Estimating Reported Income Responses using Danish Tax Reforms*

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Abstract

This paper presents evidence on reported income responses based on very rich Danish panel dataset that links tax return data to administrative data containing detailed socio-economic information for the entire universe of Danish tax payers. The identifying variation is provided by series of tax reforms that created substantial variation in marginal tax rates across different individuals and income components over time. An attractive feature of the Danish tax reforms from the perspective of empirical research is that tax changes have not been strongly correlated with income. Another attractive feature of the Danish tax system is that it involves a partially separate tax treatment of different income components such as labor income, capital income, and deductions. This feature creates considerable tax variation across taxpayers at the same income level depending on their composition of income. It also provides an opportunity to separately identify the responsiveness of the different subcomponents of reported income. Our preliminary findings are the following: (*i*) population-wide elasticities tend to be modest compared to most existing studies, (*ii*) elasticities for capital income are larger than for labor income, (*iii*) elasticities for negative income (deductions, negative capital income) are larger than for positive income, (*iv*) elasticities for the self-employed are larger than for employees, and (*v*) elasticities are monotonically increasing in income level. This set of findings is very robust to specification such as the choice of pre-reform income controls. This is reassuring and suggests that we have controlled in a sufficiently rich way for non-tax factors impacting on reported income.

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1 Introduction

The recent literature on behavioral responses to taxation has shifted its focus from the elasticity of hours worked to the elasticity of reported taxable income. Effects on taxable income capture the full range of responses to taxation, including hours worked, unobserved effort, training, occupational choice, tax avoidance and tax evasion, and therefore provides a more complete picture of the behavioral response to taxation. Moreover, as pointed out by Feldstein (1995, 1999) in two influential papers, the specific channel of response does not matter for either the revenue or the efficiency effects of taxation, which are determined simply by the total effect on the tax base as reflected by the elasticity of taxable income. This insight places the elasticity of taxable income at the centre stage of all the major normative questions in public finance such as the structure of optimal income redistribution and the size of government.

A large and growing literature estimates the elasticity of reported income using tax return data.[1] Most of this work is based on the United States and uses as its source of identification a series of tax reforms in the 1980s and 1990s that were associated with substantial tax changes at the top of the income distribution (e.g., Feldstein, 1995; Auten and Carroll, 1999; Goolsbee, 2000; Gruber and Saez, 2002; Kopczuk, 2005). In addition to the U.S. literature, a number of recent studies estimate taxable income responses in other countries that have lowered marginal tax rates at the top of the income distribution, including the flattening of the income tax in Canada in 1988 (Sillamaa and Veal, 2001), the tax cuts to high-income earners in Norway in the early 1990s (Aarbu and Thoresen, 2001), and the Tax Reform of the Century in Sweden in 1991 (e.g., Selén, 2002; Ljunge and Ragan, 2005; Hansson, 2007).

Reforms that strongly target the top of the income distribution provide interesting variation, but are also associated with some important empirical difficulties. Because the allocation of treatments (tax changes) is determined by pre-reform income level, we have to consider the possibility that different income groups differ in a number of non-tax dimensions that impact on reported income and are correlated with the tax law changes. This problem is reinforced by the fact that tax return data typically contains very little information about tax payers besides income variables and tax rates, making it difficult to control for any non-tax differences across different tax payers.

[1] See Slemrod (1998), Saez (2004), and Saez, Slemrod, and Giertz (2009) for surveys and critical discussions of this literature.

Two specific problems have been discussed in the literature (e.g., Slemrod, 1998; Saez 2004). First, it is very hard to disentangle tax-driven increases in top incomes from increases that are driven by non-tax factors such as skill-biased technical change and globalization. This problem is particularly important in countries that have experienced strong secular increases in top income shares, and may result in a substantial upward bias in the elasticity estimates. Second, defining treatments and controls according to pre-reform income level creates a mean-reversion problem, because a tax payer with a positive income shock in the pre-reform year will tend to have a lower income in the following years, independently of the reform. For tax cuts at the top, this biases elasticity estimates downwards. In order to correct for the two biases mentioned above, the literature has attempted to control in a number of ways for pre-reform income levels. However, the richness of such income controls is constrained by the fact that the identification comes from different tax changes across pre-reform income levels (Moffitt and Wilhelm, 2000), and in general the results turn out to be very sensitive to specification.

This paper presents new evidence on reported income responses based on a series of Danish tax reforms implemented over a period of about two decades and using a very rich panel dataset including the entire universe of taxpayers in Denmark. The Danish tax context and data holds the potential to avoid the biases discussed above for the following reasons. First, by linking tax return data to administrative data containing very detailed socio-economic information for each taxpayer, we control directly for some of the underlying non-tax components of permanent and transitory income that are important for the biases discussed above. Second, the evolution of the Danish income distribution has been much more stable than in most other countries, even compared to other egalitarian societies such as Sweden. To illustrate this, Figure 1 shows top income shares based on a broad income measure including all labor income, transfers, pensions, and capital income. As the figure makes clear, top income shares have been roughly constant over time with the exception of a very small increase after the mid-1990s.

Third, the Danish tax system is interesting to consider, because it is not based on a single measure of taxable income but involves a partially separate tax treatment of labor income, transfers and pensions, capital income (non-stock), stock income, and deductions, along with an asymmetric treatment of positive and negative income components. The asymmetry in the taxation of different income forms creates substantial tax variation across individuals *at the same income level* but with different compositions of income. Fourth, the period we consider (1984-

2005) encompasses a series of Danish tax reforms, which are interesting from the perspective of empirical identification. Unlike the reforms discussed above, the tax changes in Denmark were not systematically correlated with income level. The different tax acts introduced both tax increases and tax cuts at different points in the income distribution and at different points in time. For some taxpayers and years, these tax changes were very large, while for other taxpayers and years, the tax changes were of a smaller magnitude. The combination of point three and four implies substantial variation in all dimensions: across income levels, across tax payers at a given income level, across income types, and over time.

In a tax system based on separate tax treatment of different types of income, estimating an overall elasticity of taxable income would be essentially meaningless. We therefore focus separately on the underlying income components in the tax code, and estimate reported income elasticities for labor income, positive capital income, negative capital income, and deductions.[2] Our main findings are the following: (*i*) population-wide elasticities tend to be modest compared to most existing studies, (*ii*) elasticities for capital income are larger than for labor income, (*iii*) elasticities for negative income (deductions, negative capital income) are larger than for positive income, (*iv*) elasticities for the self-employed are larger than for employees, (*v*) elasticities are monotonically increasing in income level and tend to be 2-3 times larger in the top quintile of the distribution than in the bottom quintile of the distribution, and (*vi*) the largest responsiveness overall are for deductions and negative capital income among high-income and self-employed taxpayers. This set of findings is quite robust to specification such as the choice of pre-reform income controls.

As pointed out by Slemrod (1998) and Slemrod and Kopczuk (2002), reported income elasticities are not structural parameters that depend only on individual preferences. They depend in important ways on the opportunities for tax avoidance and tax evasion, which in turn depend on the tax structure (especially the broadness of tax bases) and the efficacy of tax enforcement. The fairly low responsiveness of reported incomes despite the exceptionally high marginal tax rates in Denmark suggests that the system offers small opportunities to avoid and evade taxes. There are two main reasons for this. First, tax bases are very broad in Denmark and offer limited opportunities for deductions and negative capital income to count against the income

[2]Notice that taxable capital income is here defined exclusive of stock income, which is taxed on a completely separate schedule. This version does not consider stock income, but we plan to incorporate this interesting aspect in the future.

tax base. Second, as shown by Kleven et al. (2009), tax enforcement is very effective and overall tax compliance high due to the widespread use of double-reporting by third parties such as employers and financial institutions. They also find that, once we zoom in on income which is not third-party reported and on taxpayers with negative income, tax evasion is in fact quite substantial. Those finding are entirely consistent with the findings in this paper with regard to the responsiveness of self-employment income and negative capital income. The overall conclusion which emerges from the two studies together is that a tax system with the broadest possible bases and extensive use of information reporting can impose very high marginal tax rates with fairly modest behavioral responses.

The paper proceeds as follows. Section 2 describes the Danish tax system and the tax reforms that we use to identify behavioral responses. Section 3 describes the data, while Section 4 describes the empirical specification and identification strategy. Section 5 presents our main results, while Section 6 concludes.

2 The Danish Tax System and Tax Reforms

The Danish income tax system is fairly complex. Rather than applying a progressive rate structure to a single measure of taxable income, it is based a number of different income concepts that are taxed in part separately. The income concepts of the Danish individual income tax system are shown in Table 1, and are given by labor income (LI), personal income (PI = LI + other PI), capital income (CI), deductions (D), taxable income (TI = PI + CI – D), and stock income (SI). Those basic income concepts are then aggregated into several different tax bases that are taxed at different rates. The definition of those bases as well as the associated tax rates have undergone substantial changes over time due to a series of tax reforms, and this is the variation that we explore to estimate elasticities of reported income.

Taxes are divided into national taxes and regional taxes at the municipal and county level, but the two types of taxes are enforced and administered in an integrated system. At the national level, a series of important tax acts have been implemented over the past 25 years. Those tax acts are the 1987-reform, the 1994-reform, the 1999-reform ("the Pentecost Package"), and the 2004-reform ("the Spring Package"). Most of those reforms were phased in over several years, which generates considerable tax variation in most years of the period we consider. We also

exploit changes in tax schedules at the regional level, but those changes have been much smaller and are more uniform across taxpayers than the national changes.

Throughout the period we consider, the national income tax has been divided into three main brackets: a bottom bracket, a middle bracket, and a top bracket. The general trend of the past two decades of tax reform can be summarized as follows: (*i*) a lowering of marginal tax rates in each bracket, with larger cuts in the middle and top brackets than in the bottom bracket, (*ii*) a substantial broadening of tax base definitions, (*iii*) bracket thresholds that were not adjusted corresponding to the broader bases, thereby pushing tax payers into higher brackets, and (*iv*) an increasing asymmetry in the tax treatment of different components of taxable income such as labor vs. capital income, positive vs. negative income, and deductions vs. income. Because (*i*) tend to lower tax rates overall, while (*iii*) tends to increase tax rates in specific income intervals, the combination of the two tend to create substantial and fairly unsystematic tax rate variation across the income distribution. Furthermore, point (*ii*) and (*iv*) imply very large tax changes for capital income and deductions for some taxpayers and in some years. We will now describe the impact of the reforms in more detail.

Table 2 shows the different tax rates and associated tax bases in four specific years: 1986 (before the 1987-reform), 1993 (before 1994-reform), 1998 (before the 1999-reform), and 2005 (after the 1999- and 2004-reforms). The tax system consists of a flat regional tax levied on taxable income (shown for the average municipality) and a number of national taxes levied on varying tax bases and in a progressive way. The main national taxes are the Bottom Tax, the Middle Tax, and the Top Tax, and in some years those taxes are supplemented by social security and labor market contributions. Notice that the tax rates in the table are cumulative: for example, in 1986, a taxpayer in the top bracket would face a marginal tax rate equal to 28.1 + 14.4 + 14.4 + 10.8 + 5.5 = 73.2%. However, a marginal tax ceiling is in place in all years, and this ceiling equals 73% in 1986 and is therefore binding for a taxpayer living in an average municipality. In 2005, the marginal tax ceiling has dropped to 59.0% and was indeed also binding for a taxpayer in the top bracket living in the average municipality. For labor income, there is a labor market contribution of 8% on top of the tax ceiling, but at the same time labor income enters all the other tax bases net of the labor market contribution. The effective tax ceiling on labor income in 2005 is therefore equal to 8.0 + (1 – 0.08) × 59.0 = 62.3%.

The key purpose of Table 2 is to show the major changes in tax bases. In 1986, all tax rates

applied to taxable income (TI = LI + other PI + CI – D). In 2005, only the regional tax applies to taxable income, while all the other taxes applies to either labor income (LI) or a base defined as personal income plus net capital income *if it is positive* (PI + CI if > 0). There are two important points to make with regard to those tax base changes.

First, it is not meaningful to estimate an elasticity of *taxable income* as defined in the Danish tax code. With the exception of the early years, TI is only one among several income measures in the tax system. In particular, because TI include subcomponents (LI, PI, CI, and D) that are all treated differently in the tax code, there exists no single, well-defined marginal tax rate on TI. The same issue would be present with alternative and broader bases such as PI + CI ("broad income"), because again this base is only relevant for some taxes in some years, and there is no well-defined marginal tax rates associated with this base either.

Second, the type of base broadening described above does not raise the conceptual problems that have been discussed extensively in the literature on taxable income responses (Slemrod, 1998; Kopczuk, 2005). The usual problem is that such reforms require us to consider constant-definition tax bases in order to avoid confounding behavioral and definitional changes, but in so doing we are relating the tax rate to an "artificial" tax base different from the one in the tax code in a given year. However, the base broadening shown in Table 2 does not pose this problem (and indeed create a lot of interesting variation that we will exploit), because it does not consist in including previously untaxed components in the tax system. In all years, the tax system depends on the same underlying income components, but the aggregation of those income components into tax bases changes over time.

What we do in the following is to consider the underlying components of the tax system separately: LI, other PI, CI, D, and SI. In any given year, tax liability T(.) is unambiguously defined as a function of those components, T(LI, other PI, CI, D, SI), and there is a well-defined marginal tax rate for each income component. Notice also that, under the tax code described in Table 2, the taxation of each separate income component interact and the cross-derivatives in the tax function are therefore non-zero. This creates a lot of variation in the marginal tax rates across taxpayers at a given income level (but with different compositions of income).

In the following, we take a closer look at the changes in effective marginal tax rates in each bracket over the period 1984-2005. Figures 2-5 show the evolution of the effective marginal tax rate in the bottom bracket, middle bracket, and top bracket for labor income, positive capital

income, negative capital income, and deductions. We do not show the marginal tax rate for other personal income, because it evolves very much like the tax on labor income except for a level effect due to the labor market contribution. We also do not show the evolution of taxes on stock income, which are on a completely separate schedule and not analyzed in this preliminary version of the paper.

Figure 2 shows the marginal tax rates on labor income in each of the three brackets. The marginal tax rate in the top bracket has been declining from 73% to 62%, while the tax rate in the middle bracket has been declining from 62% to 49%. On the other hand, the bottom tax rate is increasing over the early part of the period and then declining over the later part of the period. Overall, the difference between the bottom tax and the middle/top taxes has been shrinking over this period, although the relative changes have not been dramatic. However, these graphs do not reveal the implications of base broadening and bracket thresholds on tax rates across the income distribution. We come back to this below.

Figures 3 and 4 show the marginal tax rate on capital income, depending on whether it is positive or negative. The figures reveal dramatic changes both in the overall levels and the relative rates across brackets. For negative capital income, the three brackets have collapsed into one bracket with a rate equal to the bottom rate. For taxpayers in the top bracket, the marginal tax rate associated with negative capital income has dropped from about 73% to 33% over the period, while for taxpayers at the bottom the drop has been much smaller. These changes reflect that negative capital income has been excluded from the bases of the Middle Tax and the Top Tax. It should be pointed out that the changes in Figure 3 affect a very large number of taxpayers, because capital income is in fact negative for the majority of Danish taxpayers as a result of interest payments on loans (mortgage and other loans). For positive capital income, we also see very large changes. The band between the top and the bottom first narrows substantially (because all capital income is excluded from the Top Tax base) and then widens substantially (because positive capital income is reintroduced in the Top Tax base).

Figure 5 shows the marginal tax rate associated with deductions. As for negative capital income, the top rate has dropped dramatically relative to the middle and bottom rates over the period. Again, this is the result of base broadening that exclude deductions from the tax bases of the Middle Tax and Top Tax. Notice that for deductions (and to some extent negative capital income), all of the interesting variation across brackets is created by the 1987-reform, while for

the subsequent reforms there is no variation across brackets.

The figures shown so far hide the important impact of bracket thresholds. In particular, as bases were broadened for the Bottom, Middle, and Top Tax, the bracket thresholds were not adjusted entirely to account for the broader base and therefore taxpayer were pushed into higher brackets. To show the importance of this effect, Figure 6 illustrates the share of taxpayers in each of the three brackets over time (for individuals aged 25-55 and excluding those on social transfers who are always in the bottom bracket). What we see is that the share of taxpayers liable to pay the Top Tax has increased from about 10% in the mid-1980s to about 33% at the end of the period. At the same time, the share of individuals in the middle bracket has increased from 38% to 48%, and as a result of the increased concentration of taxpayers in the two upper brackets, there has been a drastic reduction of taxpayers in the bottom bracket from 50% to 18%.[3] The movements across brackets shown in the figure have important implication for tax rates on the affected taxpayers. Notice though that the effect matters only for labor income, other personal income, and positive capital income, because deductions and negative capital income have collapsed to one bracket.

The reforms described in this section implies substantial tax variation over time and across individuals. Indeed, when we describe the empirical strategy in Section 4, we show that the variation in some years and for some income forms is comparable to the major tax acts in the U.S. in the 1980s and the Tax Reform of the Century in Sweden in 1991.

3 Data

The analysis is based on a very rich panel that runs from 1980 to 2005 and covers the entire universe of Danish tax payers. The data set has been constructed by Statistics Denmark based on a number of administrative registers, including the Income Tax Register and the Integrated Database for Labor Market Research (IDA). For each individual, the data set contains detailed tax return information along with a large set of socio-economic variables such as place of residence, gender, age, marital status, number and age of kids, immigrant status, ethnicity, employment status, job experience, education (level attained, area of study, grade point average), occupation, and industry.

[3] Notice that the bottom, middle, and top bracket shares do not quite add up to 1. This is because of a small amount of taxpayer with incomes below a basic exemption level who are not liable to pay the Bottom Tax.

As described above, we do not consider aggregate tax base measures such as taxable income or broad income, because those measures consist of income subcomponents that are taxed differently. We instead focus on four subcomponents in the tax code: labor income, negative capital income, positive capital income, and deductions. The definition of those subcomponents have changed much less over time than the aggregate tax base measures, which is important because of the conceptual issues (discussed in the previous section) associated with such definitional changes. However, there has been some changes, most importantly for capital income, which was split into stock income and other capital income during the period. In what follows, and in order not to confound behavioral and definitional changes, we consider a constant definition of capital income that excludes stock income in the entire period. However, because we observe stock income in the data in all the years, we can ultimately study both forms of capital income and analyze for example the presence of shifting between the two bases. We plan to include such a study in future versions of the paper.

Marginal tax rates are not directly observed in tax return data, and we therefore have to simulate the marginal tax rate for each taxpayer based on tax return information and a model the Danish tax system. Because there exists no publicly available TAXSIM model in Denmark (unlike for example the NBER TAXSIM model for the U.S.), we have constructed our own TAXSIM model of the Danish tax system over the period 1984-2005. Based on this model and tax return data, we can compute the marginal tax rate on any given income component (at a given level of all other income components) by increasing income by DKK 100 ($\simeq$ US$ 15). In particular, if tax liability $T(.)$ is a function of n different reported incomes $z^1, ..., z^n$, we compute the marginal tax on z^j as $\tau^j = \left[T\left(z^1, ..., z^j + 100, ...z^n\right) - T\left(z^1, ..., z^j, ...z^n\right)\right]/100$.

Following Gruber and Saez (2002), the empirical strategy is to relate changes in reported income over time to changes in marginal tax rates over time for individual taxpayers. We focus on the period 1984-2005 and consider three-year intervals (1984-1987, ..., 2002-2005). We denote the first year in any given three-year interval by s and the last year by $s+3$. We include only tax payers that are also observed in year $s-1$ and $s-2$, because we use those years to construct pre-reform income controls. The three-year differences are stacked to obtain a dataset with about 25 million observations.

We restrict the sample used for estimation in the following ways. First, we exclude observations where the tax payer changes marital status in between year $s-2$ and $s+3$. Second, we

restrict the sample to individuals aged 25-55 years in order to avoid complications with respect to education and retirement decisions that we may not model properly. Third, we exclude recipients of welfare benefits in base year s, because this would require us to account for the important incentive effects of the welfare system and model extensive responses. Fourth, we require that the tax payer's broad income in year s is at least DKK 10,000 ($\simeq$ US$ 1,500). Fifth, we limit our sample to people who are fully tax liable in Denmark.

The sample restrictions just described leave us with a total of about 20 million observations. In this preliminary version of the paper, we limit ourselves to a 5% random subsample drawn from this dataset. In the future, we will expand the study to a much larger sample.

4 Empirical Strategy

4.1 A Simple Model

The economic model underlying the new tax responsiveness literature is a simple extension of the traditional labor supply model. It is assumed that each tax payer maximizes a utility function of the form $u(c, z, x)$, where c is consumption, z is reported taxable income, and x is a vector of individual characteristics. We may think of reported income z as being generated by a number of underlying choices such as hours worked, effort, training, occupational choice, tax sheltering activities, etc. Hence, the implicit (and strong) assumption in the literature is that all those underlying activities are weakly separable from consumption in utility. Utility is maximized subject to a budget constraint $c = z - T(z) = (1 - \tau) \cdot z + y$, where $T(.)$ is tax liability, $\tau \equiv T'(.)$ is the marginal tax rate, and $y \equiv \tau \cdot z - T(z)$ is virtual income. We may then write the optimal choice of taxable income as $z = z(1 - \tau, y, x)$.

In the context of the Danish tax system, we have to extend the model to account for the presence of multiple tax bases. Consider therefore a consumer choosing reported incomes $z^1, ..., z^n$ under a tax schedule $T\left(z^1, ..., z^n\right)$. This consumer maximizes utility

$$u = u\left(c, z^1, ..., z^n, x\right), \tag{1}$$

subject to a budget constraint

$$c = \sum_{j=1}^{n} z^j - T\left(z^1, ..., z^n\right) = \sum_{j=1}^{n} \left(1 - \tau^j\right) z^j + y, \tag{2}$$

where $\tau^j \equiv \partial T/\partial z^j$ is the marginal tax rate with respect to z^j and $y \equiv \sum_{j=1}^{n} \tau^j z^j - T\left(z^1, ..., z^n\right)$ is virtual income. Notice that the marginal tax rate on income base j is in general a function of all the different income bases $z^1, ..., z^n$. Moreover, notice that in the case of deductions, because the z-variables are defined as income in the above expressions, z would be equal to minus deductions.

In this model, the optimal choice of any given income type z^j would depend on all the net-of-tax prices and virtual income, i.e.

$$z^j = z^j\left(1 - \tau^1, ..., 1 - \tau^n, y, x\right). \tag{3}$$

In principle, an empirical specification for a given tax base should account for both own-price effects associated with changes in the marginal net-of-tax rate on that base as well as cross-price effects associated with changes in the net-of-tax rates on all the other bases. However, in practice, it may be difficult to separately identify the effect of different tax rates on a given base, because the marginal tax rates across bases are going to be highly correlated for each individual. Therefore, as a starting point, we make the assumption that income supplies are independent:

$$z^j = z^j\left(1 - \tau^j, y, x\right). \tag{4}$$

In the future, we plan to explore alternative alternative specifications that allow for both own- and cross-price effects.

For tax payer i at time s, a log-linear specification of the choice of income type j is given by

$$\log\left(z_{is}^j\right) = \alpha + \varepsilon \cdot \log\left(1 - \tau_{is}^j\right) + \eta \cdot \log\left(y_{is}\right) + \gamma_s^c \cdot x_i^c + \gamma^v \cdot x_{is}^v + \mu_i + \nu_{is}. \tag{5}$$

In this specification, we distinguish between time-invariant individual characteristics x_i^c whose effect may change over time, and time-variant individual characteristics x_{is}^v whose effect is constant over time. The effect of time-invariant individual characteristics whose effect is constant over time is subsumed in the individual fixed effect μ_i. The key variables of interest are the uncompensated elasticity of reported income (ε) and the income elasticity (η).[4]

In first-differenced form, the model can be written as

$$\Delta\log\left(z_{is}^j\right) = \varepsilon \cdot \Delta\log\left(1 - \tau_{is}^j\right) + \eta \cdot \Delta\log\left(y_{is}\right) + \Delta\gamma_s^c \cdot x_i^c + \gamma^v \cdot \Delta x_{is}^v + \Delta\nu_{is}. \tag{6}$$

[4]Notice that we specify the income effect in terms of virtual income as defined above. This is in contrast to some previous studies (Gruber and Saez, 2002; Kopczuk, 2005), which specify the income effect in terms of after-tax income $z - T(z)$. Despite this refinement of the modeling of the income effect, our estimates of the income effect turn out to be very consistent with the earlier studies.

In the baseline specification, differences at time s are three-year differences from s to $s+3$.

4.2 Identification Strategy and Relation to Previous Literature

Because of the nonlinearity of the tax system, the marginal tax rate and virtual income are endogenous to the choice of reported income, which creates a correlation between $\Delta \log\left(1-\tau_s^j\right)$, $\Delta \log\left(y_s\right)$, and the error term. The usual way to construct instruments for these variables is to use mechanical tax changes driven by changes in tax laws. Hence, using the Danish TAXSIM model described above, we simulate post-reform marginal tax rates at pre-reform behavior, $\tau_{s+3}^j\left(z_s^1,...,z_s^n\right)$, where we account for the fact that the marginal tax rate on income j may depend not just on the level of income j but also on the levels of the other incomes. From the simulated marginal tax rates, we obtain a mechanical net-of-tax rate change, $\log\left(1-\tau_{s+3}^j\left(z_s^1,...,z_s^n\right)\right)-\log\left(1-\tau_s^j\left(z_s^1,...,z_s^n\right)\right)$, which is used as an instrument for the observed change $\Delta \log\left(1-\tau_s^j\right)$. Analogously, we simulate post-reform virtual incomes at pre-reform behavior, $y_{s+3}\left(z_s^1,...,z_s^n\right)=\sum_{j=1}^N \tau_{s+3}^j\left(z_s^1,...,z_s^n\right) z_s^j - T_{s+3}\left(z_s^1,...,z_s^n\right)$, and an associated mechanical change in virtual income, $\log\left(y_{s+3}\left(z_s^1,...,z_s^n\right)\right)-\log\left(y_s\left(z_s^1,...,z_s^n\right)\right)$, which is used as an instrument for the observed change $\Delta \log\left(y_s\right)$.

While the mechanical tax changes used as instruments are exogenous to post-reform incomes, they do depend on pre-reform incomes. Hence, the instruments may be correlated with the error term if the pre-reform income level is correlated with the error term. The literature has discussed two channels through which this may occur. First, tax payers at different pre-reform income levels may experience different income trends for non-tax reasons. Indeed, many countries have experienced sharply increasing top income shares over the past few decades, and several studies have argued that these changes are driven by skill-biased demand shocks resulting from innovation and globalization. Unless skill can be directly controlled for, it would be captured by pre-reform income levels and skill-biased changes would then be absorbed in the estimated elasticity. Second, the pre-reform income level reflects both permanent and transitory income components, which creates a mean-reversion problem: a tax payer with a very high income in the pre-reform year will tend to have a lower income in the post-reform year, other things being equal. In the absence of controls for transitory income components, they would be captured by pre-reform income levels and hence be absorbed by the estimated tax effect.

The problems just described are particularly acute when considering a reform, or a series of

reforms, that are strongly targeted to certain income groups such as high-income earners (such as the U.S. tax reforms in 1980s). In that case, the mechanical tax changes will be strongly correlated with income level and therefore with skill-dependent demand shocks and transitory income components. To deal with this problem, Auten and Carroll (1999), Moffitt and Wilhelm (2000), Gruber and Saez (2002), and Kopczuk (2005) propose to control in different ways for pre-reform income. For example, Kopczuk (2005) proposes a specification that includes the change in income in the year prior to the reform, $z_s - z_{s-1}$, as a proxy for transitory income components, along with the lagged income level z_{s-1} as a proxy for the permanent income level. He allows for nonlinearity by experimenting with 10-piece splines in logarithms in either of the two controls. He also explores a number of other specifications, including those adopted by Auten and Carroll (1999) and Gruber and Saez (2002). The results show that the elasticity estimates are very sensitive to the precise form of pre-reform income controls included.

We include various income controls along the lines of the earlier studies. However, it turns out that the results are not very sensitive to the exact form of income controls. This is reassuring and suggests that we have controlled in a sufficiently rich way for non-tax factors impacting on reported income. There are four reasons for this. First, because of the large set of socio-economic variables in the data set, we are able to control directly for a number of underlying characteristics driving permanent and transitory income components. For permanent income, variables on education (level attained and area of study) capture skill level, which controls for the effect on the tax payer of a changing income distribution due to skill-biased demand shocks. Variables on gender, marriage, kids, immigration, and ethnicity may further control for permanent income components. For transitory income, controlling for variables such as place of residence, local unemployment, age, job experience, occupation, and industry ensure that we are comparing individuals affected similarly by the macro economy. This controls for transitory income components associated with business cycles.

Second, as discussed in the introduction and shown in Figure 1, there has been no significant secular change in the income distribution in Denmark, implying that the bias from unobserved non-tax factors affecting the income distribution is not a big concern here. This isolates mean-reversion as the potential bias that the income controls have to correct for (to the extent that the other socio-economic variables are not sufficient). Third, the potential biases from mean-reversion depend on the presence of a correlation between tax changes and pre-reform income

level. As described in Section 2, the reforms we consider have not been systematically targeted to certain income groups, and the reform-induced net-of-tax rate changes therefore vary quite unsystematically across the income distribution and over time. Fourth, as described in Section 2, the design of the Danish tax system is associated with a large degree of tax variation at given income levels, because tax liability is a function of several different tax bases that interact with one another. The combination of three and four significantly alleviates the potential biases from mean reversion or a changing income distribution.

4.3 Marginal Net-of-Tax Rate Variation

To give a more precise sense of the identifying variation, Figures 7-10 show the mechanical variation in marginal net-of-tax rates for different income types in select time intervals. In particular, we show the variation created by the 1987- and 1994-reforms, which were the largest reforms over the period. Each figure shows three-year differences in percent, where we have split the sample into five groups using base-year income variables: (*i*) individuals who are in the bottom bracket under base- and post-year rules, (*ii*) individuals who are pushed from the bottom to the middle bracket as a result of the rule-change, (*iii*) individuals who are in the middle bracket under both base- and post-year rules, (*iv*) individuals who are pushed from the middle to the top bracket, and (*v*) individuals who are in the top bracket under both base-year and post-year rules. It is of course important that the grouping is based only on base-year income variables and therefore does not incorporate a behavioral response.

This grouping of taxpayers is useful to make the reform-driven tax changes stand out. Notice that, because the tax system is not based on a single measure of taxable income but is a function of each income component separately, the grouping is different from one based on a measure of total income. Moreover, because thresholds and bases change over time, the grouping shifts across the income distribution over time. An alternative would be to split the sample by quantiles of the income distribution. Such figures would show much less *average* tax variation in each group, because we would be lumping tax reductions for those who stay in a given bracket together with tax increases for those who are pushed into a higher bracket. This means that within each income quantile group, there would be a lot of tax variation across tax payers. Indeed, as discussed above, this variation is part of what makes the Danish tax reforms attractive to study.

Each figure shows the mechanical net-of-tax rate variation in each group (blue bars) and the

size of the group as a share of the total population (red bars).[5] Figure 7 illustrates the changed taxation of labor resulting from the 1987-reform (1986-1989 difference). We see that those in the top bracket experienced an increase in the net-of-tax rate of about 14%, while those shifted into the top bracket by the reform experienced a reduction in their net-of-tax rate of about 14%. The size of those two groups is roughly the same and equal to about 9% of the total population each. Those in the middle bracket saw their net-of-tax rate increase by about 9%, while those shifted into the middle bracket saw a net-of-tax rate reduction of more than 20%. Those in the bottom bracket also experienced net-of-tax rate reductions, but of a much smaller magnitude.

Figure 8 shows the variation in the net-of-tax rate on labor around the 1994-reform (1991-1994 difference). In this reform, it was the taxpayers in the bottom bracket (about a quarter of the population) who experienced net-of-tax rate increases. The increase for this group was about 9%. Those in the middle bracket had roughly unchanged marginal tax rates, while everybody else saw their net-of-tax rate reduced. By far the largest effect was on the roughly 6% of the population that was shifted into the top bracket and as a result saw a net-of-tax rate reduction by 35%.

Figures 9 and 10 focuses on the changes in the tax treatment of capital income and deductions around the 1987-reform. Here we see even larger changes than for labor income. The marginal net-of-tax rate for those in the top bracket increased by more than 50% in the case of both negative capital income (Figure 9) and deductions (Figure 10). Those in the middle bracket as well as those moving into the top bracket experienced much smaller increases in the net-of-tax rate, while those in the bottom bracket and those moving into the middle bracket experienced net-of-tax rate reductions.[6]

To conclude, the variation shown in the above figures is very large. In terms of the relative variation across groups, the changes are comparable in size to for example the Tax Reform Act of 1986.[7]

[5] Notice that the five groups together do not quite aggregate to the full population. In the different figures, the five groups constitute about 95% of the total population, with the remaining 5% being mostly individuals below the exemption level for the bottom bracket and for whom there is not much variation to show.

[6] It may seem counterintuitive that taxpayers being pushed into the top bracket can experience an increase in the net-of-tax rate. The reason is that negative capital income and deductions. were taken out of the base for the Top Tax and Middle Tax, and therefore the post-reform tax rate on those components for taxpayers in the top bracket was in fact lower than the pre-reform marginal tax rate in the middle bracket.

[7] See Gruber and Saez (2002) for a desciption of the mechanical net-of-tax rate variation created by the Tax Reform Act of 1986.

5 Reported Income Elasticities

Reported Labor Income:

In the following sections, we describe the results from IV-estimations of specification (6) using mechanical tax changes as instruments. We run separate regressions for labor income, positive capital income, negative capital income, and deductions. The first-stage regressions (not shown) are always very strong. For the second-stage, we start by presenting regression results assuming no income effects, and then explore the potential importance of income effects separately.

Results for reported labor income are shown in Table 3A (all individual taxpayers), 3B (employees), and 3C (self-employed). In each table, we consider different specifications of pre-reform income controls: no income controls, the income controls suggested by Gruber and Saez (2002) and Kopczuk (2005), and specifications that include additional controls for transitory income components by including splines of the log-income changes from period $s-2$ to $s-1$ and from $s-1$ to s. What the tables show is that it does have an effect whether *any* income controls are included, but conditional on allowing for pre-reform income controls, the exact specification is not very important.

Table 3A shows that population-wide labor income elasticities are fairly modest and range from 0.08 and 0.10 (in specifications with income controls). To see how those elasticities vary with income, we split the sample according to income level in base year. In particular, we divide the sample into five quintiles based on broad income. What we see is that reported income responses are monotonically increasing in income, with elasticities equal to 0.02-0.04 at the bottom quintile and elasticities equal to 0.13-0.16 at the top quintile. Tables 3B and 3C show that responses are considerably higher for the self-employed than for employees. Elasticities for self-employed range from 0.13-016 on average and are equal to 0.18-0.21 at the top.

Reported Capital Income:

Capital income is a net income concept and hence may be either negative or positive. As explained above, the tax treatment of capital income depends on whether the net value is positive or negative. Under the log-specification we consider, we obviously cannot consider negative incomes, and therefore consider capital income in absolute value and run separate

regressions for negative and positive capital income.[8]

Tables 4A-4C show results for negative capital income based on the sample of all individuals, employees, and the self-employed. Notice that we would expect the elasticity of negative capital income (in absolute value) to respond negatively to the marginal net-of-tax rate. Indeed, the tables show that elasticities are always negative, except when no income controls are included. Again, the results are very robust the exact specification of income controls. The population-wide elasticities for negative capital income vary between -0.14 and -0.17 across specifications, and are hence larger in absolute value than labor income elasticities. Consistent with our findings for labor income, when we split the sample according to base-year broad income, we find that the responsiveness of negative capital income is monotonically increasing in income level. Morover, we find that elasticities are larger for the self-employed than for employees.

Table 5 show results for positive capital income. The sample size is much smaller for positive capital income, because most taxpayers in Denmark have negative capital income due to payments of interest on mortgages (combined with the fact that stock income is taxed separately and hence excluded here). The table shows that the responsiveness of positive capital income is smaller than the responsiveness of negative capital income and slightly higher than the responsiveness of labor income. Moreover, consistent with our other findings, elasticities are increasing in income.

Reported Deductions:

Our results for deductions are shown in Tables 6A-6C. These elasticities are all negative as one would expect from economic theory. The size of elasticities is of the same magnitude as those for negative capital income. The findings confirm the results above with regard to the relationship of responsiveness to income level and employment status. Indeed, the largest elasticities we find overall are for deductions among self-employed taxpayers at the high end of the distribution, where elasticities are between 0.20 and 0.25. However, these elasticity estimates are still smaller than most existing estimates of taxable income elasticities in the literature based on U.S. tax

[8] An issue here is that we have to make sure that capital income has the same sign in both the base year s and post year $s+3$. We therefore have to exclude taxpayers whose capital income change sign between the two years. This is conceptually problematic, because we are then selecting based on something that is endogenous to the behavioral response. To test for the potential importance of this selection effect, we consider a a sign-change indicator variable taking the values -1 (positive to negative), 0 (same sign), or 1 (negative to positive). We regress this sign-change indicator variable on all the right-hand side variables in (6) to see if taxes have a significant effect on the sign of capital income. [RESULTS OF THOSE REGRESSIONS TO BE INCLUDED.]

return data.

Substitution versus Income Effects:

Finally, we explore the potential importance of income effects in Table 7. Previous studies based on U.S. studies have found income effects to be small and insignificant. As shown in the table, our findings are completely consistent with those previous findings. Income elasticities are always insignificant at the conventional 5% level. The income effect is sometimes slightly negative and sometimes slightly positive, with elasticities in absolute value around 0.01-0.03.

6 Concluding Remarks and Future Work

This paper has presented preliminary findings from an empirical study of reported income responses using a tax system and a series of reforms that provide substantial tax variation across individuals, income forms, and over time. In particular, the identifying variation provided by the Danish tax system does not feature the same strong correlation between tax changes and income levels as the tax reforms in the U.S. (and several other countries) that have been extensively studied in the past decade.

Unlike previous studies, we do not focus on elasticities of total taxable income or broad income, because those income measures consists of multiple tax bases that are treated in part separately. Indeed, the presence of a partially separate treatment of different taxable income items in Denmark (and the substantial changes over time in the relative tax treatment of different items) provides an interesting opportunity to separately identify the responsiveness of different forms of reported income.

In this version of the paper, we have shown results for labor income, positive capital income, negative capital income, and deductions. Our general finding is that responses are fairly modest overall, but with significant and interesting heterogeneity across taxpayers and income forms. Responses are relative large for capital income (especially negative capital income), deductions, and self-employment income. Moreover, responses are larger at the top than at the bottom of the distribution.

The fairly low responsiveness of reported income despite the exceptionally high marginal tax rates in Denmark suggests small opportunities for avoidance and evasion. There are two reasons for this. First, tax bases are very broad and offer limited opportunities for deductions

and negative income to count against taxable income. Second, tax enforcement is very effective due to widespread third-party reporting (Kleven et al., 2009; Kleven, Kreiner, and Saez, 2009). The overall implication is that a tax system with the broadest possible bases and extensive use of information reporting can impose very high marginal tax rates with fairly modest behavioral responses.

In the future, we plan to explore the following aspects. First, we will study more carefully the responsiveness of capital income. Instead of splitting the estimations by positive versus negative net capital income, we will consider capital income items that are either always positive (e.g. interest from bonds) or always negative (e.g. interest payments on mortgage). This will allow us to not drop taxpayers whose capital income change sign between base and post year. Additionally, it would be interesting to study whether the asymmetric tax treatment of positive and negative net capital income leads to bunching around zero. Second, we will explore the responsiveness of stock income, which is taxed separately and may offer considerable scope for tax manipulation. Third, we will study the potential importance of cross-subsitution effects between different tax bases. Fourth, in light of the findings by Kleven et al. (2009) and Kleven, Kreiner, and Saez (2009) that third-party reporting is crucial for the efficacy of tax enforcement, it would be interesting to separately estimate income responses on items subject to third-party reporting vs. items that are purely self-reported. In this version, we have considered the responsiveness of self-employment income, which is indeed one of the most important forms self-reported income. In the future, we will explore this issue in more detail.

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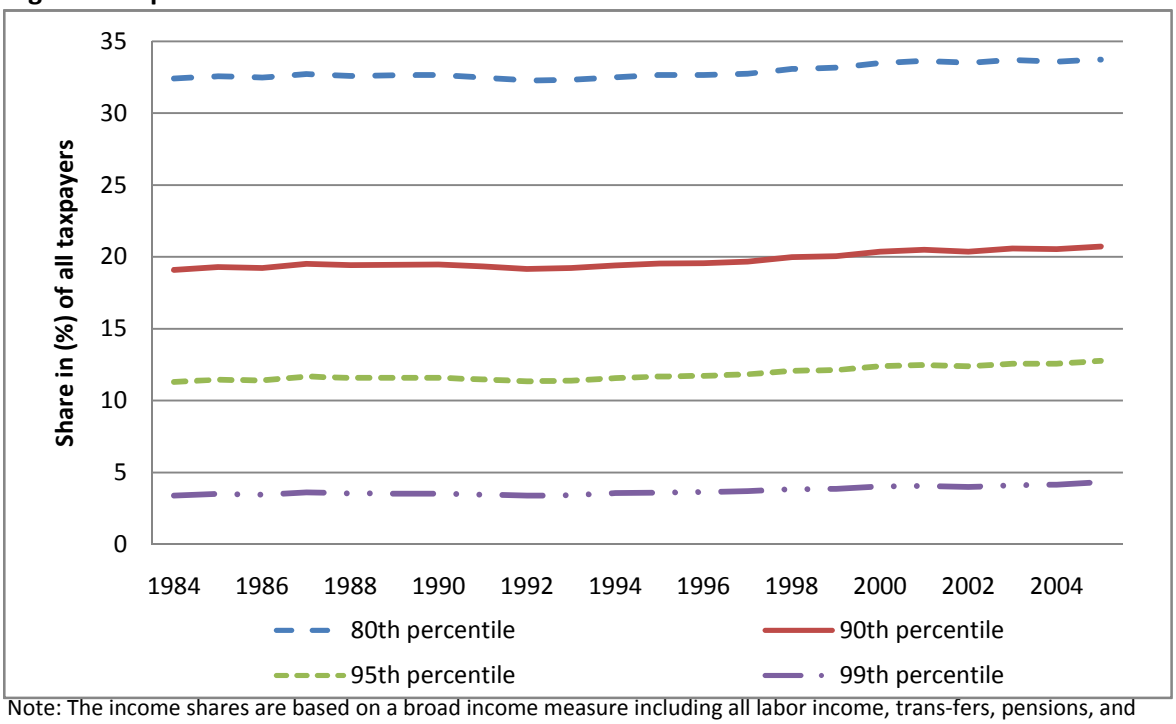
Figure 1. Top Income Shares in Denmark



Note: The income shares are based on a broad income measure including all labor income, trans-fers, pensions, and capital income.

Figure 2. Marginal Tax Rates on Labor Income

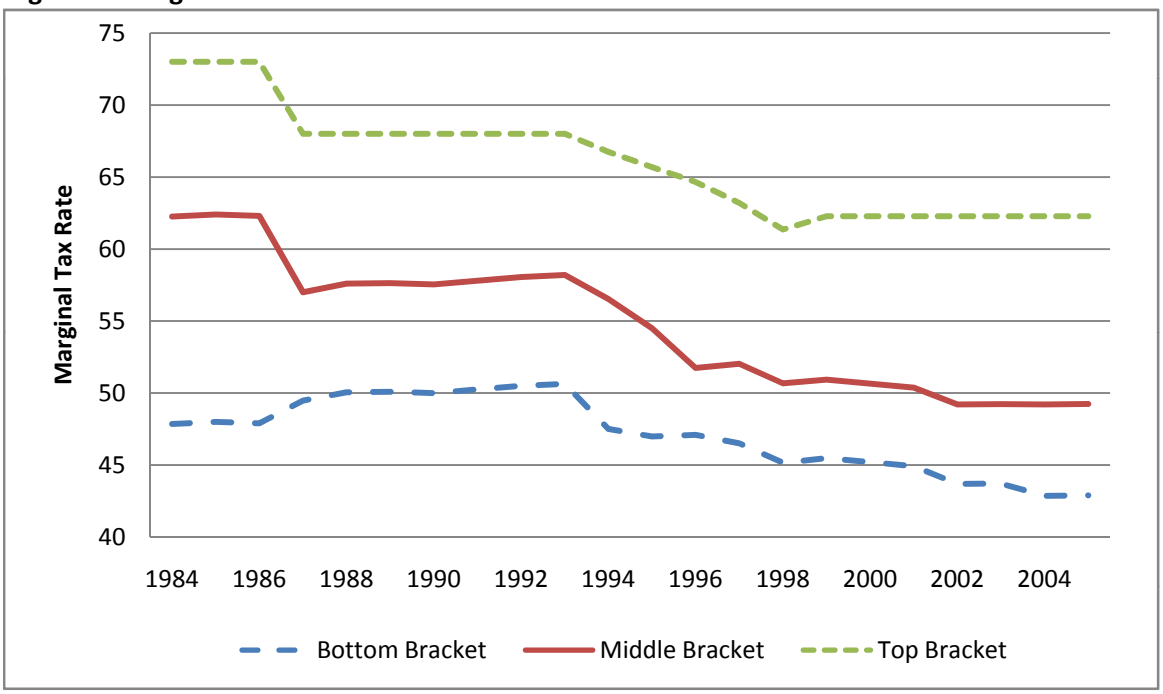


Figure 3. Marginal Tax Rates on Negative Capital Income

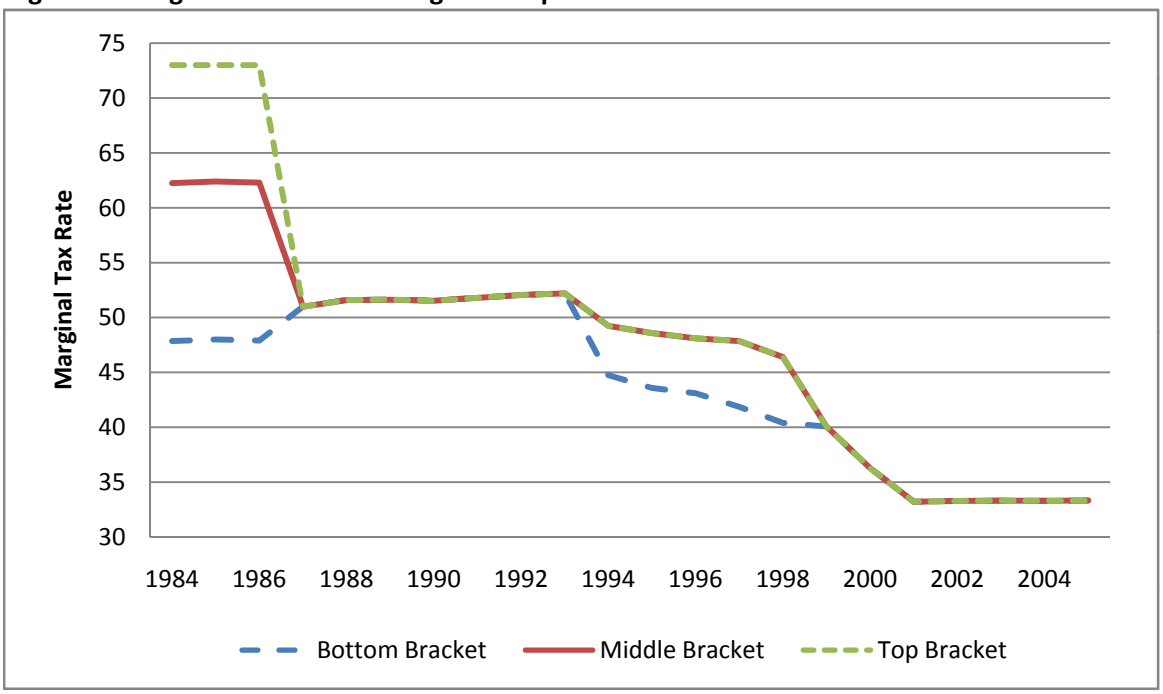


Figure 4. Marginal Tax Rates on Positive Capital Income

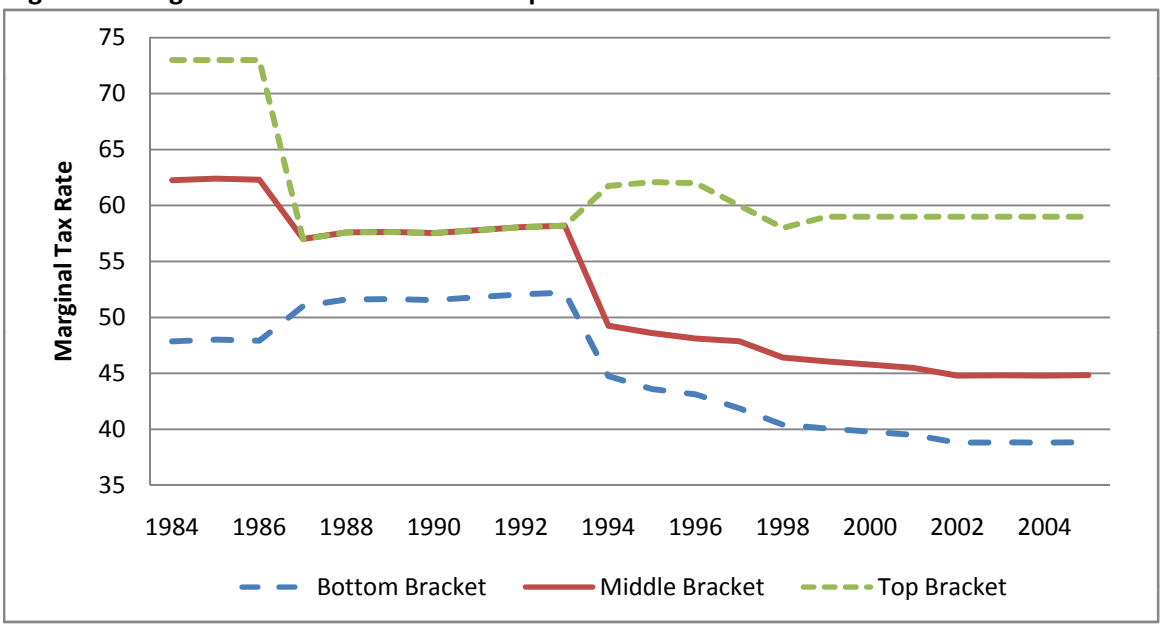


Figure 5. Marginal Tax Rates on Deductions

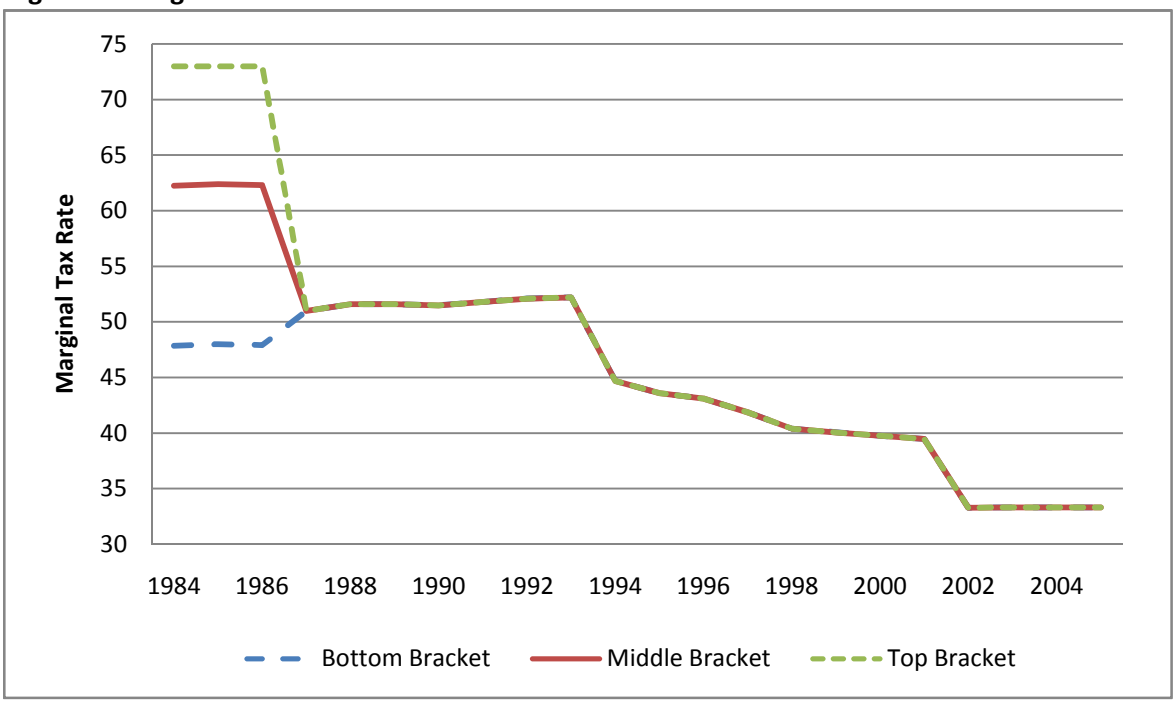


Figure 6. Share of Taxpayers in Each of the Three Tax Brackets

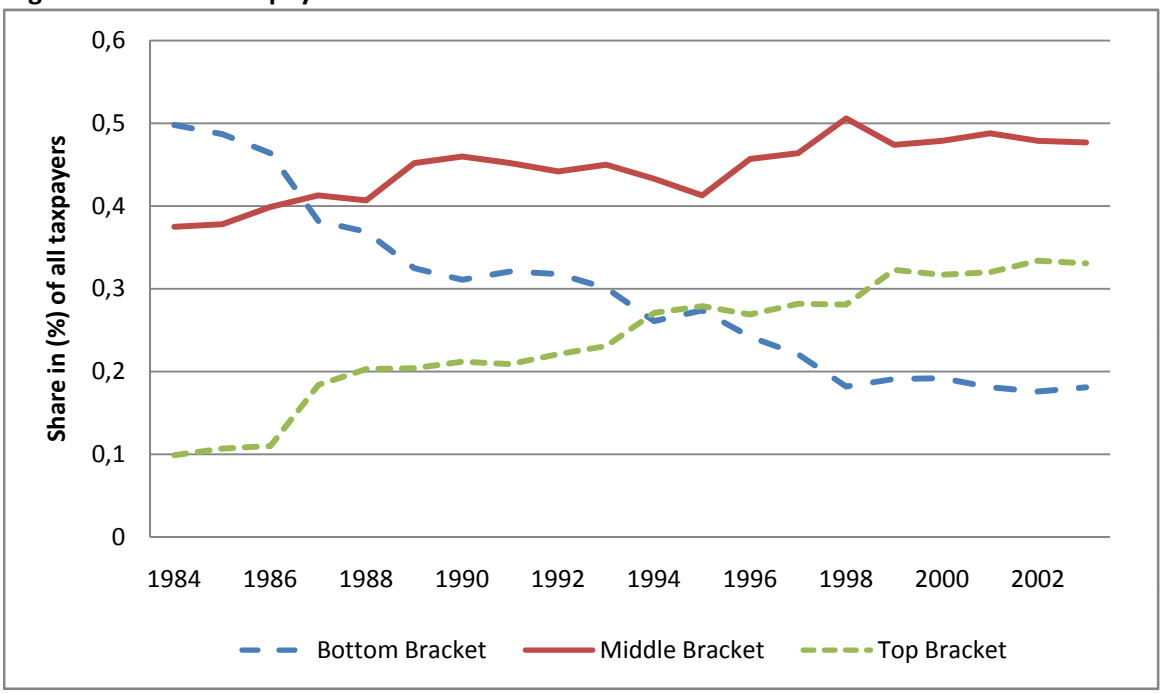


Figure 7. Mechanical Variation in the Marginal Net-of-Tax Rate on Labor Income, 1986-1989

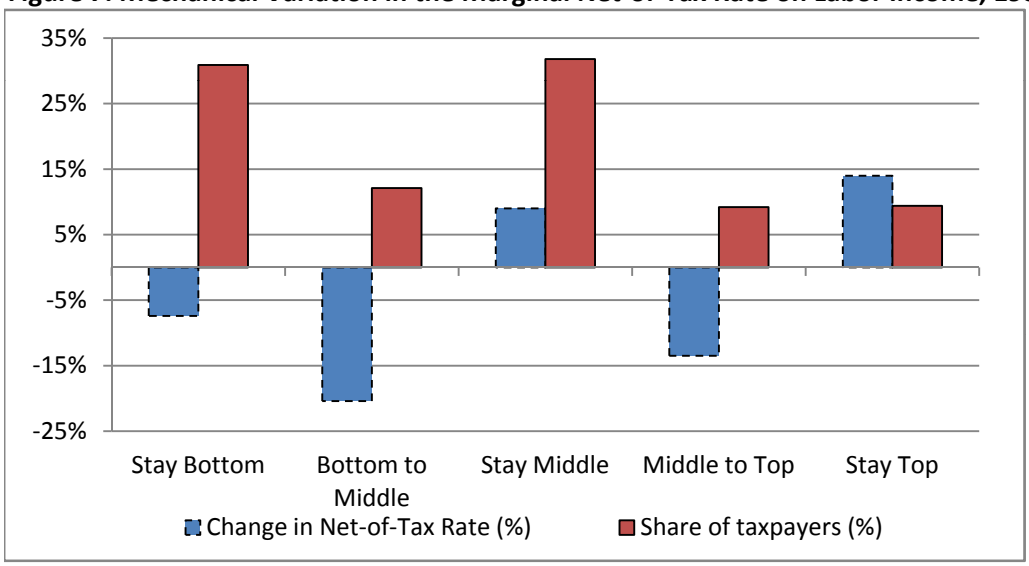


Figure 8. Mechanical Variation in the Marginal Net-of-Tax Rate on Labor Income, 1991-1994

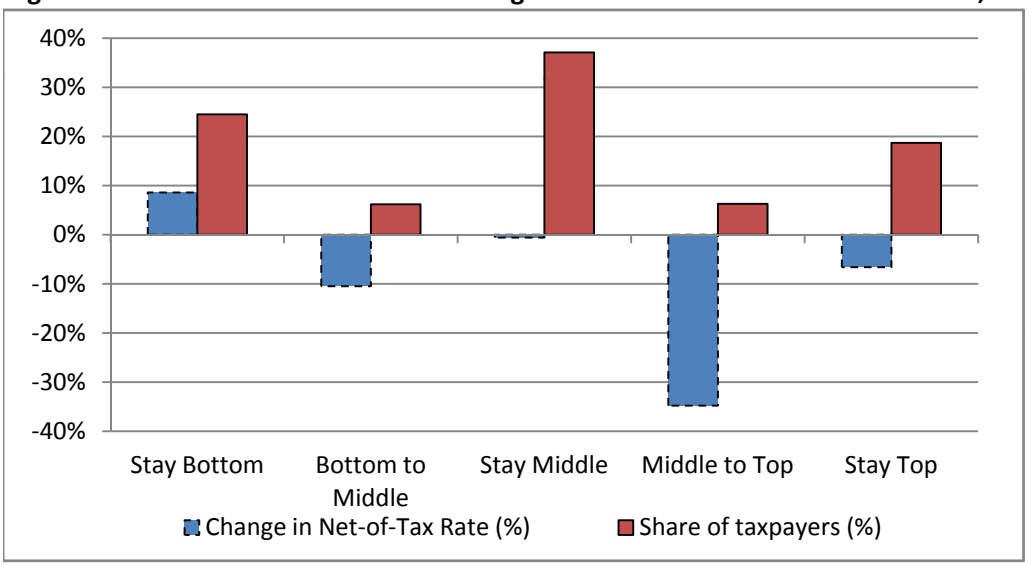


Figure 9. Mechanical Variation in the Marginal Net-of-Tax Rate on Negative Capital Income, 1986-1989

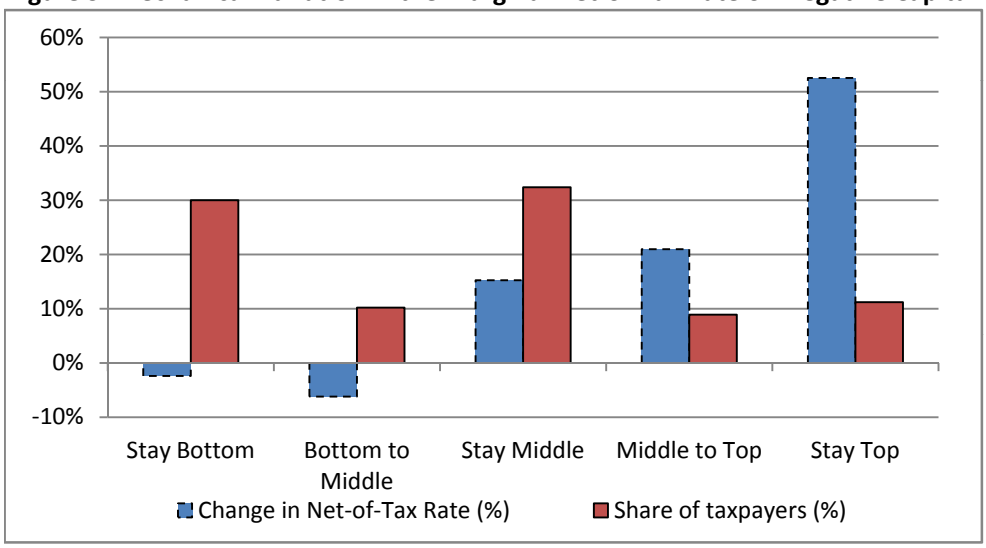


Figure 10. Mechanical Variation in the Marginal Net-of-Tax Rate on Deductions, 1986-1989

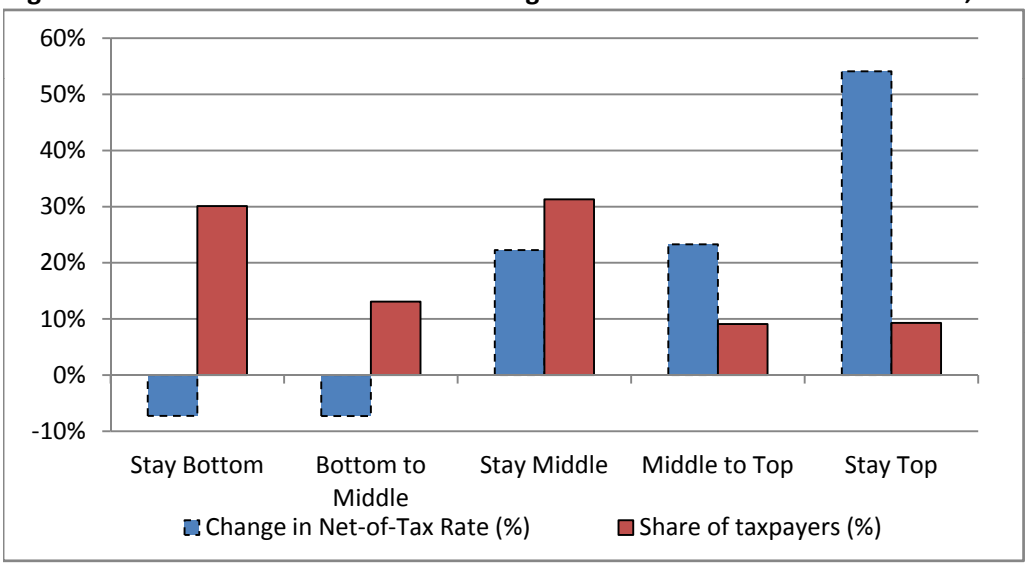


Table 1. Income concepts in the Danish individual income tax

Income concept	Acronym	Main items included
1. Labor Income	LI	Salary, wages, honoraria, fees, bonuses, fringe benefits, business earnings
2. Personal Income	PI	LI + transfers, grants, awards, gifts, received alimony – Labor Market Contribution, certain pension contributions
3. Capital Income	CI	Interest income, rental income, business capital income – interest on debt (mortgage, bank loans, credit cards, student loans)
4. Deductions	D	Commuting, union fees, UI contributions, other work expenditures, charity, paid alimony
5. Taxable Income	TI	PI + CI – D
6. Stock Income	SI	Dividends and realized capital gains from shares

Table 2. Tax bases and tax rates over time in the Danish individual income tax system

	1986		1993		1998		2005	
Tax type[1]	**Base**	**Rate (%)**	**Base**	**Rate (%)**	**Base**	**Rate (%)**	**Base**	**Rate (%)**
Regional tax[2]	TI	28.1	TI	30.2	TI	32.4	TI	33.3
National taxes:								
Bottom Tax	TI	14.4	TI	22.0	TI	8.0	PI + [CI > 0]	5.5
Middle Tax	TI	14.4	PI + [CI > 0]	6.0	PI + CI	6.0	PI + [CI > 0]	6.0
Top Tax	TI	10.8	PI	12.0	PI + [CI > 21k]	15.0	PI + [CI > 0]	15.0
Social Security Contribution	TI	5.5	–	–	–	–	–	–
Labor Market Contribution[3]	–	–	–	–	LI	8.0	LI	8.0
EITC	–	–	–	–	–	–	LI	2.5
Marginal Tax Ceiling[4]	TI	73.0	PI/CI/TI	68.0	PI/CI/TI	58.0	PI/CI/TI	59.0
Tax on stock income	–	–	SI	30.0; 40.0	SI	25.0; 40.0	SI	28.0; 43.0

1. Tax rates are cumulative. For example, the marginal tax rate in the top bracket in 1986 is equal to 28.1 + 14.4 + 14.4 + 10.8 + 5.5 = 73.2%.
   [But see footnote 4 regarding marginal tax ceiling adjustment]
2. The regional tax includes municipal, county, and church taxes. The regional tax rate in the table is an average across all municipalities in Denmark in each year.
3. After the introduction of the Labor Market Contribution, labor income enters the other tax bases net of the Labor Market Contribution. Hence, in those years, the effective tax rate on labor income equals the statutory tax rate times (1 - Labor Market Contribution).
4. If the sum of all regional and national tax rates exceeds the specified ceiling, the top tax is adjusted downward until the the marginal tax rate equals the ceiling.

Table 3A. The Elasticity of Labor Income, All Individual Taxpayers

Income controls	**All**	**1st quintile**	**2nd quintile**	**3rd quintile**	**4th quintile**	**5th quintile**
No income control	-0.04***	-0.04**	-0.03*	-0.01	0.03**	0.05***
Log of current income	0.09***	0.04**	0.05**	0.08**	0.11***	0.14***
Splines of log current income	0.08***	0.03**	0.06***	0.07***	0.12***	0.16***
Splines of log of *t-1* income and log of deviation	0.10***	0.03**	0.06**	0.08***	0.11**	0.15***
Splines of log of *t-1* income and splines of log-deviations	0.09***	0.04**	0.04**	0.08**	0.10**	0.13***
Splines of log of *t-2* income and log-deviations between both income *t* and *t-1* and *t-1* and *t-2*	0.09***	0.02*	0.04***	0.06**	0.11***	0.14***
Splines of log of *t-2* income and splines of log-deviations between both *t* and *t-1* and *t-1* and *t-2*	0.10***	0.03**	0.06***	0.07**	0.11***	0.16***
Socio-economic controls						
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,048,770	209,754	209,754	209,754	209,754	209,754

Note: Estimates from 2SLS regressions. Regressions weighted by income. "Splines" refers to a flexible piecewise linear functional form (10 components). Cutoffs: Labor income and broad income > 10,000 Dkr.

Table 3B. The Elasticity of Labor Income, Employees

Income controls	All	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
No income control	-0.05***	-0.05**	-0.03*	0.00*	0.03**	0.03**
Log of current income	0.08**	0.03**	0.04**	0.05**	0.10***	0.13***
Splines of log current income	0.07***	0.03**	0.03**	0.06**	0.08**	0.12***
Splines of log of *t-1* income and log of deviation	0.07***	0.02**	0.03**	0.05**	0.09**	0.13***
Splines of log of *t-1* income and splines of log-deviations	0.07***	0.02**	0.03**	0.04**	0.08**	0.11***
Splines of log of *t-2* income and log-deviations between both income *t* and *t-1* and *t-1* and *t-2*	0.06***	0.03*	0.03**	0.05**	0.10***	0.12***
Splines of log of *t-2* income and splines of log-deviations between both *t* and *t-1* and *t-1* and *t-2*	0.08***	0.02**	0.04**	0.05**	0.09***	0.14***
Socio-economic controls						
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	996,435	199,287	199,287	199,287	199,287	199,287

Note: Estimates from 2SLS regressions. Regressions weighted by income. "Splines" refers to a flexible piecewise linear functional form (10 components). Cutoffs: Labor income and broad income > 10,000 Dkr.

Table 3C. The Elasticity of Labor Income, Self-Employed

Income controls	All	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
No income control	-0.05***	-0.09**	-0.09*	0.04*	0.01	0.04*
Log of current income	0.15***	0.09**	0.09**	0.13***	0.16***	0.20***
Splines of log current income	0.14***	0.11**	0.10**	0.12**	0.14**	0.18***
Splines of log of *t-1* income and log of deviation	0.13***	0.09**	0.09*	0.11**	0.14***	0.18***
Splines of log of *t-1* income and splines of log-deviations	0.14***	0.09**	0.11**	0.11**	0.13**	0.19***
Splines of log of *t-2* income and log-deviations between both income *t* and *t-1* and *t-1* and *t-2*	0.15***	0.10**	0.12**	0.14***	0.15**	0.19***
Splines of log of *t-2* income and splines of log-deviations between both *t* and *t-1* and *t-1* and *t-2*	0.16***	0.08*	0.10**	0.11**	0.14**	0.21***
Socio-economic controls						
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52,335	10,467	10,467	10,467	10,467	10,467

Note: Estimates from 2SLS regressions. Regressions weighted by income. "Splines" refers to a flexible piecewise linear functional form (10 components). Cutoffs: Labor income and broad income > 10,000 Dkr.

Table 4A. The Elasticity of Negative Capital Income, All Individual Taxpayers

Income controls	All	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
No income control	0.08***	0.02**	0.03**	0.08**	0.08**	0.06**
Log of current income	-0.14***	-0.09***	-0.10***	-0.12***	-0.14***	-0.21***
Splines of log current income	-0.17***	-0.08**	-0.09**	-0.11***	-0.18***	-0.20***
Splines of log of *t-1* income and log of deviation	-0.16***	-0.11***	-0.09***	-0.10***	-0.14***	-0.19***
Splines of log of *t-1* income and splines of log-deviations	-0.16***	-0.12***	-0.10***	-0.12***	-0.15***	-0.18***
Splines of log of *t-2* income and log-deviations between both income *t* and *t-1* and *t-1* and *t-2*	-0.15***	-0.10***	-0.09***	-0.10**	-0.17***	-0.19***
Splines of log of *t-2* income and splines of log-deviations between both *t* and *t-1* and *t-1* and *t-2*	-0.15***	-0.10***	-0.09***	-0.11***	-0.13***	-0.20***
Socio-economic controls						
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	520,233	104,047	104,047	104,046	104,047	104,046

Note: Estimates from 2SLS regressions. Regressions weighted by income. "Splines" refers to a flexible piecewise linear functional form (10 components). Cutoffs: Labor income and broad income > 10,000 Dkr.

Table 4B. The Elasticity of Negative Capital Income, Employees

Income controls	All	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
No income control	0.03***	-0.03**	-0.01*	0.02*	0.03**	0.05**
Log of current income	-0.14***	-0.11***	-0.11***	-0.12***	-0.15***	-0.19***
Splines of log current income	-0.15***	-0.09**	-0.10***	-0.12***	-0.17***	-0.21***
Splines of log of *t-1* income and log of deviation	-0.16***	-0.12***	-0.10***	-0.11***	-0.15***	-0.21***
Splines of log of *t-1* income and splines of log-deviations	-0.15***	-0.11***	-0.09**	-0.12***	-0.14***	-0.19***
Splines of log of *t-2* income and log-deviations between both income *t* and *t-1* and *t-1* and *t-2*	-0.14***	-0.12***	-0.11***	-0.13**	-0.17***	-0.18***
Splines of log of *t-2* income and splines of log-deviations between both *t* and *t-1* and *t-1* and *t-2*	-0.13***	-0.09***	-0.09***	-0.11***	-0.14***	-0.19**
Socio-economic controls						
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	491,840	98,368	98,368	98,368	98,368	98,368

Note: Estimates from 2SLS regressions. Regressions weighted by income. "Splines" refers to a flexible piecewise linear functional form (10 components). Cutoffs: Labor income and broad income > 10,000 Dkr.

Table 4C. The Elasticity of Negative Capital Income, Self-Employed

Income controls	All	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
No income control	0.07***	0.07*	0.06*	0.10*	0.09*	0.08*
Log of current income	-0.17***	-0.06*	-0.09**	-0.13**	-0.12**	-0.24***
Splines of log current income	-0.18***	-0.06*	-0.09**	-0.11**	-0.18**	-0.19**
Splines of log of *t-1* income and log of deviation	-0.13**	-0.09**	-0.09**	-0.10**	-0.13**	-0.14**
Splines of log of *t-1* income and splines of log-deviations	-0.17***	-0.09**	-0.10**	-0.13**	-0.17**	-0.21**
Splines of log of *t-2* income and log-deviations between both income *t* and *t-1* and *t-1* and *t-2*	-0.17***	-0.10**	-0.09**	-0.09*	-0.15**	-0.20**
Splines of log of *t-2* income and splines of log-deviations between both *t* and *t-1* and *t-1* and *t-2*	-0.18***	-0.10**	-0.09**	-0.11**	-0.12**	-0.18**
Socio-economic controls						
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,393	5,678	5,678	5,679	5,679	5,679

Note: Estimates from 2SLS regressions. Regressions weighted by income. "Splines" refers to a flexible piecewise linear functional form (10 components). Cutoffs: Labor income and broad income > 10,000 Dkr.

Table 5. The Elasticity of Positive Capital Income, All Individual Taxpayers

Income controls	All	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
No income control	-0.03**	-0.06**	-0.03*	-0.01*	0.00	0.03*
Log of current income	0.10***	0.06*	0.07**	0.09**	0.11**	0.14**
Splines of log current income	0.11***	0.06**	0.08**	0.10**	0.12**	0.15**
Splines of log of *t-1* income and log of deviation	0.09***	0.05*	0.06*	0.08**	0.11**	0.13**
Splines of log of *t-1* income and splines of log-deviations	0.11***	0.06**	0.08**	0.11**	0.12**	0.14**
Splines of log of *t-2* income and log-deviations between both income *t* and *t-1* and *t-1* and *t-2*	0.10***	0.07*	0.08**	0.11**	0.10**	0.12**
Splines of log of *t-2* income and splines of log-deviations between both *t* and *t-1* and *t-1* and *t-2*	0.11***	0.08**	0.08**	0.10**	0.13**	0.14**
Socio-economic controls						
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	64,563	12,913	12,913	12,912	12,913	12,912

Note: Estimates from 2SLS regressions. Regressions weighted by income. "Splines" refers to a flexible piecewise linear functional form (10 components). Cutoffs: Labor income and broad income > 10,000 Dkr.

Table 6A. The Elasticity of Deductions, All Individual Taxpayers

Income controls	**All**	**1st quintile**	**2nd quintile**	**3rd quintile**	**4th quintile**	**5th quintile**
No income control	0.08***	0.05**	0.05**	0.02**	0.04**	0.03**
Log of current income	-0.15***	-0.11***	-0.11***	-0.14***	-0.18***	-0.19***
Splines of log current income	-0.16***	-0.10***	-0.14***	-0.14***	-0.17***	-0.16***
Splines of log of *t-1* income and log of deviation	-0.14***	-0.11***	-0.13***	-0.13***	-0.15***	-0.16***
Splines of log of *t-1* income and splines of log-deviations	-0.17***	-0.13***	-0.14***	-0.16***	-0.16***	-0.20***
Splines of log of *t-2* income and log-deviations between both income *t* and *t-1* and *t-1* and *t-2*	-0.15***	-0.11***	-0.12***	-0.15***	-0.17***	-0.18***
Splines of log of *t-2* income and splines of log-deviations between both *t* and *t-1* and *t-1* and *t-2*	-0.18***	-0.12***	-0.14***	-0.15***	-0.17***	-0.22***
Socio-economic controls						
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	956,244	191,249	191,249	191,249	191,249	191,249

Note: Estimates from 2SLS regressions. Regressions weighted by income. "Splines" refers to a flexible piecewise linear functional form (10 components). Cutoffs: Labor income and broad income > 10,000 Dkr.

Table 6B. The Elasticity of Deductions, Employees

Income controls	All	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
No income control	0.06***	0.07**	0.04**	0.04**	0.03**	0.05**
Log of current income	-0.14***	-0.11***	-0.11***	-0.13***	-0.17***	-0.17***
Splines of log current income	-0.13***	-0.10***	-0.13***	-0.14***	-0.15***	-0.14***
Splines of log of *t-1* income and log of deviation	-0.13***	-0.11***	-0.12***	-0.12***	-0.14***	-0.14***
Splines of log of *t-1* income and splines of log-deviations	-0.16***	-0.13***	-0.15***	-0.15***	-0.16***	-0.18***
Splines of log of *t-2* income and log-deviations between both income *t* and *t-1* and *t-1* and *t-2*	-0.15***	-0.12***	-0.11***	-0.15***	-0.16***	-0.17***
Splines of log of *t-2* income and splines of log-deviations between both *t* and *t-1* and *t-1* and *t-2*	-0.16***	-0.10***	-0.14***	-0.16***	-0.16***	-0.17***
Socio-economic controls						
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	909,109	181,822	181,822	181,822	181,822	181,822

Note: Estimates from 2SLS regressions. Regressions weighted by income. "Splines" refers to a flexible piecewise linear functional form (10 components). Cutoffs: Labor income and broad income > 10,000 Dkr.

Table 6C. The Elasticity of Deductions, Self-Employed

Income controls	**All**	**1st quintile**	**2nd quintile**	**3rd quintile**	**4th quintile**	**5th quintile**
No income control	0.03*	0.06**	0.07**	0.01*	0.07**	0.01*
Log of current income	-0.17***	-0.09**	-0.10***	-0.16***	-0.18***	-0.23***
Splines of log current income	-0.19***	-0.12***	-0.13**	-0.15***	-0.19***	-0.22***
Splines of log of *t-1* income and log of deviation	-0.17***	-0.10***	-0.10**	-0.14***	-0.16***	-0.19***
Splines of log of *t-1* income and splines of log-deviations	-0.18***	-0.10***	-0.12***	-0.14**	-0.19***	-0.22***
Splines of log of *t-2* income and log-deviations between both income *t* and *t-1* and *t-1* and *t-2*	-0.16***	-0.11**	-0.13***	-0.13***	-0.16**	-0.21***
Splines of log of *t-2* income and splines of log-deviations between both *t* and *t-1* and *t-1* and *t-2*	-0.20***	-0.09**	-0.11**	-0.18***	-0.20***	-0.25***
Socio-economic controls						
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	47,135	9,427	9,427	9,427	9,427	9,427

Note: Estimates from 2SLS regressions. Regressions weighted by income. "Splines" refers to a flexible piecewise linear functional form (10 components). Cutoffs: Labor income and broad income > 10,000 Dkr.

Table 7. Substitution versus Income Effects

Income controls		All	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
Labor income	Uncompensated elasticity	0.10***	0.05**	0.06**	0.08**	0.11***	0.14***
	Income elasticity	-0.02*	-0.01	-0.01	-0.02	-0.02	-0.03*
Negative capital income	Uncompensated elasticity	-0.17***	-0.09**	-0.12***	-0.12***	-0.16***	-0.19***
	Income elasticity	-0.02	0.01	0.01	0.01	-0.01	-0.03
Positive capital income	Uncompensated elasticity	0.13***	0.08**	0.08**	0.12**	0.13**	0.16***
	Income elasticity	-0.01	-0.02	-0.01	-0.03*	-0.01	0.02
Deductions	Uncompensated elasticity	-0.19***	-0.14***	-0.16***	-0.19***	-0.20***	-0.22***
	Income elasticity	0.03*	0.02	0.02	0.04*	0.03	0.04*
Socio-economic controls							
Educational attainment, gender, marital status, kids, immigration, ethnicity, place of residence, age, experience (also squared), industry, GDP growth, local unemployment rate, dummies for each base year		Yes	Yes	Yes	Yes	Yes	Yes

Note: Estimates from 2SLS regressions. Regressions are unweighted. Income controls: Splines of log of t-1 income and splines of log-deviation. Cutoffs: Labor income and broad income > 10,000 Dkr.