DISCUSSION PAPER SERIES

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ABSTRACT

The Elasticity of Taxable Labour Income in the Netherlands*

We study the elasticity of taxable labour income in the Netherlands. We use a large and rich data set, including both financial and demographic variables, for the period 1999–2005. The 2001 tax reform generates large exogenous variation in marginal tax rates at different segments of the income distribution. For all workers, we find an elasticity of 0.10 in the short run, 1 year after the reform, rising to 0.24 in the medium to longer run, 5 years after the reform. Furthermore, we find that the elasticity is higher for higher incomes and women. Also, we find that the elasticity of taxable labour income is higher than the elasticity of (contractual) annual hours worked.

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1 Introduction

Following the seminal contributions by Feldstein (1995, 1999), the recent public finance literature has focused on the so-called elasticity of taxable income (ETI) to measure the behavioural responses to changes in taxation. The ETI is a more comprehensive measure of behavioural responses to changes in taxation than e.g. the labour supply elasticity because it captures the full range of tax base responses including effort, occupational choice, tax avoidance and tax evasion. The ETI may therefore provide a better measure for the efficiency costs of taxation, although there is an active debate on whether or not the ETI is a sufficient statistic to measure the deadweight loss from taxation (Chetty, 2009; Saez et al., 2012; Doerrenberg et al., 2017).

In this paper we estimate the ETI for the Netherlands. Specifically, we consider the responsiveness of taxable labour income of employees to changes in (effective) marginal tax rates. We use a rich data set, the Labour Market Panel of Statistics Netherlands (2009), that contains both taxable labour income data from the Tax Office and a large number of socioeconomic variables taken from the Labour Force Survey (education) and from the municipalities (ethnicity, household type) that are typically absent from tax return data. Furthermore, for a subset of workers, the Labour Market Panel also contains data on contractual annual hours worked. For this groups we can also compare the ETI with the elasticity of (contractual) annual hours worked. The data set covers the period 1999–2005. The 2001 tax reform in the Netherlands generates large exogenous variation in marginal tax rates at different segments of the income distribution.

We estimate the ETI by running a regression of the change in log taxable labour income on the change in the log of the net-of-tax rate (1 minus the effective marginal tax rate) and a number of controls. ETI studies typically look at either the elasticity of broad income (before deductions) or the elasticity of taxable income (after deductions) as the dependent variable. Our outcome variable of taxable labour income is closer to the concept of broad income than to the concept of taxable income, taxable labour income is broad income minus work-related deductions but before personal deductions.[1] The empirical literature on the ETI has identified a number

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[1] The taxable labour income variable that we use is very close to the concept of adjusted gross income in the US.

of concerns that we need to address. One concern is the endogeneity of the marginal tax rate. In a tax system with rising marginal tax rates, a higher income leads to a higher marginal tax rate when the individual moves to a higher tax bracket. This creates a relationship between the error term and the net-of-tax rate and therefore leads to biased estimates. Following Auten and Carroll (1999) we deal with this problem by using synthetic net-of-tax rates as an instrument for actual net-of-tax rates. Specifically, we project income forward using average income growth, and calculate synthetic marginal tax rates using this projected (exogenous) income.

Another concern is mean reversion in income growth. Individuals that experience a positive (negative) shock in income in one period are more likely to have lower (higher) subsequent income growth than individuals that do not have a positive (negative) shock to income. This leads to mean reversion in incomes. When the reform targets mostly low-income groups or high-income groups this may again lead to a bias in the estimates of the ETI. Again following Auten and Carroll (1999), we control for mean reversion by including log base-year income in the control variables.

A further concern are other exogenous group-specific changes in income. For example, skill-biased technological change or globalization may cause the incomes of high-wage earners to rise faster than the incomes of low-wage earners. If the reform targets high-wage earners we run the risk of confounding the treatment effect of the change in tax rates with differential trends for different income groups. We argue that this is less of a concern in our case. First, we show that the income distribution was stable over the decade before the reform, similar to the case of Denmark studied in Kleven and Schultz (2014). Second, also similar to Kleven and Schultz (2014), we study a reform that led to significant changes in marginal tax rates for different groups of the income distribution, not just high-wage earners but also low- and middle-wage earners, and within some groups we have both positive and negative changes as well. Third, similar to Kleven and Schultz (2014), we have a data set that includes socioeconomic variables. This allows us to control for differential trends for individuals with different socioeconomic characteristics like the level of education and ethnicity. However, as a robustness check we also consider the solution to differential trends offered by Gruber and Saez (2002), they control for differential trends across the income distribution by including a spline in log base-year income in the set of controls.

Our main findings are as follows. In our base specification we find an ETI of 0.24

for all workers. This ETI is robust to different ways of controlling for exogenous income growth, the income cutoff and the choice of base year. For workers with a high income (>50K euro) the ETI is higher, though the exact value of their elasticity depends on the way we control for exogenous income growth. We also find that the ETI is higher for women than for men. Finally, we find that the ETI is higher than the elasticity of (contractual) annual hours worked.

We make three contributions to the literature. First, we present the first estimates for the ETI in the Netherlands using the Gruber and Saez (2002) methodology.[2] Indeed, there is a large number of ETI studies for Anglo-Saxon countries (e.g. Feldstein, 1995; Auten and Carroll, 1999; Sillamaa and Veall, 2001; Gruber and Saez, 2002; Kopczuk, 2005; Weber, 2014; Burns and Ziliak, 2017) and for Scandinavia (e.g. Aarbu and Thoresen, 2001; Hansson, 2007; Blomquist and Selin, 2010; Holmlund and Soderstrom, 2011; Gelber, 2014; Kleven and Schultz, 2014; Thoresen and Vatto, 2015), but only a handful of studies for Continental Europe. Table A.1 in the appendix gives an overview of ETI studies. Studies for Anglo-Saxon countries typically find a relatively high ETI, with recent estimates suggesting a value for the elasticity of broad income of 0.29 (Burns and Ziliak, 2017) to 0.48 (Weber, 2014). Studies for Scandinavia typically find a relatively low ETI, with recent estimates suggesting a value of around 0.02-0.05 for the broad income elasticity in Norway (Thoresen and Vatto, 2015), 0.06 for Denmark (Kleven and Schultz, 2014) and 0.09-0.15 for Sweden (Gelber, 2014). Clearly, the deadweight loss of taxation is quite different for an ETI of 0.1 than for an ETI of 0.4. Hence, obtaining estimates for the ETI for countries in Continental Europe is of considerable importance. Lehmann et al. (2013) estimate an elasticity of broad income of 0.22 for France, using a reform targeted at lower incomes. Doerrenberg et al. (2017) estimate a broad income elasticity of 0.16-0.28 for Germany, using several reforms. Our base estimate of 0.24 for the Netherlands is in line with the findings for France and Germany. Hence, it appears that the elasticity of broad income in Continental European countries takes an intermediate position between Anglo-Saxon countries and Scandinavia.

Our second contribution is that we compare the elasticity of taxable labour income with the elasticity of (contractual) annual hours worked. Annual hours worked responses represent real distortions, whereas other tax base responses may only represent shifting behaviour with potentially large fiscal and other externalities. There

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[2]An earlier version of this paper was published as a technical report (Jongen and Stoel, 2013).

4

are only a few studies that compare the two, information on hours worked is typically lacking in tax return data.[3] Moffitt and Wilhelm (2000) report a substantial elasticity of broad income for high-income earners in the US, but do not find an increase in reported hours of work. In a recent study, Thoresen and Vatto (2015) find a small but positive and significant hours worked elasticity for wage earners in Norway of 0.04–0.05, which is very close to their estimated broad income elasticity of 0.02–0.06. We also find a positive significant (contractual annual) hours worked elasticity for wage earners in the Netherlands of 0.05, but this elasticity is substantially lower than our estimated broad income elasticity of 0.21 for the sample for which we also have data on hours worked. Apparently, other mechanisms than hours worked seem to play a role in tax-base responses in the Netherlands, although part of the difference may still be due to changes in e.g. overtime hours.

Our third contribution is that we estimate the short- to medium- or longer-run taxable labour income elasticity, estimating the taxable labour income elasticity 1 year since the start of the reform (0.10 for the period 1999-2001), 3 years since the start of the reform (0.17 for the period 1999-2003) and 5 years since the start of the reform (0.24 for the period 1999-2005).[4] We find that the elasticity is higher for longer horizons.[5] Following Gruber and Saez (2002), it is common practice to use 3-year intervals in the base specification. Our results suggest that this interval may be too short to capture the full tax-base responses to changes in marginal tax rates, and the same is true for hours-worked responses.

The outline of the paper is as follows. In Section 2 we consider the main features of the 2001 tax reform that we use as exogenous variation in the empirical analysis. Section 3 outlines our empirical methodology. In Section 4 we discuss the data set and give some descriptive statistics. Section 5 gives the estimation results and a number of robustness checks. Section 6 discusses our findings and concludes.

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[3]Indeed, Saez et al. (2012, p.38) argue that "[I]t would certainly be valuable to follow upon Moffitt and Wilhelm (2000) and systematically compare income reporting responses to tax changes with real economic responses such as labor supply or output."

[4]Using the same sample for the different horizons.

[5]Estimating the effect for all years, the full effect is realized 4 years after the reform.

2 The 2001 tax reform

In our empirical analysis we use data for the period 1999–2005. The 2001 tax reform in the Netherlands generates large exogenous variation in effective marginal tax rates. Table 1 shows the statutory tax bracket rates and the tax bracket lengths over the data period. In both the pre- and post-reform period there were four tax brackets. In 2000, the last year before the tax reform, the first bracket rate was 33.9%, the second bracket rate was 37.95%, the third bracket rate was 50% and the fourth (open) bracket rate was 60%. In 2001, the first year of the reform, the rate in the first and second bracket dropped only slightly, to 32.35% and 37.60% respectively, and then increased somewhat in the subsequent years. The third and fourth bracket rates dropped by 8 percentage points to 42% and 52%, respectively. However, there were also important shifts in bracket lengths. The first and the second bracket became longer, reducing marginal tax rates for individuals that moved to a lower tax bracket. The third tax bracket became shorter, which moved part of the individuals that were in the third tax bracket to the fourth tax bracket, which meant a slight increase in the marginal tax rate from 50 to 52% for this group.[6]

Next to changes in bracket rates and bracket lenghts, another important driver of changes in effective marginal tax rates was the substantial increase in the (general) earned income tax credit (*Arbeidskorting*) in 2001. This earned income tax credit was phased in up to 16,000 euro in 2001.[7] This led to a significant drop in effective marginal tax rates for low incomes. Furthermore, the change from tax allowances (the benefit of which does depend on marginal tax rates) to tax credits (the benefit of which does not depend on marginal tax rates) creates additional variation in effective marginal tax rates in the lower part of the income distribution.

Figure 1 illustrates the changes in effective marginal tax rates. In this figure we plot the change in effective marginal tax rates from 1999 to 2001 (for 2001 we use synthetic marginal tax rates[8]) against income in year 1999. From the table it is

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[6]In the years after 2001, the top of the third bracket moved up again, but not in real terms, as this was simply the result of indexing the bracket lenghts with wage growth, and the same holds for the other tax brackets.

[7]In 2001, the gross annual minimum wage was 15,130 euro. In the period we consider, the earned income tax credit in the Netherlands had a phase-in range, but there was no phase-out, as opposed to e.g. the EITC in the US.

[8]Synthetic effective marginal tax rates are calculated on base year income projected forward

Table 1: Changes in the tax system: 1999–2005

	Pre reform		Post reform				
	1999	2000	2001	2002	2003	2004	2005
Bracket rates (in %)							
Income bracket 1	35.75	33.90	32.35	32.35	32.35	33.40	34.40
Income bracket 2	37.05	37.95	37.60	37.85	37.85	40.35	41.95
Income bracket 3	50.00	50.00	42.00	42.00	42.00	42.00	42.00
Income bracket 4	60.00	60.00	52.00	52.00	52.00	52.00	52.00
Bracket lengths (in €)							
Income bracket 1	6,807	6,922	14,870	15,331	15,883	16,265	16,893
Income bracket 2	21,861	22,233	27,009	27,847	28,850	29,543	30,357
Income bracket 3	48,080	48,898	46,309	47,745	49,464	50,652	51,762
Income bracket 4	∞	∞	∞	∞	∞	∞	∞
Income tax allowances and credits[a] (maximum in €)							
General allowance	3,993	4,061	–	–	–	–	–
General credit	–	–	1,576	1,647	1,766	1,825	1,894
Single parent allowance[b]	3,042	3,094	–	–	–	–	–
Single parent credit[b]	–	–	1,261	1,301	1,348	1,381	1,401
Earned income tax allowances and credits (maximum in €)							
General allowance[c]	1,440	1,605	–	–	–	–	–
General credit[d]	–	–	920	949	1,104	1,213	1,287
Single parent allowance[e]	3,042	3,094	–	–	–	–	–
Single parent credit[f]	–	–	1,261	1,301	1,348	1,381	1,401
Parent credit[g]	–	–	138	190	214	224	228
Additional parent credit[h]	–	–	–	–	–	–	389

[a]Tax allowances reduce taxable income (the financial gain depends on the marginal tax rate), tax credits reduce the amount of taxes paid (the financial gain does not depend on the marginal tax rate). [b]Single parent with a dependent child < 27 years of age. [c]Maximum tax allowance for working individuals. The tax allowance is 12% of gross earned income, up to the maximum. [d]Maximum tax credit for working individuals. The phase-in rate is (approximately) 1.7% up to 50% of the annual minimum wage, and 11% of gross earned income beyond 50% of the annual minimum wage, up to the maximum. [e]Maximum tax allowance for working single parents with a dependent child < 12 years of age. The tax allowance is 12% of gross earned income, up to the maximum. [f]Maximum tax credit for working single parents with a dependent child < 12 years of age in the year 2001 and < 16 years of age in the years beyond 2002. The tax credit is 4.3% of gross earned income, up to the maximum. [g]Tax credit for working parents with a dependent child < 12 years of age. The tax credit is independent of gross earned income, provided gross earned income exceeds (approximately) 25% of the annual minimum wage. [h]Tax credit for working single parents and secondary earners with a dependent child < 12 years of age. The tax credit is independent of gross earned income, provided gross earned income exceeds (approximately) 25% of the annual minimum wage.

Figure 1: Change in synthetic marginal tax rate by income (singles): 1999–2001
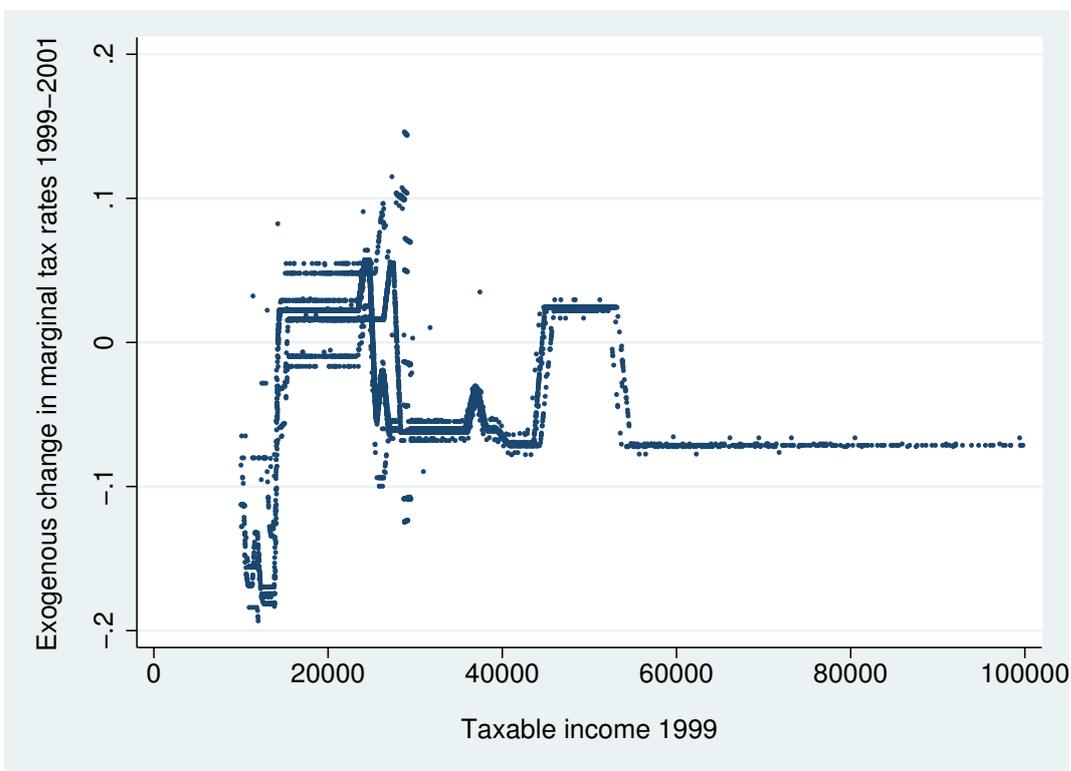
clear that the tax reform of 2001 reduced marginal tax rates for large parts of the income distribution. However, also for large parts of the income distribution there were hardly any changes. In particular, a large part of individuals in the second tax bracket experiences hardly any change, and also individuals that were shifted from the third to the fourth tax bracket hardly experienced any change. These groups serve as control groups in the empirical analysis.

Table 1 also makes clear that there was basically one major change in marginal tax rates in our data period. After 2001, tax rates and tax brackets remained rather stable, at least up to 2005. This can also be seen in Figure 2, which shows a histogram of year-on-year changes in effective marginal tax rates for our data set. We see that for all year-on-year changes except 2000–2001 most individuals experience

with the average income growth. More on this below in Section 3 where we discuss the empirical methodology.

Figure 2: Histograms of year-on-year changes in marginal tax rates

(a) 1999–2000 (observed)
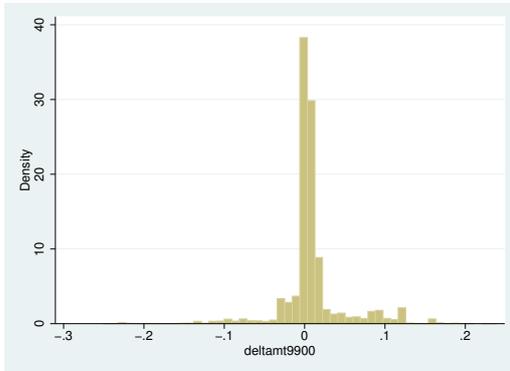
(b) 2000–2001 (synthetic)
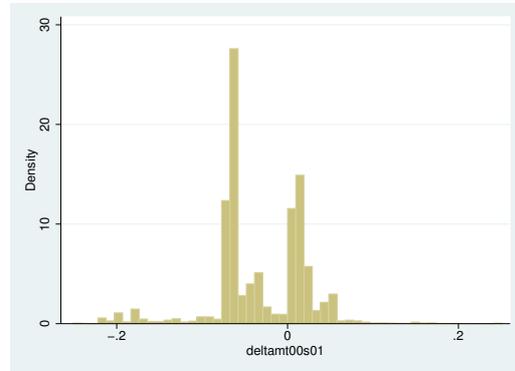
(c) 2001–2002 (synthetic)
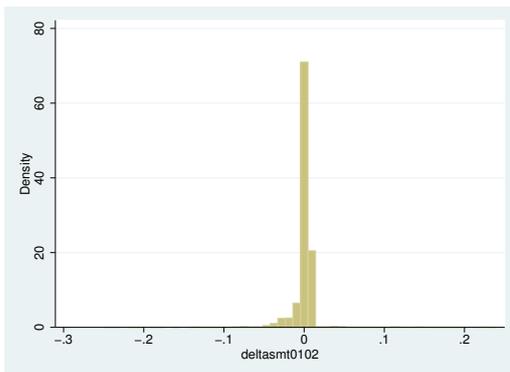
(d) 2002–2003 (synthetic)
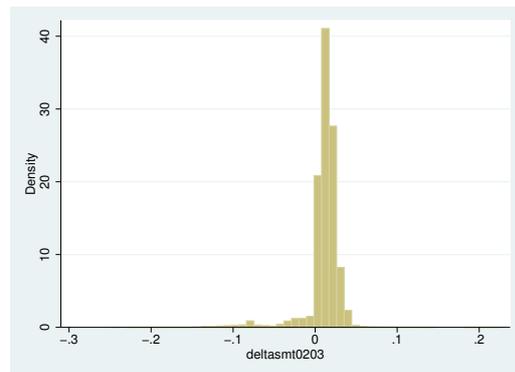
(e) 2003–2004 (synthetic)
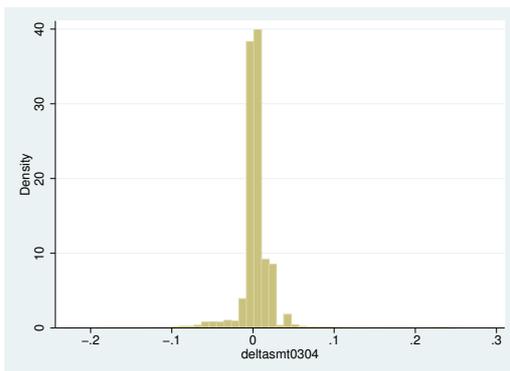
(f) 2004–2005 (synthetic)
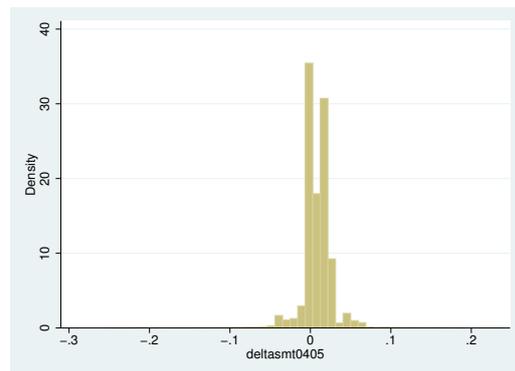
Source: Own calculations using the Labour Market Panel (Statistics Netherlands).

hardly any change in the effective marginal tax rate (of course incomes and hence marginal tax rates do change for some individuals), whereas in 2000-2001 there is a clear second spike around –8%-points and also some smaller spikes of individuals that experience a more modest decrease or increase in effective marginal tax rates.

3   Empirical methodology

Following Auten and Carroll (1999), Gruber and Saez (2002) and Kleven and Schultz (2014), our base specification reads:

$$\log\left(\frac{E_{i,t+s}}{E_{i,t}}\right) = \beta_0 + \beta_1 \log\left(\frac{1 - T'_{i,t+s}(E_{i,t+s})}{1 - T'_{i,t}(E_{i,t})}\right) + X_{i,t}\beta_{2,x} + \beta_3 \log(E_{i,t}) + \varepsilon_i. \quad (1)$$

In this regression, $E_{i,t}$ $(E_{i,t+s})$ denotes taxable labour income of individual i in year t $(t+s)$, $1 - T'_{i,t}(.)$ $(1 - T'_{i,t+s}(.))$ is the net-of-tax rate of individual i in year t $(t+s)$, X_{it} are additional control variables (demographic dummies and sector dummies), measured in the base year t, and ε_i is the error term.[9] We estimate the elasticity of taxable income for different horizons s, allowing for a difference between short- and medium-run effects. Specifically, we estimate differences for s equal to 2 years (1999–2001), 4 years (1999–2003) and 6 years (1999–2005). β_1 is our main parameter of interest, the elasticity of taxable labour income with respect to the net-of-tax rate.

There are a number of concerns that we need to address in our empirical analysis. First, the marginal tax rate is endogenous. In a progressive tax system, a higher income leads to a higher marginal tax rate when the individual moves to a higher tax bracket. This creates a relationship between the error term and the net-of-tax rate and therefore to biased estimates. Following Auten and Carroll (1999) we deal with this problem by using synthetic net-of-tax rates as an instrument for actual net-of-tax rates. Specifically, we project income forward using average income growth, and calculate synthetic marginal tax rates using this projected income which reflects the income in the absence of behavioural changes. We then estimate equation (1) using two-stage least squares with the synthetic net-of-tax rates as an instrument

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[9]In all regressions we report heteroscedasticity robust standard errors, and we weight observations by base year income and by the population weights in the data set.

for actual net-of-tax tax rates.[10] In the empirical analysis this instrument is always very strong (available on request).[11]

Another concern is mean reversion in income growth. Individuals that experience a positive shock in income in one period are more likely to have lower subsequent income growth than individuals that do not have a positive shock to income, and vice versa for individuals that experience a negative income shock. This leads to mean reversion in incomes. When the reform targets mostly low- or high-wage earners this may again lead to a bias in the estimates. Again following Auten and Carroll (1999), we control for mean reversion by including log base-year income in the explanatory variables. We expect this variable to have a negative sign, so that ceteris paribus individuals with a higher base year income will have lower subsequent income growth. The results show that it is important to control for mean reversion, in line with the findings of Kleven and Schultz (2014).

A further concern, recently emphasized by Kopczuk (2012), is that the dynamics of mean reversion may be different for the treatment group (with substantial changes in effective marginal tax rates) and control group (with minor changes in effective marginal tax rates). Below we provide graphical evidence for the pre-reform period that shows that these dynamics are quite similar for our treatment and control group.

Yet another concern is that we need to control for other exogenous changes in income. Indeed, skill-biased technological change or globalization may cause the incomes of high-wage earners to rise faster than low-wage earners. If the reform targets high-wage earners we run the risk of confounding the treatment effect of the change in tax rates with differential trends for different income groups. We believe that this is less of a concern in our case. First, the income distribution was relatively stable over the decade before the reform, similar to the case of Denmark studied in Kleven and Schultz (2014). Figure 3 shows that the income shares of

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[10]The first-stage equation reads:

$$\log\left(\frac{1 - T'_{i,t+s}(E_{i,t+s})}{1 - T'_{i,t}(E_{i,t})}\right) = \gamma_0 + \gamma_1 \log\left(\frac{1 - T'^{synthetic}_{i,t+s}(E^{synthetic}_{i,t+s})}{1 - T'_{i,t}(E_{i,t})}\right) + X_{i,t}\gamma_{2,x} + \gamma_3 \log(E_{i,t}) + \epsilon_i,$$

where $T'^{synthetic}_{i,t+s}(.)$ is the synthetic effective marginal tax rate corresponding to the synthetic income $E^{synthetic}_{i,t+s}$ in period $t + s$.

[11]Ideally, we would also have used lags of base-year income for the instrument, as suggested by Weber (2014). However, we do not have enough pre-reform years to apply this methodology.

Figure 3: Top primary income shares in the Netherlands: Income Panel
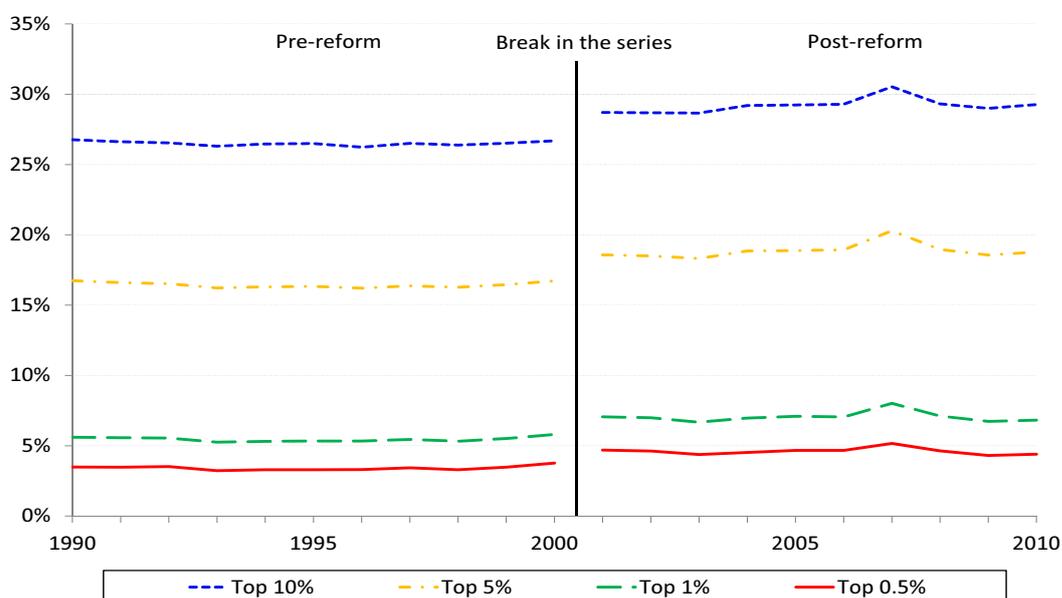
Source: Jacobs et al. (2013). Data set: Income Panel (*Inkomenspanelonderzoek*) (remote access version with uncensored top incomes) of Statistics Netherlands. The income shares are for 'primary income', the sum of wage and profit income, per individual. There is a break in the series in 2001. Additional income components (in particular one-off payments like severance pay) were included, and some income components were obtained from other data sources than before (see Knoef, 2011, for an overview of the most important changes).

Figure 4: Top wage income shares in the Netherlands: Labour Market Panel
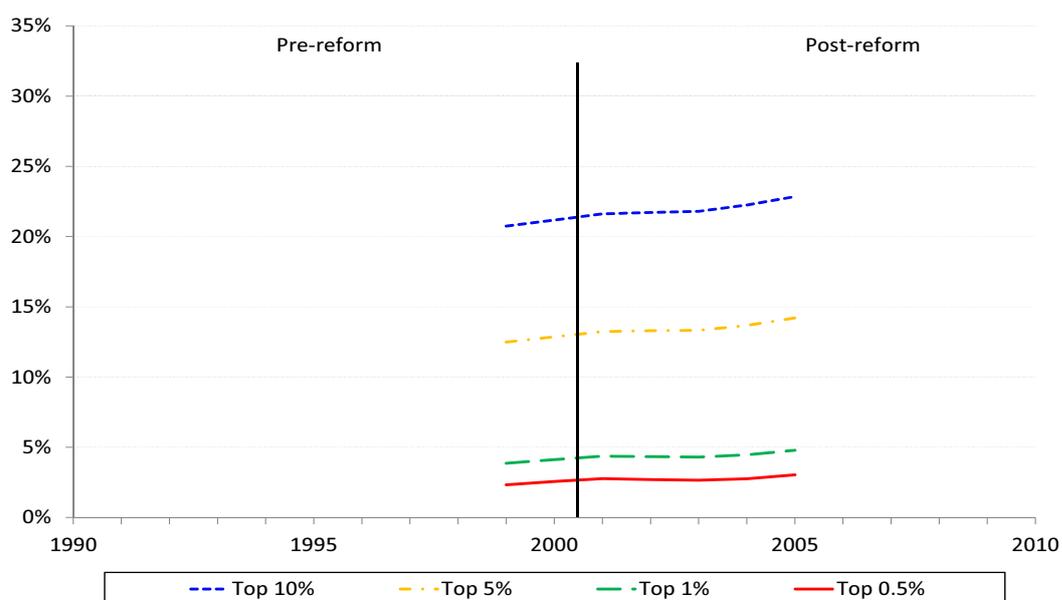
Source: Own calculations using the Labour Market Panel (*Arbeidsmarktpanel*) (uncensored wage income) of Statistics Netherlands. The income shares are for wage income per individual. There is no break in the wage income series.

the top 10, 5, 1 and 0.5% of the income distribution were very stable in the decade before the 2001 reform. Furthermore, Afman (2006, Table 1) shows that the same is true for all income deciles. Figure 3 suggests some increase in top income shares after the 2001 reform, but a break in the series, due to a change in the definition of income, makes it hard to infer the effect of the 2001 reform. Figure 4 shows the top wage income shares in our data set, there is no break in this series but the data period is much shorter. These data suggest an increase in the top incomes shares following the reform. Second, also similar to Kleven and Schultz (2014), we study a reform that led to significant changes in marginal tax rates for different groups of the income distribution, not just high-wage earners but also low- and middle-wage earners and within some income groups we have both positive and negative changes (see Figure 1). Third, similar to Kleven and Schultz (2014) we have a data set that includes socioeconomic variables that allow us to control for differential trends for individuals with different socioeconomic characteristics like the level of education and ethnicity.[12] However, as a robustness check we also consider the solution to differential trends offered by Gruber and Saez (2002) who control for differential trends across the income distribution by including a spline in log base-year income. These splines can be used to control for mean reversion and for different income growth across income groups, such as skill-biased technological progress. However, an issue with this method is that the coefficients of the splines could 'soak up' not only exogenous growth differentials but also the identifying variation of the tax reform. Keeping this concern in mind, we also present results using a 5-piece spline in log base-year income, dividing income groups in quintiles. The five knots of the spline are added as variables to the regression and the coefficients capture quintile specific income growth.

4   Data

We use data from the Labour Market Panel (*Arbeidsmarktpanel*) of Statistics Netherlands (2009). The Labour Market Panel is a rich and large administrative household panel data set, starting in 1999. We have data for the period 1999–2005. This data set combines administrative data on taxable labour income from the Tax Office with

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[12]Furthermore, we also include a dummy for the sector in which the individual is working to allow for sector-specific wage growth.

administrative demographic individual and household information from municipalities (*Gemeentelijke Basisadministratie*), administrative data on contractual annual hours worked and the sector in which the individual is working (main occupation) from the Social Statistical Panel (*Sociaal Statistisch Bestand*) and survey data on education from the Labour Force Survey (*Enquete Beroepsbevolking*).

From this data set we select employees aged 20–55 in 1999, that earn more than 10 thousand euro in 1999, that have no income from social insurance benefits (*e.g.* disability, unemployment or early retirement benefits), and that do not change between the states of single, single parent or part of a couple over the whole period of 1999–2005. We make these selections to limit problems of mean reversion and to remove big changes in marginal tax rates and income that are not linked to the tax reform. Furthermore, we do not have information on personal deductions in our data set. This creates measurement error in the net-of-tax rates, since we have an imprecise measure of taxable income, and hence also in the change in the net-of-tax rates.[13] To mitigate this problem, we drop individuals whose marginal tax rate changes by more than 30 percent, which are unrelated to the reform and more importantly are likely to contain substantial measurement error.[14] After these selections are made we are left with 160,601 observations for the regressions.

Descriptive statistics of the estimation sample are given in Table 2. Mean taxable labour income in 1999 is 30,573 euro. For the socioeconomic characteristics we use the data for the base year 1999. Individuals in our sample are on average 39.7 years old. 67% of individuals in our sample are men (due to the selections). Most of the individuals have higher secondary education (45%) or tertiary education (34%), a small minority has only primary education (4%) and some more individuals have lower secondary education (17%). Regarding ethnicity, 90% is native Dutch, 3%

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[13]For example, the steep phase-out of some income-dependent subsidies, like housing subsidies, creates very large effective marginal tax rates. When the relevant income variable is measured with error, we falsely predict large changes in effective marginal tax rates over time, which leads to a downward bias in our estimates because part of the treatment group actually does not experience a large change in the effective marginal tax rate whereas part of the control actually does experience a large change in the effective marginal tax rate.

[14]Specifically, we restrict the sample to individuals with an absolute change in the log of the net-of-tax rate less or equal to .3. Table A.4 in the appendix shows that the estimated elasticities are indeed somewhat smaller when we include the observations with bigger changes in effective marginal tax rates, consistent with classical measurement error.

Table 2: Descriptive statistics base year

	Mean	SD
Taxable labour income 1999	30,573	15,643
Net-of-tax rate	0.505	0.057
Age	39.709	7.974
Male	0.674	0.469
Female	0.326	0.469
Primary education (BO)	0.043	0.203
Lower secondary education (VMBO)	0.167	0.373
Higher secondary education (MBO, HAVO, VWO)	0.449	0.497
Tertiary education (HBO, WO)	0.342	0.474
Native	0.898	0.303
Western immigrant	0.029	0.167
Non-Western immigrant	0.074	0.261
Married couple with children	0.564	0.496
Married couple without children	0.155	0.321
Unmarried couple with children	0.032	0.175
Unmarried couple without children	0.117	0.321
Single	0.114	0.318
Single parent	0.018	0.134
Observations	160,601	

Notes: Dutch abbreviations of education levels in brackets.

is Western immigrant and 7% is Non-Western immigrant. Looking at household composition, most individuals are in a married couple with children (56%). The second largest category is individuals in a married couple without children (16%). The shares of singles and individuals in unmarried couples without children are 11% and 12%, respectively, and the shares of individuals in unmarried couples with children (3%) and single parents (2%) are small.

We use the official tax-benefit calculator MIMOS-2 of CPB Netherlands Bureau for Economic Policy Analysis for the 1999–2005 period to calculate effective marginal tax rates. MIMOS-2 is a tax-benefit calculator that contains a detailed programming of the tax-benefit system in the Netherlands, including all income dependent subsidies and tax credits. We determine effective marginal tax rates by increasing

all gross incomes by 3 percent.[15] Effective marginal tax rates are then calculated as the change in gross income minus the change in disposable income over the change in gross income.

Synthetic effective marginal tax rates are calculated for synthetic income. We use the growth of average taxable labour income in our selection to project synthetic income forward out of 1999. In the regressions we use the change in real taxable labour income in 1999 euro, incomes from later years are deflated with the CPI.

Following Weber (2014, Figure 1), Figure 5 gives a semi-parametric representation of the relation between the outcome variable (the growth in taxable labour income) and the instrument (the predicted change in the log marginal net-of-tax rate).[16] The dashed lines give the 95% confidence interval. There is a positive relationship between the instrument and the outcome variable, with some 'flattening' of the relation close to zero.[17]

Again following Weber (2014, Figure 2), Figure 6 gives a graphical representation of the first-stage of the regressions, the relation between the predicted log of the marginal net-of-tax rate change and the actual log of the marginal net-of-tax rate change. The relation is very strong for the most part. Only at the upper tail the relationship weakens and even seems to reverse, but there are only a few observations there.

Finally, following Kopczuk (2012, Figure 20), Figure 7 plots the growth in taxable labour income in the pre-reform period 1999–2000 against the level of taxable labour income in 1999, separately for the treatment group (decrease in effective marginal tax rate) and the control group (no decrease or increase in effective marginal tax rate). Note that there are no individuals in the control group (yellow lines) for the highest incomes, since the reform reduced the top marginal tax rate. We see that for the income segment for which the treatment and control group overlap, the growth in taxable labour income is quite similar. Furthermore, the relation is negative, as we would expect in the case of mean reversion.

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[15]The Netherlands has an individual tax system where some subsidies and tax credits depend on household income. For couples we calculate the effective marginal tax rate for each partner separately, keeping the income of the other partner fixed.

[16]Using the lpolyci command in Stata, with a third-order polynomial and a bandwidth parameter of 0.16, following Burns and Ziliak (2017).

[17]Other papers that present similar plots show a similar flattening of the relation close to zero (e.g. Weber, 2014; Burns and Ziliak, 2017; Doerrenberg et al., 2017).

Figure 5: Semi-parametric relation instrument and taxable labour income
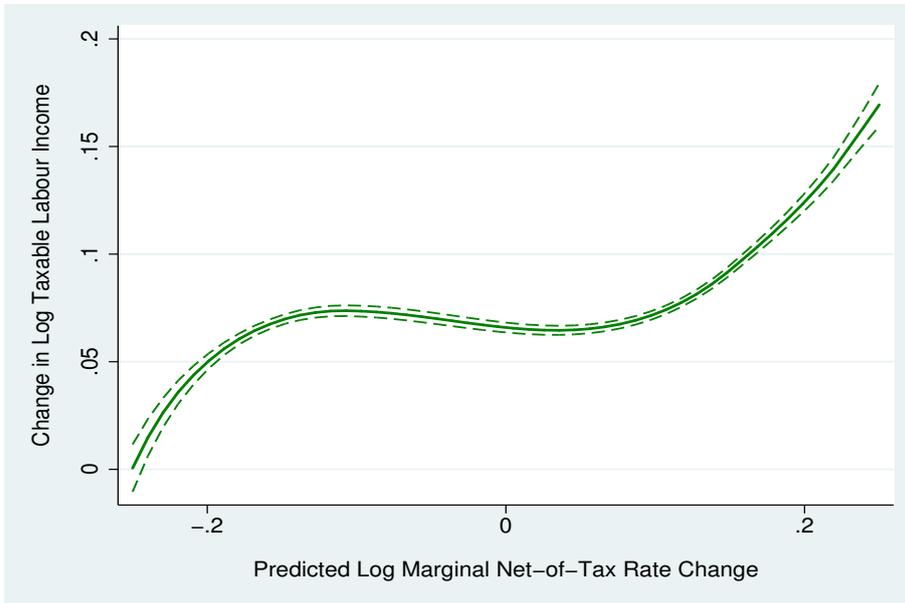
Source: Own calculations using the Labour Market Panel (Statistics Netherlands).

Figure 6: Strength of the instrument
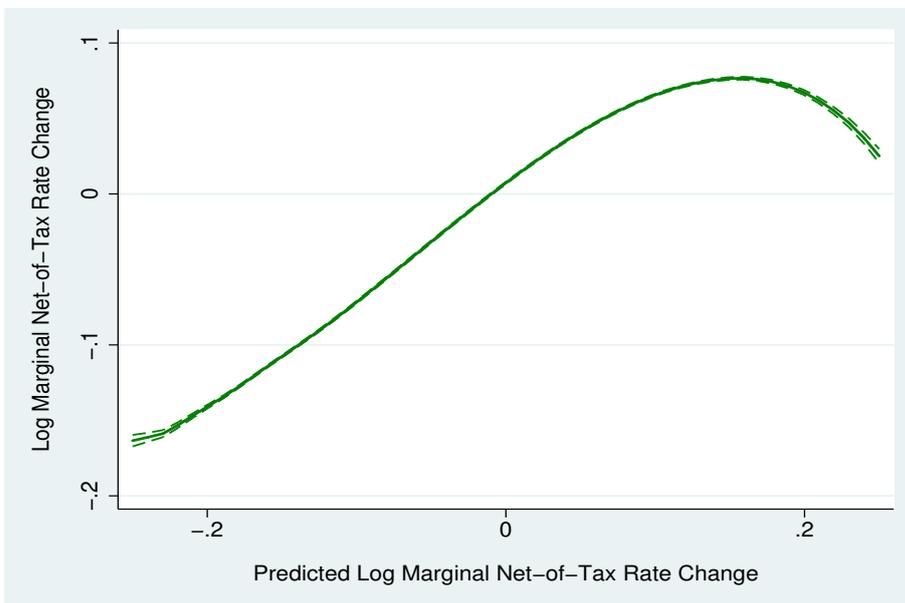
Source: Own calculations using the Labour Market Panel (Statistics Netherlands).

Figure 7: Pre-reform mean reversion treatment (green) and control group (gold)
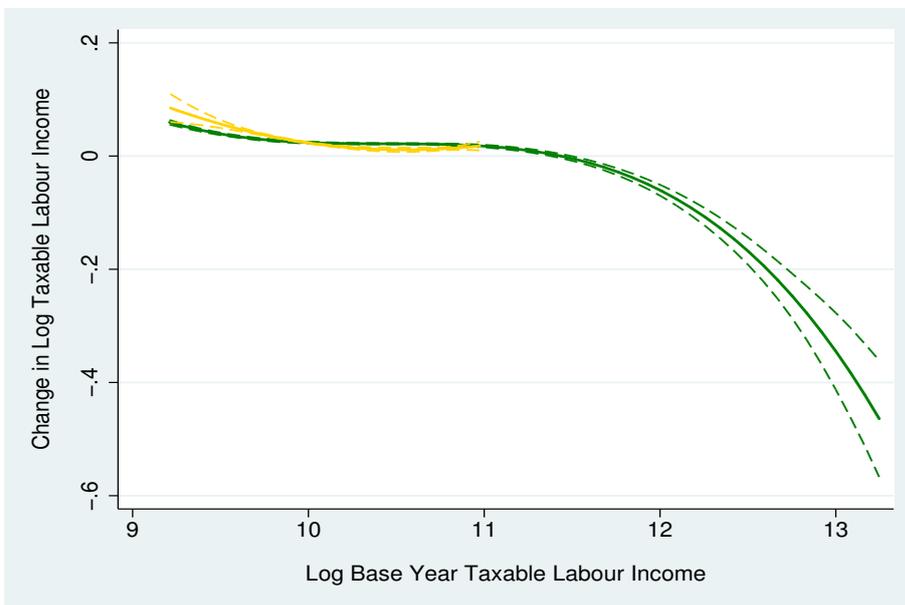
Source: Own calculations using the Labour Market Panel (Statistics Netherlands).

5 Results

Table 3 gives the base results for all workers. We show three different specifications, one with no pre-reform income controls, one with log base-year income to control for mean reversion and one with a 5-piece spline in log base-year income to control for mean reversion and other remaining differential trends in exogenous income growth. In all regressions we include socioeconomic controls and dummies for the sector in which the individual is working (all measured in 1999).

Not controlling for base-year income we find small, and even negative, ETIs, in line with the findings of Kleven and Schultz (2014). However, when we include log base-year income to control for mean reversion in income growth we find significant positive ETIs, again in line with the findings of Kleven and Schultz (2014).[18] The

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[18]Full estimation results of the base specification can be found in Table A.2 in the appendix. The controls used in the regressions are typically significant and show that income growth decreases with age, increases with an individual's level of education, is higher for males than for females, is higher for individuals in households with children, and is slightly higher for immigrants than for natives. Log base-year income has a significant negative coefficient, indicating it is important to control for mean reversion.

Table 3: Base results: all workers

	(1)	(2)	(3)
Period	1999–2001	1999–2003	1999–2005
No pre-reform income control	−0.0188*	0.0209*	0.0648***
	(0.0101)	(0.0112)	(0.0129)
Log base-year income	0.0970***	0.1657***	0.2415***
	(0.0090)	(0.0108)	(0.0143)
5-piece spline in log base-year income	0.0754*	0.1681***	0.2226***
	(0.0385)	(0.0339)	(0.0356)
Observations	160,601	160,601	160,601

Notes: Heteroscedasticity robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Observations are weighted by population weights and 1999 income. Base specification projecting synthetic incomes out of 1999 and using socioeconomic individual and household characteristics and sector dummies for 1999. Sample is restricted to individuals with labour income >10,000 euro in 1999. Full estimation results for the specification with log base-year income as the income control can be found in Table A.2 in the appendix.

elasticity rises from 0.10 in the short-run (1999–2001) to 0.24 for the medium to longer run (1999–2005) when we use log base-year income as a control. The rise in the ETI suggests that adjustment to the new marginal tax rates takes time. Since Gruber and Saez (2002), it is common practice to use 3-year intervals in the base specification (and present 1- or 2-year intervals as a robustness check). Our results suggest that this interval may be too short to capture the full tax base responses to changes in marginal tax rates.[19] Finally, when using the 5-piece spline we find very similar results, indeed the parameter estimates are not statistically

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[19]And the same is true for hours worked responses, see below. Thoresen and Vattø (2015, Table B.4) also find that the elasticity of broad income and hours worked rises when they use longer intervals, also when they increase the interval length from 3 to 4 years. Estimating the effect for all years, we find that the full effect is realized 4 years after the reform (1999-2004), see Table A.3 in the appendix. Note that there are small differences with the base results for the period 1999–2001, 1999–2003 and 1999–2005, because now we only include observations whose (absolute) change in effective marginal tax rates is less than 30% in 2002 and 2004 as well.

significantly different, the elasticity rises from 0.08 in the 1999–2001 period to 0.22 for the 1999–2005 period. The fact that we find similar results using log base-year income and using a spline in log base-year income is consistent with a stable income distribution.[20]

Table 4 shows that our results are robust to the income threshold. Specifically, when we select individuals with an income above 5,000 euro in 1999, instead of 10,000 euro in the baseline, we find similar elasticities. In particular, with our preferred specification with log base-year income as the income control, we now get an estimate of 0.23, compared to 0.24 in the base sample. The results using the 5-piece spline are also very similar, 0.20 compared to 0.22 when using the base sample.

Table 5 shows that our results are also quite similar when we use 2000 as the base year.[21] When we use 2000 instead of 1999 as the base year, we find an elasticity of 0.18 compared to 0.24 in the baseline using log base-year income, and 0.21 compared to 0.22 using the 5-piece spline. One potential advantage of using 2000 as the base year is that we can include the log of 1999 income as well as the log difference between 1999 and 2000 income, following Kopczuk (2005). This allows for a separate treatment of mean reversion and differential trends. Using these income controls we find a somewhat lower elasticity of 0.16 than the 0.18 when using only log year 2000 income.

In Table 6 we consider the outcomes of the base specification for different income subgroups. We focus on the results for the period 1999–2005. We estimate somewhat lower elasticities for the low income group (10–50K): 0.22 using log base-year income and 0.12 using the 5-piece spline.[22] Our preferred specification is with log base-year income, since the 5-piece spline is more likely to soak up part of the remaining variation in the smaller income segment. For the group with income between 50–100K, we estimate an elasticity of 0.20 using log base-year income, and the estimate

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[20]Table A.4 shows that we obtain somewhat lower estimates when we also include observations with bigger changes in effective marginal tax rates. However, as argued in the data section, the additional observations are likely to be contaminated with measurement error. Indeed, the profile of estimates with different sample selections follows the pattern of classical measurement error, with the elasticity falling somewhat as we allow for bigger (absolute) changes in the effective marginal tax rates.

[21]We prefer 1999 as the base year, because there might be anticipation effects.

[22]For each income subgroup we construct a new spline in log base-year income.

Table 4: Robustness check: base year income > 5 thousand euro

	(1)	(2)	(3)
Period	1999–2001	1999–2003	1999–2005
No pre-reform income	–0.0168*	0.0233**	0.0735***
control	(0.0098)	(0.0110)	(0.0126)
Log base-year income	0.0956***	0.1609***	0.2345***
	(0.0077)	(0.0096)	(0.0122)
5-piece spline in log	0.0503	0.1521***	0.2047***
base-year income	(0.0394)	(0.0348)	(0.0365)
Observations	170,216	170,216	170,216

Notes: Heteroscedasticity robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Observations are weighted by population weights and 1999 income. Base specification projecting synthetic incomes out of 1999 and using socioeconomic individual and household characteristics and sector dummies for 1999. Sample is restricted to individuals with labour income >5,000 euro in 1999.

Table 5: Robustness check: year 2000 as base year

	(1)	(2)	(3)
Period	2000–2001	2000–2003	2000–2005
Log base-year income	0.0412***	0.1002***	0.1812***
	(0.0115)	(0.0191)	(0.0241)
5-piece spline in log	0.0326	0.1628***	0.2074***
base-year income	(0.0245)	(0.0338)	(0.0306)
Log income 1999	0.0267***	0.0843***	0.1587***
and log deviation income 1999 and 2000	(0.0079)	(0.0132)	(0.0164)
Observations	160,065	160,065	160,065

Notes: Heteroscedasticity robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Observations are weighted by population weights and 2000 income. Base specification projecting synthetic incomes out of 2000 and using socioeconomic individual and household characteristics and sector dummies for 2000. Sample is restricted to individuals with labour income >10,000 euro in 2000.

Table 6: Heterogeneity: results for income subgroups

| | (1) | (2) | (3) |
Period	1999–2001	1999–2003	1999–2005
Income 10-50K			
Log base-year income	0.0829***	0.1430***	0.2164***
	(0.0076)	(0.0092)	(0.0116)
5-piece spline in base-year income	0.0616***	0.0859***	0.1234***
	(0.0135)	(0.0139)	(0.0197)
Observations	148,221	148,221	148,221
Income 50-100K			
Log base-year income	0.1605***	0.1401***	0.2012***
	(0.0262)	(0.0347)	(0.0418)
5-piece spline in base-year income	0.0824**	0.0692**	0.1685**
	(0.0416)	(0.0548)	(0.0698)
Observations	11,516	11,516	11,516
Income >50K			
Log base-year income	0.1292	0.3306***	0.4484***
	(0.0828)	(0.0838)	(0.0924)
5-piece spline in base-year income	0.0804*	0.1312**	0.2664***
	(0.0443)	(0.0566)	(0.0814)
Observations	12,382	12,382	12,382

Notes: Heteroscedasticity robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Observations are weighted by population weights and 1999 income. Base specification projecting synthetic incomes out of 1999 and using socioeconomic individual and household characteristics and sector dummies for 1999.

drops somewhat to 0.17 when we include a 5-piece spline. For the group with income above 50K, without upper bound[23], we estimate the largest elasticities. Using log base-year income as a control the estimate is 0.45, but this drops substantially to 0.27 when we include the 5-piece spline. Differential trends may play a role for the higher incomes, and it is not directly clear which specification is to be preferred for this group. However, our finding that taxable or broad income elasticities are higher for higher incomes is consistent with the literature (Saez et al., 2012).

We also estimate the base regressions separately for single men and women, and men and women in couples, the results can be found in Table 7. We find larger elasticities for single women than for single men, and also (much) larger elasticites for women in couples than for men in couples. The elasticity for single women is somewhat lower than for women in couples, whereas the elasticity for single men is higher than for men in couples.

Finally, also of interest is the size of the elasticity of taxable labour income relative to the elasticity of hours worked, to see how much of the estimated response is due to a change in labour supply and how much is due to other factors. We do not have full coverage of hours worked, about 40 percent of the workers are covered in the data set, which are mostly workers in the public sector and in large companies. For these workers we estimate an ETI of 0.21 and a contractual annual hours worked elasticity of 0.05.[24] Hence, the labour supply response captures only part of the tax base response. This is consistent with the findings of Moffitt and Wilhelm (2000) for high incomes in the US, but quite different from the findings of Thoresen and Vatto (2015) for Norway. We should note though that we measure contractual hours worked. To the extent that individuals work more hours due to the tax reform but this does not show up in their contractual working hours (e.g. top income earners), we may underestimate the hours worked response. However, note that the elasticity of taxable labour income also captures other effects on the tax base, like e.g. changes in effort more generally, changes in occupational choice and changes in tax avoidance via work-related tax deductibles.

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[23]We always need to include medium income individuals as a control group, since we need a control group where there was hardly any change in effective marginal tax rates.

[24]This intensive labour supply elasticity is in line with estimates of the labour supply literature, see Bargain et al. (2014) for an overview for European countries and the US, and Jongen et al. (2014) for recent estimates for the Netherlands.

Table 7: Heterogeneity: results by household type and gender

	(1)	(2)	(3)
Period	1999–2001	1999–2003	1999–2005
Single men			
Log base-year income	0.0677	0.1791***	0.2836***
	(0.0728)	(0.0350)	(0.0950)
5-piece spline in base-year income	−0.0016	0.1513***	0.2865***
	(0.0436)	(0.0548)	(0.1105)
Observations	11,114	11,114	11,114
Single women			
Log base-year income	0.1698***	0.3205***	0.4270***
	(0.0294)	(0.0424)	(0.0500)
5-piece spline in base-year income	0.1186***	0.2131***	0.3199***
	(0.0370)	(0.0541)	(0.0672)
Observations	10,194	10,194	10,194
Men in couples			
Log base-year income	0.0290*	0.0603***	0.1047***
	(0.0149)	(0.0244)	(0.0214)
5-piece spline in base-year income	0.0556**	0.1298***	0.1453***
	(0.0448)	(0.0423)	(0.0407)
Observations	97,190	97,190	97,190
Women in couples			
Log base-year income	0.1956***	0.4273***	0.4566***
	(0.0268)	(0.0464)	(0.0400)
5-piece spline in base-year income	0.2432***	0.4081***	0.4764***
	(0.0557)	(0.0738)	(0.0858)
Observations	42,103	42,103	42,103

Notes: Heteroscedasticity robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Observations are weighted by population weights and 1999 income. Base specification projecting synthetic incomes out of 1999 and using socioeconomic individual and household characteristics and sector dummies for 1999. Sample is restricted to individuals with labour income >10,000 euro in 1999.

Table 8: Elasticity of taxable labour income vs. hours worked

| | (1) | (2) | (3) |
Period	1999–2001	1999–2003	1999–2005
All workers			
Taxable labour income	0.0863***	0.1496***	0.2071***
	(0.0085)	(0.0118)	(0.0140)
Hours worked	0.0044	0.0340***	0.0466***
	(0.0085)	(0.0106)	(0.0110)
Observations	68,223	68,223	68,223

Notes: Heteroscedasticity robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Observations for taxable labour income are weighted by population weights and 1999 income. Observations for hours worked are weighted by population weights and 1999 hours worked. Base specification projecting synthetic incomes out of 1999 and using socioeconomic individual and household characteristics and sector dummies for 1999. Using log base-year income and log base-year hours worked to control for mean reversion in income and hours worked, respectively. Sample is restricted to individuals with labour income >10,000 euro in 1999 and for which hours worked are observed.

6   Discussion and concluding remarks

In this paper we have estimated the elasticity of taxable labour income in the Netherlands. In our base specification, using log base-year income to control for mean reversion, for all workers we find an elasticity of 0.10 in the short run (1999–2001) rising to 0.24 in the medium run (1999–2005). This elasticity is robust to how we control for exogenous income growth, the lower income threshold and the choice of base year. Our estimate is in between the higher estimates for Anglo-Saxon countries and the lower estimates for Scandinavia. Furthermore, our estimate is close to the recent estimates for France and Germany. We also find that the elasticity is bigger for higher incomes and for women. Furthermore, we find that the elasticity of taxable labour income is higher than the elasticity of (contractual) annual hours worked, indicating that the (contractual) hours worked responses do not capture all tax base responses.

Our findings have potential important implications for policymaking. In par-

ticular, when there are no fiscal or other externalities associated with the tax base responses, the deadweight loss from marginal tax rates are substantially higher when using the elasticity of taxable labour income than using the elasticity of (contractual) annual hours worked. For example, using a value of 0.25 for the elasticity of the tax base of the top rate, Jacobs et al. (2013) calculate that the current top tax rate is close to the top of the Laffer-curve.

We conclude by noting that there are a number of limitations to our data set and our tax-benefit calculator that prevent us from studying a number of additional issues. First, we cannot control for income effects since we have no information on unearned income. However, most ETI studies find that income effects are relatively small compared to substitution effects (Saez et al., 2012). Second, although we have self-employed in our data set, we can not study their ETI because we do not have a tax-benefit calculator to calculate their effective marginal tax rate. Third, we would like to have longer pre-reform data on income, so that we can better control for exogenous income growth and address remaining concerns about the potential endogeneity of the net-of-tax rate instrument (Weber, 2014). Finally, we would like to have more information on tax deductibles, so that we can decompose the changes in the ETI into its components and also estimate the elasticity of taxable income. In this respect the IPO (Income Panel) data set of Statistics Netherlands looks promising. This data set is available for a much longer pre-reform period, and has information on unearned income and additional information on tax deductibles. However, for the moment there is no tax-benefit calculator for the IPO for the years before 2001.

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Appendix

Table A.1: Overview of selected ETI studies

Study	Country	Sample period	Reform	Observations	Broad income elasticity	Taxable income elasticity	Source
Anglo-Saxon countries							
Feldstein (1995)	US	{1985,1988}	TRA86	3,792	-	1.10-3.05	Table 2, column (2)
Auten and Carroll (1999)	US	{1985,1989}	TRA86	15,579	0.57	0.55	Table 2, last column, Table Appendix B, last column
Gruber and Saez (2002)	US	1979-1990	ERTA81 and TRA86	69,129	0.120-0.170	0.400-0.611	Table 4, columns (3)-(6)
Kopczuk (2005)	US	1979-1990	ERTA81 and TRA86	43,785	0.190	0.309	Table 5, column (1), Table 6, column (1) (γ=0.12)
Weber (2014)	US	1983-1990	TRA86	24,576	0.475	0.858	Table 6, column (3), Table 2, column (5)
Burns and Ziliak (2017)	US	1979-2008	Multiple	198,285	0.291-0.348	0.431-0.547	Table (1), column (2) and (4)
Sillamaa and Veall (2001)	CAN	{1986,1989}	Tax reform 1988	474,040	0.260	0.139	Table 3, column (1) and (2)
Scandinavian countries							
Aarbu and Thoresen (2001)	NOR	1991-1994	Tax reform 1992	2,246	-	-0.032-0.210	Table 2, column (5) and (8)
Thoresen and Vatto (2015)	NOR	2000-2008	Tax reform 2006	2,353,603	0.022-0.055	-	Table 3, last column
Hansson (2007)	SWE	{1989,1992}	Tax reform 1991	81,995	0.426	-	Table 1, column (3b)
Blomquist and Selin (2010)	SWE	{1981,1991}	Multiple	1,108	0.194-1.386	-	Table 2, column (4) and (8)
Holmlund and Soderstrom (2011)	SWE	1991-2002	Multiple	1,366,848	-0.134-0.289	-	Table 4, column (3) and (6)
Gelber (2014)	SWE	1988-1991	Tax reform 1991	200,214	0.09-0.15	-	Table 3, column (7) and (8)
Kleven and Schultz (2014)	DK	1984-2005	Multiple	29,568,870	0.042-0.060	0.064	Table 3, column (2), Table 8, column (5)
Continental Europe							
Lehmann et al. (2013)	FRA	2003-2006	Prime pour l'Emploi	12,512	0.217	-	Table 2, column (3)
Doerrenberg et al. (2017)	GER	2001-2008	Multiple	2,713,842	0.162-0.281	0.548-0.675	Table 3, column (I) and (II)
This study	NL	1999-2005	Tax reform 2001	160,061	0.223-0.242	-	Table 3, column (3)

Table A.2: Full estimation results with log base-year income

| | (1) | (2) | (3) |
Period	1999–2001	1999–2003	1999–2005
Net-of-tax rate	0.0970***	0.1657***	0.2415***
	(0.0090)	(0.0108)	(0.0143)
Log base-year income	−0.0665***	−0.1259***	−0.1392***
	(0.0071)	(0.0105)	(0.0121)
Lower secondary education	0.0104***	0.0116***	0.0161***
	(0.0027)	(0.0029)	(0.0038)
Higher secondary education	0.0283***	0.0406***	0.0510***
	(0.0035)	(0.0035)	(0.0043)
Tertiary education	0.0768***	0.1197***	0.1529***
	(0.0050)	(0.0051)	(0.0061)
Female	−0.0524***	−0.0904***	−0.1179***
	(0.0040)	(0.0050)	(0.0052)
Western immigrant	0.0092**	0.0102**	0.0060
	(0.0040)	(0.0041)	(0.0060)
Non-Western immigrant	0.0028	0.0084***	0.0103**
	(0.0027)	(0.0031)	(0.0042)
Unmarried couple w/o children	−0.0118***	−0.0230***	−0.0295***
	(0.0040)	(0.0034)	(0.0050)
Married couple w/o children	−0.0188***	−0.0186***	−0.0199***
	(0.0040)	(0.0033)	(0.0050)
Unmarried couple w/ children	0.0025	0.0069	0.0185**
	(0.0068)	(0.0061)	(0.0088)
Married couple w/ children	−0.0029	0.0075***	0.0148***
	(0.0041)	(0.0026)	(0.0046)
Single parent	0.0274***	0.0460***	0.0740***
	(0.0050)	(0.0054)	(0.0079)
Age	−0.0039***	−0.0029**	0.0069***
	(0.0010)	(0.0011)	(0.0014)
Age squared	0.0000**	0.0000	−0.0002***
	(0.0000)	(0.0000)	(0.0000)
Observations	160,601	160,601	160,601

Notes: Heteroscedasticity robust standard errors clustered at the individual level in parentheses, * denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Observations are weighted by population weights and 1999 income. Base specification projecting synthetic incomes out of 1999 and using socioeconomic individual and household characteristics and sector dummies for 1999. Sector dummies are included but not reported (available on request). The sample is restricted to individuals with labour income >10,000 euro in 1999.

Table A.3: Results for all reform years

	(1)	(2)	(3)	(4)	(5)
Period	1999–2001	1999–2002	1999–2003	1999–2004	1999–2005
No pre-reform income control	0.0236**	0.0204**	0.0298***	0.0752***	0.0716***
	(0.0102)	(0.0104)	(0.0113)	(0.0123)	(0.0130)
Log base-year income	0.1003***	0.1276***	0.1724***	0.2352***	0.2442***
	(0.0090)	(0.0103)	(0.0109)	(0.0128)	(0.0144)
5-piece spline in log base-year income	0.0816***	0.1583***	0.1856***	0.2371***	0.2333***
	(0.0395)	(0.0413)	(0.0348)	(0.0356)	(0.0363)
Observations	157,249	157,249	157,249	157,249	157,249

Notes: Heteroscedasticity robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Observations are weighted by population weights and 1999 income. Base specification projecting synthetic incomes out of 1999 and using socioeconomic individual and household characteristics and sector dummies for 1999. The sample is restricted to individuals with labour income >10,000 euro in 1999.

Table A.4: Results using different sample selections for the maximum (absolute) change in the net-of-tax rate

	(1)	(2)	(3)	
Period	1999–2001	1999–2003	1999–2005	Observations
| Change in net-of-tax rate | <= 100%	0.0858***	0.1142***	0.1820***	175,763
	(0.0256)	(0.0115)	(0.0159)	
| Change in net-of-tax rate | <= 75%	0.0855***	0.1125***	0.1853***	173,855
	(0.0261)	(0.0115)	(0.0159)	
| Change in net-of-tax rate | <= 50%	0.0899***	0.1208***	0.1873***	171,244
	(0.0260)	(0.0115)	(0.0153)	
| Change in net-of-tax rate | <= 40%	0.1017***	0.1363***	0.2125***	168,944
	(0.0267)	(0.0115)	(0.0153)	
| Change in net-of-tax rate | <= 30%[a]	0.0970***	0.1657***	0.2415***	160,601
	(0.0090)	(0.0108)	(0.0143)	

Notes: Heteroscedasticity robust standard errors clustered at the individual level in parentheses, * denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Observations are weighted by population weights and 1999 income. Base specification, using log base-year income as the income control, projecting synthetic incomes out of 1999 and using socioeconomic individual and household characteristics and sector dummies for 1999. Sector dummies are included but not reported (available on request). The sample is restricted to individuals with labour income >10,000 euro in 1999. [a]Base specification.