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The Elasticity of Taxable Income for the Self-Employed:

Heterogeneity across Reforms and Income Levels

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The Elasticity of Taxable Income for the Self-Employed: Heterogeneity across Reforms and Income Levels*

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Abstract

This paper studies the causal relation between effective marginal tax rates for the self-employed and their taxable income using panel data for the period 1999–2012. This period contains three tax reforms that we use to identify the elasticity of taxable income (ETI). We estimate an ETI of 0.3 for the self-employed. Individuals respond stronger to the major tax reform in 2001 than to two smaller reforms in 2005 and 2007. We reveal significant heterogeneity in ETI across the income distribution and occupational choice. Contrary to earlier studies, the ETI is higher for self-employed with a lower income than for self-employed with a higher income. We also find that self-employed respond much stronger to financial incentives than wage earners. However, there is little heterogeneity in responses for demographic subgroups: women only have a slightly higher ETI than men, and the ETI is roughly similar across educational levels. We carefully assess our instruments using recent insights in the ETI literature. Instruments based on lagged income are not preferable for our sample of self-employed who experience high variation in income. And the choice of sampling weights - base-year income or lagged income - matters in our analysis which again demonstrates the high heterogeneity across income levels.

JEL classification codes: H24, H31, J22

Keywords: Time allocation, self-employed, elasticity of taxable income

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1 Introduction

According to the theory of optimal taxation, there are several reasons why income from self-employment should be taxed less than income from wage employment (Mirrlees, 1971, 1976). One of the reasons is that self-employed individuals have more possibilities to evade or avoid paying taxes. They can underreport income, have more tax deductions/exemptions or can choose to incorporate their business. Furthermore, they can easily adjust their working hours or their investment decisions. In the Netherlands, several tax policies favouring income from self-employed were implemented or strengthened in the period 1999–2012. At the same time, the share of self-employed (in total employment) increased from 11% to 15% over the period 1999–2012, which is remarkable compared to the stable shares in other countries (OECD, 2016).

This paper examines the elasticity of taxable income (ETI) for the self-employed in the Netherlands. We exploit several tax reforms in the period 1999-2009 to estimate the intensive margin responses to changes in marginal tax rates. We use information from the Labour Market Panel (LMP) of Statistics Netherlands. The LMP is a large administrative panel data set with information on income reported to the Dutch Tax Administration and detailed background characteristics, such as household composition, education and ethnicity.

The ETI is a measure of welfare loss of taxation.[1] It includes both real responses, such as investment and working hours, and income shifting responses, such as tax avoidance and tax evasion. A higher ETI indicates that the welfare losses of taxation are higher compared to a lower ETI. However, several papers argue that the ETI is not a sufficient statistic for welfare losses (Doerrenberg et al., 2015; Chetty, 2009). Since the ETI is not a structural parameter due to its dependence on compliance aspects of the tax system, country-specific estimations are informative and necessary (Kopczuk, 2012). There are only a handful empirical papers on the ETI of the self-employed, and this paper is the first to estimate the ETI for the Dutch self-employed.

Following earlier work by Sillamaa and Veall (2001), Gruber and Saez (2002), Heim (2010), Kleven and Schultz (2014) and Burns and Ziliak (2017), we estimate the ETI while taking into account several methodological issues. First, we use instrumental variable estimation to address the problem of simultaneity bias. As is common in the ETI literature we use synthetic marginal tax rates as instruments (Gruber and Saez, 2002). These instruments measure the mechanical change in the tax rate, which is unrelated to behavioural

[1] Formally, the ETI measures the percentage change in individual's reported taxable income in response to a one percent change in their marginal net-of-tax rate

responses to the tax reform. Second, we control for changes in taxable income that are unrelated to the tax reform. A potential concern is skill-biased technological change, which favours income from higher income groups over lower income groups. Another concern is mean-reversion in which case an individual with an unexpected low income in period $t-1$ is more likely to have a higher income in period t which is unrelated to the tax reform. To control for both issues, we use functions of base-year income and lagged base-year income as control variables (Kopczuk, 2005) and employ instruments based on lagged income (Weber, 2014).

Our main findings are as follows. First, we estimate an ETI of 0.3 for self-employed individuals in the Netherlands. Given the large variation in the ETI literature, our results are in between those found by Kleven and Schultz (2014) for Denmark, who find an ETI of 0.1, and Heim (2010), who estimates an ETI of 0.9 for the United States. Second, we find that self-employed respond stronger to the major tax reform in 2001, the ETI is 0.50, than to the smaller tax reforms in 2005 and 2007 resulting in an ETI of 0.25. Third, we reveal significant heterogeneity in ETI across the income distribution and occupational choice. Self-employed with a lower income have a higher ETI than self-employed with higher incomes. Furthermore, we find that self-employed respond much stronger to financial incentives than wage earners. However, there is little heterogeneity in responses for demographic subgroups: women only have a slightly higher ETI than men, and the ETI is roughly similar for different education levels. Finally, we use recent insights from the ETI literature to carefully assess the endogeneity of our instruments. All our results are robust to different income controls, the definition of self-employment and taxable income, and potential selection bias. Furthermore, instruments based on lagged income are not preferable for our sample of self-employed who experience high variation in income, and selecting the sampling weights based on lagged income or base-year income demonstrates the large heterogeneity across income.

This paper contributes to the existing literature in the following ways. First, while there is quite an extensive literature on the ETI of wage earners, there are only a handful empirical papers on the ETI of the self-employed (Sillamaa and Veall, 2001; Heim, 2010; Kleven and Schultz, 2014; Harju and Matikka, 2016). Second, our data set contains three tax reforms of which two reforms are targeted explicitly at self-employed individuals. By contrast, the U.S. tax reforms in Heim (2010) and the Danish tax reforms in Kleven and Schultz (2014) are more general and affect both wage earners and self-employed. In addition, We show that the self-employed respond much stronger to the larger reform in 2001 than to the smaller reforms in 2005 and 2007. The large variation found in earlier studies could be the result of different reforms used to identify the ETI. Third, we reveal much heterogeneity across income levels. Contrary to other studies (Heim, 2010; Kleven and Schultz, 2014), our ETI for self-employed with a lower income is much higher than the ETI for high-income self-employed. A possible explanation is that these earlier studies exploit reforms that also affected high-income taxpayers, whereas the Dutch reforms hardly affected high-income taxpayers. Fourth, our paper addresses two methodology issues. Although instruments based on lagged income may be preferable from a theoretical point of view, they are less strong as profit income from the self-employed varies considerably. Besides the F-test statistic, we believe one should also graphically inspect the strength of the instruments across the income distribution. In addition, we show that choice of the sampling weights - based on base-year or lagged income - makes a difference for our analysis. We believe this might be relevant for other ETI studies who reveal much heterogeneity in responses.

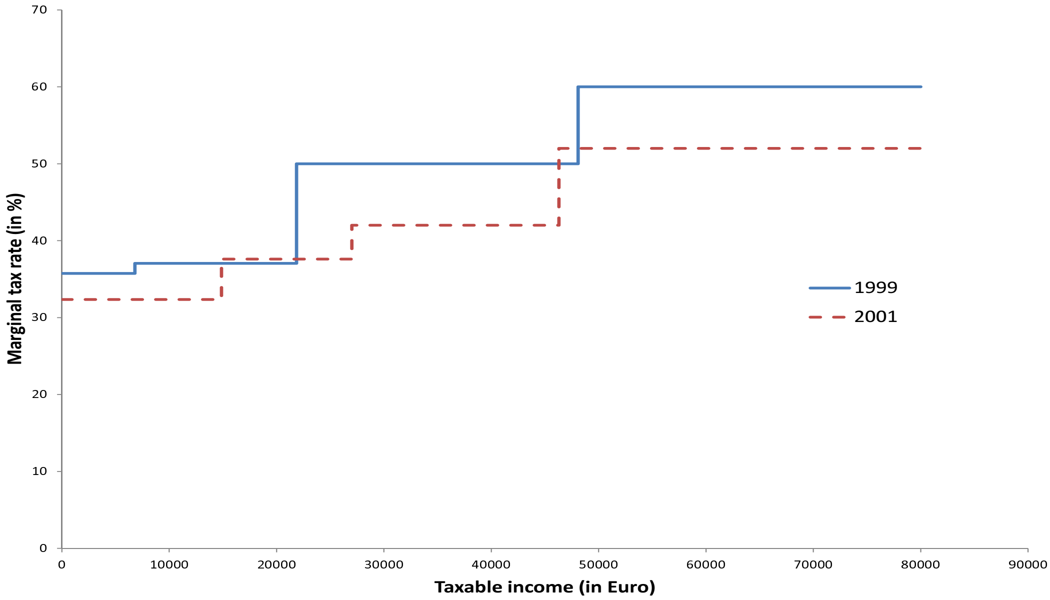
The paper is organized as follows. Section 2 describes the tax reforms in our sample period. Section 3 sets out our methodology to estimate the ETI. Section 4 then describes the data set we use in our estimation. In Section 5 we present the estimation results. Section 6 concludes.

2 Tax Reforms

In the Netherlands, income is taxed progressively and the same tax schedule applies to self-employed and wage income (see Table A.1). The tax schedule consists of four tax brackets with increasing marginal tax rates. Self-employed have two additional tax exemptions, an income dependent exemption (Ex. I, in Dutch: *zelfstandigenaftrek*) and an exemption rate (Ex. II, in Dutch: *MKB winstvrijstelling*). From an international perspective these exemptions are unique as they are unconditional. That is, they reduce taxable income without the need for expenses incurred in generating that income (OECD, 2015). One motivation for these tax advantages is to promote self-employment because of their alleged positive effects on economic growth and innovation. Another motivation is to support low-income earners.

We witness three types of tax reforms in the period 1999–2009. First, the major tax reform in 2001, which lowered marginal tax rates for most self-employed and wage earners. Table A.1 shows that the large tax reform in 2001 reduced the two highest tax brackets by 8 percentage points in 2001. The rate of the second tax bracket has gradually been increased and has virtually converged to the third tax rate. The first income tax rate hardly changed. Figure 1 compares the marginal tax rates in 1999 and 2001 and shows that there is substantial variation in the marginal tax rates. The introduction of

Figure 1: Reform 2001: Change in marginal tax rate

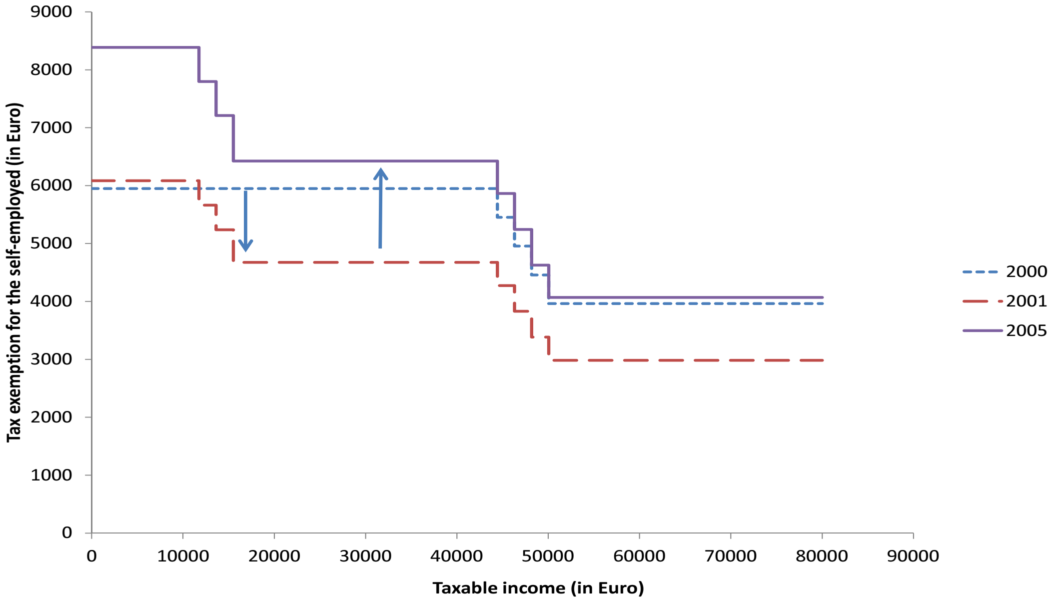


an earned-income tax credit in 2001 sharply reduced marginal tax rates at lower income levels (not shown in Table A.1).

Second, there has been a reform in the income dependent tax exemption for self-employed (in Dutch: *zelfstandigenaftrek*) in 2001 and 2005. For self-employed with a relatively low income, the first 5,949 euro was exempted from taxation, while for self-employed with a relatively high income the first 3,962 euros was exempted in 2000 (see Table A.1). This tax exemption has also changed over time. Policies changed both the amount and the income dependency of this exemption. Figure 2 shows that the level of the tax exemption was reduced for most income levels in 2001. Furthermore, the graph illustrates the increased income dependency of the tax exemption in 2001: its level was gradually reduced for self-employed with an income between 12,000–16,000 euros. From 2005 onwards, the self-employment exemption has been increased again, especially for self-employed with a relatively low income. A higher tax exemption lowers taxable income, which in turn lowers effective marginal tax rates.

Our third reform is the introduction of a profit rate exemption (in Dutch: *MKB-winstvrijstelling*) in 2007. The motivation for this reform was to balance the tax treatment of self-employed paying personal income tax and owners of small corporations paying corporate income tax. More specifically, the profit rate exemption has been introduced to counterbalance the lower corporate income tax in 2007. The profit rate exemption was 10

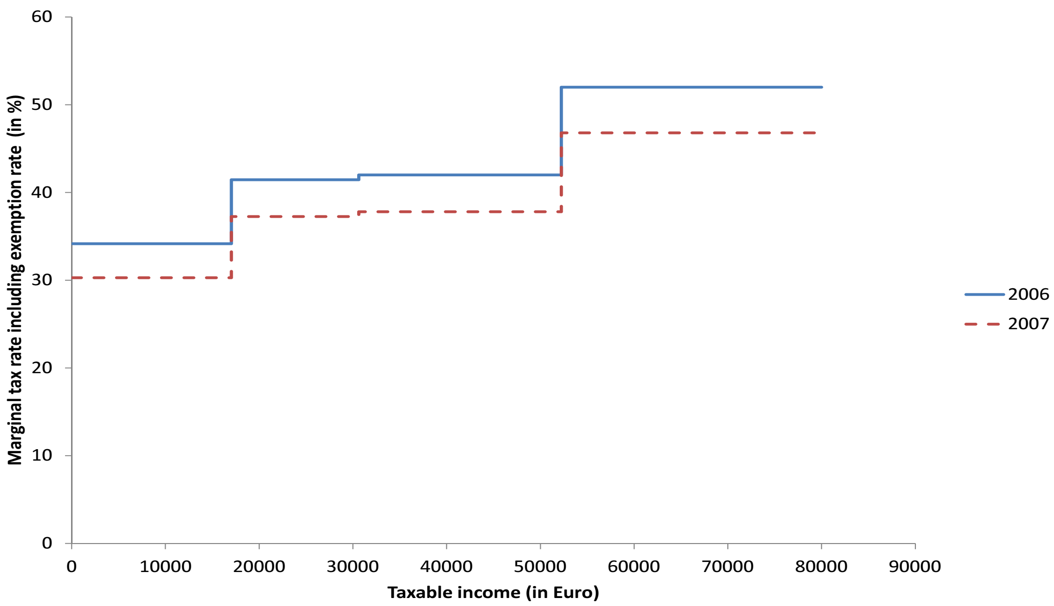
Figure 2: Reforms 2001 and 2005: Tax exemption self-employed



percent in 2007 which means the exemption τ_e reduced the marginal tax rate τ by $\tau_e * \tau$, compared to 2006. Because of the progressive tax system, the marginal tax reduction increased with income.[2] Figure 3 illustrates this by comparing the effective marginal tax rates in 2006 en 2007. The Dutch government raised the profit rate exemption from 10 to 12 percent of profit income over the period 2007–2010 in response to a lower effective corporate income tax.

[2]The marginal tax rate in the first tax bracket was 33.65% in 2007. A profit rate exemption of 10% then lowered the marginal tax rate by 3.365%. The highest marginal tax rate was 52% and the profit rate exemption lowered the top marginal tax rate by 5.2%. In that case, the effective marginal top tax rate was 46.8%.

Figure 3: Reform 2007: Introduction exemption rate



3 Methodology

We start with the canonical method of Gruber and Saez (2002), which is described in Section 3.1 below. Next, Section 3.2 sets out the main contributions of Weber (2014) to the traditional approach. We use these recent insights in our sensitivity analysis.

3.1 Canonical method of Gruber and Saez, 2002

This section sets out the canonical method of Gruber and Saez (2002) which has been extensively applied, e.g. Kleven and Schultz (2014). We estimate the following equation for (reported) taxable income z:

$$\Delta \ln(z_{is}) = \beta_1 \Delta \ln(1 - \tau_{is}) + x_i \beta_2 + \mu_t + \delta f(z_{i,t}) + u_{it} \quad (1)$$

where Δ is the time-difference operator between two dates s. In our baseline specification, we use a three-year difference.[3] The variable $\Delta \ln(1-\tau_{is}) = \ln(1-\tau_{i,t+3}) - \ln(1-\tau_{i,t})$ represents the change in the marginal net-of-tax rate.[4] Our main coefficient of interest

[3]Similar to Gruber and Saez (2002), Kleven and Schultz (2014) and Kopczuk (2005). With a longer time period, we can capture long-term behavioural effects. In our sensitivity analysis, we also consider shorter time lags ($t+1$ and $t+2$).

[4]Kleven and Schultz (2014) also take other income types into account so as to be able to distinguish between capital and labor income.

(β_1) measures the uncompensated elasticity with respect to the marginal-net-of-tax rate (1- τ_{is}).

Individual characteristics x_i are age, education, marital status and the presence of young children. The specification also includes base-year fixed effects μ_t to account for period-specific income growth. The regression is weighted by earnings and population weights, such that individuals contribute to the average ETI in proportion to their income. We also include functions of base-year income ($f(z_{i,t})$), which we explain below. We abstract from income effects because we do not have information on virtual non-labor income in our data set. Based on the literature, we expect that the income elasticity is small (Gruber and Saez, 2002; Kleven and Schultz, 2014; Saez et al., 2012).

There are several methodological issues when estimating equation (1). There is simultaneity bias, as there is a reverse effect from taxable income on marginal taxes because of the nonlinearity of the tax and payroll system. To overcome this problem, we need to instrument the changes in marginal net-of-tax rates. A common approach is to calculate so-called synthetic marginal tax rates based on base-year inflation-adjusted taxable labour income (Gruber and Saez, 2002; Kleven and Schultz, 2014):[5]

$$\bar{z}_{i,t+3} = z_{i,t}\pi_{t+3} \tag{2}$$

where π_{t+3} is the cumulative growth rate of prices between years t and t+3. The instrument for the change in the log of the marginal net-of-tax rate is then given by:

$$\Delta \ln(1 - \bar{\tau}_{i,t}) = \ln(1 - \bar{\tau}_{i,t+3}) - \ln(1 - \tau_{i,t}) \tag{3}$$

where $\bar{\tau}_{i,t+3}$ is the marginal net-of-tax rate in year $t+3$ for base-year inflated-adjusted taxable labour income $\bar{z}_{i,t+3}$. Clearly, the mechanical changes in tax rates do not depend on post-reform income.

However, the instrument may still be endogenous because it depends on base-year income which can be correlated with the error term. The literature reveals two sources of endogeneity resulting from non-tax related changes in taxable income. First, skill-biased technological change, which favours income of higher skill groups over lower skill groups, may shift the earnings distribution unrelated to the tax reform. As long as skills cannot be fully observed and controlled for, changes in income are incorrectly attributed to changes in taxes. Second, mean-reversion also leads to changes in taxable income that are unrelated to the tax reform. Income is a combination of both permanent income and transitory income. This transitory part generates mean-reversion, an individual with an

[5] We use consumer price index to hold real income constant. As a robustness check we also use average wage changes. This hardly affects our results.

unexpected low income in period $t-1$ is more likely to have a higher income in period t and vice versa. The empirical literature has a long-standing tradition to tackle this problem by including functions of base-year income as additional controls inspired by the seminal paper by (Gruber and Saez, 2002).

The common strategy in the ETI literature is to include a function of base-year income as additional controls. Usually, studies use a continuous piecewise linear spline is fitted that creates new variables $(S_1, .., S_n)$ which are included in the regression.[6] Splines are preferred to linear controls as they can account for income-class specific growth that is nonlinear with respect to income. To account for both sources of potential bias, Kopczuk (2005) proposes two income controls. The first income control is a 10-piece spline of the difference in lagged base-year and base-year income $(\ln(z_{i,t}) - \ln(z_{i,t-1}))$ to take away mean reversion. The second income control is a 10-piece spline of lagged taxable income $(z_{i,t-1})$ to control for shifts in the earnings distribution. However, including income controls poses a challenge for the identification of the ETI as they may absorb changes in tax rates, particularly if income controls are close to certain thresholds in the tax system. For the identification of the ETI, one needs enough variation within each income class to estimate the behavioural responses due to the tax reform. The implicit assumption of using one income trend for each income class is that underlying income trends are the same for treatment groups, that are affected by tax changes, and control groups that are unaffected by tax changes.

3.2 Alternative Weber instruments

A recent paper by Weber (2014) contains three main contributions to the traditional approach. First, Weber (2014) proposes an alternative instrument for the endogenous tax rates based on lags of base-year income. Increasing the number of lags will make the instrument more orthogonal to the error term. An instrument based on base-year income is expected not to be orthogonal to the error term because base-year income captures both transitory income and permanent income. The preferred instrument in Weber (2014) is based on lag(s) of taxable income:

[6] The new income variables are:

$$\begin{cases} S_1 = min(z_{it}, k_1) \\ S_i = max(min(z_{it}, k_i), k_{i-1}) \quad i = 2, ..., n-1 \\ S_n = max(z_{it}, k_{n-1}) \end{cases} \tag{4}$$

The function is continuous because at the knot (k) the upper bound of a lower income segment equals the lower bound of the higher segment. A 10-piece linear spline is normally used with 9 knots ($k = 9$, $n = 10$).

$$\Delta \ln(1 - \bar{\tau}^l_{i,t}) = \ln(1 - \bar{\tau}^l_{i,t+3}) - \ln(1 - \tau^l_{i,t}) \tag{5}$$

where $\bar{\tau}^l_{i,t+3}$ is the marginal tax rate in year $t+3$ for lag inflated-adjusted taxable labour income $\bar{z}^l_{i,t+3} = z_{i,t-1}\pi_{t+4}$. Second, Weber (2014) theoretically shows that including income splines based on base-year income does not remove the remaining endogeneity of the tax rate. They can however be usual in controlling for heterogeneous income trends. Third, the common approach is to use base-year income as weights in the regression, which may lead to inconsistent results as base-year income is endogenous. Therefore, in contrast to usual ETI studies the baseline results in Weber (2014) are unweighted and weights based on lagged income are only applied in a sensitivity analysis.

We apply both instruments based on base-year income and lagged income. Due to our rather short sample period before the main reform, we can only use one-year lag. We follow (Kopczuk, 2005) and use two income controls to account for heterogeneous income trends and mean-reversion. We follow Weber (2014) and use weights based on lag income in our baseline specification and test the importance of including weights in a sensitivity analysis.

4 Data

We use the Labour Market Panel (LMP, *Arbeidsmarktpanel* in Dutch) from Statistics Netherlands. The LMP is a large administrative household panel data set with annual data for the period 1999–2012. The LMP contains a rich set of individual and household characteristics, including gender, month and year of birth, the highest completed level of education and ethnicity for all adult members of the household, the ages of the children and the area of residence. The LMP also contains administrative data on taxable income reported to the Tax Administration.

A common problem in empirical analysis of self-employed concerns the definition of self-employment. In this paper, we use the definition of self-employment constructed by Statistics Netherlands. An individual is considered to be self-employed either if his profit exceeds his wage income, or if his wage income is below 70 percent of the minimum wage, irrespective of the level of profits.[7] We do not include freelancers and owners of small corporations (In Dutch: *Directeur-GrootAandeelhouder*). They are not entitled to the self-employment tax deductions which we use for identification, and owners of small corporations face different rules with respect to their labour income.

[7] Other definitions of self-employment hardly affect our results.

We make the following sample selections. We select all self-employed individuals with positive earnings.[8] Furthermore, we keep the so-called hybrid self-employed who earn wage income as well.[9] Next, we restrict our sample to individuals aged 20-55.[10,11] Our analysis focuses on three-year intervals (t, $t-3$) and we exclude individuals for whom household composition changes in that interval (*e.g.* singles who get married, or couples who divorce).[12] The reason for this is that these transitions are likely to affect marginal tax rates and incomes, whereas we are only interested in changes in profits and marginal tax rates that are driven by tax reforms. We restrict our sample to those observed in five subsequent years ($t-1$ to $t+3$), as our most extensive specification uses income in year $t-1$. Finally, we exclude individuals whose (absolute) change in the logarithm of actual and synthetic marginal tax rates exceeds 0.5.[13,14] As it turns out, the synthetic marginal tax rates are weak instruments for very large changes in marginal tax rate. This leaves us with 134,196 observations.

Since the ETI depends on the taxable income concept, Table 1 shows our taxable profit income. Given a certain level of earned income, the tax base can be adjusted by individuals. Individuals can consume more from services or goods that are tax deductible (e.g. charitable givings, health expenses). In addition, self-employed have more possibilities to lower taxable income, either by loss offsets by shifting income between periods, or by investing in goods that are tax deductible, see Table 1. The attractiveness of these responses depends on the broadness of the tax base (deductions, exemptions) and the degree and effectiveness of enforcement. For this reason, the ETI is a function of the administrative and compliance aspects of the tax system (Slemrod and Kopczuk, 2002). Our dataset contains taxable profit income which provides us with a constant tax base across tax reforms, see Table 1. We use the tax-benefit calculator MIMOSI to simulate the two tax exemptions for self-employed. Unfortunately, we do not observe all personal tax deductions (e.g. mortgage interest payments). Therefore, our income definition is closer to broad income than to taxable income, the latter is more common in ETI studies, and consequently we would expect to find a relatively low ETI.[15]

Table 2 shows the descriptive statistics of our sample pooling years 1999–2009. The

[8] Here we follow for instance Kleven and Schultz (2014).

[9] As a robustness check, we estimate the ETI for different selections.

[10] Approximately 10% of the observations.

[11] For older individuals early retirement decisions may be important, which may bias the estimated ETI.

[12] Approximately 8% of the observations.

[13] Approximately 14% of the observations.

[14] We relax this selection in a sensitivity analysis.

[15] A recent paper by Doerrenberg et al. (2015) convincingly shows the positive impact of tax deductions on the ETI.

Table 1: Taxonomy of taxable income

Fiscal profit (change in assets) ("broad income")
-/- exemptions (e.g. agriculture income)
-/- deductions (e.g. clothing, phone use, literature)
-/- loss offsets
-/- reservations (e.g. pension, maintenance)
Taxable profit income [observed, profit variable z_{it}]
-/- tax exemption [simulated]
-/- exemption rate [simulated]
Taxable income before investment and personal deductions
-/- investment deduction
-/- charitable givings
-/- mortgage interest deduction
-/- other itemized deductions (e.g. alimony paid, health)
Taxable income

average age in our sample is 43 years. The average effective marginal rate is 38 percent. The majority of individuals in our sample is male (61%) and native (90%). Furthermore, 22% of the individuals has primary/lower education, 49% has a higher vocational education and 30% completed tertiary education. Self-employed vary in their household composition. A vast majority have a partner (89%)[16] and one-third does not have children. Still, 18% have a youngest child aged between 0–3 years, 29% have a youngest child of 4–11 years of age and 20% have a youngest child aged between 12–17 years of age. On average profit equals 39,505 euro. Figure 4 clearly shows that the income distribution is quite dispersed and that a majority of self-employed earn less than minimum wage. The vertical bars in the graph divide the distribution in three equal parts.

To determine effective marginal tax rates, we use the MIMOSI model (Koot et al., 2016).[17] It takes into account all taxes, social security premiums, and income independent subsidies and tax credits. To calculate the marginal tax rate (τ), we first calculate disposable household income (n_0) at the initial taxable labour income level (z_0). Next, we increase profit by 3 percent (z_1), and calculate the corresponding new disposable household income (n_1). The marginal (synthetic) tax rate then equals 1 minus the change in

[16] At first sight, the share of couples is high. However, even in the sample without selections, 85% of self-employed have a partner. The share increases slightly because of a selection effect. More successful individuals (self-employed at t and $t+3$) are more likely to have a partner.

[17] MIMOSI is the official tax-benefit calculator of the Dutch government for the (non-behavioural) analysis of the redistributional and budgetary effects of reform proposals. For the years 1999–2001, we use its predecessor MIMOS-2.

Table 2: Descriptive statistics

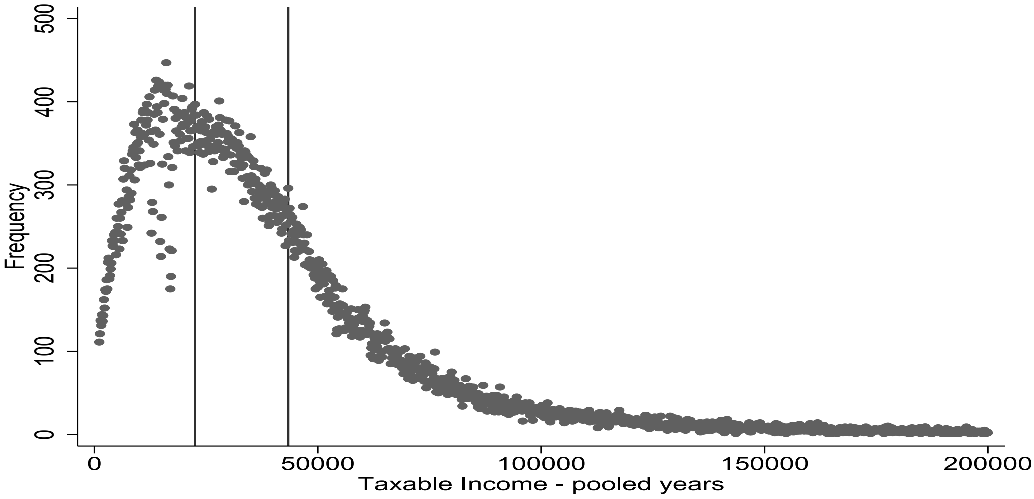
	Mean	SD
Age (years)	42.97	6.91
Average real profit (euro)	39,505	34,505
Marginal tax rate (%)	38	17
	Shares in percentages	
Gender		
Men	61	
Women	39	
Ethnicity		
Native	90	
Western immigrant	4	
Non-Western immigrant	7	
Education		
Lower education	22	
Middle education	49	
Higher education	30	
Household		
Single	11	
Couple	89	
Children		
No children	33	
Youngest child 0-3 yrs	18	
Youngest child 4-11 yrs	29	
Youngest child 12-17 yrs	20	
Observations	134,196	

disposable household income over the change in taxable labour income:

$$\tau = 1 - \left(\frac{n_1 - n_0}{z_1 - z_0} \right). \tag{6}$$

Figure 5 shows the variation in the synthetic marginal tax rate generated by the tax reform in 2001. The difference between the actual and synthetic marginal rates is plotted on the vertical axis for singles. Figure 5 illustrates that the 2001 tax reform lowered marginal tax rates for most self-employed. The changes in the synthetic marginal tax

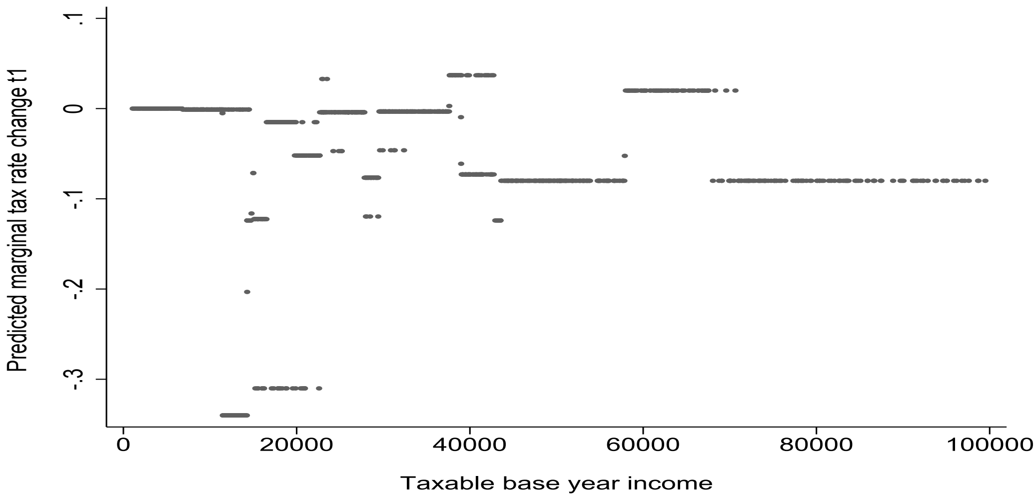
Figure 4: Income distribution, in 150-euro bins



Notes:
This figure shows the sample distribution of profit income below 200,000 euro. The data is collapsed into 150-euro bins. The vertical lines cut the distribution in three equal parts.

rates for all other years is given in Figure A.1. Clearly, the Dutch reforms affected self-employed individuals across the entire income distribution and generated both upward and downward movements in the tax rates.

Figure 5: Change in synthetic marginal tax rate by income, 2000-2001



5 Estimation results

5.1 First stage results

Following Weber (2014), Figure 6 shows the relationship between our instrument and the actual change in the marginal net-of-tax rates. It includes a third order polynomial regression, where the dashed lines indicate the 95 percent confidence interval. The instrument is much weaker for more extreme values of the actual marginal net-of-tax rate.[18]

[18]This is visualized in Figure A.2 in the appendix where we allow for more extreme values of the change in the net-of-marginal tax rates (0.75) than in our baseline sample.

Figure 6: Strength of the instrument

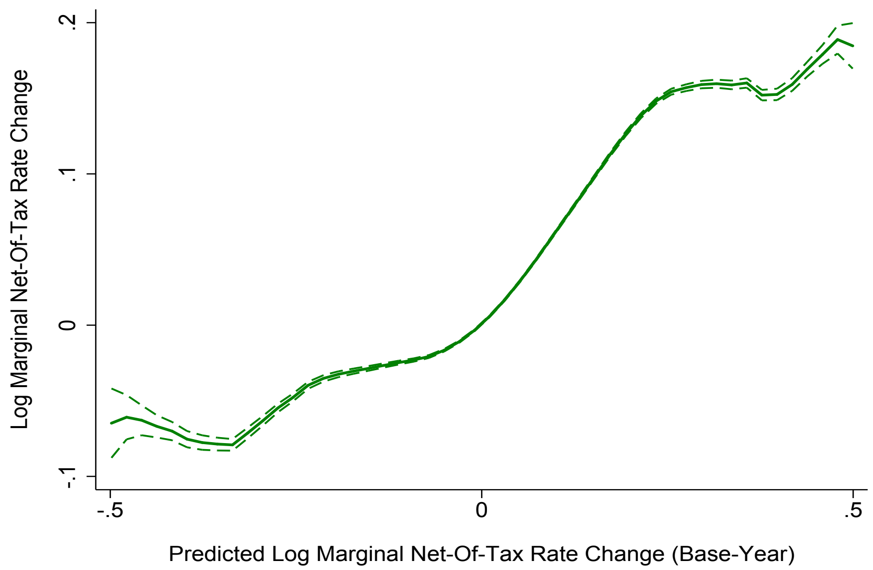
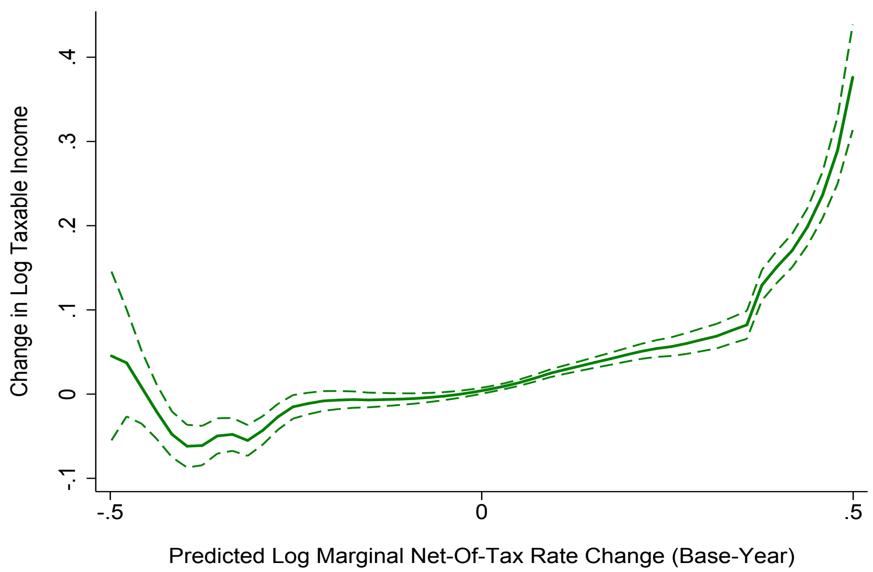


Figure 7: Relationship taxable income and instrument



In line with the graphs, Table A.3 in the appendix indicates that the instrument is positively correlated with the actual change. The coefficient of $\Delta \ln(1 - \bar{\tau}_{is})$ equals 0.377 and is highly significant. The F-test conveys that our instrument is strong (F=3,951).

Table 3: Elasticity of taxable income self-employed

	(1) OLS	(2) No income controls	(3) $ln(z_{i,t})$	(4) 10 splines $ln(z_{i,t})$	(5) 10 splines Δ ln($z_{i.t-1}$)	(6) 10 splines Δ ln($z_{i.t-1}$)
ETI	-1.272***	0.151***	0.351***	0.328***	0.303***	0.272***
	(0.016)	(0.044)	(0.045)	(0.046)	(0.045)	(0.045)
$ln(z_{i,t})$			yes			
10 splines $ln(z_{i,t})$				yes		
10 splines Δ ln($z_{i.t-1}$)					yes	yes
10 splines Δ ln($z_{i.t-1}$)					yes	yes
Demographic controls	yes	yes	yes	yes	yes	no
F-test		4250	4062	3787	3951	3982
Observations	134,196	134,196	134,196	134,196	134,196	134,196

Notes: Regressions include demographic characteristics (age, education, household composition) and year fixed effects.
Clustered robust standard errors in parentheses.
Splines are based on a flexible piecewise linear functional form with ten components.
Full model results are shown in Table A.4 and Table A.5.
All regressions are weighted with lagged income and population weights.
*** p<0.01, ** p<0.05, * p<0.10.

The coefficients on the splines indicate that the income trend differs across the income distribution. Including both lagged base year income and the deviation between lagged base year and base year income renders some of the coefficients insignificant.

5.2 Results

Before we turn to the estimates, Figure 7 visualizes the relationship between our dependent variable, the logarithm of the change in taxable income, and the instrument which is the logarithm of the difference in the synthetic net-of-marginal tax rate $1 - \bar{\tau}_{t+3}$ and the actual net-of-marginal tax rate $1 - \tau_t$, as in Weber (2014). Figure 7 shows that there is a positive relationship at a large part of the income distribution between the change in taxable income and the change in (synthetic) marginal net-of-tax rates, as expected.

Table 3 shows the estimated ETI for our baseline specification. We start with an OLS estimation without income controls. Column (1) shows a negative ETI of -1.272. Next, column (2) presents the estimation results including instruments but without income controls. The ETI is 0.151. However, we need income controls to account for mean reversion and exogenous income trends. We present three ways to control for income: log base-year income (column (3)), ten splines of log base-year income (column (4)) and ten splines of lagged log base-year income and its deviation from base year income (column (5) and (6)). Table 3 shows that income controls are important and that non-tax related changes in income lower the estimated ETI. Hence, not controlling for income trends leads to a (downward) biased ETI. The same result is found by Heim (2010) and Kleven and Schultz (2014). Our ETI is robust for our income controls. In the most extensive income control specification we estimate an ETI of 0.303. Reported taxable income increases by 0.303 percent if the marginal net-of-tax rate increases by 1 percent. The coefficients of the splines themselves (see Table A.5) vary along the income distribution and support the use of flexible 10-piece spline instead of the simple log-base year income.

The regressions in columns (1) – (5) include demographic characteristics such as gender, age, education, ethnicity, presence of a partner and young children. Table A.4 shows that the coefficients for these characteristics are highly significant in most specifications. Income growth is lower for women than for men and the growth in taxable income increases with education. Income growth is also higher for self-employed individuals with a partner and/or children. Column (6) in Table 3 gives the ETI when we do not include the demographic controls. This reduces the ETI to 0.272.

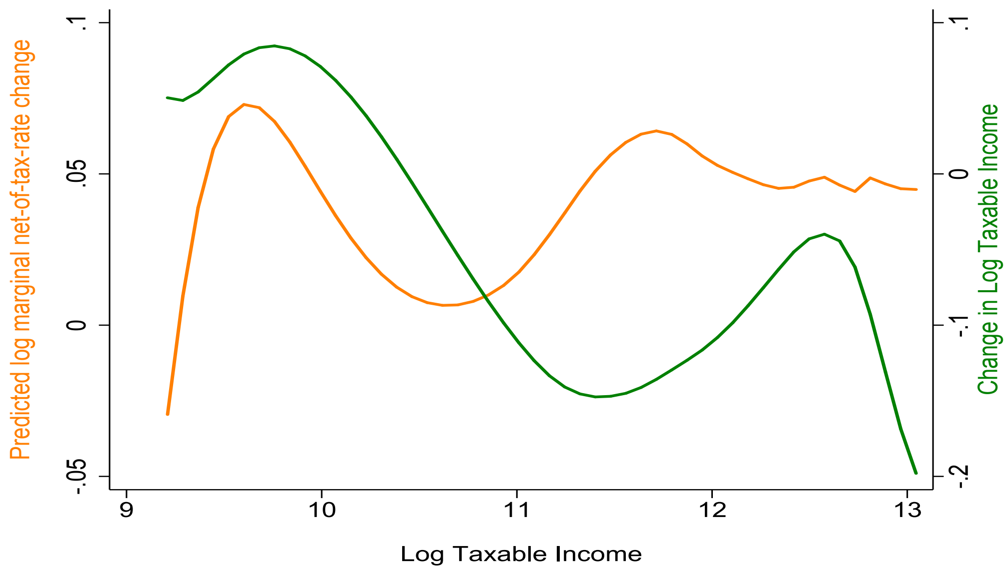
We correct for heterogeneous income trends to control for endogeneity of the tax rate (see Section 3.1), but we believe this problem may not be so severe in our case. First, the tax reform is not targeted at certain income groups and generated both increases and decreases in tax rates. Therefore there is no strong link between income level - and their transitory income and related mean-reversion - and tax changes. Second, the income distribution in the Netherlands is rather stable.

5.3 Heterogeneous responses

Table 4 displays the ETI estimates for subgroups. We do not find large differences in the ETI between men and women. In our most extensive specification, with ten splines of lagged log base-year income and its deviation from base-year income, the ETI for men is 0.290 whereas the ETI for women is 0.352. This in line with earlier studies that find a higher ETI for women than for men (Heim, 2010; Kleven and Schultz, 2014). Table 4 also provides the ETI for different educational attainment. The results reveal that the ETI is roughly similar for different education levels. The ETI is 0.319 for self-employed with a lower or middle education, whereas higher educated self-employed have a slightly lower ETI of 0.282.

In addition, Table 5 presents the results for three income levels. Figure 8 illustrates

Figure 8: Heterogeneity income



the heterogeneity with respect to income. At the lower end and middle of the income distribution, there is a positive correlation between the change in taxable income change and the change in the net-of-tax rate. This is not true for higher income levels. For individuals with an income above 43K (log income 10.7) there is an increase in the net-of-tax rate untill a certain income level. At the same time, taxable income falls, increases and falls again. For high-income self-employed there seems to be no correlation between changes in tax rates and taxable income. Moreover, the tax reforms hardly affected their marginal net-of-tax rates.

Next, Table 6 shows the results for different sub-periods with larger and smaller reforms. By using the period 1999–2003, we only use the variation resulting from the major tax reform in 2001 which generates an ETI of 0.502. Whereas including only post-2001 years that incorporates the smaller tax reforms generates a lower ETI of 0.253. Hence, individuals respond stronger to the large tax reform in 2001 than to the smaller reforms in the period 2002-2012. This is in line with the result found by Kleven and Schultz (2014).

Finally, we also estimate the ETI for wage earners by using the tax reform in 2001 which lowered marginal tax rates for both self-employed and wage earners. The smaller tax reforms in 2005 (income dependent tax exemption) and 2007 (introduction profit exemption rate) only benefit the self-employed. Therefore, we restrict the sample period to the period 1999–2003 for wage earners. The last column in Table 6 highlights that

Table 4: Elasticity of taxable income self-employed: by gender and education

	(1) Men	(2) Women	(3) Lower education[a]	(4) Middle education[b]	(5) Higher education[c]
$ln(z_{i,t})$	0.378***	0.304***	0.315***	0.331***	0.374***
	(0.057)	(0.077)	(0.099)	(0.063)	(0.090)
10 splines $ln(z_{i,t})$	0.289***	0.383***	0.341***	0.304***	0.395***
	(0.054)	(0.082)	(0.102)	(0.064)	(0.092)
10 splines Δ ln($z_{i.t-1}$)	0.290***	0.352***	0.319***	0.319***	0.282***
	(0.056)	(0.075)	(0.103)	(0.063)	(0.085)
Observations	81,481	45,826	27,806	62,704	39,061

[a] In Dutch: Basisonderwijs, VMBO

[b] In Dutch: MBO, HAVO, VWO

[c] In Dutch: HBO, WO

Notes: Clustered robust standard errors in parentheses.

Splines are based on a flexible piecewise linear functional form with ten components.

All regressions are weighted with lagged income and population weights.

*** p<0.01, ** p<0.05, * p<0.10.

self-employed are more responsive than wage earners.

5.4 Sensitivity checks

In this section, we perform several sensitivity checks whose results are shown in Tables A.6–A.11 in the Appendix. Now the rows present the results for separate regressions using different income controls, similar to the columns in Table 3.

First, we analyze the sensitivity of the ETI across income levels and using different lower bounds on income. Column (1) in Table A.6 repeats our baseline specification, where we select all self-employed with positive taxable income and include self-employed individuals who also earn wage income. The estimate of the ETI in column (2) is based on individuals with only self-employment income. Both selections yield similar elasticities indicating that other sources of income are not relevant. Because mean-reversion is expected to be more severe at the lower end of the earnings distribution, we impose a minimum level of 10,000 euro. Again, this hardly affects the ETI, see column (3). Next, we check for potential selection bias because self-employed are a selected sample. For this, we include an inverse Mills ratio from the first-stage selection probit where we use partner

Table 5: Elasticity of taxable income: heterogeneity over income

	(1) Lowest third (1K-22K)	(2) Middle third (22K-43K)	(3) Highest third (> 43K)
$ln(z_{i,t})$	1.247***	0.436***	-0.028
	(0.182)	(0.086)	(0.061)
10 splines $ln(z_{i,t})$	1.127***	0.409***	0.078
	(0.172)	(0.087)	(0.057)
10 splines Δ $\ln(z_{i.t-1})$	1.169***	0.434***	0.018
	(0.173)	(0.084)	(0.062)
Observations	44,734	44,728	44,734

Notes: Clustered robust standard errors in parentheses.
Splines are based on a flexible piecewise linear functional form with ten components.
All regressions are weighted with lagged income and population weights.
*** p<0.01, ** p<0.05, * p<0.10.

variables and presence of children as exclusion restrictions. The results do not change when including a correction for these non-observables (column (4)), therefore we do not find evidence of selection bias. A comparison of the rows shows that the results are robust among different specifications of income controls.

Second, Table A.7 shows the sensitivity of the results to weights. In the literature on taxable income, it is standard to weight by sampling weights and by the level of taxable income. In that case, all individuals contribute to the average ETI in proportion to their income, which is relevant for the measurement of the deadweight loss of income taxes. In column (1) and (2), we respectively use lagged or base-year income. The advantage of using income lagged one period is that is is less endogenous to the instrument. Lagged income and base-year income are highly correlated - the correlation coefficient equals 0.85. In column (3), we only use sampling weights and individuals with lower taxable income now get a higher weight than before. Consequently, the ETI increases to 0.374 which means a relatively large share of the responsiveness in taxable income comes from individuals with a lower taxable income.

Third, we either expand or reduce our sample by allowing for more or less extreme values of the changes in (synthetic) net-of-tax rates, see Table A.8. On one hand, allowing for more extreme responses may improve identification. On the other hand, extreme changes in marginal tax rates may be the result of measurement error and as such including

Table 6: Elasticity of taxable income: small versus large reforms and self-employed versus wage earners

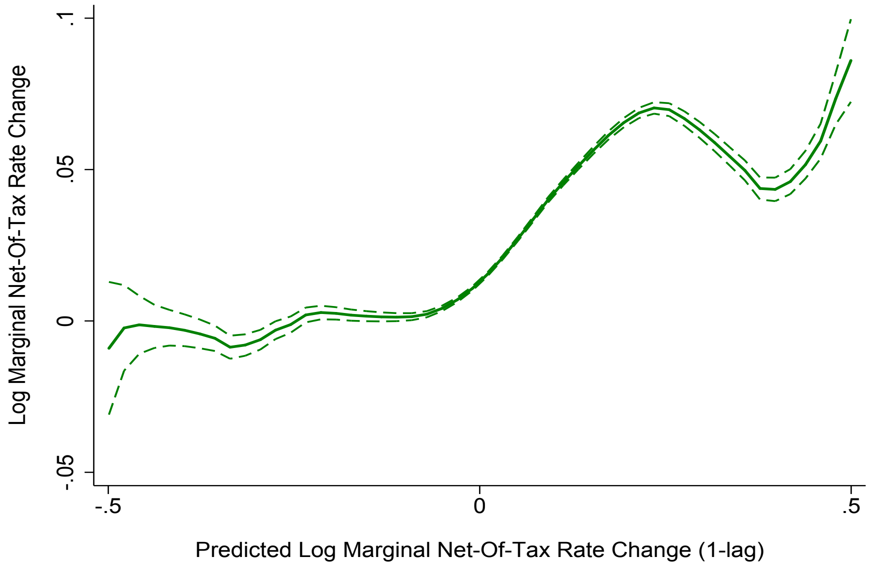
	(1) self-employed 1999-2003	(2) self-employed 2002-2012	(3) wage earners[a] 1999-2003
$ln(z_{i,t})$	0.608***	0.219***	0.197***
	(0.059)	(0.040)	(0.006)
10 splines $ln(z_{i,t})$	0.502***	0.253***	0.077***
	(0.098)	(0.044)	(0.017)
Observations	29,597	141,759	464,811

(a) For wage earners we only include the period 1999–2003 because the reforms after 2001 only affected the self-employed. We follow the analysis by Jongen and Stoel (2016) and restrict the sample to individuals with an absolute change in the log marginal net-of-tax rate of at most 0.30.
Notes: Clustered robust standard errors in parentheses.
Splines are based on a flexible piecewise linear functional form with ten components.
All regressions are weighted with base-year income and population weights.
*** p<0.01, ** p<0.05, * p<0.10.

them weakens the instrument. The definition of taxable income used in the estimation misses some important tax deductions, such as mortgage interest deductions and the investment deduction for self-employed, and as a result our estimate is smaller than ETI for taxable income (see Table 1). Consequently, this introduces measurement error in determining the effective marginal tax rates. In our baseline specification we restrict our sample to individuals who experience changes in their log marginal net-of-tax rates of at most 0.5. This is equivalent to a decrease in the marginal tax rates from 52%, which is top marginal tax rate, to 21%, which is 10 percentage points below the marginal tax rate in the lowest tax bracket (see also Table A.2). A more narrow sample increases the ETI, whereas the extended sample reduces the ETI. A close look at the instrument in Figure A.2 highlights that the instrument becomes weaker for more extreme values, particularly at the lower end of the distribution.

Fourth, we consider different time lags in Table A.9, similar to Gruber and Saez (2002), Kleven and Schultz (2014) and Kopczuk (2005). The results suggest that the time period interval matters, although the differences are small. The largest difference is between one-year (0.2) and two-year differences (0.3). On one hand, individuals need time to respond

Figure 9: Strength of the instrument based on Lag Income



to changes in tax rates and therefore, a one-year time difference is too short and one should consider longer time periods. On the other hand, three-year differences might be too long and might mix up both increases and decreases in tax rates.

Fifth, we follow Weber (2014) and employ an alternative instrument based on lagged income. In contrast to the instrument based on base-year income, the instrument based on lagged income seems weaker (see Figure 9). Furthermore, the figure shows that there is non-monotonicity between our instrument and the actual change in the marginal net-of-tax rates. For higher values of the net-of-tax rate change the instruments appears to be weak. The estimation results are shown in separate columns in in Table A.11. Column (1) provides the baseline ETI (0.313) for the Weber sample with additional selections for the synthetic marginal tax rates based on lag income (this reduces the sample to 129,571). Although the first-stage results indicate that the instrument is strong enough (F=377), the coefficient only equals 0.110 and Figure 9 shows that there is non-monotonicity between our instrument and the actual change in the marginal net-of-tax rates. For higher values of the net-of-tax rate change the instruments appears to be weak. Column (2) indicates that the results are not robust for the income controls. Including both instruments based on base-year income and lag income, column (3), hardly affects the result. The existence of two instruments for one endogenous variable enables us to perform an over-identification test. Assuming the first instrument is exogenous, we then test whether the second instrument is endogenous Weber (2014). We can reject the null hypothesis that the instrument is exogenous at the 5% significant level. Once we weight with base-year income the instruments appear to be exogenous and this gives us some reliance on the instruments. However, these instruments might no be valid and we believe the instrument based on lagged income is not strong enough, even though it passes the overall F-test see Table A.10.

6 Conclusions

In this paper, we investigate how self-employed respond to financial incentives. We exploit three tax reforms to estimate the intensive margin responses of self-employed. We estimate an ETI of 0.3 for self-employed individuals in the Netherlands, which is in between the results found by Kleven and Schultz (2014) for Denmark (0.1), and Heim (2010) for the U.S. (0.9). Moreover, we find that self-employed respond stronger to the major tax reform in 2001 than to the smaller tax reforms in 2005 and 2007. We reveal significant heterogeneity in ETI across the income distribution and occupational choice. Self-employed with a lower income have a higher ETI than self-employed with higher incomes, and self-employed respond much stronger to financial incentives than wage earners. However, there is little heterogeneity in responses for demographic subgroups: women only have a slightly higher ETI than men, and the ETI is roughly similar for different education levels.

Our results clearly show that the self-employed adjust their taxable profit income in response to a change in marginal tax rates. This has important policy implications. A reduction in the net-of-tax rate with 1% leads to a lower increase in revenues because self-employed lower their taxable income by 0.3%.

Our study adds to the sparse empirical literature on self-employed and reveals significant heterogeneity. We reveal large variation in ETI across the income distribution. Contrary to other studies we find largest responses among low-income self-employed and smallest responses for high-income self-employed. We attribute this to the small changes in tax rates for high-income self-employed. Furthermore we show that the ETI estimates vary across reforms. In reaction to the major tax reform the self-employed respond stronger than to a series of smaller tax reforms. We believe this could explain some of the large variation in ETI found in earlier studies.

The ETI of self-employed is larger than the ETI of wage earners. According to the theory of optimal taxation, there are several reasons why income from self-employment should be taxed less than income from wage employment (Mirrlees, 1971, 1976). Indeed, the current tax policy in the Netherlands ensures that self-employed on average pay less income taxes than wage ea. Over the past decade this preferential tax treatment has been increased in the Netherlands. Moreover, the preferential tax treatment of the self-employed may also affect the decision to become self-employed. Whether this substantial tax difference is desirable from an optimal taxation perspective is an interesting avenue for further research.

A Appendix

A.1 Additional Graphs and Tables

Table A.1: Tax schedule

Year	Tax 1 (%)	Tax 2 (%)	Tax 3 (%)	Tax 4 (%)	End of bracket 1 (Euro)	End of bracket 2 (Euro)	End of bracket 3 (Euro)	Exemption self-employed Ex. I Max (Euro)	Exemption self-employed Ex. I Min (Euro)	Exemption self-employed Ex. II Rate (%)
1999	35.75	37.05	50	60	6,807	21,861	48,080	5,361	3,410	–
2000	33.90	37.95	50	60	6,922	22,233	48,898	5,949	3,962	–
2001	32.35	37.60	42	52	14,870	27,009	46,309	6,084	2,984	–
2002	32.35	37.85	42	52	15,331	27,847	47,745	6,358	3,162	–
2003	33.15	38.65	42	52	15,883	28,850	49,464	6,430	3,119	–
2004	33.15	40.35	42	52	16,265	29,543	50,652	6,585	3,194	–
2005	34.40	41.95	42	52	16,893	30,357	51,762	8,386	4,068	–
2006	34.15	41.45	42	52	17,046	30,631	52,228	8,885	4,310	–
2007	33.65	41.40	42	52	17,319	31,122	53,064	9,028	4,379	10.0
2008	33.60	41.85	42	52	17,579	31,589	53,860	9,096	4,412	10.0
2009	33.50	42.00	42	52	17,878	32,127	54,776	9,251	4,488	10.5
2010	33.45	41.95	42	52	18,218	32,738	54,367	9,427	4,574	12.0
2011	33.00	41.95	42	52	18,628	33,436	55,694	9,484	4,602	12.0
2012	33.10	41.95	42	52	18,945	33,863	56,491	7,280	0	12.0

Table A.2: Outliers

	Base		
$\tau_{i,t}$	52	52	52
$\bar{\tau}_{i,t+3}$	35	21	0
$1-\tau_{i,t}$	48	48	48
$1-\bar{\tau}_{i,t+3}$	65	79	100
$\Delta\ln(1-\bar{\tau}_{is})$	0.30	0.50	0.73

Figure A.1: Percent change in the net-of-tax rates - singles

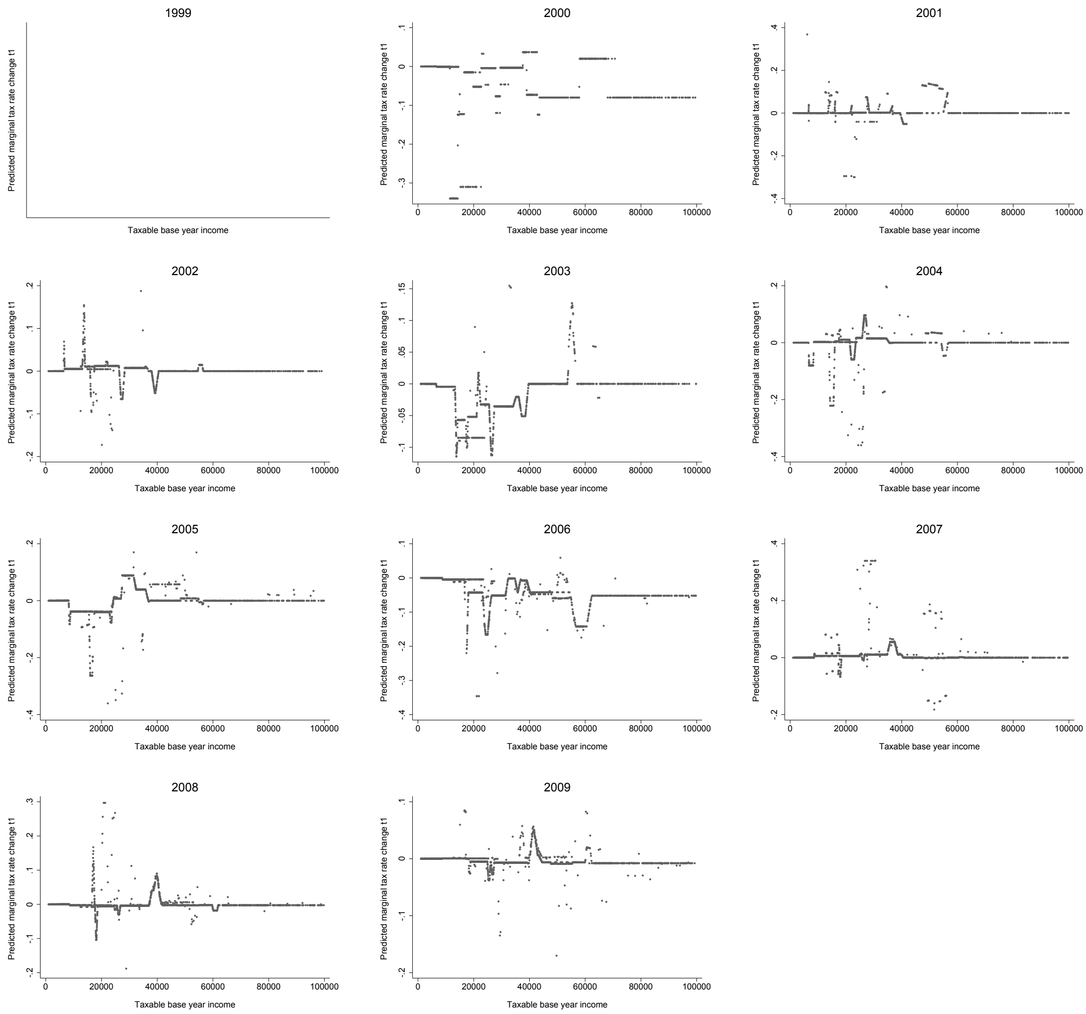


Figure A.2: Strength of the instrument

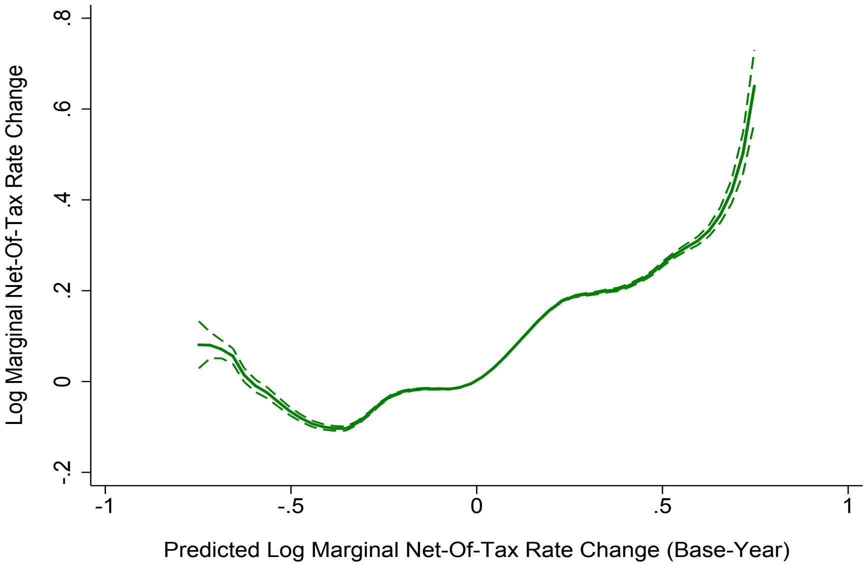


Table A.3: First-stage regression

Female	0.012***	Spline 1 lag base-year	0.035***
	(0.001)		(0.004)
Age	0.001***	Spline 2 lag base-year	0.035***
	(0.000)		(0.009)
Higher vocational education	-0.004***	Spline 3 lag base-year	0.071***
	(0.001)		(0.013)
Tertiary education	-0.015***	Spline 4 lag base-year	0.074***
	(0.002)		(0.016)
Native background	-0.001	Spline 5 lag base-year	-0.064***
	(0.002)		(0.018)
Partner	-0.007***	Spline 6 lag base-year	-0.048**
	(0.002)		(0.019)
Youngest child 0–3 yrs	0.008***	Spline 7 lag base-year	0.054***
	(0.002)		(0.019)
Youngest child 4–11 yrs	-0.004***	Spline 8 lag base-year	0.056***
	(0.001)		(0.016)
Youngest child 12–17 yrs	-0.001	Spline 9 lag base-year	0.037***
	(0.001)		(0.008)
2001	-0.037***	Spline 10 lag base-year	0.004*
	(0.002)		(0.003)
2002	-0.041***	Spline 1 diff lag base-year	-0.038***
	(0.002)		(0.004)
2003	-0.062***	Spline 2 diff lag base-year	-0.051***
	(0.002)		(0.012)
2004	-0.022***	Spline 3 diff lag base-year	-0.058***
	(0.002)		(0.021)
2005	-0.020***	Spline 4 diff lag base-year	-0.038
	(0.002)		(0.030)
2006	0.000	Spline 5 diff lag base-year	-0.032
	(0.002)		(0.038)
2007	-0.035***	Spline 6 diff lag base-year	-0.009
	(0.002)		(0.040)
2008	-0.034***	Spline 7 diff lag base-year	-0.050
	(0.002)		(0.033)
2009	-0.031***	Spline 8 diff lag base-year	-0.017
	(0.002)		(0.026)
Instrument $\Delta \ln(1-\bar{\tau}_{i,t})$	0.377***	Spline 9 diff lag base-year	-0.092***
	(0.006)		(0.017)
Constant	-0.360***	Spline 10 diff lag base-year	-0.077***
	(0.036)		(0.006)
F-test	3951		
Observations	134,196		
R-squared	0.137		

Notes: Clustered robust standard errors in parentheses.
The first-stage equation is

$$\Delta \ln(1-\tau_{is}) = \gamma_1 \Delta \ln(1-\bar{\tau}_{is}) + x_i \gamma_2 + \mu_t + \delta f(z_{i,t}) + u_{it} \tag{A.1}$$

*** p<0.01, ** p<0.05, * p<0.10.

Table A.4: Elasticity of taxable income self-employed: full results

	(1) OLS	(2) No income controls	(3) $ln(z_{i,t})$	(4) 10 splines $ln(z_{i,t})$	(5) 10 splines Δ ln$(z_{i.t-1})$	(6) 10 splines Δ ln$(z_{i.t-1})$
ETI	-1.272***	0.151***	0.351***	0.328***	0.303***	0.272***
	(0.016)	(0.044)	(0.045)	(0.046)	(0.045)	
Female	-0.005	-0.011**	-0.084***	-0.080***	-0.061***	
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	
Age	-0.002***	-0.003***	-0.003***	-0.003***	-0.004***	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
Higher vocational education	0.011**	0.011**	0.026***	0.025***	0.022***	
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	
Tertiary education	0.064***	0.053***	0.168***	0.142***	0.136***	
	(0.005)	(0.006)	(0.007)	(0.007)	(0.007)	
Native	0.000	0.004	0.004	0.012**	0.004	
	(0.006)	(0.006)	(0.008)	(0.007)	(0.007)	
Partner	0.012*	0.014**	0.033***	0.032***	0.033***	
	(0.006)	(0.007)	(0.008)	(0.008)	(0.008)	
Youngest child 0–3 yrs	0.015**	0.015**	0.031***	0.028***	0.026***	
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	
Youngest child 4–11 yrs	0.016***	0.024***	0.040***	0.035***	0.035***	
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	
Youngest child 12–17 yrs	0.017***	0.020***	0.036***	0.033***	0.034***	
	(0.006)	(0.006)	(0.007)	(0.006)	(0.007)	
2001	-0.129***	-0.029***	-0.007	-0.005	-0.025***	-0.028***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
2002	-0.073***	0.023***	0.042***	0.040***	0.030***	0.029***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
2003	-0.040***	0.096***	0.120***	0.115***	0.098***	0.097***
	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
2004	0.111***	0.151***	0.159***	0.157***	0.150***	0.151***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
2005	0.064***	0.104***	0.116***	0.114***	0.119***	0.119***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
2006	0.007	0.009	0.020**	0.017**	0.016**	0.016**
	(0.008)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)
2007	-0.196***	-0.108***	-0.067***	-0.071***	-0.062***	-0.067***
	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
2008	-0.179***	-0.094***	-0.056***	-0.059***	-0.073***	-0.079***
	(0.007)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
2009	-0.163***	-0.080***	-0.055***	-0.061***	-0.088***	-0.092***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)

Table A.5: Elasticity of taxable income self-employed - continued Table A.4 and Table 3

	(1) OLS	(2) No income controls	(3) $ln(z_{i,t})$	(4) 10 splines $ln(z_{i,t})$	(5) 10 splines Δ ln($z_{i.t-1}$)	(6) 10 splines Δ ln($z_{i.t-1}$)
ETI	-1.272***	0.151***	0.351***	0.328***	0.303***	0.272***
	(0.016)	(0.044)	(0.045)	(0.046)	(0.045)	(0.045)
Log base-year inc			-0.177***			
			(0.005)			
Spline (lag) base-year inc 1				-0.630***	-0.216***	-0.206***
				(0.059)	(0.018)	(0.017)
Spline (lag) base-year inc 2				-0.180***	-0.082***	-0.065**
				(0.056)	(0.029)	(0.029)
Spline (lag) base-year inc 3				0.007	-0.109***	-0.099**
				(0.058)	(0.041)	(0.041)
Spline (lag) base-year inc 4				-0.087*	-0.106**	-0.091*
				(0.053)	(0.048)	(0.047)
Spline (lag) base-year inc 5				-0.405***	-0.098*	-0.073
				(0.059)	(0.050)	(0.050)
Spline (lag) base-year inc 6				-0.173***	-0.100**	-0.076
				(0.059)	(0.049)	(0.049)
Spline (lag) base-year inc 7				-0.341***	-0.231***	-0.193***
				(0.057)	(0.049)	(0.049)
Spline (lag) base-year inc 8				-0.175***	-0.127***	-0.094**
				(0.051)	(0.043)	(0.043)
Spline (lag) base-year inc 9				-0.211***	-0.105***	-0.032
				(0.033)	(0.031)	(0.031)
Spline (lag) base-year inc 10				0.019**	-0.064***	-0.025*
				(0.010)	(0.014)	(0.013)
Spline 1 diff lag base-year					0.193***	0.175****
					(0.016)	(0.016)
Spline 2 diff lag base-year					0.410***	0.381***
					(0.043)	(0.043)
Spline 3 diff lag base-year					0.404***	0.379***
					(0.074)	(0.074)
Spline 4 diff lag base-year					0.457***	0.425***
					(0.098)	(0.098)
Spline 5 diff lag base-year					0.289**	0.239*
					(0.128)	(0.129)
Spline 6 diff lag base-year					0.067	0.055
					(0.133)	(0.134)
Spline 7 diff lag base-year					0.555***	0.472***
					(0.112)	(0.112)
Spline 8 diff lag base-year					0.216**	0.199**
					(0.086)	(0.087)
Spline 9 diff lag base-year					0.514***	0.506***
					(0.070)	(0.069)
Spline 10 diff lag base-year					0.385***	0.364***
					(0.033)	(0.032)
Observations	134,196	134,196	134,196	134,196	134,196	134,196

*** p<0.01, ** p<0.05, * p<0.10.

Table A.6: Elasticity of taxable income: sensitivity to selections and specifications

	(1) SE + wage Income > 0K	(2) Only SE Income > 0K	(3) Only SE Income > 10K	(4) Participation probit
$ln(z_{i,t})$	0.351***	0.367***	0.354***	0.354***
	(0.045)	(0.047)	(0.048)	(0.045)
10 splines $ln(z_{i,t})$	0.328***	0.329***	0.300***	0.332***
	(0.046)	(0.048)	(0.047)	(0.046)
10 splines $\Delta ln(z_{i,t-1})$	0.303***	0.312***	0.311***	0.307***
	(0.045)	(0.047)	(0.048)	(0.045)
Observations	134,196	123,354	110,654	134,196

(1) Individuals with self-employment income and possibly wage income > 0 euro, weighted by population and income weights.

(2) Individuals with only self-employment income > 0 euro, weighted by population and income weights.

(3) Individuals with only self-employment income > 10,000 euros, weighted by population and income weights.

(4) Including inverse mills ratio from first stage where partner dummy and presence of children act as exclusion restrictions.

Notes: Clustered robust standard errors in parentheses.
Splines are based on a flexible piecewise linear functional form with ten components.
All regressions are weighted with lagged income and population weights.
*** p<0.01, ** p<0.05, * p<0.10.

Table A.7: Sensitivity: sampling weights

	(1) Lag income	(2) Base-Year income	(3) no weight
$\ln(z_{it})$	0.351 ***	0.221***	0.374***
	(0.045)	(0.037)	(0.037)
10 splines $\ln(z_{it})$	0.328 ***	0.239***	0.433***
	(0.046)	(0.038)	(0.039)
10 splines $\Delta\ \ln(z_{i,t-1})$	0.303 ***	0.178***	0.375***
	(0.045)	(0.036)	(0.036)
Observations	134,196	134,196	134,196

Notes: Clustered robust standard errors in parentheses.
Splines are based on a flexible piecewise linear functional form with ten components.
All regressions are weighted with lagged income and population weights.
*** p<0.01, ** p<0.05, * p<0.10.

Table A.8: Sensitivity to selection marginal tax rates

	$\lvert\Delta \ln(1-\bar{\tau}_{is})\rvert$		
	(1)	(2)	(3)
	< 0.50	< 0.30	< 0.75
$ln(z_{i,t})$	0.351***	0.353***	0.121***
	(0.045)	(0.044)	(0.039)
10 splines $ln(z_{i,t})$	0.328***	0.360***	0.043
	(0.046)	(0.048)	(0.038)
10 splines $\Delta ln(z_{i,t-1})$	0.303***	0.325***	0.094**
	(0.045)	(0.045)	(0.038)
F-test	3951	5936	4107
Observations	134,196	114,541	146,732

Notes: Clustered robust standard errors in parentheses.
Splines are based on a flexible piecewise linear functional form with ten components.
All regressions are weighted with lagged income and population weights.
*** p<0.01, ** p<0.05, * p<0.10.

Table A.9: Sensitivity to time differences

	(1) s=3	(2) s=2	(3) s=1
$ln(z_{i,t})$	0.351^{***}	0.355^{***}	0.215^{***}
	(0.045)	(0.048)	(0.045)
10 splines $ln(z_{i,t})$	0.328^{***}	0.310^{***}	0.212^{***}
	(0.046)	(0.047)	(0.042)
10 splines $\Delta ln(z_{i,t-1})$	0.303^{***}	0.322^{***}	0.208^{***}
	(0.045)	(0.049)	(0.041)
Observations	134,196	150,214	174,131

Notes: Clustered robust standard errors in parentheses.
Splines are based on a flexible piecewise linear functional form with ten components.
All regressions are weighted with lagged income and population weights.
*** p<0.01, ** p<0.05, * p<0.10.

Table A.10: Elasticity of taxable income: First-stage results

	(1) Gruber Saez	(2) Weber	(3) Gruber Saez and Weber	(4) Gruber Saez and Weber
$\Delta \ln(1-\bar{\tau}_{i,t})$	0.379^{***}		0.372^{***}	0.385^{***}
	(0.006)		(0.006)	(0.006)
$\Delta \ln(1-\bar{\tau}_{i,t-1})$		0.110^{***}	0.037^{***}	0.031^{***}
		(0.006)	(0.006)	(0.005)
Observations	129,571	129,571	129,571	129,571
R^2	0.138	0.084	0.139	0.132
First stage F-statistic	3755	377	1936	2508

Notes: Clustered robust standard errors in parentheses.
Splines are based on a flexible piecewise linear functional form with ten components.
All regressions are weighted with lagged income and population weights.
*** p<0.01, ** p<0.05, * p<0.10.

Table A.11: Elasticity of taxable income: choice of instruments

	(1) Gruber Saez	(2) Weber	(3) Gruber Saez and Weber	(4) Gruber Saez and Weber
$\ln(z_{it})$	0.359^{***}	0.449^{***}	0.362^{***}	0.228^{***}
	(0.047)	(0.133)	(0.046)	(0.037)
10 splines $\ln(z_{it})$	0.334^{***}	0.241^{*}	0.331^{***}	0.247^{***}
	(0.047)	(0.132)	(0.047)	(0.039)
10 splines Δ $\ln(z_{i,t-1})$	0.314^{***}	0.399^{***}	0.307^{***}	0.185^{***}
	(0.046)	(0.151)	(0.045)	(0.037)
First stage F-statistic	3755	377	1936	2508
Instruments	0 lag	1 lag	0,1 lag	0,1 lag
Weights	lag income	lag income	lag income	base-year income
Hansen J statistic (p-value)			0.0243	0.4673
Observations	129,571	129,571	129,571	129,571

Notes: Clustered robust standard errors in parentheses.
Splines are based on a flexible piecewise linear functional form with ten components.
All regressions are weighted with lagged income and population weights.
*** p<0.01, ** p<0.05, * p<0.10.

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