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Behavioural Effects of a Top Marginal Income Tax Rate Increase

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Abstract

This paper estimates the elasticity of taxable income (ETI) for the top 1% of income earners, utilising a change in taxation in 2013, when a new top tax bracket was added to the earned income tax schedule in Finland. The response of top earners is crucial in determining the revenue-maximising level of top income taxation, and this study contributes to the top income ETI literature by employing a differences-in-differences method comparing changes in income within the same income groups for different time periods. The results suggest that the ETI for top wage earners (0.5) may be higher than found in previous population estimates. This finding is primarily driven by individuals experiencing fewer labour market frictions, such as those who have changed employer or have multiple concurrent employers.

Keywords: Behavioural response, income taxation, labour supply
JEL Classification: H21; H24

1 Introduction

Understanding the mechanisms of how individuals respond to taxation is essential for designing effective income tax regimes. A well-established measure for behavioural responses to taxation is the elasticity of taxable income (ETI), often estimated by exploiting changes in tax schemes or other discontinuities in the tax system, as randomised trials are typically infeasible. Following the influential analysis on the elasticity of taxable income by Feldstein (1995, 1999), the estimation of ETI from tax schedule changes using panel data has become a significant area of empirical literature (see e.g. the review by Saez et

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al., 2012). However, these estimates are subject to several well-known weaknesses due to the income dynamics of individuals. Factors such as mean reversion, differential trends and movement in and out of the treated tax bracket have led to considerable variation in estimates based on methodological choices (see e.g. Neisser 2021).

Despite the heated discussions about the taxation of high-income individuals, there are not yet many estimates of the top income elasticity in the literature. Elasticity among top earners is a critical parameter in designing optimal income tax policies and estimating revenue-maximising top marginal income tax rates. This paper contributes to the top income ETI literature by exploiting a change in earned income taxation for the top 1% of income earners in Finland. In 2013, the marginal tax rate for the highest income tax bracket was increased by 2 percentage points, resulting on average in a drop of approximately 4.5% in the marginal net-of-tax rate. The reform affected individuals with annual earnings exceeding EUR 100,000. As municipalities set their income tax rates independently, the top marginal income tax rate varied widely between 52.6 – 58% in 2013, with a weighted average of 55.5%. This paper also utilises the additional variation in the individual net-of-tax rates caused by changes in municipal tax rates over the periods analysed, which has a significant effect on the precision of the elasticity estimates.

The elasticities are estimated using a differences-in-differences estimation strategy and a novel graphical approach for the validation of identifying assumptions presented by Jacobsen and Søgaard (2022). The challenges of mean reversion and heterogeneous trends are addressed by comparing income changes within the same income groups across different time periods. This method provides a valuable approach to studying ETI in the Finnish context, as the more traditional methods cannot be reliably applied because of mean reversion and lack of parallel trends among the income groups of interest. The analysis is based on detailed personal income tax data, allowing for the examination of different margins where high-earning employees respond to income taxation. When comparing income growth trends for the two-year pre-reform and reform periods, the identifying assumption is supported, as the trends are similar for both periods in the validation region representing the control group.

The main contribution of this paper is to provide new insights into the labour market responses of top income earners when the income-shifting opportunities are small. To limit tax avoidance possibilities, the self-employed individuals are excluded from the main analysis, although the estimates including them are also provided. The elasticity for earned income is found to be 0.50 for employees, and 0.46 when including self-employed individuals in the analysis. The results are robust when controlling for several observable characteristics. Only the municipality control has a significant effect on the estimates, highlighting the importance of accounting for the substantial variation in municipal tax rates. Heterogeneity analysis reveals larger elasticities for income levels close to the threshold. The results are driven by individuals with an educational background in

engineering and relatively young individuals.

There is clear evidence that upper incomes respond to tax rates when tax avoidance opportunities, such as income shifting, are available. The elasticity estimates found here for broad income, including taxable income for both labour and capital, are 0.43 for the entire data and 0.37 for employees excluding the self-employed. This would suggest that the effect is not primarily driven by income shifting.

In the ETI literature, the estimated elasticities for high-income earners in the absence of avoidance opportunities appear modest and not much different from the average elasticities (e.g. Piketty et al. 2014). In Sweden the behavioural response of the top 5% of earners was estimated to be close to 0.2 by Miao et al. (2025), which is lower than the estimate found in this paper. Matikka (2018) estimated the average ETI in Finland to be approximately 0.2 and found no significant difference between the average ETI and the ETI for high-income individuals, although there is some uncertainty associated with the income group-specific estimates and a lack of data precise enough for top earners. On the other hand, Pirttilä and Selin (2011) do find a stronger response among high earners compared to the average elasticity. It should be noted, however, that the top elasticity estimated in this paper is a very local elasticity, as the reform only affected the top 1% of earners. The Finnish 2013 reform was also quite salient, as adding a new tax bracket is a simple change, and it was much discussed in the media. To extend the analysis to lower income levels, I have also studied the 2016 reform, when the highest income threshold was lowered, so that the highest income tax rate also applied to income levels of EUR 79,000 – 97,600. The elasticities found here are close to zero and insignificant. This would indicate that the large elasticities exist only at the highest end of the income distribution, and decline to a moderate level among other high-earning individuals.

It is well known that the behavioural response to taxation in macroeconomic research tends to be larger than suggested by the elasticities found in empirical microeconometric studies. Labour market frictions often prevent immediate responses to taxation, and long-run causal identification in micro estimations is usually impossible. Kleven et al. (2025) argue that studying career workers at discreet job events (e.g. job switches) can reveal true long-run elasticities, as both realised earnings and latent earnings (effort) align at this point, making micro and macro elasticities identical. Inspired by their work, I estimate the elasticities for workers who switched jobs during the two-year period. The elasticity of taxable income estimated separately for job changers yields non-significant estimates. However, including the interaction for job changers and the treatment in the main specification results in a significant interaction estimate of 1.7, while the baseline estimate is close to zero and non-significant. This elasticity is much higher than the dynamic elasticity of 0.6 - 0.7 for the top income decile found by Kleven et al. (2025) and even higher than typical macro estimates. Miao et al. (2025), on the other hand, did not find any larger effect for job changers when studying a reform where marginal tax rates

where raised for the top 5% of income earners. While no clear selection bias is detected among job changers based on observable characteristics in this study, caution is advised in drawing conclusions about long-term top income elasticity.

In addition, I examine employees who have had multiple employers simultaneously over a year, since they can be identified as a group with potentially more flexible working arrangements. The estimated elasticity for these flexible workers is 1.6, and it is significant and robust to multiple controls. Although there is clear selection bias among flexible workers and this estimate cannot represent the aggregate long-term ETI for top earners, it suggests that when labour market frictions are smaller, the elasticity of taxable income for the very highest top income earners may indeed be somewhat higher than previously thought.

The paper proceeds as follows. Sections 2 and 3 describe the institutional setting and data. Section 4 presents the conceptual background and empirical method, and Section 5 the results together with a heterogeneity and robustness examination. Section 6 concludes.

2 Institutional Setting

In Finland, earned income and capital income are taxed separately, and the taxation is individual-based, independent of marital status or the number of children. Earned income includes, e.g. wages, the proportion of entrepreneurial income defined as earned income, pension income, and other taxable welfare benefits, such as unemployment, sickness and parental allowances. Taxation is based on gross income minus deductions, with taxable income defined separately for central government and municipal taxation. Table 1 shows the central government income tax brackets and tax rates. Capital income was subject to a flat tax rate of 28%, which was increased to 30% and, for income exceeding EUR 50,000, to 32% in 2012.

Table 1: Central government income tax parameters in Finland 2010-2016

Earned income	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Marginal tax rate, 1. level	6,50 %	6,50 %	6,50 %	6,50 %	6,50 %	6,50 %	6,50 %
Marginal tax rate, 2. level	17,50 %	17,50 %	17,50 %	17,50 %	17,50 %	17,50 %	17,50 %
Marginal tax rate, 3. level	21,50 %	21,50 %	21,50 %	21,50 %	21,50 %	21,50 %	21,50 %
Marginal tax rate, 4. level	30,00 %	30,00 %	29,75 %	29,75 %	29,75 %	29,75 %	31,75 %
Marginal tax rate, 5. level				31,75 %	31,75 %	31,75 %	
Income threshold 1	15 200	15 600	16 100	16 100	16 300	16 500	16 700
Income threshold 2	22 600	23 200	23 900	23 900	24 300	24 700	25 000
Income threshold 3	36 800	37 800	39 100	39 100	39 700	40 300	40 800
Income threshold 4	66 400	68 200	70 300	70 300	71 400	71 400	72 300
Income threshold 5				100 000	100 000	90 000	
Capital income							
Tax rate 1	28 %	28 %	30 %	30 %	30 %	30 %	30 %
Tax rate 2			32 %	32 %	32 %	33 %	34 %
Capital income threshold			50 000	50 000	40 000	30 000	30 000

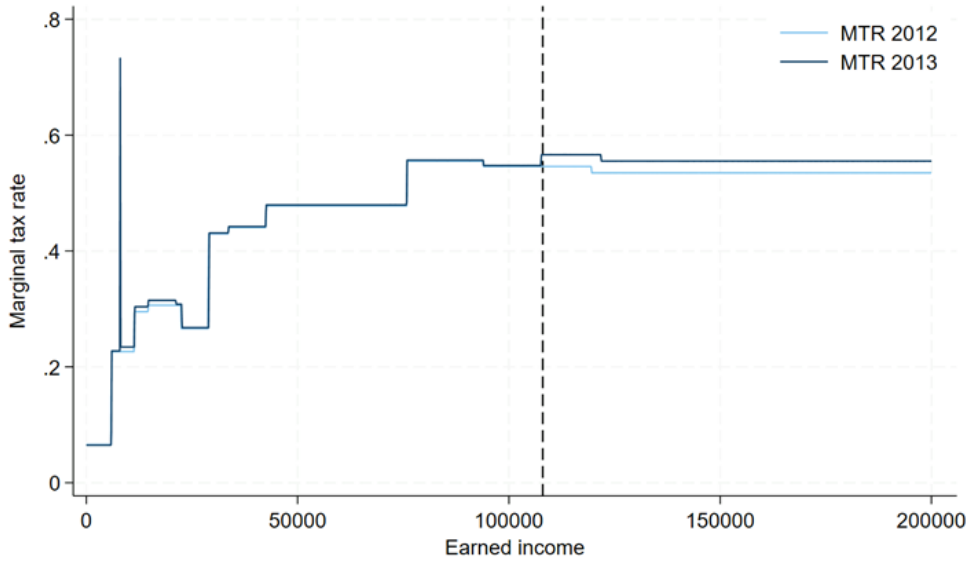
The marginal tax rate used in the analysis includes all taxes and contributions collected from employees' pay, such as the progressive central government tax, the flat-rate municipal tax, the media tax, the contribution to health insurance, unemployment insurance premiums and pension contributions. Employer social security contributions and consumption-related taxes are not included in the marginal tax rate.

2.1 Top Income Tax Reform in 2013

In the paper I focus mainly on studying a tax increase among the top 1% of earners in Finland. In the early 2010s, the Finnish government aimed to balance public finances, e.g. by increasing income tax revenue, and enhancing the fairness of taxation by raising taxes for high-income earners. A new temporary tier was added to the progressive income tax scale for incomes exceeding EUR 100,000 (top 1% of income earners), which increased the taxation for these individuals by 2 percentage points compared to the year 2012. The 2012 government proposal estimated that there were approximately 50,000 wage earners earning more than EUR 100,000, and this so-called "solidarity tax" was estimated to increase tax revenue on earned income by around EUR 30 million. The tax reform was passed by Parliament in November 2012 and implemented on January 1, 2013.

Figure 1 shows the marginal tax rates in 2012 and 2013 for nominal earned income. The EUR 100,000 income limit stated in the reform applies to the tax base in central government earned income taxation. Therefore, when taking into account the statutory deductions, the reform affects wage income over approximately EUR 107,700. It is possible that the actual threshold in terms of earned income was not clear to all individuals, creating some vagueness around the income limit to which individuals might respond.

Figure 1: Marginal tax rates in 2012 and 2013



Note: Fig. 1 shows marginal tax rates in 2012 and 2013 by annual level of nominal earned income. The marginal tax rates include central government and average municipal taxes and all social and insurance contributions paid by the employee.

2.2 Income Tax Reform of 2016

The tax parameters for top income individuals were changed again in 2015 and 2016. The income threshold for the highest bracket was lowered from EUR 100,000 to EUR 90,000 in 2015, and again to EUR 72,300 in 2016, which used to be the same level as the second-highest income threshold. The second-highest tax rate was thus abolished, while the other rates stayed unchanged (see Table 1). The 2016 reform affected individuals earning EUR 79,000–97,600 before statutory deductions, and they faced a 2-pp rise in their marginal tax rate. The threshold change in 2016 offers an interesting setup to study, since even though if was not billed as a marginal tax rate change, the effect on individual taxation was very similar to the solidarity tax reform in 2013, except that it fell on lower income levels. This allows me to study the elasticity of taxable income for different income levels, and compare the results to the response of the top of the income distribution.

However, when we look at the real change in net-of-tax rates for the two-year pre-reform period of 2013-2015 and the reform period of 2015-2017 in Figure A.4 (Panel B), we see that the actual real average change in net-of-tax rates is modest. The main reason for this is that the inflation adjustments made annually to the income thresholds were higher than actual inflation, especially in the reform period (pre-reform adjustment of 1.6% vs. inflation of 0.8% and reform period adjustment of 2.4% vs. inflation of 1.1%). This deflates the effect of the marginal tax rate rise in the real two-year net-of-tax rate from around 6% to around just 2%.

3 Data and Descriptive Statistics

The data available is a full population-level register dataset provided by Statistics Finland. The data contains administrative information on income, employment, socioeconomic status, family statistics, education and firm ownerships.

The income data originates from the tax authority and includes detailed items from tax returns. The main variable of interest is earned taxable income in central government taxation, which is the income after all individual deductions but before statutory deductions. All amounts in the study are adjusted using the consumer price index to reflect 2013 prices. Earned income is used as the measure for income group, excluding capital gains, since the treatment pertains to earned income.

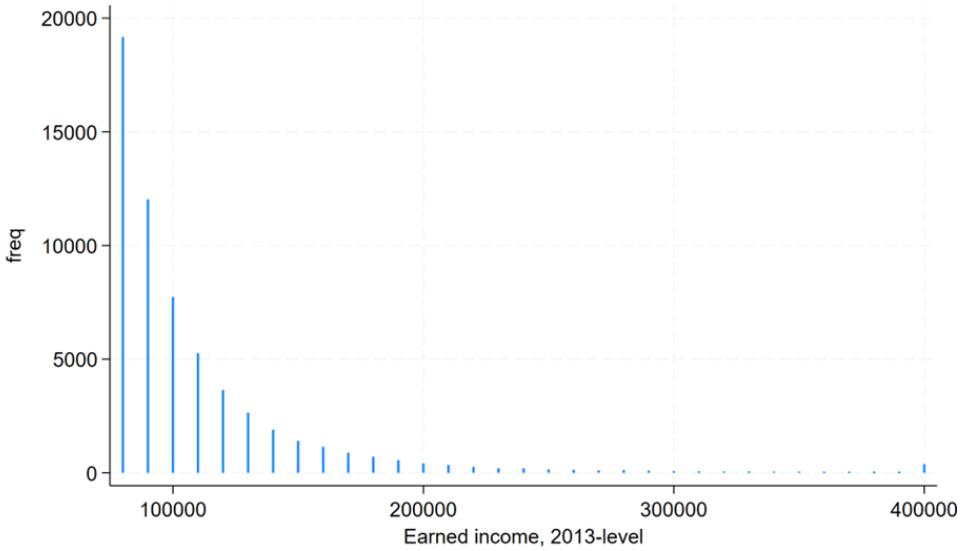
Marginal tax rates are not directly observed in the data, hence, they are calculated separately for each year and income level (rounded to the nearest EUR 100), taking into account the relevant earned income tax and social contribution parameters, as well as all municipal tax rates.

After excluding social benefit recipients from the data, the requirement of having the same individual in the analysis for t+2 years reduces the data used in the analysis by approximately 19%. This excluded share consists of individuals who, by the end of the period, had received social benefits (e.g. unemployment, pension, or parental benefits) and are therefore dropped out from the data, or are missing from the register for some other reason. This means that the elasticity estimate reflects only the intensive margin responses.

I also estimated the elasticity of reported broad income with respect to the marginal net-of-tax rate on earned income. Broad income includes both taxable earned income and taxable capital income. The average capital income is, however, low among top earned income individuals: only about 10% of individuals included in the analysis have capital income exceeding EUR 10,000 annually (14% in the treated group and 7% in the control group). When examining broad income, most of the in-and-out fluctuation from the top income group is typically due to volatility in capital income.

Studying the top 1% of earners in a small country like Finland may pose challenges for in-depth behavioural analysis due to the lack of statistical power. Figure 2 shows the distribution of individuals by earned income level in 2012, and the number of individuals drops drastically for the treated group, with most observations falling between EUR 100,000 and EUR 200,000.

Figure 2: Distribution by earned income level in 2012



Note: Fig. 2 shows the distribution of 25-60y individuals by earned income level in 2012 for over EUR 75,000 income. Income levels are rounded to nearest EUR 10,000, and the last bin includes all individuals with annual earned income over EUR 400,000.

The analysis is restricted to individuals aged 25-60 years, excluding those who received any form of social security benefits[1] during the start or end year of the period. Thus 54,300 individuals were excluded so as to be able to study pure intensive margin tax incentives without confounding factors such as parental leave decisions (over 40% of exclusions), retirement decisions (20%) or health issues (20%). In addition, individuals earning over EUR 1 million are considered outliers and were removed from the analysis[2], although this restriction does not affect the estimates.

The primary interest of this paper lies in the behaviour of wage earners, hence, the self-employed are excluded from most specifications. The data does not explicitly indicate entrepreneurship status, but those whose socioeconomic status in the register data is entrepreneur, receive entrepreneurial income, or are identified as owners of non-listed companies are labelled as self-employed in the analysis.

The descriptive statistics in Table 2 provide details of the treated and control groups. The treated group consists of individuals whose annual taxable income before statutory deductions is over EUR 107,700 (over EUR 100,000 after statutory deductions), while the control group comprises individuals with annual taxable income of EUR 80,000 – 107,700 before statutory deductions. The division is based on the initial-year information, and with groups formed based on age, education and capital income as presented in the table. The share of self-employed individuals is quite large in both groups: 35% in the control

[1]The benefits include pension income, unemployment benefits, sickness allowances, social assistance, child home care allowance and partial care allowance, parental allowances, housing benefits and study grants.

[2]around 80 observations

group and 43% in the treated group. More than half of these are also owners of non-listed companies (21% and 27%). Individuals in the control group receive less capital income, although capital income is trivial for most individuals in both groups.

The individuals in the treated group are slightly older, more likely to be male, have children, and live in the capital city area more often than individuals in the control group. They also have an educational background in business, law or health more often and in Math, IT and Tech less often than in the control group. While some of these differences are statistically significant, they are not extremely large.

4 Conceptual Background and Empirical Method

4.1 Conceptual Background

The taxable income literature is usually based on an economic model that is a simple extension of the traditional labour supply model (for a concise presentation see e.g. Kleven & Schultz 2014). Economic theory suggests that the incentive to work diminishes when compensation or net-of-tax pay decreases. However, quantifying this magnitude is challenging, as work and effort decisions are influenced by numerous, often conflicting, motivations and opportunities. It can be argued that the elasticity of taxable income (ETI) is higher at the upper end of the income distribution, as high-income individuals are often more capable of utilising mechanisms such as income shifting, timing of compensation and capital gains realisations to mitigate tax burdens, as discussed e.g. by Saez, Slemrod, and Giertz (2012). They also may be in positions where they have greater flexibility in deciding their labour supply, whereas individuals in the middle of the income distribution typically work in structured jobs with limited possibilities to adjust taxable income, resulting in lower elasticity. At the lower end of the income distribution, elasticity may again be higher, e.g. due to the potentially greater ability to adjust working hours in part-time jobs.

The contribution of this paper is to enhance understanding of the behavioural response of high-income wage earners. By focusing on workers and excluding self-employed individuals, I try to minimise the effect of tax planning and tax avoidance. Previous studies have shown that the self-employed individuals' elasticity is strongly affected by income reclassification and other tax avoidance possibilities (Saez et al., 2012, Piketty et al 2014, Neisser 2018, Pirttilä & Selin 2011, Koivisto 2023, Kotakorpi & Matikka 2017, Harju & Matikka, 2016 etc.). These opportunities are, however, much less available to workers employed by others.

In the baseline analysis the dependent variable reflects two-year income differences between the tax years 2010 and 2012 (pre-reform period) and between 2012 and 2014 (reform period). We might expect, based on previous literature, the elasticity for high-

Table 2: Descriptive Statistics

Variable	Treated	Control	Total
Number of observations	38,199 (39.0%)	59,825 (61.0%)	98,024 (100.0%)
Earned income	167,839 (77,831)	98,354 (8,751)	125,431 (59,629)
Capital income	17,912 (210,036)	6,365 (60,516)	10,864 (139,491)
Self-employed	0.432 (0.495)	0.350 (0.477)	0.382 (0.486)
Owner of unlisted company	0.273 (0.446)	0.207 (0.405)	0.233 (0.422)
Job changer	0.223 (0.416)	0.207 (0.405)	0.213 (0.409)
Flexible	0.269 (0.444)	0.226 (0.418)	0.243 (0.429)
Age group			
Age 25–43	11,783 (30.8%)	21,871 (36.6%)	33,654 (34.3%)
Age 44–50	13,888 (36.4%)	19,853 (33.2%)	33,741 (34.4%)
Age 51–60	12,528 (32.8%)	18,101 (30.3%)	30,629 (31.2%)
Gender			
Male	30,829 (80.7%)	44,441 (74.3%)	75,270 (76.8%)
Female	7,370 (19.3%)	15,384 (25.7%)	22,754 (23.2%)
Children			
No	11,219 (29.4%)	19,485 (32.6%)	30,704 (31.3%)
Yes	26,980 (70.6%)	40,340 (67.4%)	67,320 (68.7%)
Educational level			
Masters/PhD	24,934 (65.3%)	32,713 (54.7%)	57,647 (58.8%)
Tertiary/Bachelor	7,909 (20.7%)	16,809 (28.1%)	24,718 (25.2%)
Secondary Educ.	3,941 (10.3%)	7,716 (12.9%)	11,657 (11.9%)
Not Classified	1,415 (3.7%)	2,587 (4.3%)	4,002 (4.1%)
Educational field			
Human and Society	5,697 (14.9%)	9,933 (16.6%)	15,630 (15.9%)
Business and law	11,271 (29.5%)	14,363 (24.0%)	25,634 (26.2%)
Math, IT and Tech	12,451 (32.6%)	22,873 (38.2%)	35,324 (36.0%)
Health	7,174 (18.8%)	9,741 (16.3%)	16,915 (17.3%)
Other fields	1,606 (4.2%)	2,915 (4.9%)	4,521 (4.6%)
Capital income			
$ci < 750$	21,772 (57.0%)	41,943 (70.1%)	63,715 (65.0%)
750–6,000	8,564 (22.4%)	11,041 (18.5%)	19,605 (20.0%)
6,000–10,300	2,411 (6.3%)	2,490 (4.2%)	4,901 (5.0%)
10,300–24,200	2,527 (6.6%)	2,374 (4.0%)	4,901 (5.0%)
$ci > 24,200$	2,925 (7.7%)	1,977 (3.3%)	4,902 (5.0%)
Municipality type			
Capital area	18,990 (49.7%)	25,426 (42.5%)	44,416 (45.3%)
Other urban municipalities	15,018 (39.3%)	25,749 (43.0%)	40,767 (41.6%)
Semi-urban municipalities	2,760 (7.2%)	5,379 (9.0%)	8,139 (8.3%)
Rural municipalities	1,431 (3.7%)	3,271 (5.5%)	4,702 (4.8%)

Note: Table 2 shows the descriptive statistics for the data used in the analysis. The data consists of full population data for two years (2010 and 2012) for individuals whose earned income exceeds EUR 80,000, are 25-60 years old, have not received any benefits and are included in the data for t+2 years. The treated group has taxable income before statutory deductions over EUR 107,700, and the control group has income between EUR 80,000 – EUR 107,700.

income employees to exceed the aggregate ETI estimates in Finland (around 0.2 (Matikka 2018, Jäntti et al. 2015)), as top earners may be financially more flexible and have more adaptable participation in the labour market. Also, we can not fully rule out greater tax planning responses, even when the self-employed are excluded. We would nevertheless expect the elasticity to remain rather small due to mostly fixed working hours and adjustment costs related to job search (Chetty et al. 2011).

The ultimate question for tax designers is not how much workers react to separate and often small policy changes in the short run, but what kind of behavioural effects taxation and the tax structure have in the long run. Microeconometric estimates based on small changes in taxation might underestimate the actual long-run response due to labour market frictions and relatively high adjustment costs (Chetty et al.2011), and to support this Kleven and Schultz (2014) have been able to graphically show that the size of the elasticity estimate is affected by the size of the tax reform, e.g. smaller changes in taxes producing smaller elasticity estimates.

Recent economic analysis has attempted to better address this question by incorporating dynamic returns to effort into a microeconometric approach. According to Kleven et al. (2025), examining workers at discrete job events, e.g. when changing jobs, allows for the identification of true long-run elasticities, since at these points realised earnings and latent earnings (effort) coincide. Following this idea, I estimate the elasticities separately for workers who changed jobs within the two-year period. It should be noted, however, that in this paper, job changer only refers to individuals who changed employer during the observed period, while in the Kleven et al. (2025) analysis the definition of job switcher includes both firm and occupation switches.

If we wish to interpret the elasticity estimate for job changers as an indication of a general long-run elasticity, the switching probability should be equal for all individuals. While selection into switching cannot be directly observed in the data, comparing observable characteristics shows that changers are very similar to job stayers. However, it is difficult to determine how ability and other personal features, such as responsiveness to income taxes and risk-taking, compare between groups. Therefore, caution is advised when interpreting the higher elasticity for changers found in this paper as an average long-run elasticity for high-income earners. Nevertheless, since the elasticities estimated for groups with fewer labour market frictions are clearly higher than the average elasticity for top earners, this can be seen as evidence that the long-term true elasticity may indeed be higher than implied by the average point estimates.

4.2 Identification

With a nonlinear tax system, marginal tax rates are endogenous to the choice of taxable income. A common approach to address this problem is to use mechanical tax changes

caused by tax legislation as an instrument for actual changes in marginal tax rates (see e.g. Gruber & Saez, 2002), and the same method is used here. However, this instrumentation may not fully resolve the endogeneity problem if there is a correlation between pre-reform income and the error term, particularly when the reform is targeted at the high end of the income distribution. The two channels by which this occurs that are often discussed in the literature are skill-biased demand shocks and mean reversion. Top earners may face different kinds of non-tax-related income trends that are difficult to control for, and volatile income components included in pre-reform income may often result in lower income in the post-reform period, causing mean reversion (e.g. Kleven & Schultz 2014).

To address this issue, I use a differences-in-differences approach with a visualised identification assumption introduced by Jacobsen and Søgaard (2022). As the parallel income trends assumption needed in the standard DID estimation strategy cannot reliably be verified, the identifying assumption is that trend differentials are constant across the income distribution over time. Earned income is assumed to develop similarly within each income level (income bin) across time periods, but this does not need to be the case across the income distribution. For each income bin, I compare the two-year change in income in the pre-reform period to the two-year change in income in the reform period. Without the reform, these changes are assumed to be similar for each income level. In the analysis, I show that the key identification assumption does hold (see Figure 3).

The treated group consists of individuals whose annual taxable income before statutory deductions is over EUR 107,700 (over EUR 100,000 after statutory deductions), while the control group comprises individuals with annual taxable income between EUR 80,000 and EUR 107,700 before statutory deductions. This grouping is convenient, as all the individuals in the analysis were in the same tax bracket before the 2013 reform. Therefore, the only change in 2013 taxation between the treatment and control groups was the introduction of a new tax bracket for the treated group.

To allow taxpayers time to adjust their behaviour, I studied two-year periods before and after the reform. Although a longer time period could be justified[3], I use two-year periods where the only changes made to tax parameters were index (inflation) adjustments. I compare the average changes in income within the same income level between the pre-reform period and the reform period. The log change in earned income from 2010 to 2012 is calculated for the pre-reform period, where the tax system was stable, and the log change in earned income from 2012 to 2014 is calculated for the reform period, where the central government tax reform changed tax rates differently for different groups in the beginning of 2013.

For the comparison of trend differentials, individuals with annual earnings over EUR

[3]Indeed, Kleven and Schultz (2014) show graphically that a three-year interval would allow enough time for behavioural adjustments to capture long-term effects, without losing too much variation and power.

80,000 are divided into 15 equally sized bins based on the initial income level in 2010 or 2012. The equation is

$$\Delta \ln z_{it} = \beta_0^t + \beta_1^{'t} D_{it-2}^{inc} + v_{it}, \tag{1}$$

where the dependent variable is the two-year change in income, and $D_{(it-2)}^{inc}$ is the dummy for 15 initial income groups. The regression is run separately for both periods.

I study a reform where the taxation is raised, i.e., the marginal net-of-tax rate is lowered for top income earners. Following standard theory, if taxpayers respond to the reform, we should be able to see a behavioural effect such that the treated individuals' income is lower after the reform.

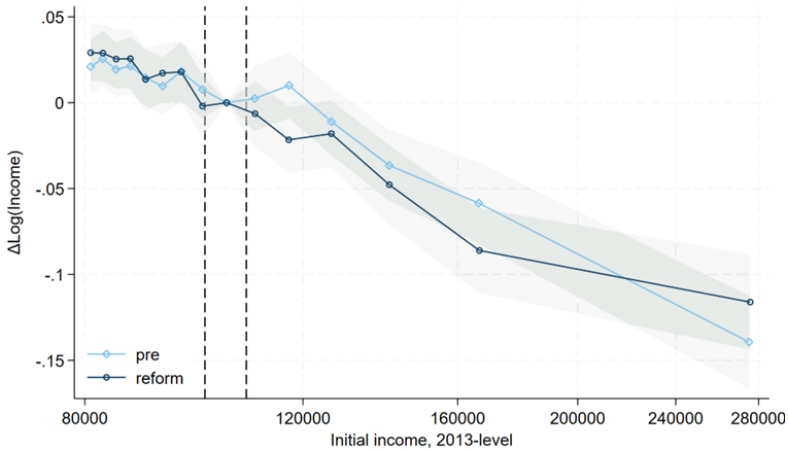
The mean reversion bias can be observed graphically in Figure 3, as there is a negative relationship between earnings growth and baseline income level. The figure shows that the log income change is rather similar for both periods in the validation region (income EUR 80,000 – 107,700), supporting the identifying assumption. The trends between periods differ around income levels EUR 120,000 – 160,000 in the identification (treatment) region. Due to the small number of the highest earners, the highest bin includes all incomes from EUR 188,000 to 1,000,000 and shows contrary change with large confidence intervals. While the trends differ visibly in the identification region, the difference is not statistically significant. The elasticity estimation using average municipal tax rates in determining individual marginal tax rates yields non-significant estimates, but the estimates are significant when precise municipal-level marginal tax rates are applied, as discussed in more detail below.

The variation in the marginal net-of-tax rates caused by changes in the municipal flat tax rates is shown in Figure A.1 in the appendix. Even though the marginal tax rate changes are on average driven by changes in central government tax parameters, municipalities can independently decide on the municipal tax rate[4]. To account for the local economic situation in municipalities potentially affecting income trends differently across municipalities in the two periods, municipality controls are added in all the specifications. Individual marginal net-of-tax rates are calculated using actual municipal tax rates instead of the average national municipal tax rate. The average change in the municipal tax rate was positive during the observed periods: 0.25 percentage points in 2010-2012 and 0.58 percentage points in 2012-2014. This means that part of the identification also comes from the validation region. However, the aggregate response in the validation region is close to zero and non-significant.

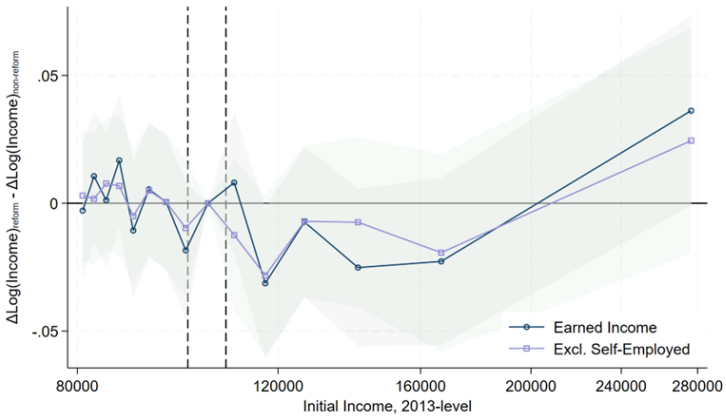
[4]Municipal tax rates were raised in 170 and lowered in 11 municipalities between 2010-2012 and raised in 295 and lowered in 8 municipalities between 2012-2014. There were 320 municipalities in Finland in 2013.

Figure 3: Identification

Panel A. Change in earned taxable income



Panel B. Estimated two-year changes in income trend differentials



Note: Panel A shows the change in earned labour income (log) in 15 income bins relative to the EUR 108,000 bin in 2010-2012 (pre-reform period) and 2012-2014 (reform period), excluding initial-year self-employed. Panel B shows the differences in average log changes in income between periods for the same income bins. The lavender line shows the trend differential for individuals excluding initial-year self-employed, as in Panel A, whereas the blue line shows the trend differential for all individuals. The vertical lines mark the income levels of EUR 100,000 and 107,700 in both figures. Municipality controls are added and 1% tails for the observed $\triangle lnz$ are winsorized. The gray area shows the 95% confidence bound. While the graph does not show any significant difference between the periods in the identification area, the elasticity estimates are significant when municipality-specific tax rates are used in the estimation.

There is considerable variation in the two-year changes in marginal net-of-tax rates caused by municipal tax rates, and we can observe some regional differences. In the capital city area, the simulated two-year changes in log marginal net-of-tax rates for the control group, who only faced municipal tax changes, went from a pre-period average of -0.012 to a reform period average of -0.008, while in the other urban areas the corresponding changes were -0.004 and -0.021. This means that the difference in log marginal net-of-tax rate changes between periods for the treated group was also larger in other urban areas (-0.008 vs. -0.061) than in the capital city area (-0.014 vs. -0.048).

The graph in Panel A in Figure 3 looks similar to Figure A.2, which shows the pure

two-year log change in income for both periods, with added controls for municipality, gender, age, capital income, education level and field of education. This would indicate that the changes in income growth are not affected by these observable characteristics available for the analysis.

4.3 Estimation

To estimate the earned income elasticity, I regress log change in income on log changes in marginal tax rates:

$$\Delta \ln z_{it} = \gamma_0 + \gamma_1' D^{inc}_{(it-2)} + \gamma_2 D^{post}_{it} + \gamma_3 \Delta \ln \tau_{it} + v_{it}, \tag{2}$$

where z_{it} is taxable income, D^{inc}_{it-2} is a vector of initial income bin dummies (income rounded to nearest EUR 1,000), D^{post}_{it} is a period dummy and $\tau_{it} = 1 - T_t'(z_{it}, x_{it})$ is the individual marginal net-of-tax rate. Following the common practise in literature, the change in the actual marginal net-of-tax rate $\triangle \ln \tau_{(it)}$ is instrumented by the simulated (predicted) change in the marginal net-of-tax rate $\triangle \ln \tau^p_{(it)}$ for the initial income level. The simulated marginal net-of-tax rate depicts changes in tax policy in the absence of changes in income.[5] The 1% tails for the observed $\triangle \ln z_{it}$ are winsorized in all the estimates.

5 Results

5.1 Main results

The reduced-form elasticity estimates based on equation (2) are shown in Table 3. The elasticity for all high-earning individuals is estimated to be 0.46. To obtain the main estimate of interest in this paper, the ETI for wage earners, initial-year self-employed individuals are excluded from the analysis. The estimate for the elasticity for wage earners is 0.50 and statistically significant at the 1% level. If I also exclude those who changed status from worker to self-employed during the two-year estimation period, the elasticity estimate decreases to 0.38.

[5] As shown in Figure A.1, the simulated changes in the marginal net-of-tax rates used as an instrument are not zero in the control group. The average marginal net-of-tax rate changes exhibit some discontinuities at several points, despite central government tax rates remaining unchanged aside from the treatment. This is caused by discrepancies between the consumer price index used to transform income to the 2013 level in this study and the (forecast) index used to update the legislative tax parameters before the start of each year in question. There are also some minor changes in tax credits over the years, but it is very unlikely that taxpayers were aware of these jumps, as they are not easily observed in reality and were not widely reported in the media. The 2013 reform, targeted at high-earners, was reported in the media at the time and was likely to have been even more salient than the changes in municipal tax rates.

Elasticities are often found to be higher for the self-employed, but here the opposite seems to be the case. It is likely that the self-employed accounted for the high marginal tax rates for earned income and therefore did not react to an additional tax increase of 2 percentage points.[6] The first-stage estimates were significant and at around 0.6-0.7 level in all the specifications (see Table A.1).

Table 3: Estimates of elasticity of taxable income with respect to marginal net-of-tax rate

	All	Wage earners	Wage earners
	(1)	(2)	(3)
Elasticity estimate	0.458**	0.500**	0.377*
	(0.154)	(0.164)	(0.151)
Excl. self-employed		X	X
Excl. self-employed to-be			X
Municipality controls	X	X	X
Observations	98 024	60 599	54 555
Estimation period	2 years	2 years	2 years

Note: This table reports earnings elasticity estimates with respect to marginal net-of-tax rate based on equation (2). Elasticities are estimated for 25-60-year-old individuals with no social benefits during the period. Column (1) shows the elasticity estimate for all the data, the estimate in column (2) the initial-year self-employed are excluded, and in column (3) both the initial-year self-employed and those who become self-employed during the period analysed are excluded. The estimation periods are 2010-2012 for the pre-reform period and 2012-2014 for the post-reform period. The 1% tails for the observed $\triangle \ln z$ are winsorized. Robust standard errors are given in parentheses, * p<0.05, ** p<0.01, *** p<0.001.

5.2 Heterogeneity

As observed in the trend differentials in Figure 3, there is heterogeneity between income groups. We can explore heterogeneity across the income distribution by forming five income groups and adding interactions for the log change in the marginal net-of-tax rate (treatment) and each of the income groups.

The second-stage equation is

$$\begin{aligned}\Delta \ln z_{it} = \gamma_0 + \gamma_1' D^{inc}_{(it-2)} + \gamma_2 D^{post}_{it} + M_i + \gamma_3 \Delta \ln \tau_{it} \\ + \sum_k \delta_k (\mathbb{1}\{group = k\} * \Delta \ln \tau_{it}) + v_{it},\end{aligned} \tag{3}$$

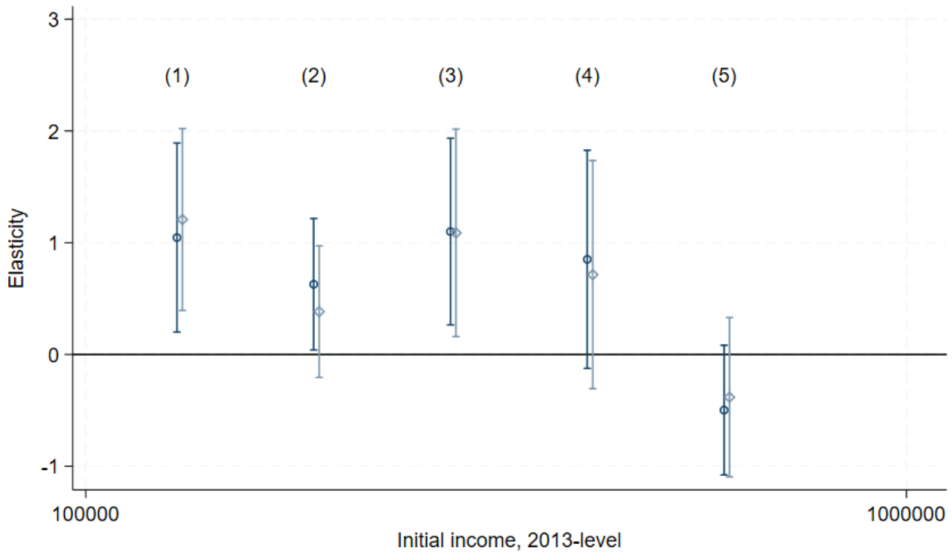
where z_{it} is taxable income as before, D^{inc}_{it-2} a vector of initial income bin dummies

[6]The self-employed may have optimised their taxation between earned income and capital income already before the reform, and this reform may have had only a minor effect on their incentives to work or shift income.

(income rounded to EUR 1,000), D_{it}^{post} a year dummy and M_i municipality fixed effects. The change in the marginal net-of-tax rate τ_{it} is included here both by itself and interacted with each of the five initial-income group dummies. All treatment terms are instrumented with the corresponding predicted changes in the net-of-tax rate.

The elasticities for different income groups are shown by δ_k, (k $\in$ 1,..,5) in equation (3). The income group elasticities for both all individuals as well as wage earners are shown in Figure 4. The estimates are quite high and statistically significant close to the treatment threshold and around EUR 150,000 level, but turn to negative for the highest income group.

Figure 4: Elasticity estimates for different income levels



Note: Fig. 4 shows elasticity estimates based on equation (3) for different income levels. The income groups of the estimates are (1) EUR 108,000–125,000, (2) EUR 125,000–145,000, (3) EUR 145,000–165,000, (4) EUR 165,000–185,000 and (5) EUR 185,000–1,000,000. The dark blue marks the estimates using all the data, and the light blue shows the estimates for wage earners where initial-year self-employed are excluded. Municipality controls are added and 1% tails for the observed $\triangle \ln z$ are winsorized in both specifications. The confidence bounds of 95% are based on robust standard errors.

Behavioural responses to taxation may materialise in several ways. A labour supply response would mean that individuals change their work effort and/or hours in response to the tax change. Individuals may also shift income between tax bases in order to minimise their tax burden. As shown by Neisser (2018), many tax systems offer plenty of deductions to legally avoid taxes, in addition to real responses (e.g. changes in labour supply). It is also widely known (see discussion e.g. Saez, Slemrod, and Giertz 2012, Piketty et al. 2014 and Jacobsen and Søgaard 2022) that top-income earners react readily to taxation using the tax avoidance possibilities available. Even tax avoidance is one channel of response, but this is very difficult to detect in this kind of study.

As seen in Table 3, part of the wage earners' behavioural response to the tax change comes from individuals who become self-employed during the two years after the reform

came into force. Even if I have tried to minimise the effect of income shifting by studying wage earners separately, it is possible that there is still some room for tax planning that remains unobserved. The strong response of the employees who decided to become self-employed during the period may indicate this kind of behaviour. This was even encouraged, as the taxation of dividends from non-listed companies was changed in 2014 to allow more lightly taxed dividends, and the new upper threshold for relieved dividends was raised to EUR 150,000. In the new system, the amount of tax relief depends on the net asset value of the firm, creating a strong incentive to leave income in the firm. Excluding all individuals receiving dividends from non-listed companies during the period from the analysis does not change the elasticity estimate, but it is possible that the newly self-employed individuals postponed their income to accumulate the net asset value of their firm. In addition, there may be some other channels of income shifting for non-self-employed individuals, e.g. via family relationships within the treated group.

To see if wage earners show any response to the reform on other income margins, I studied the effect of the reform on several income items. I looked at deductions and less heavily taxed items inside the scope of earned income, such as fringe benefits, travel expense deductions, options based on employment relationships, other earned income, and the deduction for work-related expenses. A change in these might indicate some reform-inspired tax-planning. I regressed the change in the item in question on the change in the marginal net-of-tax rate[7], for those who reported the item, and the results are shown in Appendix in Table A.3. No behavioural response was found in any of these, nor any change in the probability of reporting such items. However, this is not very surprising as the room for manoeuvre for these items is very limited in tax legislation, especially when excluding self-employed individuals. In addition, I also conducted the main analysis with earned income *before* individually made deductions as the dependent variable, instead of taxable income, and the results were very similar to those presented in this paper.

One way to detect income-shifting responses is to study the elasticity of broad income. Broad income includes both labour and capital taxable income, and the analysis is done for the same groups of individuals as in the main specifications. If we compare Figure A.3 with Figure 3, we can see that the figures are not vastly different, and the differing trends in the identification region also prevail when studying broad income. This is not surprising, however, as the average capital income received by the top income earners is very low: as seen in the Table 2 only 10% of individuals included in the analysis have capital income over EUR 10,300 annually (14% in the treated group and 7% in the control

[7] I use the following equation to estimate the reform effect on income items

$$\Delta \ln m_{it} = \gamma_0 + \gamma_1' D^{inc}_{(it-2)} + \gamma_2 D^{post}_{it} + \gamma_3 \Delta \ln \tau_{it} + M_i + v_{it},$$

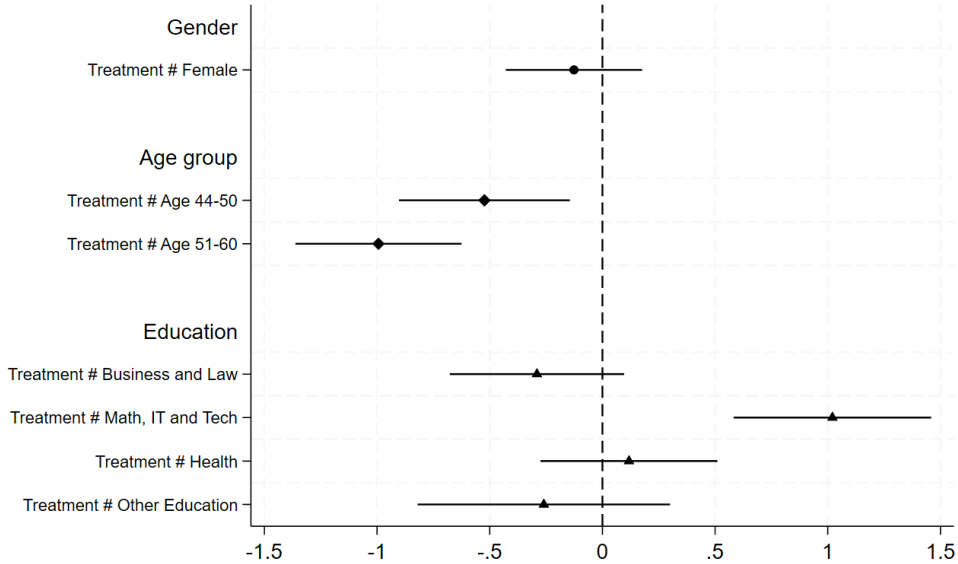
where m_{it} is the income item in question, D^{inc}_{it-2} is a vector of initial income bin dummies, D^{post}_{it} is the period dummy, M_i the municipality control and τ_{it} is the individual marginal net-of-tax rate, instrumented by the predicted change in the marginal net-of-tax rate.

group).

I estimated the elasticity of reported broad income with respect to the marginal net-of-tax rate on earned income. The elasticity estimate found is 0.43 for all the data and 0.37 for wage earners in Table A.2, and both estimates are significant at the 95% level. This would indicate that the elasticity of taxable income is not significantly driven by income shifting.

Next, I studied heterogeneity for different individual characteristics, such as gender, age and education. The combined results from three separate regressions are shown in Figure 5. I estimated the interactions for the log change in the marginal net-of-tax rate (treatment) and gender, age groups (25-43, 44-50, and 51-60 years), and the educational background groups (Human and Society, Business and Law, Math, IT and Tech, Health, and Other Education)[8].

Figure 5: Gender, age and educational heterogeneity



Note: Fig. 5 shows interactions regressed separately for gender, age group and educational background, excluding initial-year self-employed. The baseline estimates are Male, Age group 25-43 years old and education in Human and Society. Municipality controls are added and 1% tails for the observed $\triangle \ln z$ are winsorized in both specifications. The confidence bounds of 95% are based on robust standard errors.

The elasticity estimate is slightly smaller for women compared to men, but the difference is not significant. An age group examination shows lower estimates for older age groups, which means that the average elasticity is driven by the baseline estimate of age

[8]The heterogeneity estimation is regressed separately using

$$\Delta \ln z_{it} = \gamma_0 + \gamma_1' D^{inc}_{(it-2)} + \gamma_2 D^{post}_{it} + \gamma_3 \Delta \ln \tau_{it} + \gamma_4 D^{b}_{(it-2)} + \gamma_5 \Delta \ln \tau_{it} * D^{b}_{(it-2)} + M_i + v_{it},$$

where $D^{b}_{(it-2)}$ is the dummy variable for gender, age groups, or educational background groups. As before, z_{it} is taxable income, D^{inc}_{it-2} is a vector of initial income bin dummies, D^{post}_{it} is the period dummy, M_i the municipality control and τ_{it} is the individual marginal net-of-tax rate, instrumented by the predicted change in the marginal net-of-tax rate.

group for the 25-43 years old. Educational background has also a strong effect: with education in Math, IT and Tech the elasticity is clearly larger than in the baseline estimate of Human and Society.

In addition, regional heterogeneity analysis shows that the elasticity is significantly lower in the capital city area and higher in other urban areas. One possible explanation may relate to the higher average tightening of municipal taxation in the other urban areas in the observed periods, as mentioned in Section 4.2. This could explain at least part of the regional variation in the elasticity estimates, if we assume that observed elasticity increases with the size of the tax variation from which the estimate is identified, as suggested by Chetty et al. (2011) and Kleven and Schultz (2014).

5.3 Minimising the effect of labour market frictions: job changers and flexible workers

As discussed in the beginning of Section 4, quasi-experimental studies of earnings responses to tax reforms using a short time window are likely to underestimate long-run responses. As shown in a theoretical model by Kleven et al. (2025), the true long-run elasticities can be revealed by using a setting where the returns to effort are dynamic and mediated by job switches. The latent compensation for effort would be realised when an employee changes job or position. The elasticity of taxable income estimated from job changers can be interpreted as the structural elasticity only if there is no selection to job changers. For data availability reasons, I define the job changers as persons who changed their employer during the two-year period analysed. This differs from the Kleven et al. (2025) definition, as they were able to include both firm and occupation switches in their analysis. In Table 4, I estimated the elasticity separately for job changers in column (1), but unlike Kleven et al. (2025), I do not find a clear indication of higher elasticity for job changers, and possibly due to a lack of power the elasticity is not significant. However, when the interaction for the treatment and job changers dummy is included in the main specification in column (2), the effect for changers is large and highly significant.

Comparing observable characteristics for job stayers and changers in Table A.4, I see that other than being a little younger, job changers are quite similar to job stayers. While the probability of changing employer is somewhat higher in the treated group (21.5 for the treated and 20.0 for the control group, excluding self-employed), the probability was not affected by the reform.

In addition, I extended the analysis to those employees who had several employers simultaneously during the period studied. The results of a separate regression for these flexible workers are shown in Table 4, columns (3)-(4). While their elasticity estimate cannot be generalised to the whole top-income population, it does give us some indication of a higher elasticity when respondents are less restricted by labour market frictions.

Table 4: Job changers and flexible workers

	Job changers	Wage earners	Flexible workers	Flexible workers
	(1)	(2)	(3)	(4)
Elasticity estimate	0.287	0.060	1.974**	1.453**
	(0.538)	(0.147)	(0.614)	(0.538)
Excl. self-employed	X	X	X	X
Excl. self-employed to-be	X	X		X
Field of education controls	X	X		X
Level of education control	X	X		X
Control for children	X	X		X
Control for gender	X	X		X
Control for age group	X	X		X
Control for capital income group	X	X		X
Municipality controls	X	X	X	X
Job changer		-0.111***		
Treatment x job changer		1.679***		
		(0.273)		
Observations	10,426	54,555	11,235	9,482
Estimation period	2 years	2 years	2 years	2 years

Note: This table reports earnings elasticity estimates with respect to the marginal net-of-tax rate based on equation (2). The first column is estimated separately for those who changed jobs during periods, with multiple controls for observables. Column (2) shows the elasticity estimate for all wage earners when interaction for the treatment and job changers dummy is included. In column (3) the regression is run only for workers who had multiple employers simultaneously during periods. In column (4) multiple controls for observables are added to the column (3) estimation. The estimation periods are 2010-2012 for the pre-reform period and 2012-2014 for the post-reform period. 1% tails for the observed $\triangle \ln z$ are winsorized from the full data. Robust standard errors are provided in parentheses, * p<0.05, ** p<0.01, *** p<0.001.

Employees who worked for several employers during the period studied are likely to deviate from an average employee by their personal features, and some of these differences can also be seen in the data. The ability to work flexibly may depend on the profession, and comparing the characteristics for the flexible and non-flexible workers indeed shows considerable differences in the field of education, as well as some differences in gender, age group, level of education and residential area (descriptive statistics in Table A.5). Controlling for the field of education affects the point estimate, but controlling for other observables does not really change the estimate.

The ETI captures different kinds of behavioural responses to taxation. By excluding self-employed individuals, the analysis minimises the scope for tax avoidance, thereby approximating a "real" response, such as adjustments in labour supply. However, even wage earners may have ways to minimise their tax burden. Excluding also individuals who became self-employed during the observation period — thus acquiring new incentives to shift income or retain it within the firm — reduces the elasticity to 0.377. It is therefore reasonable to conclude that the true real-response elasticity lies below this value.

The elasticity of taxable income estimated in this paper is very local, and it cannot be used directly to evaluate the effect for public funds even for all high-income earners. Above all, the analysis excludes those who receive benefits, most of all pensioners who typically have zero elasticity of taxable income. On the other hand, it is possible for the (high) marginal tax rate to have some effect on occupational choices, e.g. decisions about family leave of absence or retirement. Excluding extensive margin effects from the analysis may cause downward bias to the ETI presented in this paper.

Finally, the findings for job changers and flexible workers provide additional insight into the sources of responsiveness. The estimated response is considerably larger when labour-market frictions are limited, as expected. Nevertheless, interpreting these estimates as structural elasticities would require stronger evidence that the results are not driven by selection effects.

5.4 Robustness and validity

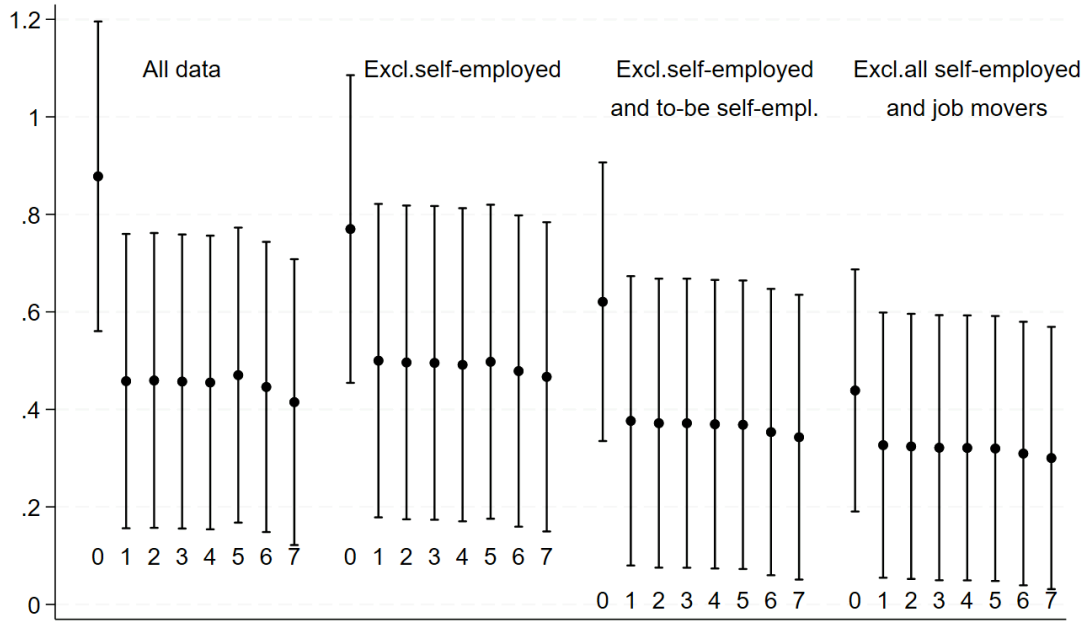
The validity of the results lies in the assumption that earned income would develop in a similar way for the control group and the treatment group. I added a wide set of controls into the estimation to find support for the validating assumption. I also examined a placebo setup to find out how income developed in other income groups in the same time periods. Another common placebo examination, with different time periods, is not feasible here, as the tax parameters for the upper end of the income distribution have not stayed stable long enough, and the reform took place between the 2008-2009 financial crisis and the Covid-19 pandemic in 2020. In addition, I examined whether there were any changes in the group composition caused by the tax reform.

Controlling for observables

To see how possible heterogeneity between groups might affect the results, I added controls for municipalities, gender, age, capital income, education level and the field of education. Apart from the control for the municipality of residence, the controls do not significantly affect the estimates. Figure 6 shows ETI estimates for the four main groups of interest: 1. all observations, 2. excluding self-employed, 3. excluding self-employed and those who changed to self-employment during the two-year period and 4. excluding job changers as well as self-employed and those who became self-employed during the period.

The first estimate for each group is the baseline estimate, and then I cumulatively added the other controls, starting with the municipality controls. If the controls were added separately to the municipality controls, instead of cumulatively, the graph would look the same.

Figure 6: Cumulative controls on the ETI estimate



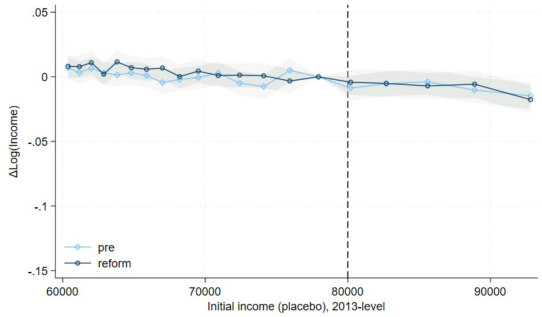
Note: Fig. 6 shows elasticity estimates for four specifications based on equation (2) with cumulatively added controls. The first specification is estimated for all data and the second excluding initial-year self-employed. The third specification excludes both self-employed and those who changed status from wage earner to self-employed during period, and in the fourth the job changers are also excluded. The first estimate (0) in all specifications is without controls and the following controls are then added cumulatively: (1) municipality control, (2) gender control, (3) age group control, (4) control for children, (5) capital income group control, (6) education level control and (7) a control for the field of education. 1% tails for observed $\triangle \ln z$ are winsorized in all specifications and the 95% confidence intervals are based on robust standard errors.

Placebo income groups

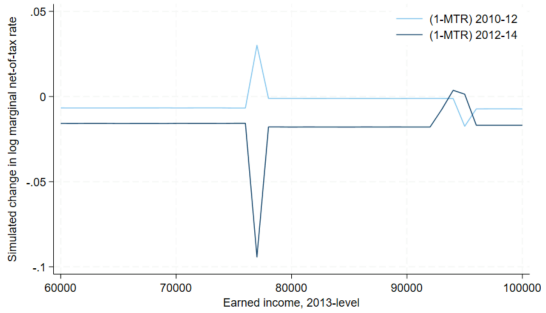
The validating assumption is difficult to prove, but one way to try to assess the credibility of our identifying assumption is to look at what happened in other income groups during the same period. Individuals with income EUR 80,000 - 95,000 are now the placebo treatment group, and income group EUR 60,000 - 80,000 is a placebo control group. As can be seen in Figure 7, there are no significant differences in logarithmic income changes between periods in the identifying region. Using as before equation (2) and simulated log changes in marginal net-of-tax rates as an instrument, I do not find any significant non-zero elasticities.

Figure 7: Placebo income level

Panel A. Change in taxable earned income



Panel B. Two-year change in average net-of-tax rate



Note: Panel A shows the change in earned income (log) in 20 income bins in 2010-2012 (pre-reform period) and 2012-2014 (reform period), excluding initial-year self-employed and those who became self-employed during period. The vertical line demonstrates the placebo treatment threshold of EUR 80,000 income. Municipality controls are added and 1% tails for observed $\triangle \ln z$ are winsorized. The gray area shows the 95% confidence bound. Panel B shows the real two-year change in the average marginal net-of-tax rate (1-MTR) in 2010-2012 and 2012-2014.

Group composition

Marginal tax rates depend on the municipality of residence, so people can affect their taxation by their choice of home municipality. The municipal tax rates differ substantially, varying between 16.25% and 22% in 2013. Also, the reason for higher tax rates is not always a higher service level aspiration, but often the unequal financial situation between municipalities caused by e.g. different population structure. To make sure that the group composition was not affected by the 2013 central government tax reform, I regressed separately various control variables on the treatment, namely age, gender, in-country migration, being or becoming self-employed, being a flexible employee, changing employer, level of education, field of education and residential region (see Table A.6). Apart from the field of education, the estimates for treatment and year interaction were insignificant in all cases.

5.5 Tax reform in 2016

After the 2013 reform, the tax parameters for top-income individuals were changed again in 2015 and in 2016, when the income threshold for the highest bracket was lowered first from EUR 100,000 to EUR 90,000 and then to EUR 72,300 in 2016. The second-highest tax rate was thus abolished while the other rates stayed unchanged (see Table 1). The 2016 reform affected individuals earning EUR 79,000–97,600 before statutory deductions, and they faced a 2-pp raise in their marginal tax rate. As mentioned earlier, the actual real average change in net-of-tax rates in the reform period is, however, modest, due to high inflation adjustments made to the income thresholds (see Figure A.4).

The analysis is carried out as for the 2013 reform, the pre-reform period now being

2013-2015 and the reform period 2015-2017. To avoid confusion about the threshold, individuals with annual income over EUR 90,000 are excluded from the analysis. The treated group consists of individuals with annual income of EUR 79,000 – 90,000, and the control group of individuals with annual income of EUR 60,000 – 79,000.

The estimates in Table 5 for the elasticity of taxable income exploiting the 2016 reform are close to zero and not significant in all specifications. Using only a one-year response period with pre-reform period 2014-2015 and reform period 2015-2016, the real change in the simulated net-of-tax rates is larger, around 5.5%. However, the estimation results in the one-year estimation are similar to those for the two-year estimation: close to zero and highly insignificant.

Table 5: Estimates of ETI with respect to marginal net-of-tax rate using the 2016 reform

	All	Wage earner	Wage earner	All	Wage earner	Wage earner
	(0)	(1)	(2)	(3)	(4)	(5)
Estimate	-0.013	-0.037	-0.010	0.036	-0.011	0.005
	(0.057)	(0.051)	(0.052)	(0.057)	(0.052)	(0.053)
Excl. self-employed		X	X		X	X
Excl. self-employed to-be			X			X
Municipality controls	X	X	X	X	X	X
Observations	171,921	122,242	112,165	181,654	128,998	122,453
Estimation period	2 years	2 years	2 years	1 year	1 year	1 year

Note: This table reports earnings elasticity estimates with respect to the marginal net-of-tax rate based on equation (2). Elasticities are estimated for 25-60-year-old individuals with no social benefits during the periods, both all and excluding self-employed. For the two-year estimation the periods are 2013-2015 (pre-reform) and 2015-2017 (post-reform), and for the one-year estimation the periods are 2014-2015 and 2015-2016. 1% tails for observed $\triangle \ln z$ are winsorized. Robust standard errors are provided in parentheses, * p<0.05, ** p<0.01, *** p<0.001.

The absence of significant elasticity estimates for the 2016 tax reform, in contrast to the substantial effects observed following the 2013 reform, raises important questions. One plausible explanation may relate to heterogeneity in tax responsiveness across the income distribution. High-income earners, in particular, may exhibit a greater behavioural response to tax changes. This may be due not only to greater opportunities for income shifting and tax planning, but also to their financial flexibility and more adaptable participation in the labour market.

It is also possible that changes in marginal tax rates are more salient to taxpayers than alterations in income thresholds. Individuals may find it easier to comprehend the direct impact of marginal rate changes on their net-of-tax income. Furthermore, the 2013 reform may have attracted more extensive media coverage, thereby increasing public awareness and potentially influencing behavioural responses.

6 Conclusions

With the ever-growing literature on the elasticity of taxable income, it has become clear that elasticities derived in empirical microeconometric studies vary for many reasons, some of which are also studied in this paper. There is considerable variation in the elasticities depending on the income group, whether it is the whole population or a specific part of the income distribution. Opportunities for income shifting and tax evasion have a significant effect on elasticities, and labour market frictions affect different groups differently. Observed elasticity estimates may differ depending on the size of the tax variation from which the estimate is identified, and factors such as salience can have a marked impact on behaviour. Therefore, when estimating the policy effects of a tax policy change, it is important to acknowledge the population affected by the change and use appropriate elasticity of taxable income in the evaluation.

In this paper, the elasticity of taxable income is estimated for the top 1% of income earners using a tax reform in Finland in 2013. The set-up is rather clear, as the reform only introduced a new highest tax bracket, thus raising the marginal tax rate by 2 pp. The ETI for the top 1% of income earners is found to be 0.46 for all the data and 0.50 excluding self-employed individuals. However, it is clear that even though the assumption of constant trend differentials seems to hold in the validation region, it is always possible that the overall economic situation is reflected differently in the level of income growth for the top earners versus the control group. Another point to keep in mind is the difficulty in extracting the income shifting response from the labour supply effect, especially for high-income individuals. It is possible that some unobserved channel of income shifting or maybe even tax evasion remains.

The main results in this paper fall at the upper end of the elasticity of taxable income (ETI) estimates reported in the literature, but other high estimates have been documented as well (e.g. Gruber & Saez 2002, Weber 2014, Kleven et al. 2025). High elasticities are also found in empirical studies focusing on countries such as South Africa and Uruguay (Axelson et al. 2024, Giaccobasso et al. 2025), although it is uncertain how well these results compare to those found in developed countries. The average of the after-deductions elasticity in the meta-regression analysis by Neisser (2021) is 0.403, albeit with substantial variance across studies, and 0.287 for the before-deductions estimates. Given the salience of the reform and top earners being among the most responsive income groups, the elasticities of 0.46 for the whole study population and 0.50 for wage earners cannot be considered unusually high.

These results differ clearly from the elasticity of 0.16 reported by Miao et al. (2025) for the top 5% of income earners in Sweden, another Nordic country. Their elasticity estimate was driven by wage adjustments, and not by job switches, which is very different from the results in this paper. Behavioural differences between the top 1% and the

broader top 5% of the income distribution in the Swedish reform may account for this divergence. Evidence from the 2016 Finnish reform, discussed in Section 5.5, supports this interpretation: no statistically significant income response is observed among individuals in the top 2–4% of the distribution.

The question of the position in the Laffer curve, which describes the relationship between tax rate and tax revenue, often creates public interest. The optimal tax rate for top earners is typically determined by two parameters: the Pareto parameter of the income distribution and the elasticity of top earnings with respect to the tax rate (e.g. Piketty et al. 2014). If we look at the specific group of top earners studied in his paper, excluding self-employed individuals, and assume that there is no income-shifting possibility, we could use the simple equation of $t^{max} = 1/(1 + a * e)$. Using an elasticity of income of 0.5, the equation gives us a revenue-maximising top tax rate as low as 40%. If we assumed that there could still be some income-shifting activity reflected in the elasticity estimate, the change in economic activity is smaller and some of the lost tax revenue will likely be recovered through another tax base. With, e.g. labour supply elasticity of $e^1 = 0.4$ and tax avoidance elasticity of $e^2 = 0.1$, the t^{max} would be 50%, which is still lower than the highest marginal tax rate of 59% in Finland in 2025.[9] Therefore, it is likely that lowering the marginal tax rate for wage earners in a way that is comprehensible to taxpayers would increase tax revenue from this group of employees.

However, when considering policy implications, it is necessary to understand what kind of contribution top earners make to productivity and growth in the economy. The effect can be both positive and negative (Kleven 2025). These workers are often highly educated and may possess specialised knowledge and skills that boost innovation, benefiting the whole economy due to positive externalities. On the other hand, top earners may also have a negative effect on welfare, as they are sometimes blamed for rent-extraction, political influence, and a perniciously competitive work environment. Adding positive top income earner externalities into the equation would lower the optimal top tax rate, whereas negative externalities would raise it. Results from the latest research suggest these externalities are small but positive (Jacobsen et al. (2024)).

[9] I used a Pareto coefficient of $a = 3$ in the first equation and $a = 2.4$ when taking account the income shifting, both calculated from the data. The latter equation is $t^{max} = (1 + a * t * e^2)/(1 + a * e)$, where t=0.40 is the marginal tax rate of the alternative tax base and $e^2 = e - e^1$ the part of the ETI that is due to income shifting.

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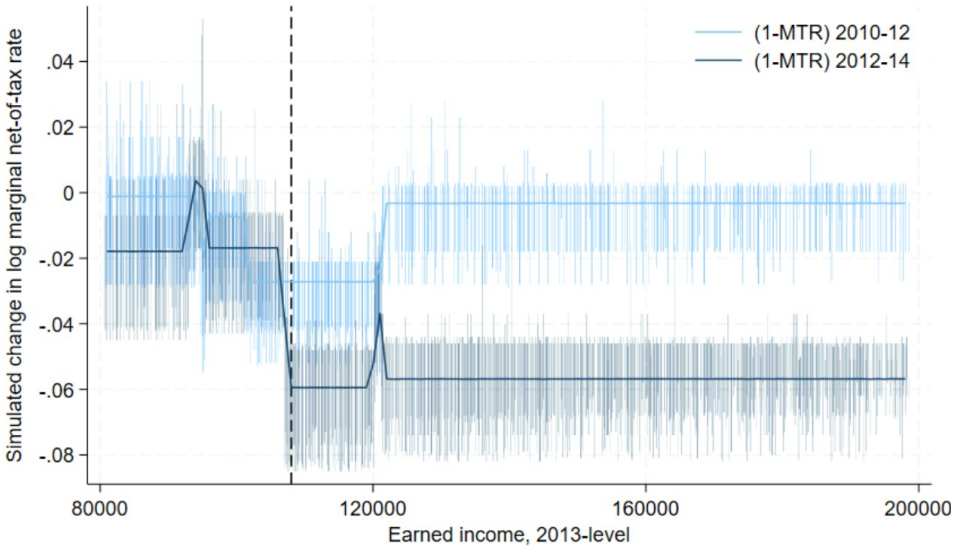
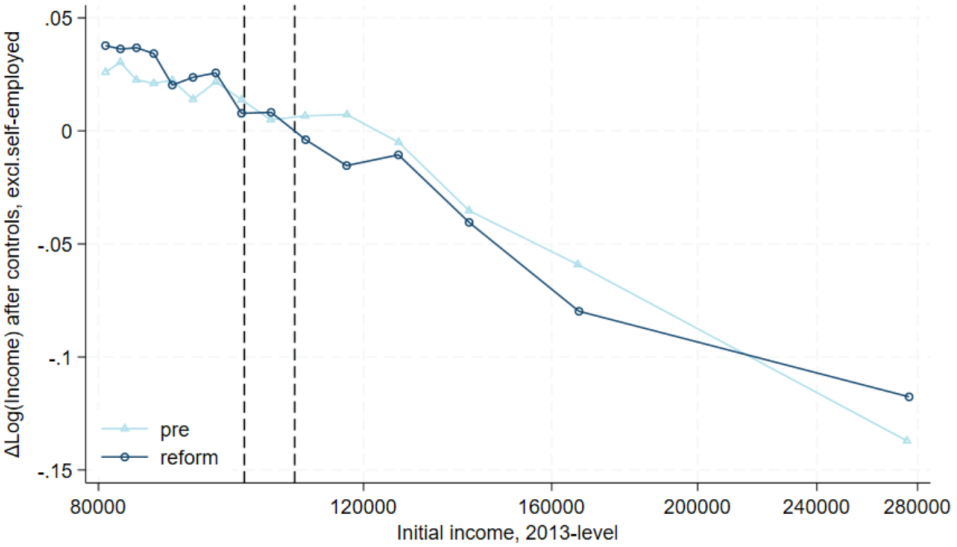
A Appendix

Figure A.1: Simulated real two-year changes in average marginal net-of-tax rate



Note: Fig. A.1 shows simulated real two-year change in average marginal net-of-tax rate (1-MTR) in periods 2010-2012 (pre) and 2012-2014 (post), income at 2013 level. The light spikes show extreme changes caused by varying two-year changes in municipal tax rates, and the vertical dashed line shows the EUR 107,700 income level.

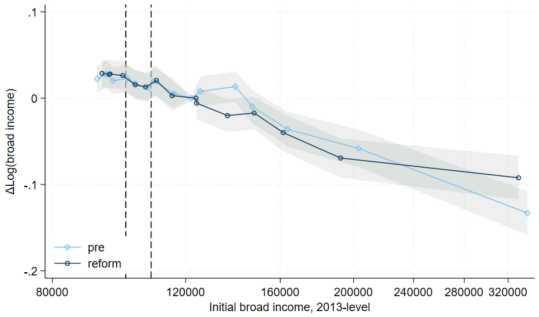
Figure A.2: Two-year log changes in earned income, with controls



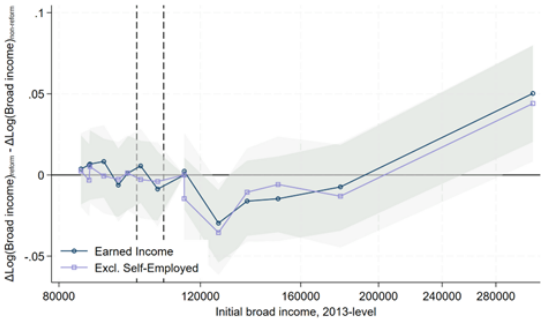
Note: Fig. A.2 shows the change in average log income between periods for 15 income bins, with controls for municipalities, gender, age, capital income group, education level and field of education. The vertical lines mark the income levels of EUR 100,000 and 107,700.

Figure A.3: Broad income identification

Panel A. Change in the broad income



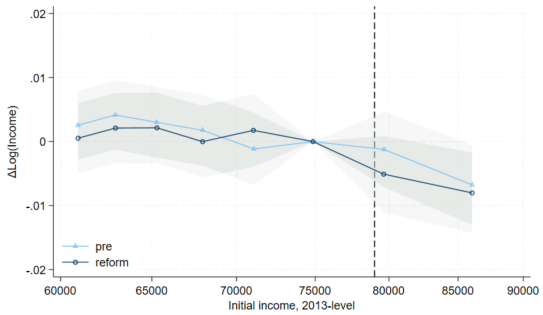
Panel B. Changes in income trend differentials



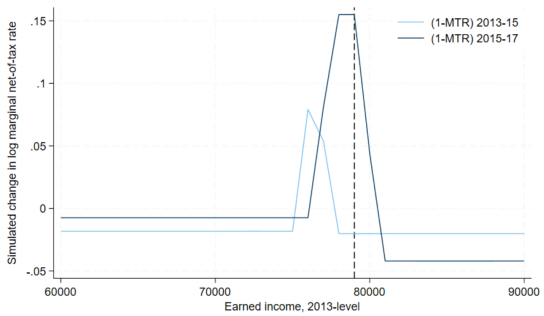
Note: Panel A shows the change in broad income (log) in 15 income bins in 2010-2012 (pre-reform period) and 2012-2014 (reform period), excluding initial-year self-employed. Panel B shows the differences in average log changes in income between periods for 15 income bins. The lavender line shows the trend differential for individuals excluding initial-year self-employed, as in Panel A, whereas the blue line shows the trend differential for all individuals. The vertical lines mark the income levels of EUR 100,000 and 107,700. Municipality controls are added and 1% tails for observed $\triangle \ln z$ are winsorized. The gray area shows the 95% confidence bound.

Figure A.4: Tax reform in 2016

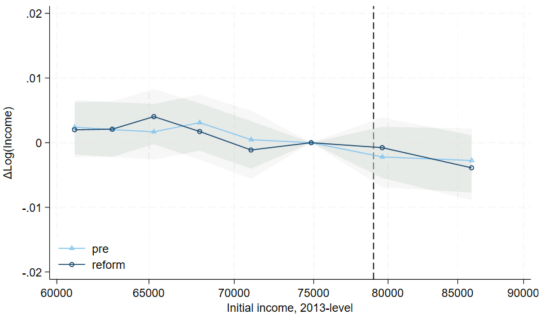
Panel A. Two-year change in taxable earned income



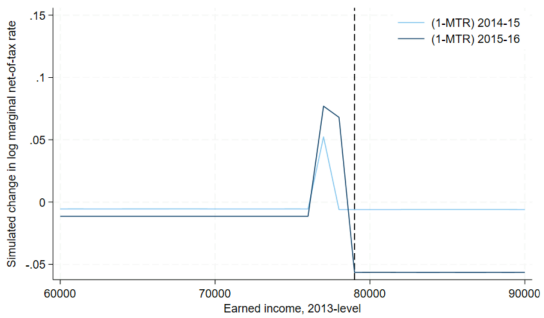
Panel B. Two-year change in average net-of-tax rate



Panel C. One-year change in taxable earned income



Panel D. One-year change in average net-of-tax rate



Note: Panel A shows the two-year change in earned income (log) in 8 income bins relative to the EUR 75,000 bin in 2013-2015 (pre-reform period) and 2015-2017 (reform period), excluding self-employed. The vertical line demonstrates the treatment threshold of EUR 79,000 income. Municipality controls are added and 1% tails for observed $\triangle \ln z$ are winsorized. The gray area shows the 95% confidence bound. Panel B shows the real two-year change in the average marginal net-of-tax rate in 2013-2015 and 2015-2017. Panels C and D show corresponding one-year changes, for the periods 2014-2015 and 2015-2016.

Table A.1: First-stage estimates for the main results

	All	Wage earners	Wage earners
First stage	0.644***	0.665***	0.686***
	(0.021)	(0.022)	(0.020)
Excl. self-employed		X	X
Excl. self-employed to-be			X
Municipality controls	X	X	X
Observations	98 024	60 599	54 555
Estimation period	2 years	2 years	2 years

Note: This table reports the first-stage estimates for the main results in Table 3. Robust standard errors are provided in parentheses, * p<0.05, ** p<0.01, *** p<0.001.

Table A.2: Elasticity estimates for broad income with respect to the marginal net-of-tax rate

	All	Wage earners	Wage earners
	(1)	(2)	(3)
Elasticity estimate	0.430**	0.368*	0.285
	(0.153)	(0.164)	(0.154)
Excl. self-employed		X	X
Excl. self-employed to-be			X
Municipality controls	X	X	X
Observations	98 024	60 599	54 555
Estimation period	2 years	2 years	2 years

Note: This table reports broad income elasticity estimates with respect to the marginal net-of-tax rate based on equation (2). Elasticities are estimated for 25-60-year-old individuals with no social benefits during the period. Column (1) shows the elasticity estimate for all the data, in the column (2) estimate the initial-year self-employed are excluded, and in column (3) both initial-year self-employed and those who become self-employed during the period analysed are excluded. The estimation periods are 2010-2012 for the pre-reform period and 2012-2014 for the post-reform period. 1% tails for observed $\triangle \ln z$ are winsorized. Robust standard errors are given in parentheses, * p<0.05, ** p<0.01, *** p<0.001.

Table A.3: Estimates for reform effect on other income margins

Dependent variable	All	Wage earners
Fringe benefits	0.218	0.296
	(0.513)	(0.599)
Travelling costs deductions	0.247	-0.091
	(0.438)	(0.539)
Options based on employment relationships	4.195	3.107
	(3.943)	(4.350)
Other earned income	-4.785	-0.612
	(4.995)	(3.642)
Deduction for work-related expenses	0.990	0.112
	(0.938)	(1.469)
Excl. self-employed		X
Municipality controls	X	X
Estimation period	2 years	2 years

Note: This table reports elasticities regressed separately for several income items with respect to a change in the marginal net-of-tax rate. Elasticities are estimated for 25-60-year-old individuals with no social benefits during the periods. The estimation periods are 2010-2012 for the pre-reform period and 2012-2014 for the post-reform period. Robust standard errors are given in parentheses, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table A.4: Descriptive Statistics by Job Changers

Variable	Stayer	Changer	Total
Number of observations	48,158 (79.5%)	12,441 (20.5%)	60,599 (100.0%)
Earned income	122,945 (55,736)	124,007 (55,532)	123,163 (55,695)
Capital income	3,671 (42,989)	6,183 (107,514)	4,186 (61,989)
Flexible	0.173 (0.378)	0.239 (0.426)	0.186 (0.389)
Control group	0.646 (0.478)	0.626 (0.484)	0.642 (0.479)
Age group			
Age 25–43	15,693 (32.6%)	5,507 (44.3%)	21,200 (35.0%)
Age 44–50	16,928 (35.2%)	4,316 (34.7%)	21,244 (35.1%)
Age 51–60	15,537 (32.3%)	2,618 (21.0%)	18,155 (30.0%)
Gender			
Male	36,765 (76.3%)	9,375 (75.4%)	46,140 (76.1%)
Female	11,393 (23.7%)	3,066 (24.6%)	14,459 (23.9%)
Children			
No	15,515 (32.2%)	3,564 (28.6%)	19,079 (31.5%)
Yes	32,643 (67.8%)	8,877 (71.4%)	41,520 (68.5%)
Educational level			
Masters/PhD	28,642 (59.5%)	7,577 (60.9%)	36,219 (59.8%)
Tertiary/Bachelor	13,360 (27.7%)	3,354 (27.0%)	16,714 (27.6%)
Secondary Educ.	4,654 (9.7%)	1,116 (9.0%)	5,770 (9.5%)
Not Classified	1,502 (3.1%)	394 (3.2%)	1,896 (3.1%)
Educational field			
Human and Society	7,050 (14.6%)	1,872 (15.0%)	8,922 (14.7%)
Business and law	13,597 (28.2%)	3,449 (27.7%)	17,046 (28.1%)
Math, IT and Tech	19,323 (40.1%)	5,074 (40.8%)	24,397 (40.3%)
Health	6,250 (13.0%)	1,539 (12.4%)	7,789 (12.9%)
Other fields	1,938 (4.0%)	507 (4.1%)	2,445 (4.0%)
Capital income group			
$ci < 750$	35,399 (73.5%)	9,317 (74.9%)	44,716 (73.8%)
750–6,000	8,781 (18.2%)	2,096 (16.8%)	10,877 (17.9%)
6,000–10,300	1,741 (3.6%)	438 (3.5%)	2,179 (3.6%)
10,300–24,200	1,413 (2.9%)	354 (2.8%)	1,767 (2.9%)
$ci > 24,200$	824 (1.7%)	236 (1.9%)	1,060 (1.7%)
Municipality type			
Capital area	23,339 (48.5%)	6,130 (49.3%)	29,469 (48.6%)
Other urban municipalities	19,590 (40.7%)	5,069 (40.7%)	24,659 (40.7%)
Semi-urban municipalities	3,511 (7.3%)	869 (7.0%)	4,380 (7.2%)
Rural municipalities	1,718 (3.6%)	373 (3.0%)	2,091 (3.5%)

Note: Table A.4 shows the descriptive statistics for the data used in the analysis by job changing status, excluding self-employed. Individuals who changed employer during the observed two-year period are classified as job changers. The data consists of data for two years (2010 and 2012) for workers whose earned income exceeds EUR 80,000, are 25-60 years old, have not received any benefits and are included in the data for t+2 years.

Table A.5: Descriptive Statistics by Worker Flexibility

Variable	Not flexible	Flexible	Total
Number of observations	49,020 (81.4%)	11,235 (18.6%)	60,255 (100.0%)
Earned income	122,372 (53,901)	126,455 (62,598)	123,133 (55,648)
Capital income	3,626 (31,141)	6,614 (128,238)	4,183 (62,100)
Job changer	0.190 (0.393)	0.260 (0.439)	0.203 (0.402)
Control group	0.649 (0.477)	0.616 (0.486)	0.643 (0.479)
Age group			
Age 25–43	16,721 (34.1%)	4,305 (38.3%)	21,026 (34.9%)
Age 44–50	17,361 (35.4%)	3,778 (33.6%)	21,139 (35.1%)
Age 51–60	14,938 (30.5%)	3,152 (28.1%)	18,090 (30.0%)
Gender			
Male	38,229 (78.0%)	7,610 (67.7%)	45,839 (76.1%)
Female	10,791 (22.0%)	3,625 (32.3%)	14,416 (23.9%)
Children			
No	15,237 (31.1%)	3,712 (33.0%)	18,949 (31.4%)
Yes	33,783 (68.9%)	7,523 (67.0%)	41,306 (68.6%)
Educational level			
Masters/PhD	27,770 (56.7%)	8,361 (74.4%)	36,131 (60.0%)
Tertiary/Bachelor	14,630 (29.8%)	1,961 (17.5%)	16,591 (27.5%)
Secondary Educ.	5,001 (10.2%)	693 (6.2%)	5,694 (9.4%)
Not Classified	1,619 (3.3%)	220 (2.0%)	1,839 (3.1%)
Educational field			
Human and Society	7,259 (14.8%)	1,558 (13.9%)	8,817 (14.6%)
Business and law	14,514 (29.6%)	2,491 (22.2%)	17,005 (28.2%)
Math, IT and Tech	20,957 (42.8%)	3,307 (29.4%)	24,264 (40.3%)
Health	4,263 (8.7%)	3,510 (31.2%)	7,773 (12.9%)
Other fields	2,027 (4.1%)	369 (3.3%)	2,396 (4.0%)
Capital income group			
$ci < 750$	35,903 (73.2%)	8,550 (76.1%)	44,453 (73.8%)
750–6,000	8,966 (18.3%)	1,860 (16.6%)	10,826 (18.0%)
6,000–10,300	1,802 (3.7%)	365 (3.2%)	2,167 (3.6%)
10,300–24,200	1,466 (3.0%)	287 (2.6%)	1,753 (2.9%)
$ci > 24,200$	883 (1.8%)	173 (1.5%)	1,056 (1.8%)
Municipality type			
Capital area	24,560 (50.1%)	4,794 (42.7%)	29,354 (48.7%)
Other urban municipalities	19,356 (39.5%)	5,138 (45.7%)	24,494 (40.7%)
Semi-urban municipalities	3,503 (7.1%)	858 (7.6%)	4,361 (7.2%)
Rural municipalities	1,601 (3.3%)	445 (4.0%)	2,046 (3.4%)

Note: Table A.5 shows the descriptive statistics for the data used in the analysis by worker flexibility, excluding self-employed. Flexible worker is defined here as an employee who had several employees simultaneously during the observed periods. The data consists of data for two years (2010 and 2012) for workers whose earned income exceeds EUR 80,000, are 25-60 years old, have not received any benefits and are included in the data for t+2 years.

Table A.6: Group Composition

Dependent Variable	Treatment	Post	Treatment#Post	Constant
Age	0.929***	0.0942	-0.0575	45.93***
	(0.0646)	(0.0567)	(0.0909)	(0.0401)
Gender	-0.0627***	0.00538	-0.00318	0.254***
	(0.00392)	(0.00344)	(0.00552)	(0.00243)
Change of Residential	-0.00166	0.00252	-0.00138	0.0518***
Municipality	(0.00207)	(0.00182)	(0.00291)	(0.00128)
Self-employed	0.0873***	0.0102**	-0.00905	0.344***
	(0.00451)	(0.00396)	(0.00634)	(0.00280)
Change to self-employed	0.00870**	-0.00494	0.00177	0.111***
	(0.00294)	(0.00258)	(0.00414)	(0.00182)
Flexible	0.0414***	0.000975	0.00317	0.226***
	(0.00400)	(0.00351)	(0.00563)	(0.00248)
Job changer	0.0131***	0.0135***	0.00575	0.200***
	(0.00381)	(0.00335)	(0.00536)	(0.00236)
Level of Education				
Master/PhD	0.109***	-0.00428	-0.00613	0.549***
	(0.00456)	(0.00400)	(0.00641)	(0.00283)
Tertiary/Bachelor	-0.0768***	-0.00563	0.00568	0.284***
	(0.00403)	(0.00354)	(0.00567)	(0.00250)
Secondary Educ.	-0.0265***	0.00918***	0.00115	0.124***
	(0.00301)	(0.00264)	(0.00424)	(0.00187)
Not Classified	-0.00585**	0.000731	-0.000704	0.0429***
	(0.00184)	(0.00162)	(0.00259)	(0.00114)
Field of Education				
Human and Society	-0.0177***	0.000849	0.00147	0.166***
	(0.00341)	(0.00299)	(0.00479)	(0.00211)
Business and Law	0.0578***	0.00151	-0.00559	0.239***
	(0.00408)	(0.00359)	(0.00575)	(0.00253)
Math, IT and Tech	-0.0632***	-0.00903*	0.0136*	0.387***
	(0.00446)	(0.00392)	(0.00628)	(0.00277)
Health	0.0314***	0.00337	-0.0127*	0.161***
	(0.00352)	(0.00309)	(0.00495)	(0.00218)
Other Education	-0.00834***	0.00330	0.00319	0.0471***
	(0.00195)	(0.00171)	(0.00275)	(0.00121)
Region				
Helsinki-Uusimaa	0.0641***	-0.00621	-0.00719	0.558***
	(0.00459)	(0.00403)	(0.00646)	(0.00285)
South Finland	-0.0174***	0.00270	-0.00527	0.148***
	(0.00324)	(0.00285)	(0.00456)	(0.00201)
West Finland	-0.0256***	0.00240	0.00757	0.167***
	(0.00341)	(0.00299)	(0.00480)	(0.00211)
North and East Finland	-0.0202***	0.00146	0.00461	0.122***
	(0.00298)	(0.00262)	(0.00419)	(0.00185)
Åland	-0.000980	-0.000340	0.000284	0.00530***
	(0.000644)	(0.000565)	(0.000906)	(0.000399)

Note: Standard errors are in parentheses, * p<0.05, ** p<0.01, *** p<0.001.