CPB Background Document

'Estimating the Elasticity of Taxable Labour Income in the Netherlands'

Background material to the Dutch CPB Policy Brief 2013/04 'Over de top'

29 May 2013

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Estimating the Elasticity of Taxable Labour Income in the Netherlands*

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May 2013

Abstract

We study the elasticity of taxable labour income (ETI) of employees in the Netherlands. The large 2001 Dutch tax reform generates substantial variation in marginal tax rates at different segments of the income distribution. We instrument the endogenous marginal tax rates with synthetic marginal tax rates using projected exogenous income. We control for exogenous income growth by including a number of socioeconomic variables, sector dummies, and log base-year income or a spline in log base-year income. For all workers we find an ETI of 0.24. For workers with high labour income the ETI rises to 0.26 (50-100K) and 0.46 (>50K). The ETI is higher for women than for men. Over all workers, the ETI is only slightly larger than the elasticity of annual hours worked, for high-wage workers the ETI is much larger than the elasticity of annual hours worked.

JEL codes: H24, H31, J22
Keywords: Elasticity of taxable income, The Netherlands

*We are grateful to Maya Verhoeve for her assistance in using the tax-benefit calculator MIMOS-2 with our dataset, and Floris Zoutman for his help with the inversion from fiscal wages to gross wages. We have benefitted from comments and suggestions by Leon Bettendorf, Bas Jacobs, Henrik Kleven, Hendrik Vrijburg, Floris Zoutman and seminar participants at CPB Netherlands Bureau for Economic Policy Analysis and the Tinbergen Institute Rotterdam. All remaining errors are our own.

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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 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).

In this paper we estimate the ETI for the Netherlands.[1] Specifically, we consider the responsiveness of taxable labour income of employees to changes in (effective[2]) marginal tax rates, using the large 2001 tax reform in the Netherlands. We use a rich data set from Statistics Netherlands that contains both taxable 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. The data set covers the period 1999–2005.

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. The literature on the ETI has identified a number of concerns that we need to address. One concern is the endogeneity of the marginal tax rate. 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 relation 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. 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 shock in income in one

[1] To the best of our knowledge, we are the first to study the ETI in the Netherlands.

[2] We use the MIMOS-2 tax-benefit calculator of CPB to calculate effective marginal tax rates. MIMOS-2 takes into account not only statutory tax rates, but also all income dependent tax credits and subsidies.

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 shock in income. 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 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 is that we need to control for other exogenous changes in income. For example, skill-biased technological change and/or globalization may cause the incomes of high-wage earners to rise faster than 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 believe 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 (2012). Second, also similar to Kleven and Schultz (2012), 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 groups we have both positive and negative changes. Third, similar to Kleven and Schultz (2012) 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) who control for differential trends across the income distribution by including a spline in income.

Our main findings are as follows. In our base specification we find an ETI of 0.24 for all workers. For workers with high labour income the elasticity rises to 0.26 (50–100K) and 0.46 (>50K). We als also find that the elasticity is higher for women than for men.[3] For the average worker, we find that most of the change in taxable labour income comes from the change in hours worked. For high-wage workers most of the change in taxable labour income does not come from the change in hours worked. A number of robustness checks indicate that our results are robust.

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.

[3]This is in line with the finding from the labour supply literature that the labour supply elasticity of women is larger than for men (Bargain et al., 2011) (at least in couples)

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.

2 The 2001 tax reform

The main ingredient of the 2001 tax reform relevant for this study is the change in marginal tax rates. In our empirical analysis we will use data for the period 1999–2005. Table 1 shows the statutory (direct) marginal tax rates and bracket lengths over this period. In both the pre and post reform period there were four tax brackets. In 2000, just before the tax reform, the first bracket had a rate of 33.9% and the top rate was 60%. In 2001, the first year of the reform, the rate in the first bracket dropped slightly to 32.35% and the top rate dropped to 52%. However, there were also a number of 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 to the fourth tax bracket, which meant a slight increase in the marginal tax rate from 50 to 52% for this group (recall that at the same time the top rate was reduced from 60 to 52%).

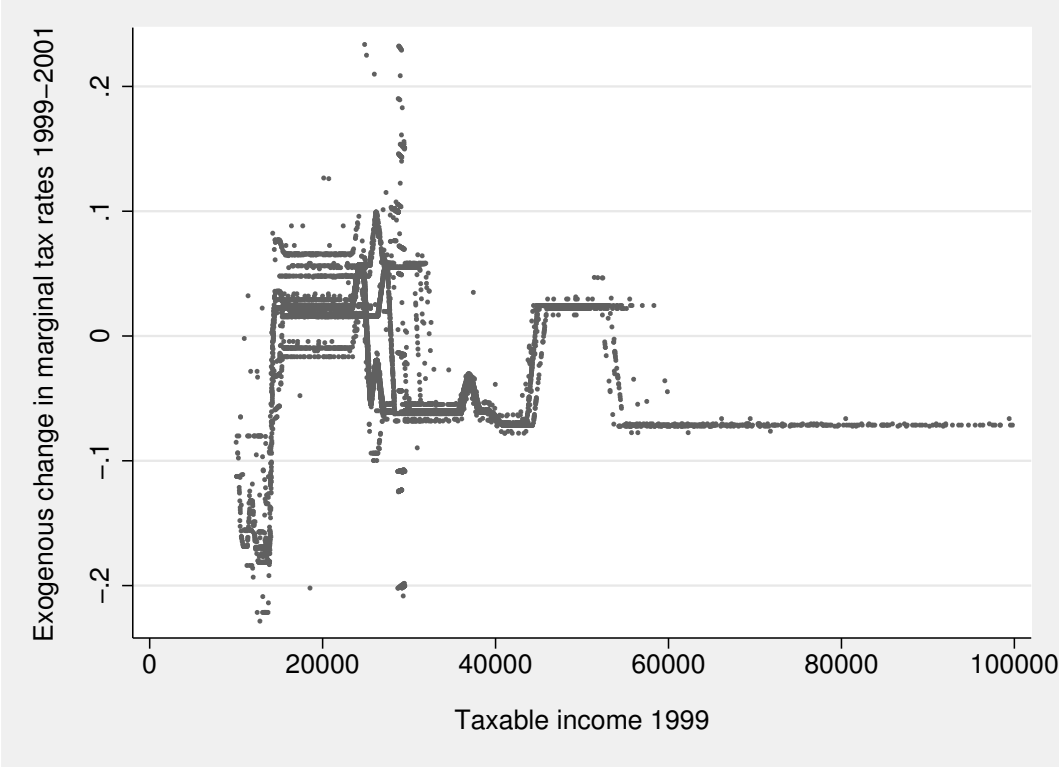
From the table it is clear that the tax reform of 2001 reduced marginal tax rates for large parts of the income distribution. However, also for large parts of the income distribution there were hardly any changes. In particular, a large part of individuals in the second tax bracket experiences hardly any change, and also individuals that were shifted from the third to the fourth tax bracket hardly experienced any change. Figure 1 illustrates this. In this figure we plot the change in effective marginal tax rates from 1999 to 2001 (for 2001 we use synthetic marginal tax rates, more on this below) against income in year 1999. Effective marginal tax rates take into account statutory tax rates and various kinds of income dependent tax credits and subsidies in the tax system. Figure 1 also shows that there were more changes than the changes in statutory tax rates. In particular, for low incomes we also see a significant drop in marginal tax rates. This is due to the increase in the earned income tax credit (EITC) which is phased in up to 16,000 euro in 2001.[4] Furthermore, the change from tax allowances (the benefit of which depends on marginal tax rates) to tax credits

[4]In the period we consider, the general earned income tax credit in the Netherlands had a

Table 1: Tax bracket rates and lengths: 1999–2005

Year	1999	2000	2001	2002	2003	2004	2005
First bracket							
Rate (in %)	35.75	33.90	32.35	32.35	33.15	33.15	34.40
Top (in euro)	6,807	6,922	14,870	15,331	15,883	16,265	16,893
Second bracket							
Rate (in %)	37.05	37.95	37.60	37.85	38.65	40.35	41.95
Top (in euro)	21,861	22,233	27,009	27,847	28,850	29,543	30,357
Third bracket							
Rate (in %)	50.00	50.00	42.00	42.00	42.00	42.00	42.00
Top (in euro)	48,080	48,898	46,309	47,745	49,464	50,652	51,762
Fourth bracket							
Rate (in %)	60.00	60.00	52.00	52.00	52.00	52.00	52.00
Top (in euro)	∞	∞	∞	∞	∞	∞	∞

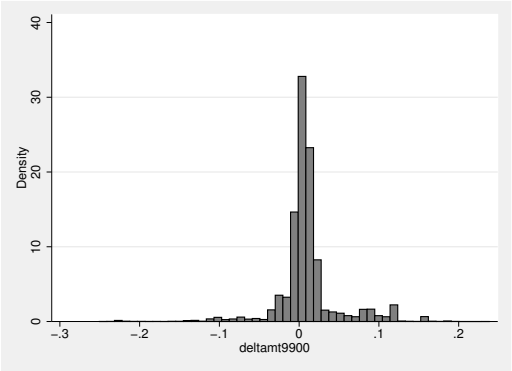
Figure 1: Change in (synthetic) marginal tax rate by income (singles)



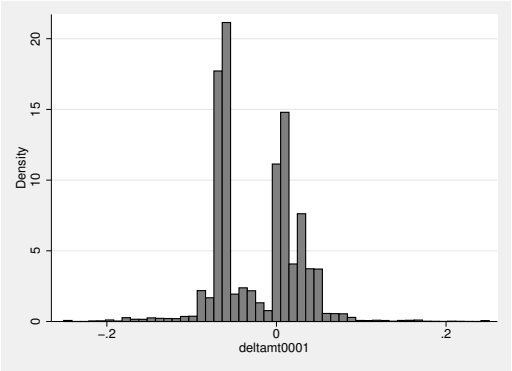
Source: Labour Market Panel 1999-2005 (Statistics Netherlands) and own calculations.

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

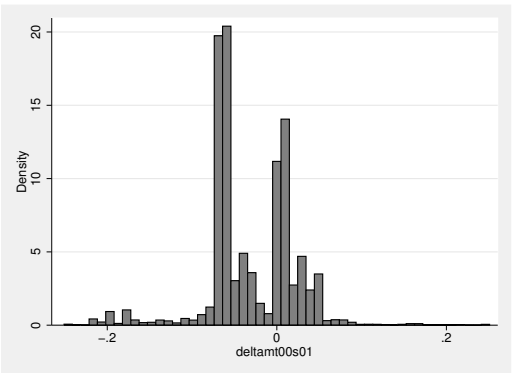
(a) 1999–2000



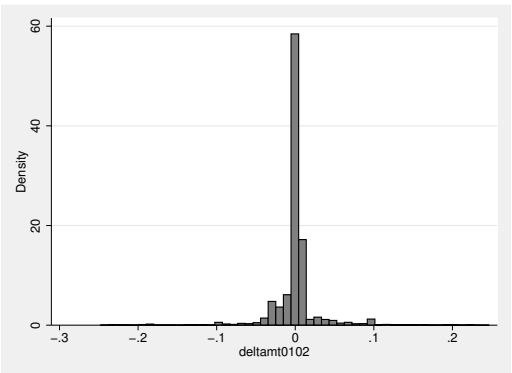
(b) 2000–2001



(c) 2000–2001 (synthetic)



(d) 2001–2002



Source: Labour Market Panel (Statistics Netherlands) and own calculations.

(the benefit of which does not depend on marginal tax rates) creates additional variation in marginal tax rates in the lower part of the income distribution as well. Finally, there were also some changes in employees' social security premiums that generate some additional variation in changes in effective marginal tax rates.[5]

phase-in range, but there was no phase-out, as opposed to e.g. the EITC in the US.

[5]In the Netherlands benefits of employees are linked to the premiums they pay, more income leads to more premiums but also higher benefits, so it is not clear whether these premiums should be considered taxes. However, in the period we consider employees' social security premiums changed but benefits did not, so the change in premiums is in effect a change in effective marginal tax rates.

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 marginal tax rates for our dataset for 1999–2000, 2000–2001 and 2001–2002, for 2000–2001 we also show the changes in synthetic marginal tax rates. We see that in 1999–2000 and 2001–2002 most individuals experience hardly any change in marginal tax rate (of course incomes and hence marginal tax rates do change for some individuals), whereas in 2001-2002 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 marginal tax rates.

3 Empirical methodology

Following Auten and Carroll (1999) and Kleven and Schultz (2012) our base specification reads

$$\Delta \ln(E_{it}) = \beta_0 + \beta_1 \Delta \ln(1 - T'_{it}(E_{it})) + X_{it}\beta_2 + \beta_3 \ln(E_{it}) + \varepsilon_{it}. \tag{1}$$

In this regression, E_{it} denotes taxable labour income of individual i in the base year t, $1-T'_{it}(z)$ is the net-of-tax rate of individual i in the base year t, X_{it} are socioeconomic characteristics in the base year such as age, gender, the level of education and household type. We estimate the elasticity of taxable income over different horizons, allowing for a difference between short, medium and longer run effects. The base year is 1999, the reform starts in 2001. We estimate differences at time t of 2 years (1999–2001), 4 years (1999–2003) and 6 years (1999–2005).

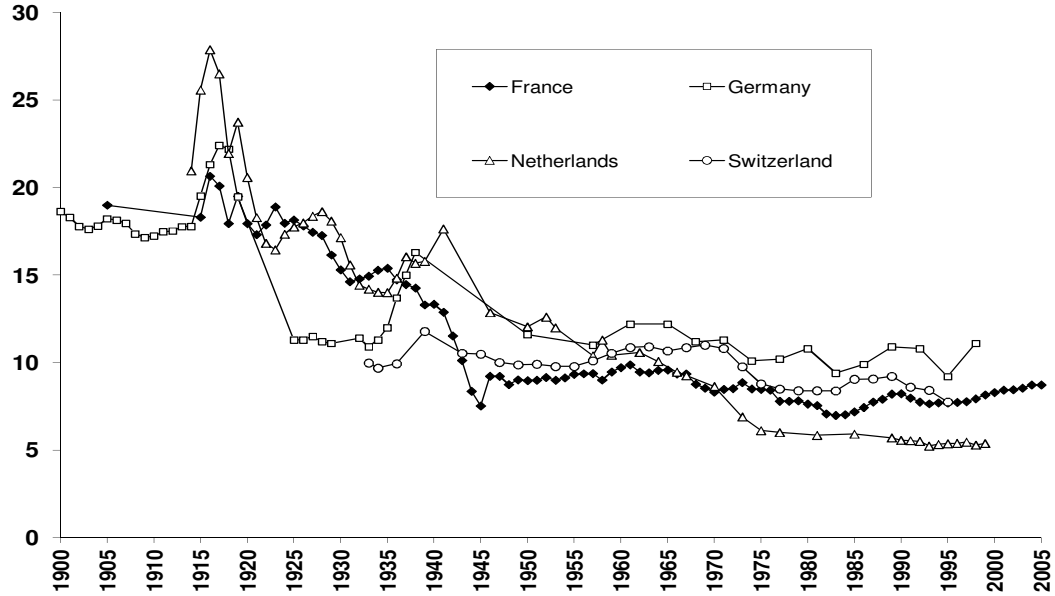
There are a number of concerns that we need to address. First, the marginal tax rate is endogenous. In a progressive tax system, a higher income leads to a higher marginal tax rate when the individual moves to a higher tax bracket. This creates a relation between the error term and the net-of-tax rate 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 for actual net-of-tax tax rates. In the empirical analysis this instrument is always very strong.

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 of the ETI. 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 (2012).

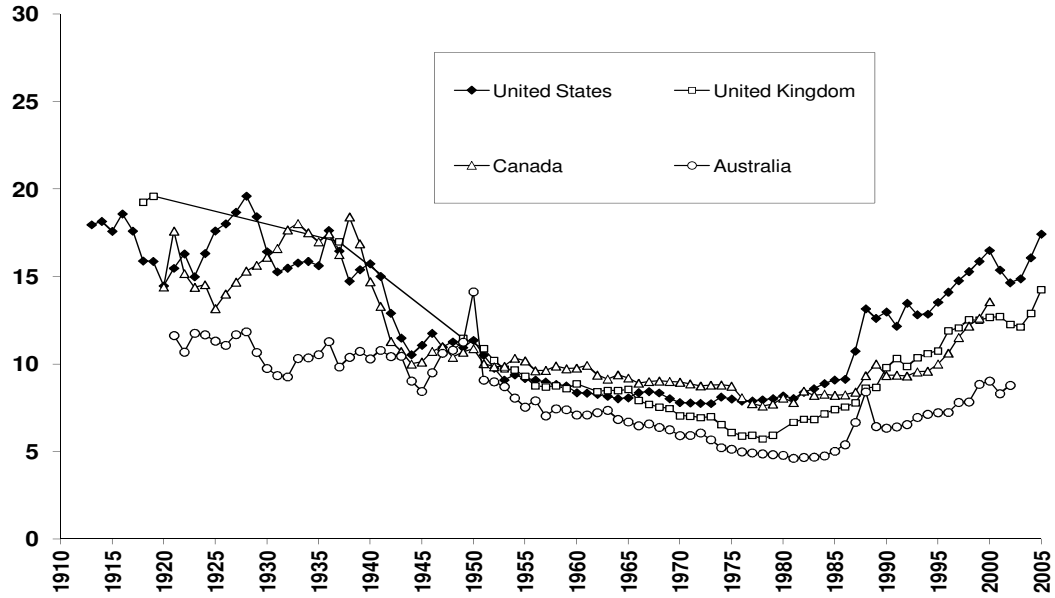
A further concern is that we need to control for other exogenous changes in income. Indeed, skill-biased technological change and/or globalization may cause the incomes of high-wage earners to rise faster than low-wage earners. If the reform targets high-wage earners we run the risk of confounding the 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 (2012). We illustrate this with Figures 3, 4 and 5 and Table 2. Figure 3 shows that, in line with a number of other continental European countries, the income share of the top 1% of income earners was very stable in the decade before the reform we consider. This contrasts with the experience of the Anglo-Saxon countries in Figure 4, which have witnessed a steep rise in the income share of the top 1% since the 1980s. Furthermore, Figure 5 shows that in the Netherlands also the income shares of the top 10, 5 and 0.5% of the income distribution were very stable in the decade before the 2001 reform. Table 2 shows that the same was true for the whole income distribution in the Netherlands. Second, also similar to Kleven and Schultz (2012), 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 groups we have both positive and negative changes. Third, similar to Kleven and Schultz (2012) we have a data set that includes socioeconomic variables that allow us to control for differential trends

Figure 3: Top 1% income share Middle Europe (1900–2005)



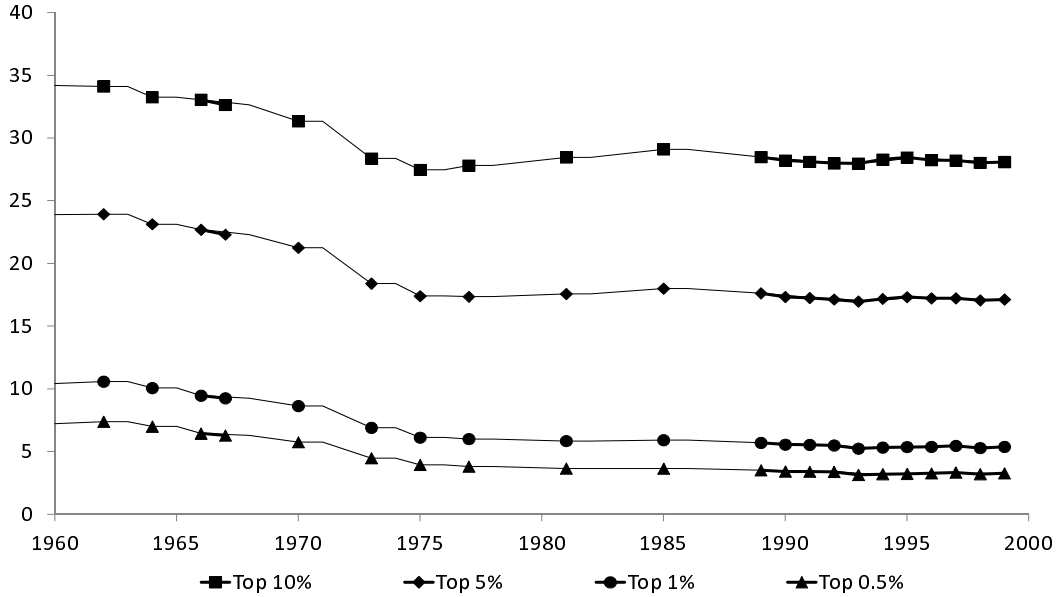
Source: The World Top Incomes Database (Alvaredo et al., 2013).

Figure 4: Top 1% income share Anglo-Saxon countries (1910–2005)



Source: The World Top Incomes Database (Alvaredo et al., 2013).

Figure 5: Top income shares in the Netherlands (1960–1999)



Source: Atkinson and Salverda (2005).

Table 2: Gross income shares by income deciles in the Netherlands

Year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1990	2.18	4.24	5.63	7.30	9.23	11.30	13.73	17.26	28.20
1991	2.34	4.28	5.66	7.35	9.23	11.28	13.71	17.23	28.11
1992	2.41	4.31	5.70	7.31	9.21	11.29	13.79	17.32	27.99
1993	2.59	4.28	5.68	7.32	9.25	11.33	13.85	17.46	27.96
1994	2.50	4.27	5.59	7.18	9.12	11.26	13.81	17.58	28.28
1995	2.44	4.26	5.56	7.14	9.05	11.18	13.75	17.50	28.45
1996	2.52	4.38	5.68	7.23	9.11	11.19	13.69	17.42	28.24
1997	2.57	4.46	5.75	7.23	9.05	11.08	13.63	17.34	28.21
1998	2.70	4.62	5.82	7.31	9.08	11.07	13.62	17.34	28.03
1999	2.69	4.50	5.83	7.33	9.07	11.04	13.59	17.26	28.09
2000	2.84	4.56	5.91	7.38	9.07	10.99	13.47	17.01	27.97

Source: Afman (2006).

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) who control for differential trends across the income distribution by including a spline in 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. An issue with this method is however, that the coefficients of the splines could take up not only exogenous growth but also the endogenous growth caused by the tax reform. In this way the splines could 'soak up' the identifying variation and can therefore best be used if the time frame of the data is long enough. Keeping this concern in mind, we use a 5-piece spline, dividing income groups in quintiles. The five knots of the spline are added as variables to the regression and the coefficients show income growth specific for the income groups.

A final concern could be the change in indirect taxes. Changes in indirect taxes are typically ignored in the empirical ETI literature, although many reforms feature a combination of changes in direct and indirect taxes. In an extension we also consider the effect of the change in indirect taxes, that was part of the same 2001 reform, on the ETI.[6] However, since we assume that the change in indirect taxes was proportional to the net of the tax rate for all workers, which Bettendorf et al. (2012) have shown to be a very good approximation for the Netherlands, this has virtually no effect on the results.[7]

In all regressions we report robust standard errors clustered at the individual level and we weight observations by base year income.

[6]We adjust the marginal tax rates using

$$T'_{adj,it} = 1 - \frac{1 - T'_{it}}{1 + T'_{ind,t}} \tag{2}$$

where $T'_{ind,t}$ is the average indirect tax rate on private consumption. We use an adjusted inflation series to construct real incomes, where the effect of changes in indirect taxes such as VAT and excise duties are taken out of the inflation.

[7]Brewer et al. (2010) also find that adding consumption taxes hardly affects the results in their elasticity calculations for top incomes in the UK.

4 Data

We use data from the Labour Market Panel (*Arbeidsmarktpanel*) of Statistics Netherlands (Statistics Netherlands, 2009). The Labour Market Panel is an administrative household panel data set, starting in 1999. We have data for the period 1999–2005. The dataset combines information from municipalities (*Gemeentelijke Basisadministratie*) on demographic individual and household characteristics, from the Social Statistical Panel (*Sociaal Statistisch Bestand*) on income from employment and benefits, and information on the sector the individual is working in, from the Labour Force Survey (*Enquete Beroepsbevolking*) on the level of education, and from the Tax Office on taxable labour income.

From this data set we select individuals aged 20–55 in 1999 that are working, earn more than 10 thousand euro in 1999, and have no income from some type of benefits (*e.g.* disability, unemployment or early retirement), and do not change between the states of single, single parent or part of a couple over the whole period of 1999–2005. We select these individuals 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. More generally, we drop individuals whose marginal tax rate changes by more than 25 percentage points, which is due to other factors than the reform. This leaves us with 157,510 individuals.

Descriptive statistics of our selection are given in Table 3. Mean taxable labour income in 1999 is 30,980 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 in 1999. 70% of individuals in our sample are men (due to the selections). Most of the individuals have higher vocational training (45%) or tertiary education (34%), a small minority has only primary education (4%) and some more individuals have lower vocational training (17%). Regarding ethnicity, 90% is native Dutch, 3% is Western immigrant and 7% is Non-Western immigrant. Looking at household composition, most individuals are in a married couple with children (57%). The second largest category is individuals in a married couple without children (15%). The shares of singles and individuals in unmarried couples without children are close to 12%, the shares of individuals in unmarried couples with children (3%) and single parents (2%) are small.

We use the sophisticated tax-benefit calculator MIMOS-2 of CPB to calculate

Table 3: Descriptive statistics, 1999

	Mean	SD
Taxable labour income 1999	30,980	15,457
Net-of-tax rate 1999	0.504	0.056
Age	39.72	7.996
Male	0.700	
Female	0.300	
Primary education (BO)	0.043	
Lower vocational training (VMBO)	0.167	
Higher vocational training (MBO, HAVO, VWO)	0.446	
Tertiary education (HBO, WO)	0.343	
Native	0.897	
Western immigrant	0.030	
Non-Western immigrant	0.074	
Married couple with children	0.565	
Married couple without children	0.153	
Unmarried couple with children	0.032	
Unmarried couple without children	0.116	
Single	0.115	
Single parent	0.019	
Observations	157,510	

Source: Labour Market Panel 1999–2005 (Statistics Netherlands) and own calculations for the net-of-tax rate.

effective marginal tax rates. This is a (non-behavioural) microsimulation model that contains a detailed programming of the tax-benefit system in the Netherlands for the period 1999-2005. We determine effective marginal tax rates by increasing all gross incomes by 3 percent (in case of couples, for each partner separately). Effective marginal tax rates are then calculated as the change in gross income minus the change in net disposable income over the change in gross disposable income.

Calculating the marginal tax rates takes considerable effort. First, we need to construct the variables from the *Arbeidsmarktpanel* which MIMOS-2 needs to calculate marginal tax rates. This includes, for example, data on the partner, the number and ages of the children and the sector in which the individual works. Second, MIMOS-2 needs gross income as input while we have taxable labour income.[8]

[8]Gross income is actually very similar to taxable labour income. To go from taxable labour

Hence, to calculate marginal tax rates we first need to convert our taxable labour income into gross income. These calculations were done using the formulas of Microtax from CPB, which is a simplified version of MIMOS-2 in Excel. However, this simplified version is sufficient for our inversion since employees' social security premiums and the employers' contribution to health care depend only on individual characteristics, not on household characteristics. Microtax, like MIMOS-2, distinguishes between three sectors: the private sector, the government and the health care sector. These sectors have different premiums that are in between gross income and taxable labour income. For all relevant years (1999-2005) we calculate a large set of combinations of gross income and taxable labour income, with a stepsize of 100 euro. For certain values of taxable labour income there is not a unique gross income, because of the discontinuity in health care premiums. We eliminated these discontinuties by taking out values of taxable labour income for which gross income is lower than it is for a lower value of taxable labour income, so that gross income always increases with taxable labour income. We then find gross income corresponding to a particular taxable labour income interpolating between these discrete points (using Matlab). The calculated gross incomes were thoroughly checked by filling in these gross incomes in Microtax and comparing the value for taxable labour income calculated by the model with the actual taxable income. Also graphs of gross income and taxable income show that the inversion was done properly (available on request). We then use these gross incomes series with MIMOS-2 to calculate the net disposable income.

Synthetic marginal tax rates are calculated using synthetic income, where we use the growth of average taxable labour income in our selection to project 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.

5 Empirical results

Table 4 gives our base results for all workers. We do not show the results for the first-stage regressions, the instrument is always very strong.[9] We show three different

income to gross income we basically need to subtract the employers' contribution for health care and to add employees' social security premiums.

[9] Available on request.

Table 4: Base results: all workers

	(1)	(2)	(3)
Period	99–01	99–03	99–05
No pre-reform income control	–0.0054	0.0045	0.0591***
	(0.0075)	(0.0091)	(0.0112)
Log base-year income	0.0861***	0.1598***	0.2371***
	(0.0077)	(0.0100)	(0.0135)
5-piece spline in base-year income[a]	0.0634***	0.1342***	0.2450***
	(0.0112)	(0.0152)	(0.0213)
Observations	157,510	157,510	157,510

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 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 can be found in Table A.1 in the Appendix. [a]Including a 5 piece spline in log base-year income.

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 for 1999.

Not controlling for base-year income we find small, even negative and often insignificant ETIs, in line with the findings of Kleven and Schultz (2012). However, when we include log base-year income to control for mean reversion in income growth we find significant positive ETIs (full estimation results of the base specification can be found in Table A.1 in the Appendix).[10] The elasticity rises from 0.09 in the

[10]The controls used in the regressions are highly significant and show that income growth decreases with age, increases with an individual's education level, 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 5: Results for income subgroups

	(1)	(2)	(3)
Period	99–01	99–03	99–05
Income 10-50K			
Log base-year income	0.0690***	0.1289***	0.2103***
	(0.0064)	(0.0083)	(0.0118)
5-piece spline in base-year income	0.0513***	0.0938***	0.2164***
	(0.0119)	(0.0157)	(0.0273)
Observations	145,316	145,316	145,316
Income 50-100K			
Log base-year income	0.1528***	0.1940***	0.2627***
	(0.0218)	(0.0274)	(0.0357)
5-piece spline in base-year income	0.0694***	0.1008**	0.1993***
	(0.0345)	(0.0410)	(0.0609)
Observations	11,346	11,346	11,346
Income >50K			
Log base-year income	0.1715***	0.3829***	0.4604***
	(0.0584)	(0.0688)	(0.0721)
5-piece spline in base-year income	0.0772**	0.1384**	0.2886***
	(0.0359)	(0.0440)	(0.0702)
Observations	12,196	12,196	12,196

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.

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. When using the 5-piece spline we find very similar results, the elasticity rises from 0.06 in the 1999–2001 period to 0.25 for the 1999–2005 period.

In Table 5 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): 0.21 using log base-year income and 0.22 using the 5-piece spline[11]). For the group with income between 50–100K,

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

Table 6: Results for other subgroups

	(1)	(2)	(3)
Period	99–01	99–03	99–05
Single men	0.0692***	0.1640**	0.1849***
	(0.0305)	(0.0288)	(0.0158)
Observations	11,124	11,124	11,124
Single women	0.1918***	0.3599***	0.5703***
	(0.0297)	(0.0390)	(0.0575)
Observations	9,994	9,994	9,994
Men in couples	0.0310***	0.0748***	0.1057***
	(0.0113)	(0.0166)	(0.0214)
Observations	99,123	99,123	99,123
Women in couples	0.2028***	0.2925***	0.4566***
	(0.0213)	(0.0284)	(0.0319)
Observations	37,269	37,269	37,269

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.

we estimate an elasticity of 0.26 using log base-year income, although the estimate drops to 0.20 when we include a 5-piece spline. For the group with income above 50K, without upper boundary[12], we estimate the largest elasticities. When we add log base-year income as a control the estimate is 0.46, but this drops to 0.29 when we include the 5-piece spline. Hence, for the very high incomes it may be necessary to control for differential trends other than those captured by the other controls.

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 6. We find (much) larger elasticities for single women than for single men, and also for women in couples relative to men in couples. Singles also seem somewhat more responsive than individuals in couples.

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

Table 7: Results by sector

	(1)	(2)	(3)
Period	99–01	99–03	99–05
Financial sector	0.1344***	0.2728***	0.4654***
	(0.0199)	(0.0294)	(0.0422)
Observations	27,892	27,892	27,892
Public sector	0.0567***	0.1392***	0.1708***
	(0.0095)	(0.0124)	(0.0154)
Observations	58,618	58,618	58,618
Other sectors	0.0844***	0.1156***	0.1879***
	(0.0148)	(0.0286)	(0.0258)
Observations	71,000	71,000	71,000

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.

Table 7 gives the results for individuals working in three different sectors in 1999. We find that individuals in the financial sector have the highest ETI. Individuals in the public sector and the remaining sectors have a more modest ETI.

Also of interest is the size of the elasticity of taxable labour income relative to the elasticity of annual 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 in the range of 0.21 and a labor supply (annual hours) elasticity of 0.19. This intensive labour supply elasticity is broadly in line, perhaps a bit larger than the estimates of the labour supply literature.[13] Hence, for the average worker, most of the change in taxable labour income comes from the change in hours worked. We also estimate these elasticities for high-wage workers (>50K). The estimated taxable income elasticities is 0.20 as well (recall that a large part of these workers are in the public sector). The estimated labour elasticity is

[13]For a recent analysis for the Netherlands see Mastrogiacomo et al. (2013), and for an overview for European countries and the US see Bargain et al. (2011).

Table 8: Elasticity of taxable income vs. annual hours worked[a]

	(1)	(2)	(3)
Period	99–01	99–03	99–05
All workers			
Taxable annual labour income	0.0708***	0.1347***	0.2077***
	(0.0079)	(0.0100)	(0.0140)
Annual hours worked	0.0513***	0.1250***	0.1875***
	(0.0081)	(0.0105)	(0.0126)
Observations	66,595	66,595	66,595
Income >50K			
Taxable annual labour income	0.1436***	0.2039***	0.1955***
	(0.0427)	(0.0475)	(0.0589)
Annual hours worked	0.0170	0.0525**	0.0876***
	(0.0159)	(0.0215)	(0.0251)
Observations	5,324	5,324	5,324

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. [a]Elasticity of taxable income and hours worked for the sample of workers for which annual hours worked are observed in the Labour Market Panel.

much smaller at 0.09. So, for high income workers, the elasticity of taxable income is much higher than the labour supply elasticity, indicating that this group reacts mostly in other ways to changes in marginal tax rates.

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 ETI of 0.09 in the short run (1999–2001) rising to 0.24 in the medium run (1999–2005). For workers with an income between 10–50K, we find an ETI of 0.07 in the short run rising to 0.21 in the medium run. For individuals with an income between 50–100K we find an ETI of 0.15 in the short run rising to 0.26 in the medium run. For high income individuals with >50K we find an ETI of 0.17 in the short run rising to 0.46 in the medium run. The medium

run elasticities are somewhat lower when we include a 5-piece spline for middle and high income earners, 0.20 for 50-100K and 0.29 for >50K respectively. The ETI is larger for women than for men, and for individuals working in the financial sector. Furthermore, for the average worker, most of the ETI consists of the labour supply response, whereas for high-wage workers most of the ETI is from other decision margins.

There are a number of limitations to our data and tax-benefit calculator that prevent us from studying a number of additional issues. First, we can not 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 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, 2011). Finally, we would like to have more information on tax deductibles, so that we can decompose the changes in the ETI into its components. In this respect the IPO (Income Panel Survey) 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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Table A.1: Base specification: full estimation results

$\Delta \ln(E_{it})$	1999–2001	1999–2003	1999–2005
Net-of-tax rate	0.0861***	0.1598***	0.2371***
	(0.0077)	(0.0100)	(0.0135)
Log base-year income	–0.0721***	–0.1211***	–0.1265***
	(0.0071)	(0.0085)	(0.0090)
Lower secondary education	0.0107***	0.0099***	0.0130***
	(0.0021)	(0.0024)	(0.0032)
Higher secondary education	0.0299***	0.0397***	0.0471***
	(0.0024)	(0.0029)	(0.0034)
Tertiary education	0.0788***	0.1165***	0.1442***
	(0.0034)	(0.0042)	(0.0046)
Female	–0.0430***	–0.0739***	–0.0950***
	(0.0028)	(0.0035)	(0.0037)
Western immigrant	0.0080**	0.0101***	0.0068
	(0.0036)	(0.0036)	(0.0056)
Non-Western immigrant	0.0038*	0.0087***	0.0102***
	(0.0020)	(0.0024)	(0.0033)
Unmarried couple w/o children	–0.0105***	–0.0217***	–0.0251***
	(0.0022)	(0.0026)	(0.0034)
Married couple w/o children	–0.0132***	–0.0165***	–0.0154***
	(0.0020)	(0.0023)	(0.0029)
Unmarried couple w/ children	0.0028	0.0096**	0.0207***
	(0.0037)	(0.0042)	(0.0055)
Married couple w/ children	0.0014	0.0069***	0.0153***
	(0.0017)	(0.0018)	(0.0024)
Single parent	0.0256***	0.0415***	0.0729***
	(0.0033)	(0.0043)	(0.0064)
Age	–0.0043***	–0.0030***	0.0047***
	(0.0007)	(0.0009)	(0.0011)
Age squared	0.0000***	–0.0000	–0.0001***
	(0.0000)	(0.0000)	(0.0000)
Observations	157,510	157,510	157,510

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 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 and to individuals that do not change between the states of single, single parent and living in a couple.