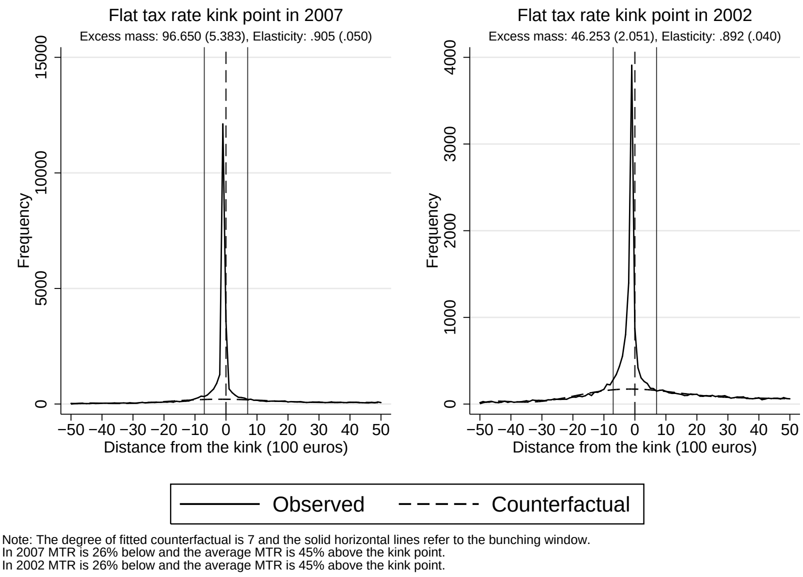


Figure 7: Dividend income distribution around the flat-tax rate kink point, years 2007 (left) and 2002 (right)

There are few aspects that are worth noting when interpreting Figure 7. 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 7 implies that owners are very aware of their individual kink points, as there is no other explicit reason to locate at the kink except the discontinuous change in the marginal tax rate. Second, 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 and earned income from other sources).

We conduct an indirect bunching analysis for wages by studying the distribution of progressively taxed earned income around the kink points of central government income tax rate schedule.[13] The exact location in the taxable income distribution is what matters in terms of bunching at kink points. Thus it is not relevant to analyze only the distribution of wages from the firm, as other progressively taxed income also affects the

[13] Central government income tax rate schedule includes various kink points (in total 5 in 2002 and 4 in 2007). Small amounts of earned income are not taxed by the central government. The first kink appears at a point where the central government tax rate first applies. Various kink points are associated with marginal tax rate increases between 4-12 percentage points. At the first income threshold, there is a clear increase in the marginal tax rate. In addition to the first kink point, the last kink involves the most distinctive increase in the tax rate. Changes in the effective marginal tax rates around the first, third and last kink point of the central government tax rate schedule in 2002 and 2007 are presented in Figure 8.

location of the owner in the taxable income distribution. However, in our analysis we only include owners who do not receive wages or other earned income outside their firm. Nevertheless, the results are similar when we include all owners in the data.

Figure 8 presents the distributions of earned income relative to different kink points in the marginal tax rate schedule for 2002 and 2007 (+/- 5,000 € in bins of 200 €). The Figure shows that there is no statistically significant excess bunching at the kink points of the earned income tax rate schedule. The Figure presents only 3 kink points in both years, but the result of no significant bunching holds for all kink points.

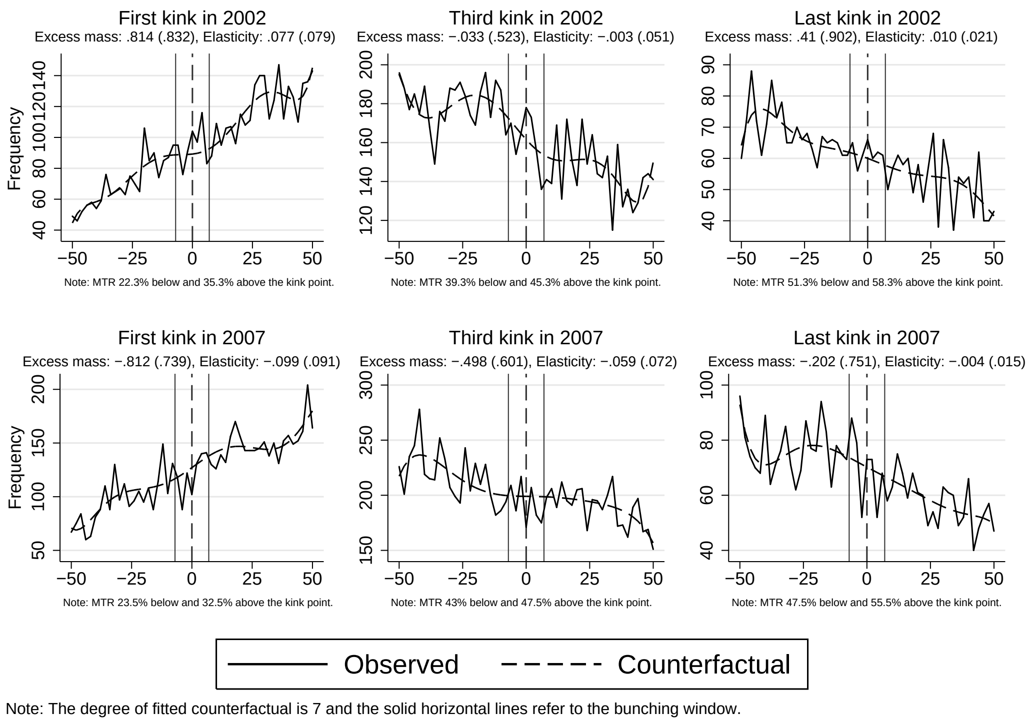


Figure 8: Taxable earned income distributions relative to different kink points in bins of 200 €, years 2002 (above) and 2007 (below)