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Abstract:
The elasticity of taxable income (ETI) is known to represent a summary measure of tax efficiency costs, which means that further information about the behavioral components of the ETI is not required for its use in tax policy design. However, as there are response margins that may cause biases in the estimation of the elasticity, we advise against neglecting information about the composition of the behavior seized by the ETI. When using responses of the Norwegian self-employed to the tax reform of 2006 for illustration, we discuss how four different responses relate to the overall ETI, given characteristics of the reform. Effects on working hours, on tax evasion, and from shifts in organizational form and across tax bases are discussed in terms of to what extent they represent sources to estimation bias, or enter into the ETI in a decompositional way. We provide empirical illustrations of the effects of each of these margins, and we show that the estimated ETI is biased downward because of organizational shifts.

Keywords: elasticity of taxable income, self-employed, tax evasion, organizational shift

JEL classification: H24, H26, H31, J2

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Sammendrag

Siden Martin Feldsteins artikkel fra 1995, der han brukte den amerikanske skattereformen fra 1986 (under Reagan) til å identifisere hvor elastisk inntektene er i forhold til endringer i marginalskatten på inntekt (ETI), har det vært en omfattende aktivitet for å bringe frem tilsvarende elastisitetsestimater fra andre økonomier. Årsaken til dette er blant annet at ETI-en oppsummerer det totale effektivitetstapet ved en økning i marginalskatten, uten at en trenger å diskutere nærmere hvilke type responser som leder frem til endringen i inntekt. Det vil si at en behøver ikke ta stilling til om responsen i inntekt skyldes for eksempel endringer arbeidstid, lønnsøkninger som følge av økt arbeidsinnsats eller endringer i skatteunndragelse. I dette arbeidet advarer vi mot at noen slike underliggende responser (fanget opp av ETI'en) kan være kilder til skjeve ETI-estimater. Vi diskuterer dette problemet ved å se på i hvor stor grad inntektene til norske selvstendig næringsdrivende responderer på endring i marginalskatten, der skatteendringene ved skattereformen i 2006 anvendes i identifikasjonen av hvordan skatteendringer influerer på inntekt. Vi gir beskrivelser av hvordan skattereformen (separat) virker på arbeidstid, skatteunndragelser, organisasjonsmessige skift og skift mellom å ta ut kompensasjon i næringsinntekt og kapitalinntekt. Det argumenteres for at de to siste responsene kan gi skjeve ETI-estimater, mens effekter på arbeidstid og skatteunndragelser representerer konvensjonelle dekomponeringer av elastisiteten. Vi finner relativt lave ETI-estimater for de selvstendig næringsdrivende, og vårt hovedestimat er på om lag 0,15. Dette estimatet er imidlertid ikke konsistent estimert, og det ville ha vært høyere, om lag 0,18, dersom en tar hensyn til at skattereformen også hadde innvirkning på endringer av organisasjonsform, dvs. skattereformen gjorde det mindre attraktivt for selvstendig næringsdrivende å skifte til aksjeselskap. Resultatene gir videre støtte til at skatteunndragelsene har blitt noe redusert etter skattereformen og at mesteparten av responsen i inntekt skyldes at arbeidstiden har økt etter reformen.

1. Introduction

After Feldstein (1995), it has become widespread to obtain estimates of income responses to tax changes by analyzing panel data over a tax reform period, exploiting the variation in changes in marginal net-of-tax rates across individuals to obtain estimates of the elasticity of taxable income (ETI). In the most straightforward version, one identifies a "control group" that represents the change in income which would have occurred to the "treatment group", if the tax reform did not take place. As the ETI in principle captures all tax induced responses, and as estimates can be derived by standard econometric tools, deriving estimates of the ETI from micro data has become a popular empirical strategy for measuring the efficiency costs of taxation (Saez, Slemrod and Giertz, 2012; Slemrod and Gillitzer, 2014).

In the case when private and social costs of changes in the marginal tax rate are equal, the ETI can be seen as a "sufficient statistic" for welfare analysis, as the optimal tax rate is a simple function of the ETI (Feldstein, 1999; Saez, 2001; Chetty, 2009). Then the behavioral anatomy of the response does not matter for measuring tax efficiency costs. However, such simple relationships do not typically exist. One reason is that the social implications of the behavioral responses to tax changes differ to the extent there are external effects involved. Externalities may, for example, arise because the ETI captures highly valued activities, as charitable giving, or because it consists of detrimental activities, as tax evasion. However, the ETI literature includes contributions on how ETI estimates still can be used to measure tax efficiency effects in the presence of behavioral diversities, see Chetty (2009) and Slemrod and Gillitzer (2014).

Further, it is well established that the ETI is a function of the environment from which it is derived, and therefore can be seen as subject to policy control (Slemrod, 1996; Slemrod and Kopczuk, 2002; Giertz, 2009; Fack and Landais, 2016). It means that policy-makers often have a wide range of policy instruments to control different margins of the response, and it implies that the broader tax system design influences the overall ETI through the components of behavioral response.[1]

In the present study we shall direct attention to another implication of multiple response margins in the ETI literature, namely that the econometric identification of the ETI is sensitive to what type of response margins that are involved in the identification. There are well-known econometric challenges

[1] See also Doerrenberg, Peichl and Siegloch (2016) on the use of the ETI as a sufficient statistics in the presence of deduction possibilities.

concerning the identification of the ETI, given that net-of-tax rate depends on income and therefore is clearly endogenous, see Auten and Carroll (1999), Moffitt and Wilhelm (2000), Gruber and Saez (2002), and Kopczuk (2005). Here we warn that responses may represent source to estimation bias in the identification of the ETI. The econometric challenges come in the form of endogenous sample selections and omitted variables, thus, representing violations of assumptions for consistent identification of the ETI. Thus, the main message of the present study is that the behavioral anatomy of the ETI may matter and should not be neglected, as there are response margins that may cause estimation bias.

We discuss the various underlying behavioral responses empirically by employing micro data on the Norwegian self-employed, exploiting the tax changes due to tax reform of 2006 in the identification. The self-employed are chosen as it is typically acknowledged that they have wider scope for behavioral response than the wage earners (Heim, 2010).[2] Empirical evidence of four separate response dimensions are discussed: effects on working hours, income underreporting (or tax evasion), organizational shifts, and shifts between tax bases within the personal income tax schedule. We obtain evidence about the magnitudes of the response margins and place them in a "response account", distinguishing between "causes to estimation bias" and "components of the ETI", where the latter type relates to the ETI in a conventional decompositional manner.

Before further explaining why some response dimensions may represent sources to estimation bias, and others may not, let us briefly restate the standard method of obtaining ETI estimates. The ETI provides an intensive margin response, which is (conventionally) identified by addressing information on taxable income over a period where there is variation in the net-of-tax rate (1 minus the marginal tax rate), generated by a tax reform. Thus, inspired by Feldstein (1995), a great majority of empirical studies of the ETI have used panel data in the identification,[3] where first differenced income for each individual in the panel is regressed against an expression for the change in the net-of-tax rate. To allow for the new tax prices being absorbed by the agents, it has become standard to use three-year span in data, from pre-reform to post-reform. Following Auten and Carroll (1999), Moffitt and Wilhelm (2000), and Gruber and Saez (2002), most studies use an instrument for the tax change based on

[2] Whereas estimates of the ETI for wage earners have been obtained for a wide selection of countries, see Auten and Carroll (1999) and Gruber and Saez (2002) for the U.S., and Aarbu and Thoresen (2001), Blomquist and Selin (2012), and Kleven and Schultz (2014) for Norway, Sweden and Denmark, respectively, there are relatively few studies of the ETI for the self-employed. Exceptions include Wu (2005), Blow and Preston (2002), Heim (2010), Kleven and Schultz (2014). Note also that Saez (2010), le Maire and Schjerning (2013) and Bastani and Selin (2014) estimate taxable income elasticities for the self-employed, but use bunching techniques for identification.

[3] However, Lindsey (1987) used repeated cross-sections. See also Goolsbee (1999).

statutory tax changes, obtained by letting the tax law at time *t* and time *t*+3 (mechanically) be applied to the same pre-reform income, a employ predicted values through a two-stage-least-squares procedure.

At this point, we use the organizational shift margin to illustrate that the estimation of the ETI is sensitive to the type of responses involved. It follows from the standard data selection criteria of the ETI framework that data are established by conditioning on being self-employed in both periods, *t* and *t*+3. This is an innocuous sample selection condition as long as the tax changes do not induce taxpayers to move out of the personal income tax base. However, several studies, as Slemrod (1995), Gordon and Slemrod (2000), Goolsbee (2000), Thoresen and Alstadsæter (2010), Edmark and Gordon (2013) and Harju and Matikka (2016) advise against ignoring organizational shifts when discussing tax responses. The organizational shift aspect is clearly critical in the present context, given that we use the Norwegian tax reform of 2006 in the identification of effects, and the tax schedule prior to the 2006-reform is known to have included incentives to shift organizational form, see Thoresen and Alstadsæter (2010). Taxpayers moved out of the so-called split model for the self-employed, and took advantage of the lower taxation of capital income (dividends). As the Norwegian tax reform of 2006 involved tax changes meant to abolish these incentives (Sørensen, 2005), both through a reduction in the marginal tax rate on labor income and taxation of dividend income, more business owners likely remain in the self-employment data sample after the reform, compared to the counterfactual situation, without a reform. As high-income taxpayers were overrepresented among those who shifted out of self-employment prior to the reform (Thoresen and Alstadsæter, 2010), we get a non-random addition to the treatment group because of self-selection. If not precautionary measures are taken, we are in danger of erroneously attributing increases in income due to more high-income individuals staying self-employed to the reduction in marginal tax rates, causing bias in the estimation of the ETI. Thus, we have what is commonly referred to as self-selection bias in the estimation of the ETI, reflected in a behavioral component of the ETI.

We are able to investigate effects of organizational shifts on the ETI because of the richness in the data we have had available for this study. The main data source is the yearly Income Statistics for Families and Persons, which is based on information from administrative registers (as the Register of Tax Returns), covers the whole population, includes a large set of control variables, and can be turned into a panel data set through personal id numbers. Observations during the period from 2001 to 2010 are used in the present analysis. Further, we combine the income data with three other data sources in order to explore the extent of organizational shifts: information from the Business and Enterprise

Register, the Shareholder Register and the End of the Year Certificate Register. By combining information from these data sources, we can establish whom among the taxpayers having moved out of self-employment to be shareholder in the same firm as they are employed. A difference in these movements from the pre-reform to the post-reform period is taken as corroborative evidence of a measurement problem in the estimation of the ETI, expected to cause biased estimation results.

In contrast, in terms of a response account of the ETI, we argue that the effect on working hours relates to the ETI in a conventional decompositional sense. We estimate a working hours tax elasticity and show how this response estimate enter into the relationship by employing repeated cross-sectional data, derived from the Labour Force Surveys. Correspondingly, we categorize tax evasion as a standard component of the ETI. We illustrate the effect of tax evasion, empirically, by using the so-called expenditure approach (Pissarides and Weber, 1989) for identification of the tax evasion component. This methodology is based on comparison of food consumption and income among wage earners and the self-employed, under the assumption that evasion is found only in the latter group. Information from the Survey of Consumer Expenditure is used to estimate Engel curves for food for wage earners and the self-employed, which in turn are used to calculate the amount by which reported income must be scaled up by in order to obtain true income levels for tax evaders. As we have data both for pre-reform and post-reform periods, a difference in the estimated tax evasion between the two periods can be attributed to the increase in the net-of-tax rate after the 2006-reform, engendering a tax evasion component of the overall ETI.

With respect to base shifts between labor income and capital income bases, one may argue that the main problem is that capital income is left out of our definition of taxable income, but this is similar to several other studies, such as Feldstein (1995) and Heim (2010). Analyses based on U.S. data often do not include capital gains in taxable income. Similar to as for organizational shifts, base shifts within the personal income represent a fiscal externality effect, which means that revenue effects are misleading if not accounting for revenue effects working through other tax bases. However, here we draw attention to another complicating factor in the identification of the ETI: effects of contemporaneous tax changes. Given that the tax reform we use in the identification of the ETI also involves a change in the capital income taxation, the lack of control for the simultaneous effect from other tax changes, gives bias in the estimation of the ETI – we may characterize it as an omitted variable bias. We discuss this component by addressing empirical evidence about the income composition of the treatment group.

The paper is organized as follows. In Section 2, we present the Norwegian tax schedule and the reform of 2006, which is used in the identification of the ETI. Further, in Section 3, the empirical approaches to obtain estimates of the effects of different response margins and the overall ETI are presented, before estimation results for the different response margins are presented in Section 4. Section 5 concludes the paper.

2. The Norwegian dual income tax and the reform of 2006

The Norwegian dual income tax schedule in 2006 is used to obtain tax response estimates. A dual income tax schedule combines a low proportional tax rate on capital income and progressive tax rates on labor income, and was introduced in Norway by the 1992-reform. Thus, as the system involves separate rate schedules for different income components, there are certainly prospects of obtaining a variety of behavioral effects when reforming the system.

The dual income tax proliferated throughout the Nordic countries in the early 1990s, and the Norwegian version had a flat 28 percent tax rate levied on corporate income, capital and labor income, coupled with a social security contribution and a progressive surtax applicable to labor income. The post-1992 schedule implied that taxpayers receiving dividends were given full credit for taxes paid at the corporate level, and the capital gain tax system exempted gains attributable to retained earnings taxed at the corporate level. These separate schedules for capital and labor income created obvious incentives for taxpayers to recharacterize labor income as capital income. To limit such tax avoidance, the 1992-reform introduced the so-called "split model" for the self-employed, partnerships and closely held firms.[4] Rules were established for dividing business income into capital and labor income by imputing a return to business assets and attributing the residual income to labor. Labor income was subject to a social security contribution and a two-tier surtax.

Between 1992 and 2004, both the threshold for the second tier of the surtax and marginal rates increased, resulting in the statutory marginal tax rates as shown for 2004 (the last year before the reform) in Figure 1, with 55.3 percent at the maximum.[5] Under the split model, imputed return to the capital invested in the firm is calculated by multiplying the value of the capital assets by a fixed rate of return on capital. This imputed return to capital is taxed by the corporate tax rate, which also equals the capital income tax rate at the individual level, fixed at 28 percent in the period under consideration here. Business profit net of imputed return to capital is the imputed return to labor, which is taxed as

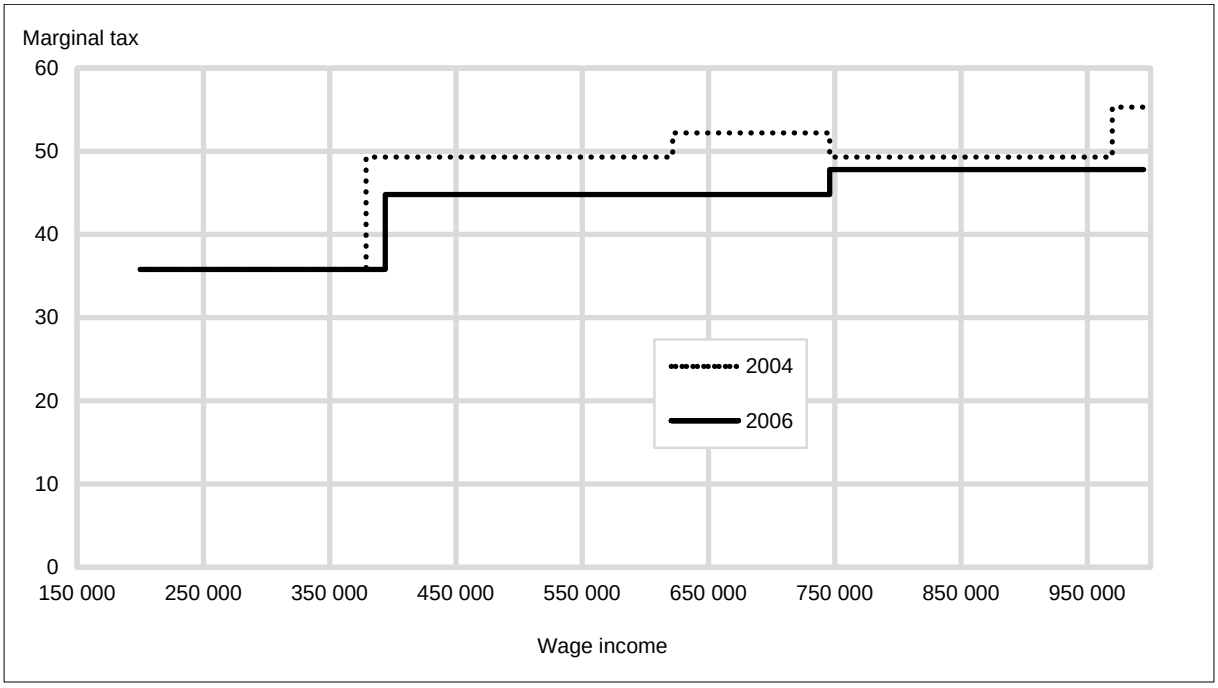
[4] The latter is defined as businesses in which the active owner holds more than two-thirds of the shares.

[5] Use 1 USD = 6.42 Norwegian kroner (NOK) and 1 Euro = 8.05 NOK to convert to US dollars and Euros.

labor income, so-called personal income, independently of whether the income is retained in the firm or transferred to the owner.

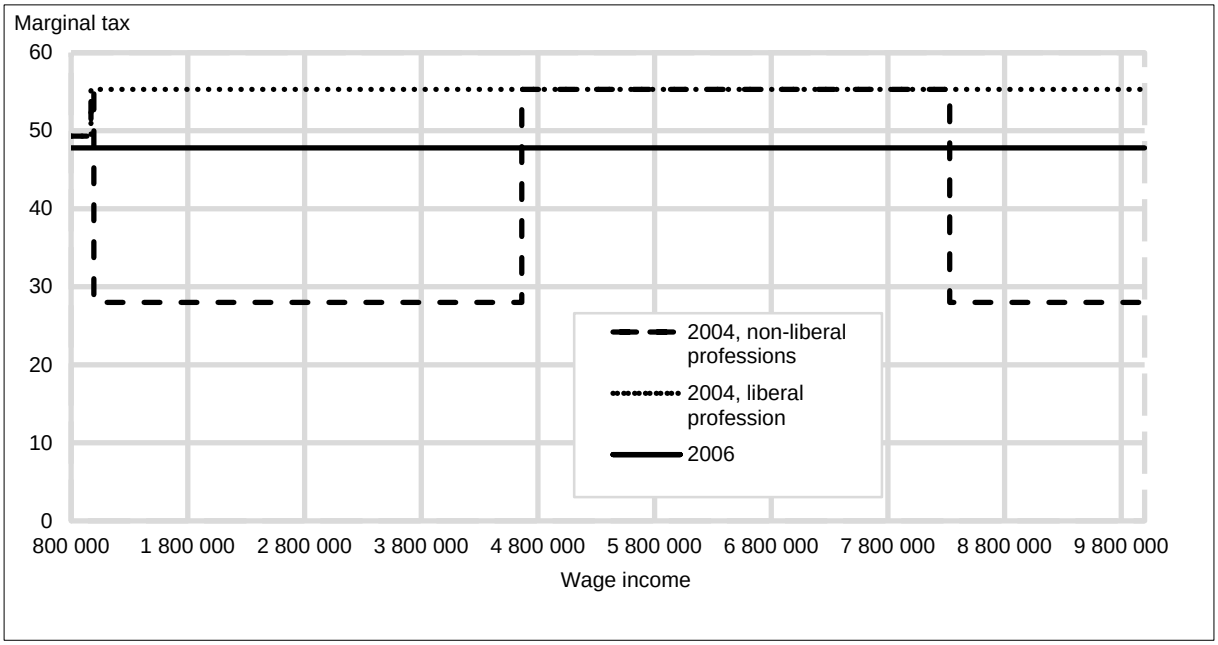
A main ambition of the Norwegian dual income tax was to tax labor income with a single schedule, independent of whether the income came from regular wage payments or was obtained by the split model. However, the 1990s saw increasing pressure on the dual income tax system, resulting in numerous "patches".[6] For example, a distinction between liberal professions (lawyers, dentists, doctors and other independent contractors delivering services to the public) and other professions was introduced in terms of ceilings, from which labor income part is taxed by the capital income tax rate (28 percent) only. The special treatment of the liberal occupations was abolished in 1998, and the low-tax income intervals are kept for other professions until the split model was eliminated in 2004.[7] In Figure 1, which describes schedules before and after the reform, the remarkable system for non-liberal professions prior to the reform is seen in the lower panel.

Figure 1. Marginal tax rates for the self-employed in 2004 and 2006. Income < 1 mill. NOK in upper panel, income in interval [0.8,10] mill. NOK in lower panel



[6] Christiansen (2004) sees this as resulting from political games motivated in part by the concerns of politicians of various colors with special interest groups.

[7] This particular schedule represents a separate opportunity for identification of response to tax changes, but, as seen, it only applies to very large incomes.



*1 mill NOK ≈ $ 156,000, ≈ € 124,000, in 2006.

The reform of 2006 emerged as an attempt to create a system that would prevent taxpayers from transforming labor income into capital income, to benefit from the lower flat rate applied to the latter; see Sørensen (2005) for the wider background to the reform and steps taken to adjust the dual income tax. Harmonization of the marginal tax rates on capital income and labor income is achieved by cutting top marginal tax rates on wage income, see Figure 1. This tax cut represents an increase in the net-of-tax rate for most taxpayers. However, as already mentioned, some groups of the self-employed experienced a decrease in the net-of-tax rate after the reform (see the lower panel). After the revision of the dual income tax in 2006, owners of sole proprietorships are taxed under the so-called self-employment model (*foretaksmodellen*), which shares important similarities with the split-model. According to the new rules, business income from a sole proprietorship activity in excess of the risk-free return allowance, calculated on the invested capital, is taxed as imputed personal income and is subject to surtax and social security contribution.[8]

The other initiative to curb the incentives to shift income comes from increases in the taxation of dividends and capital gains. Individual dividend incomes and capital gains above a rate-of-return allowance, that is, on profits above a risk free rate of return, are taxed at 48.2 percent at the maximum

[8] The basis for calculation of the risk-free rate is the arithmetic average observed on Treasury bills with 3 months maturity, as published by the Central Bank every year.

after the reform in 2006. Thus, this is a clear example of policy-makers having access to several tools in the tax optimization.

3. Problematic responses?

3.1 Estimation of the overall ETI

In this section, we discuss to what extent the various response margins reflected in the overall ETI represent sources to estimation bias, or if they are conventional components of the ETI. Estimates of the overall ETI for the self-employed are few, compared to both results for wage earners (see Footnote 2) and to the literature on how tax changes affect decisions to enter or exit self-employment, see reviews in Parker (2009) and Heim (2010). Heim (2010) and Kleven and Schultz (2014) provide ETI estimates for the self-employed by using the same methodology as employed here, whereas Saez (2010), le Maire and Schjerning (2013) and Bastani and Selin (2014) obtain ETI estimates by using bunching techniques.

Subsequent to Feldstein (1995), a standard estimation procedure for the identification of the ETI has been developed, benefitting from contributions by, among others, Auten and Carroll (1999), Moffitt and Wilhelm (2000), Gruber and Saez (2002), and Kopczuk (2005).[9] Recall that in the estimation of the elasticity, $e_{tot} = \frac{1-\tau}{x}\frac{\delta x}{\delta(1-\tau)}$ (τ is the marginal tax rate, x is income), the main data source is income panel data, covering a period with assorted variation in the net-of-tax rate across individuals. As one has settled down on measuring three-year differences in income, the estimated equation can be specified as

$$\log\left(\frac{x_{i,t+3}}{x_{it}}\right) = \alpha_t + \beta \log\left(\frac{1-\tau_{i,t+3}}{1-\tau_{it}}\right) + B_i'\theta + M_{it}'\eta + \varepsilon_{it}\,, \qquad (3.1)$$

where x_{it} and $x_{i,t+3}$ are taxable income for individual i before and after the reform (t and $t+3$), $1-\tau_{it}$ and $1-\tau_{i,t+3}$ are the corresponding net-of-tax-rates, α_t is a time specific effect, B_i is a vector of individual observed characteristics that are time-invariant (but may change relationship with income over time), and M_{it} is a vector of observed time-variant variables. The error term, ε_{it}, is assumed to be independently and identically distributed.

[9] Note that there is another acronym too: Goolsbee (1999) refers to studies in this field as belonging to the "new tax responsiveness literature" (NTR).

As already denoted, the marginal tax rate in this set-up is clearly endogenous, and studies typically employ the change in net-of-tax rates based on fixed first period income as instrument in an IV regression, see Auten and Carroll (1999) and Gruber and Saez (2002). The instrument is obtained by letting the tax rate in year $t+3$ be applied to income in year t (base year), inflated by the average income growth. This means that $\log\left(\frac{1-\tau_{i,t+3}}{1-\tau_{it}}\right)$ is instrumented by $\log\left(\frac{1-\tau^{I}_{i,t+3}}{1-\tau_{it}}\right)$, where $\tau^{I}_{i,t+3}$ symbolizes the marginal tax rate in year $t+3$ when applied to income of year t.

The difficulty with this representation of the tax change is that $\log\left(\frac{1-\tau^{I}_{i,t+3}}{1-\tau_{it}}\right)$ is likely correlated with the differenced error in Equation (3.1), see discussion in Moffitt and Wilhelm (2000). Mean reversion stems from individuals with temporarily high levels of income in period *t*, and therefore mistakenly placed in the treatment group with large reductions in marginal tax rates, returning to their normal income levels in period $t+3$. To account for the mean reversion bias, Auten and Carroll (1999) suggest including $\log x_{it}$, log of base year income, as an additional control variable,

$$\log\left(\frac{x_{i,t+3}}{x_{it}}\right) = \alpha_t + \beta \log\left(\frac{1-\tau_{i,t+3}}{1-\tau_{it}}\right) + B_i'\theta + M_{it}'\eta + \rho \log x_{it} + \varepsilon_{it}\,. \tag{3.2}$$

Further, Gruber and Saez (2002) propose adding a ten piece spline in the log of base year income (each decile of the income distribution) to account for (exogeneous) developments in the income distribution, and Kopczuk (2005) suggests including splines in the lagged base year income and in the deviation of lagged base year income from base year income. These approaches can be seen as

$$\log\left(\frac{x_{i,t+3}}{x_{it}}\right) = \alpha_t + \beta \log\left(\frac{1-\tau_{i,t+3}}{1-\tau_{it}}\right) + B_i'\theta + M_{it}'\eta + \mu Splines \log x_{it} + \varepsilon_{it}\,, \tag{3.3}$$

in the Gruber and Saez specification, and

$$\begin{aligned}\log\left(\frac{x_{i,t+3}}{x_{it}}\right) = \alpha_t + \beta \log\left(\frac{1-\tau_{i,t+3}}{1-\tau_{it}}\right) + B_i'\theta + M_{it}'\eta + \phi Splines \log x_{it} \\ + \pi Splines \log\left(\frac{x_{i,t-1}}{x_{it}}\right) + \varepsilon_{it}\,,\end{aligned} \tag{3.4}$$

in the Kopczuk version. It follows that μ and ϕ are vectors of parameters. In Section 4 we shall present results for estimations of Equations (3.2), (3.3) and (3.4), using 2SLS and the net-of-tax rate instrument as specified above, also controlling for a number of individual characteristics (included in B_i' and M_{it}').

It follows from this exposition that the exogeneity of the tax change instrument is the key condition for consistent estimation of the ETI. Estimation bias appears when there are systematic differences across income groups correlated with, but not caused by, the tax reform under investigation. In terms of the tax reform exploited in the identification here, the identification relies on the control group, people with less than approximately 375,000 NOK in self-employment income in 2004, see Figure 1, representing a valid control group for the "treated".

As revealed by this brief review, there are obvious methodological weaknesses and challenges in the standard procedure of obtaining ETI estimates. Here, we would like to draw attention to additional problems in the estimation of the elasticity, namely that some of the underlying response margins may represent causes to inconsistent estimates.

3.2 Response in working hours

Let us start with what we believe is a less problematic response margin. Of course, there may be effects on working hours that work through the other response dimensions (see on), for example because of shifts, but we maintain that, at least with respect to the way we identify the working hours response here, there are no reasons to believe that this margin is contaminated. Thus, we shall classify this response margin as a conventional component of the ETI.

To obtain empirical evidence about this response margin is, however, challenging. Scarcity of data sets with a panel dimension on working hours most likely explains why we see fewer studies (along the same lines as described here) with changes in working hours as the dependent variable.[10] However, cross-sectional data can straightforwardly be used to obtain ETI estimates, as emphasized by Saez, Slemrod, and Giertz (2012), and here we use ten cross-sections from the Labor Force Surveys (Statistics Norway, 2003), covering the period 2001–2010, to identify the response in working hours to the tax change.

Thus, the ambition is to obtain an estimate of $e_h = \frac{1-\tau}{h}\frac{\delta h}{\delta(1-\tau)}$, derived from repeated cross-sections. An estimate of an elasticity for working hours, e_h, which is comparable to the overall ETI in a decompositional context is derived by accounting for taxable income also reflecting other response margins. Then, after adjustments, an estimate of e_h can be contrasted to an estimate of e_{tot} (of

[10] Of course, the most important reason is that effects on income is the preferred measure for estimating efficiency costs, as made clear by Feldstein (1995; 1999).

Section 3.1), seen as $e_{tot} = e_h + e_{r1}$, where we expect e_h to be positive, and e_{r1} is the remaining response, which can be negative or positive, dependent on effects of other margins.

Given that we have access to information about working hours through cross sectional data, the identification strategy relies on assigning individuals to the "treatment" and "control" groups, and applying the standard difference-in-differences estimator for identification.[11] This framework can be seen as,

$$h_{it} = \alpha + \gamma D_i + \lambda Q_t + \delta D_i Q_t + B_i'\theta + M_{it}'\eta + \omega_{it}, \quad (3.5)$$

where h_{it} is working hours for individual i in the cross-section at time t, α is a constant, D_i is a dummy variable for belonging to the treated, and Q_t is a time dummy variable for the post-reform period. As for the estimation of the overall ETI, B_i and M_{it} refer to individual characteristics (but here the distinction between time-invariant and time-variant characteristics is not important), and ω_{it} is the error term. Now δ measures the effect of the tax reform on working hours. Given that we in this part of the analysis uses cross-sectional data instead of data with a panel dimension (as for the overall ETI in the previous subsection), the econometric identification procedure differs. However, based on the estimate of δ, we provide measures of the hours of work elasticity comparable to the ETI.

The allocation of observations into treatment and control groups is done by using individual calculations of the net-of-tax rate, similar to the instrument used in Section 3.1. As data sets contain personal identification numbers, we can add information obtained from the Income Statistics data to the observations of the Labor Force Surveys.

3.3 Contribution from tax evasion

Next, we would like to see how the tax evasion component relates to the ETI for the self-employed, and enters into to the overall response account. The self-employed are known to be disproportionately more involved in tax evasion than wage earners. In fact, the identification of the tax evasion component, in many studies, relies on wage earners not evading. But are there reasons to caution against this dimension in terms of estimation inconsistency? In other words, are there reasons to reject the equal trend assumption of the ETI methodology? One reason, given that high-income self-employed are more involved in tax evasion than others, see Nygård, Slemrod and Thoresen (2016), could then be new initiatives by the tax administration to reduce evasion. However, we have no priors in this direction, and tax evasion is here assigned to the decompositional part of the ETI.

[11] Angrist and Pischke (2009) provide several examples of use of this technique.

It is not obvious how changes in marginal tax rates affect tax evasion, and thereby it is uncertain whether the tax evasion component of the overall ETI estimate holds a negative or positive sign. The theoretical literature, as Allingham and Sandmo (1972) and Yitzhaki (1974), offers no clear answers,[12] and empirical findings are mixed (Freire-Serén and Panadés, 2013). Some of the early studies, as Clotfelter (1983), find increased tax evasion for higher marginal tax rates. More recently, Kleven et al. (2011) obtain a very small positive relationship, based on a randomized tax enforcement experiment in Denmark, whereas Gorodnichenko, Martinez-Vazquez and Peter (2009) find a strong positive relationship.

Nevertheless, it seems that the self-employment ETI literature (Heim, 2010; Doerrenberg and Duncan, 2014) adopt a perspective where reported income is increasing in the net-of-tax rate, i.e., that tax evasion is increasing in the marginal tax rate. This means that ETI estimates for the self-employed are larger than for wage earners if there is a discernible effect on tax evasion from the change in the marginal tax rate. Thus, in a synthesis of the components discussed so far (where e_{r2} is the remaining response), $e_{tot} = e_h + e_{ev} + e_{r2}$, if anything, we expect that there is a positive tax evasion contribution, e_{ev}, to the overall ETI, similar to the working hours component.[13]

We obtain an estimate of e_{ev} by addressing estimates of tax evasion before and after the 2006-reform, using the so-called expenditure approach (Pissarides and Weber, 1989). It builds on one group reporting income correctly and another not, but both groups reporting food expenditures truthfully. Thus, this part of the analysis involves the use of consumption data from the Survey of Consumer Expenditure (Holmøy and Lillegård, 2014). Under the assumption that the two groups share the same preferences for food, given a set of observable characteristics, estimates on the degree of underreporting among evading households are obtained by exploiting observations on income and food expenditures. More precisely, a common point of departure is the log-linear Engel function, $\log C_h = Z_h'\psi + \xi \log Y_h^*,$ where $\log C_h$ is the log of food expenditure for household, h, Z_h is a set of observable household characteristics, and $\log Y_h^*$ is the log of "true" disposable income.[14] A standard assumption is that underreporting takes place at a constant fraction, such that $Y_h^* = kY_h$, where Y_h is

[12] In the seminal model of Allingham and Sandmo (1972) a tax increase has two contradicting effects on tax evasion: the return to cheating goes up, but at the same time it lowers (full compliance) post-tax income, which most likely make people more risk averse.

[13] See also Kuka (2014) on obtaining a tax evasion component, but with the use of bunching techniques.

[14] Thus, reflecting that the household is the economic unit in the consumption data.

the reported income, and there is underreporting if $k > 1$. Here, as in Engström and Holmlund (2009), the following reduced form specification is employed,[15]

$$\log C_h = Z_h'\psi + \mu \log Y_h + \kappa SE_h + u_h, \tag{3.6}$$

where SE_h is a dummy for being self-employed. A positive κ suggests that the self-employed underreport income, and the number which can be used to multiply reported self-employment income to obtain "true income", is given by $k = \frac{\kappa}{\mu}$; the relationship between the shift parameter, κ, and the slope of the Engel curve, μ. It follows that estimates of k before and after the 2006-reform are used to give an estimate of the e_{ev} component of the ETI.

3.4 Organizational shifts generate measurement problem

Now, we direct attention to how we obtain information about the two dimensions that potentially impose biases in the estimation of the ETI, namely organizational shifts and income shifting between tax bases. Given that high-income taxpayers were overrepresented among those who shifted out of self-employment prior to the reform (Thoresen and Alstadsæter, 2010), and because of the tax changes of the 2006 tax reform, more high-income business owners likely remain in the self-employment data sample after the reform. Thus, as already denoted, we get a non-random addition to the treatment group because of self-selection, and the organizational shift response margin therefore enforces a measurement problem in the identification of the ETI. We would like to obtain an estimate of e_{tot} in the response account that is not contaminated by shifting behavior, say e_{tot}^*. This effect has been addressed in several studies from the U.S. too. For instance, at the same time of the Tax Reform Act of 1986, which has been used in several studies of the ETI in the U.S., and which gave substantial reductions in the top marginal tax rate, there were large shifts of business income from so-called C corporations to so-called S corporations (Gordon and Slemrod, 2000).

We explore the extent of organizational shifts before and after the tax reform by utilizing information from three different registers: the Business and Enterprise Register, the Shareholder Register and the End of the Year Certificate Register. By combing information from these three data sources with the income data, each individual is linked to companies, in terms of ownership, employment and transfers of dividends. In turn, these data are used to distinguish between individuals who move out of out of self-employment because of a "real" change in occupation (i.e., decide to take on paid employment), and those who turn up as wage earners because they have decided to run their businesses as

[15] As both income and k are assumed to be stochastic according to Pissarides and Weber (1989), there are more complications involved when obtaining estimates of k, discussed with respect to Norwegian data in Nygård, Slemrod and Thoresen (2016).

incorporated firms. Thus, we attribute fewer organizational shifts after the reform to the tax changes of the reform.

3.5 Shifting between tax bases

In addition to shifts in organizational form, incomes of the self-employed are likely directly affected by the harmonization of marginal tax rates on self-employment income and capital income after the reform. The self-employed then to a larger degree, ceteris paribus, choose to be paid in terms of business income instead of dividend income. Such effects have been reported in previous analyses of the Norwegian dual income tax, see, for example, Alstadsæter and Fjærli (2009) and Alstadsæter and Jacob (2015).[16] One reason for income shifting representing a proble m in the present context is that capital income is left out of our definition of taxable income, but this is similar to what is seen in several other studies, as Feldstein (1995) and other analyses based on U.S. data. However, here we would like to put forward the effect of contemporaneous tax changes in the identification of the ETI; in this case, the taxation of capital gains and dividends after the reform of 2006, see Section 2. As self-employment income does not include income from other capital sources, the dependent income variable potentially picks up effects of base shifts after the reform. This effect is therefore representing another potential source for bias in the estimation of e_{tot}, which we may characterize as an omitted variable problem, as it is caused by the lack of control for the effect working through the changed capital taxation.

In this part of the analysis, traces of response due to tax base shifts are searched for by examining how the self-employed, in the treatment group, with large capital incomes, prior to the reform, respond compared to their self-employment counterparts, also in the treatment group, with less income from capital. Relatively large responses in the high-capital income group can be seen as indicative evidence of contribution from tax base shifts, which represent a source to bias in the estimation. Thus, we shall discuss this issue by providing evidence of how the labor income and the capital income of taxpayers who are in the treatment group develop over time (before and after the reform).

[16] See Christiansen and Tuomala (2008) for a discussion of consequences of income shifting for optimal taxation.

4. The overall ETI and its components

4.1 The ETI of the Norwegian self-employed

As already denoted, there are numerous studies of the responsiveness of wage earners using the standard method to derive estimates of the ETI, whereas there are relatively few estimates of the ETI for the self-employed. Two recent studies of the ETI for the self-employed are Heim (2010) and Kleven and Schultz (2014). Heim suggests that the overall elasticity is around 0.9 for the U.S., and identifies a "real" elasticity part of approximately 0.4 when controlling for tax evasion.[17] Kleven and Schultz, using data for Denmark, find that the total elasticity of taxable income is about twice as large for the self-employed compared to the wage earners. However, both elasticity estimates are relatively small, and approximately 0.1 for the self-employed.[18]

In the present study, we benefit from having access to large administrative datasets, close to 75,000 self-employed each year, based on information from income tax returns (Statistics Norway, 2005). Self-employment is defined by conditioning on both self-employment income being higher than wage income and yearly income being larger than 100,000 NOK ($16,000 or £12,500). See Table A.1 and Table A.2 in the Appendix for summary statistics. As we use data for the period 2001–2010, we have access to information about 400,000–500,000 three year differences in the estimation of the ETI. This also means that observations from periods without any major changes in the net-of-tax rates are included.

It is a main problem in this type of studies that the identification of the effect of the net-of-tax rate often becomes blurred, as both the mean reversion control and the tax change instrument depend on income. This problem is alleviated here by including periods both with and without tax changes in the estimation, and it is also reduced by the tax burden depending on other characteristics than income alone. With respect to the latter, information about type of profession, given the different tax treatment of liberal and non-liberal professions (see Figure 1) is used, and it is also helpful that marginal tax rates are lower for people located in the northern part of Norway.

[17] Heim (2010) distinguishes between a real response part and an evasion part by adopting estimates of Clotfelter (1993) and Joulfaian and Rider (1998) for the latter.

[18] Of course, one should not necessarily find similar response estimates across countries and across studies. One obvious source to variation in estimates is the size of the tax reform used in the identification of effects, as discussed by Chetty (2012). However, as the literature seems to suggest stronger responses in the U.S. than in the Scandinavian countries, this is worth taking a closer look at in the future. See also Kleven (2014).

Table 1 presents estimation results for five different specifications. As expected, IV-estimation without any mean reversion control gives negative ETI estimates, see column (1). Estimation results for Equations (3.2)–(3.4) (see Section 3) are reported in columns (2)–(4), demonstrating that results to some extent are sensitive with respect to the mean reversion control technique used.[19] However, all estimates point to relatively small effects, in the range from 0.09 to 0.15. These estimates are not far from those Kleven and Schultz (2014) found for Denmark, and as them, we find results which indicate that the self-employed are somewhat more tax responsive than the wage earners, when using findings of Thoresen and Vattø (2015) as evidence for the tax responsiveness of Norwegian wage earners (over the same reform period).

Table 1. Overall ETI estimation results

	(1)	(2)	(3)	(4)
Net-of-tax rate	-0.963***	0.123***	0.091***	0.152***
	(0.013)	(0.016)	(0.016)	(0.016)
Age	-0.008***	0.003***	0.003***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Age squared	0.6×10^{-4}***	-0.6×10^{-4}***	-0.6×10^{-4}***	-0.3×10^{4}***
	(0.7×10^{-5})	($0.9*10^{-5}$)	($0.9*10^{-5}$)	($0.9*10^{-5}$)
Male	-0.006***	0.090***	0.084***	0.066***
	(0.001)	(0.002)	(0.002)	(0.002)
Children	0.008***	0.016***	0.015***	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)
Married	0.007***	0.016***	0.015***	0.016***
	(0.001)	(0.002)	(0.002)	(0.002)
Norwegian born	-0.003	0.020***	0.017***	0.014***
	(0.003)	(0.004)	(0.004)	(0.004)
Log of period *t* (Auten/Carroll)		X		
Splines of log of period *t* income (Gruber/Saez)			X	
Splines of log *t*-1 income and log deviation between *t*-1 and *t* incomes (Kopczuk)				X
N	488,258	488,258	488,258	416,735

Instrumental variable estimation (2SLS). Additional control variables: dummy variables for educational field, length of education, county and years. Robust standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

[19] Application of the instrumentation method of Weber (2014), in combination with the mean reversion control method of Kopczuk (2005), gives results close to those reported in Table 1.

4.2 Estimation results for working hours

As explained in Section 3, due to constraints in the access to information about hours of work for the self-employed, estimates of the response in working hours are obtained by using information from repeated cross-sections, derived from the Labor Force Surveys (Statistics Norway, 2003). As the Labor Force Survey consists of approximately 22,000 observations per year in total, it follows that the evidence with respect to responses in working hours is based on a smaller data set than the one used to obtain estimates of the ETI.

Moreover, as these data do not contain any (usable) panel dimension, estimates of responses in working hours are obtained by dividing the sample into "treatment group" and "control group" and by using a standard difference-in-differences estimation technique on groups in repeated cross-sections, see Equation (3.5).[20] Individuals that experienced an increase in the net-of-tax rate due to the tax reform[21] belongs to the treated, and compared to the self-employed experiencing no changes or a reduction in the net-of-tax rate. In two specifications, we also include wage earners (experiencing no tax changes) in the control group. More information about the data can be found in the Appendix, Tables A.3 and A.4 and Figures A.1–A.4, also showing graphical evidence of over time developments.

Table 2 presents response estimates for four alternative specifications, which vary with respect to the sample definition and whether the dependent variable is measured in log or level. As explained in Section 3, estimates of δ in Equation (3.5) are used to calculate elasticity estimates that are comparable to the overall ETI. The (implied) estimated response ranges from 0.13 to 0.17, but only the tax treatment estimate of column (4) is significantly different from zero. In other words, only when adding wage earners to the control group, we obtain a statistically significant result for the tax treatment variable. However, we see that the point estimate of the regression for the self-employed only, reported in column (2), is almost identical to this estimate.

[20] Note that Saez, Slemrod and Giertz (2012) argue that repeated cross-section analysis may be preferable to panel data studies in some contexts.

[21] The net-of-tax variable is added to observations of the Labor force survey through personal identification numbers.

Table 2. Estimation results for working hours

	(1) Level	(2) Log	(3) Level, large control group	(4) Log, large control group
Tax treatment	0.481	0.016	0.468	0.017*
	(0.585)	(0.015)	(0.371)	(0.010)
Treatment group	0.232	0.007	3.841***	0.087***
	(0.443)	(0.011)	(0.270)	(0.007)
Constant	28.056***	3.381***	35.795***	3.592***
	(3.821)	(0.098)	(0.792)	(0.022)
Age	0.325**	0.008**	-0.002	-0.000
	(0.158)	(0.004)	(0.020)	(0.001)
Age squared	-0.004**	-0.000**	-0.000	0.000
	(0.002)	(0.000)	(0.000)	(0.000)
Male	5.881***	0.157***	3.443***	0.097***
	(0.413)	(0.011)	(0.061)	(0.002)
Number of children	-0.795**	-0.022**	-0.576***	-0.017***
	(0.377)	(0.010)	(0.061)	(0.002)
Married	0.009	-0.001	-0.511***	-0.015***
	(0.355)	(0.009)	(0.059)	(0.002)
Norwegian born	1.642**	0.046**	0.332***	0.010***
	(0.683)	(0.019)	(0.114)	(0.003)
Elasticity	0.130	0.169	0.126	0.166
N	3,664	3,664	64,900	64,900

Additional control variables: dummy variables for educational field, length of education, county and years. Robust standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

4.3 Less tax evasion after the reform?

Next, we add the tax evasion component to ETI response account, by examining to what extent the overall ETI estimate is influenced by changes in the income reporting caused by the tax reform.[22] Table 3 presents separate estimation results for the coefficient k, before and after the reform, which gives the number by which the average self-employed person's income has to be multiplied in order to obtain the "true" income. As discussed in Section 3.3, we are inclined to expect a reduction in tax evasion from lower marginal tax rates, and in accordance with this, we see a 2.5 percentage point

[22] Table A.6 and Table A.7 in the Appendix provide more information about the data used in this part of the analysis, which primarily are from the Survey of consumer expenditure.

reduction in k when moving from the pre-reform to the post-reform tax schedule.[23] Note that the difference in the estimate of k is not strictly significant, even though we observe a clear reduction in the self-employment parameter estimate.[24] However, to illustrate the implication of the point estimate for k in terms of the overall ETI, a "back-of-the-envelope" calculation suggests that the tax evasion component of the ETI is approximately 0.04. This estimate is obtained by calculating the percentage change in income evaded due to the reform. Then the "evasion elasticity" is derived by dividing this figure by the percentage change in the net-of-tax rate, when restricting to self-employed with higher net-of-tax rates (those assumed to react), and then multiplying and dividing with tax evasion and income reported before the reform, respectively.

Table 3. Tax evasion before and after the reform

	Before reform 2003-2004	After reform 2006-2007
Income	0.597***	0.554***
	(0.043)	(0.036)
Self-employed	0.109**	0.087**
	(0.046)	(0.044)
Age	0.033***	0.045***
	(0.007)	(0.007)
Age squared	-0.33×10^{-3}***	-0.42×10^{-3}***
	(0.72×10^{-4})	(0.72×10^{-4})
Male	-0.026	-0.097***
	(0.027)	(0.030)
Children under 7	0.115***	0.117***
	(0.017)	(0.022)
High school	0.029	0.099***
	(0.045)	(0.036)
Higher education	0.028	0.149***
	(0.048)	(0.039)
Constant	1.940***	2.237***
	(0.492)	(0.454)
Tax evasion	1.182**	1.157**
N	2,221	2,041

Additional control variables: dummy variables for regions. Standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

[23] Weaknesses in the empirical approach are admitted, although we do not believe them to affect results. For example, ideally we would like to use a measure of permanent income when estimating the relation between consumption and income, as is done in Nygård, Slemrod and Thoresen (2016).

[24] We use the so-called delta method to calculate standard errors for k, based on parameter estimates of κ and μ, see Section 3.3.

In terms of a response account, if we exemplify by using the overall ETI estimate obtained by the Kopczuk-specification, which is 0.15 (see Table 1), we have 0.15 = 0.17 + 0.04 + e_r, when we have used $e_{tot} = e_h + e_{ev} + e_r$ and the estimate of e_h from column 4 of Table 2. However, when contrasting the tax evasion estimate to a lower bound estimate for e_{tot}, which is 0.10, (of course) the relative importance of tax evasion becomes larger.

4.4 Implications of organizational shifts

To obtain information about the extent of organizational shifts over the reform period, information from the Business and Enterprise Register (*Virksomhet og foretaksregisteret*) (Hansson, 2007), the Shareholder Register (*Aksjonærregisteret*) (Statistics Norway, 2015) and the End of the Year Certificate register (*Lønns- og trekkoppgaveregisteret*) (Aukrust et al., 2010) are used. By establishing a longitudinal dataset we can verify if the self-employed have moved their business activities from self-employment to an incorporated firm, and assess to what extent these movements have been altered by the reform, and thereby representing a source to estimation bias. An organizational shift is defined by moving from self-employment (as defined above) to be an employee in an incorporated firm, in combination with holding shares in the same firm. See Table A.8 and Table A.9 in the Appendix for more information about the "shifters".

Table 4. Self-employed in year *t* who have incorporated in year *t*+1, *t*+2, and *t*+3, 2001–2011

	1 year difference		2 year difference		3 year difference	
T	Number	Percent of self-employed	Number	Percent of self-employed	Number	Percent of self-employed
2001	-		-		5,611	4.14
2002	-		4,275	3.13	5,724	4.20
2003	2,617	2.08	4,293	3.41	4,370	3.45
2004	3,187	2.38	3,716	2.78	6,138	4.59
2005	2,458	1.78	5,482	3.96	7,160	5.18
2006	2,053	1.57	4,206	3.22	5,464	4.18
2007	2,045	1.56	3,828	2.91	5,130	3.89
2008	1,413	1.14	2,968	2.39	4,113	3.31
2009	1,553	1.26	3,012	2.44	4,549	3.69
2010	1,482	1.20	3,452	2.79	-	-
2011	1,550	1.29	-	-	-	-

This part of the analysis is constrained by information from the Shareholder Register only being available from 2004 and onwards, which implies that 2004 is the first year with information about the owner/employment combination in incorporated firms. Correspondingly, in Table 4, we show the number of shifts in the period from 2001 to 2011, dependent on time intervals, with the organizational form of 2001 represented by the 2004-choice. As expected, the figures of Table 4 indicate that there is a reduction in the movement out of self-employment after the reform. If we focus on the three-year differences, we see that the average share of the self-employed having changed organizational form is reduced from 4.1, before the reform (2001–2004), to 3.6, after the reform (2007–2009).

To illustrate how changes in these movements work on the ETI estimate, we do some crude adjustments in data, where we modify the sample used in the estimations for the reduction in organizational shifts, and re-estimate the ETI on the new sample. We use information about the individuals that shift before the reform to find self-employed individuals after the reform with similar characteristics, to obtain a data set with unaltered organizational shift patterns over time. In practice, this implies that 1,100 individuals are taken out of the samples in 2008, 2009, and 2010 by random draws based on "shifting characteristics".[25] We acknowledge that this a somewhat simple procedure to obtain magnitudes, but recall that our main ambition here is to provide illustrations of the effect of the response dimensions that may represent sources to bias.

Table 5. ETI estimates when accounting for changed organizational shift patterns after the reform

	(1)	(2)	(3)	(4)
Net-of-tax rate	-0.948***	0.129***	0.137***	0.177***
	(0.013)	(0.018)	(0.017)	(0.017)
Log of period *t* (Auten/Carroll)		X		
Log of period *t* income in splines (Gruber/Saez)			X	
Splines of log *t*-1 income and log deviation between *t*-1 and *t* incomes (Kopczuk)				X
N	433,707	433,707	433,707	372,105

Control variables: age, age squared, male, children, married, Norwegian born, educational field, length of education, county and years. Robust standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

ETI estimates for this alternative data set are presented in Table 5, and we see that the ETI estimates of Table 5 are higher than those reported in Table 1. For example, the estimate for e^*_{tot} is 0.18 according

[25] These following characteristics are those in which the individuals who have shifted organizational form differ most from the average self-employed: age, business income and the income base of the surtax. In addition, random draws are done separately for males and females and for different education levels, to obtain similar group compositions before the reform.

to column (4). Thus, this suggests that the standard ETI estimate (in this case) is biased downward because of the measurement errors stemming from organizational shifts. Thus, the response account is now changed to $0.18 = 0.17 + 0.04 + e_r$.

4.5 Contribution of tax base shifts

Finally, we bring up the implication of shifts across tax bases for the measurement of the ETI. Similar to as for the organizational shift response, new patterns of shifts across tax bases enforces a possible bias in the estimation of the ETI. To fully understand the implications of this effect, we would benefit from a thorough empirical analysis founded on taxpayers' decision-making with respect to business income and capital income, accounting both for real responses and income shifting. As this is beyond the scope of the present analysis, we instead provide some simplified illustrations.

We focus on differential income developments for taxpayers in the treatment group, i.e., among persons who experienced an increase in the net-of-tax rate because of the reform. Figure 2 and Figure 3 show how business income (as defined by the income base for the surtax) and capital income evolve over time for the treated, separately for groups with initial low and high capital incomes. Initial high capital income means that the person receives more than 50,000 NOK in capital income in the years prior to the reform. Figure 3 illustrates that dividend income is substantially reduced after the reform,[26] see the sizeable drop between 2005 and 2006 for taxpayers with high income from capital. For the same group, in Figure 2, we observe an increase in business income soon after the reform, even though the curve flattens out in the subsequent years and also goes back. Moreover, in Table 6 we report separate ETI estimates for the four groups which are focused at in Figure 2 and in Figure 3.[27]

[26] As seen elsewhere, see Alstadsæter and Fjærli (2009) and Thoresen et al. (2012).

[27] See Table A.10 and Table A.11 in the Appendix for descriptive statistics for the groups.

Figure 2. Developments in the surtax base income for taxpayers with lower marginal tax rates after tax reform, separately for high and low capital income earners

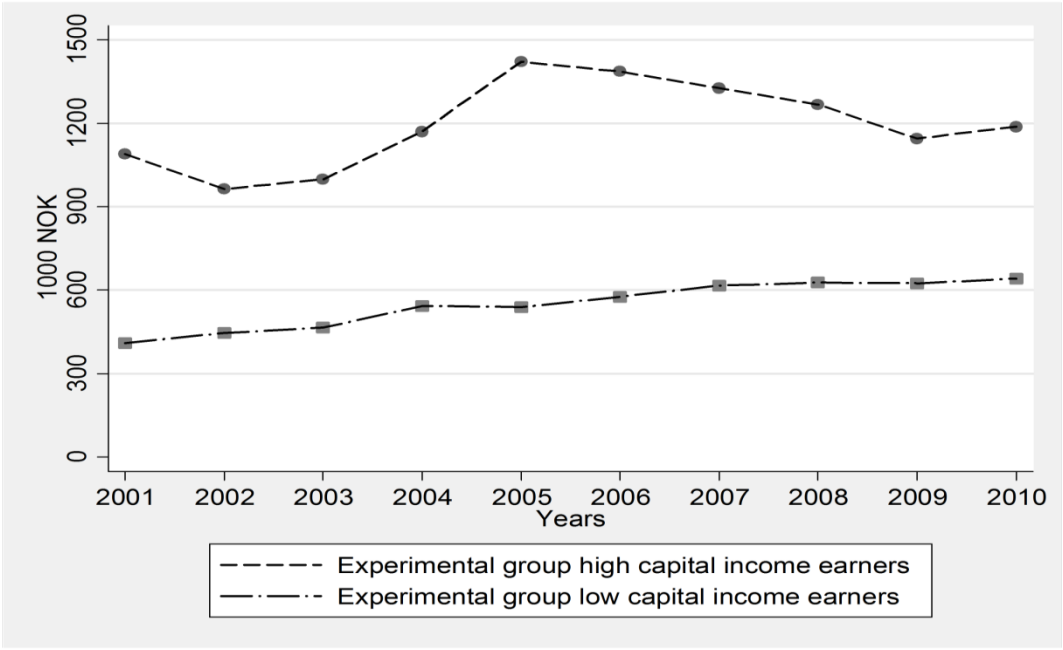
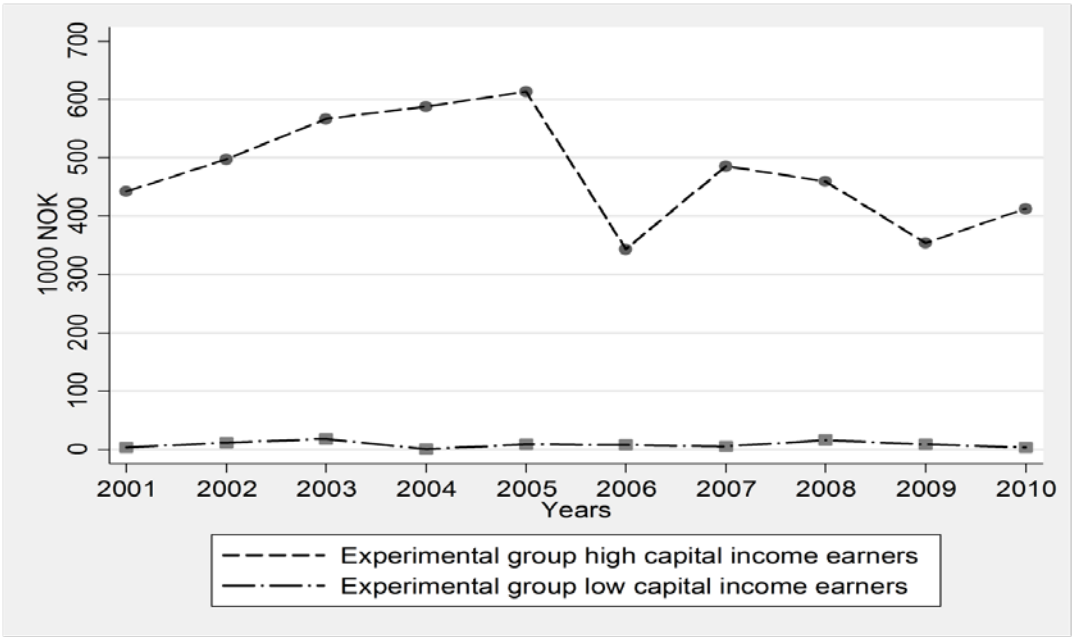


Figure 3. Developments in capital income for those with lower marginal tax rates after tax reform, separately for high and low capital income earners



As expected, given the patterns seen in the graphs, the ETI estimate for the self-employed who also have high capital income prior to the reform, 0.4, is large compared to what is found in the "low-capital" income group. We take this as corroborative evidence of taxpayers in this former group,

because of the tax changes, having decided to receive less capital income after the reform, and instead receive compensation in terms of more business income. This type of shifts represents a source to measurement error in the estimation of the overall ETI, and causes an upward bias in the ETI.[28]

Table 6. ETI estimates for subgroups of the self-employed

	(1) High capital income	(2) Low capital income	(3) High surtax tax base	(4) Low surtax tax base
Net-of-tax rate	0.401***	0.124***	0.200***	0.147***
	(0.100)	(0.017)	(0.057)	(0.017)
N	17,763	351,309	57,473	316,853

Instrumental variable estimation (2SLS), with splines of log *t*-1 income and log deviation between *t*-1 and *t* incomes (Kopczuk) as mean reversion control. Control variables: age, age squared, male, children, married, Norwegian born, dummies for educational field, education level, county and years. Robust standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

However, we admit that the evidence is indicative, and as there may be other sources to heterogeneity too, it is hard to be very precise about the magnitude. Moreover, as this group is relatively small, we may expect that the effect of tax base shifting has limited effect on estimates of the ETI. This is also substantiated by observing small differences between the response of the "low-capital-income" group (Table 6) and the average response for all (reported in Table 1).

5. Conclusion

The "sufficient statistics" interpretation of the ETI has received a lot of attention in applied public finance recently. A major attraction of the approach is that one does not need to address the behavioral anatomy of the ETI. However, in this paper we warn against neglecting the effects of various response dimensions, as they can create biases in the estimation of the ETI. To differentiate between different types of response margins, conceptually, we have divided our empirical investigations into "decompositions" and "sources to bias". Access to several data sets, mainly from Norwegian administrative registers, has been essential for this analysis probing deeper into the various effects underlying the overall ETI, and how they fit into a response account.

The ETI estimates for the self-employed obtained here are relatively small, in the range from 0.09 to 0.15, which is close to findings for Denmark, reported in Kleven and Schultz (2014), and considerably smaller than found for the U.S. by Heim (2010). Further, the decomposition analysis shows that effects on working hours is the dominant response margin, but we also attribute some of the overall

[28] Note that Gordon and Slemrod (2000) and Goolsbee (2000) find that income shifting is increasing in income.

tax response to tax evasion, for the latter effect finding evidence suggesting that tax evasion is increasing in the marginal tax rate.

However, the main message of the present study is that such estimates (and thereby also international comparisons of estimates) are in danger of being misleading if not controlling for confounding factors in the identification of the ETI. We find indications of more people staying in self-employment after the 2006-reform, due to fewer organizational shifts, which represents a source to downward bias in the ETI. Further, shifts in payments across tax bases within the personal income tax schedule, because of harmonization of marginal tax rates on earnings and capital income, works in the other direction. Most likely the organizational shift bias is most important of the two: a tentative result suggests that the ETI would have been 0.03 higher if the organizational shift effect did not contaminate the ETI estimate.

Finally, we assert that more investigations of the multiple behavioral components of the ETI benefit the understanding of it, both in a national and an international context. Such examinations are demanding with respect to data, but with increased access to larger and richer data sources in the future, we expect to see more studies along the line of the present analysis.

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Appendix A: Summary statistics

A.1 Income data

Table A.1. Average income and net-of-tax rate, 2001–2010

Year	Reported income Mean	Net-of-tax rate Mean	Self-employed individuals Number
2001	299,782	0.576	71,353
	(307,815)	(0.074)	
2002	316,467	0.583	72,590
	(290,482)	(0.073)	
2003	317,794	0.589	72,103
	(293,629)	(0.072)	
2004	377,000	0.584	74,257
	(316,001)	(0.073)	
2005	397,739	0.594	74,749
	(391,337)	(0.063)	
2006	431,448	0.601	76,220
	(421,270)	(0.050)	
2007	468,548	0.595	77,781
	(436,927)	(0.052)	
2008	452,082	0.597	77,380
	(393,619)	(0.052)	
2009	451,961	0.600	77,485
	(406,667)	(0.051)	
2010	469,104	0.600	77,701
	(427,944)	(0.051)	

Standard deviations in parentheses.

Table A.2. Descriptive statistics for control variables in the estimation of the ETI

Characteristic	Mean	Length of education	Percentage in sample	Educational field	Percentage in sample
Male	0.75	No education	0.1	General	31.2
Age	46.0	Primary school	0.1	Humanities and arts	4.5
Dummy for children	0.59	Secondary school	19.8	Teaching	2.1
Married	0.57	High school, started	25.5	Social science and law	3.4
Birth country	0.93	High school, completed	28.8	Business and administration	9.3
		High school, supplement	2.4	Science, crafts and technology	24.9
		University, undergrad	12.5	Health, social and sports	11.5
		University postgrad	9.18	Agriculture and fishery	5.5
		Research degree	0.3	Transport, security and services	5.6
		Unknown	1.3	Unknown	1.8

A.2 Working hours data

Table A.3. Hours of work and net-of-tax rate in groups, before and after the reform

	Treated		Small control group		Large control group	
	Hours of work	Net-of-tax rate	Hours of work	Net-of-tax rate	Hours of work	Net-of-tax rate
Before reform	41.3	0.517	42.2	0.618	36.2	0.625
	(9.1)	(0.055)	(9.6)	(0.053)	(6.3)	(0.047)
After reform	40.7	0.558	41.0	0.615	35.7	0.624
	(9.1)	(0.043)	(9.7)	(0.044)	(6.6)	(0.038)

Standard deviations in parentheses.

Table A.4. Descriptive statistics for control variables involved in the working hours estimation

	Treated Mean	Small control group Mean	Large control group Mean
Male	0.80	0.78	0.49
Age	48.0	47.3	40.9
Child	0.63	0.61	0.57
Married	0.61	0.62	0.50
Birth country	0.93	0.95	0.94
Length of education	Treated Percentage	Small control group Percentage	Large control group Percentage
No education	0.0	0.0	0.1
Primary school	0.1	0.0	0.1
Secondary school	15.0	20.3	14.3
High school, started	16.2	30.9	18.5
High school, completed	24.3	33.3	34.0
High school, supplement	2.0	2.6	3.4
University, undergrad.	18.0	9.1	28.8
University, postgrad.	22.0	3.5	3.7
Research degree	0.7	0.0	0.2
Unknown	1.7	0.5	0.9
Educational field			
General	22.6	34.8	24.5
Humanities and arts	4.2	3.8	4.4
Teaching	2.2	2.3	7.5
Social science and law	7.4	1.2	2.2
Business and administration	8.7	11.2	13.9
Science, crafts and technology	21.6	30.0	26.1
Health, social and sports	24.9	5.6	15.6
Agriculture and fishery	3.0	4.7	1.1
Transport, security and services	3.5	5.6	3.1
Unknown	2.0	0.9	1.5

Figure A.1. Average working hours for the treatment and the control group. Only self-employed in control group

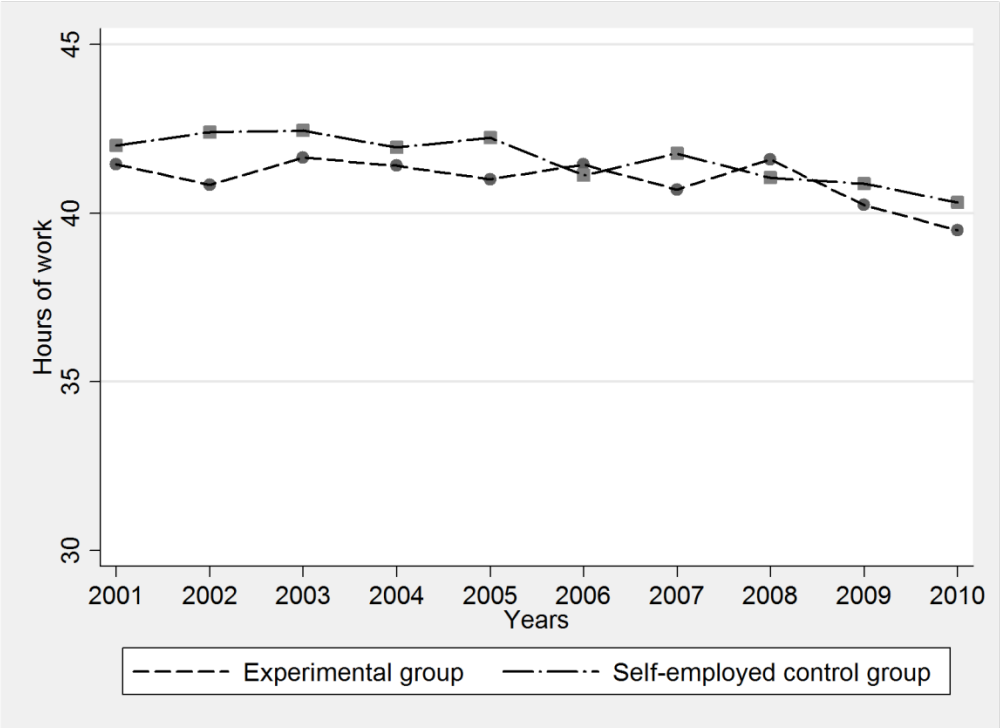

Figure A.2. Difference in average working hours between the treatment group and the control group. Only self-employed (not wage earners) in the control group

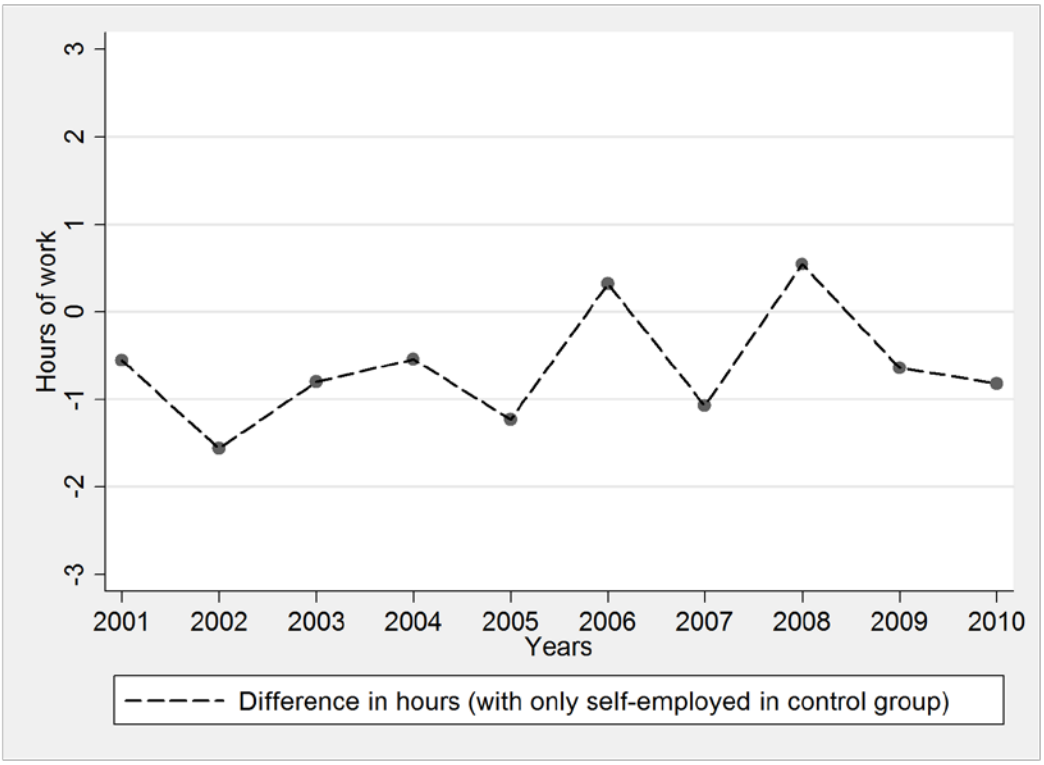

Figure A.3. Average working hours for the treatment group and the control group. Both wage earners and self-employed in the control group

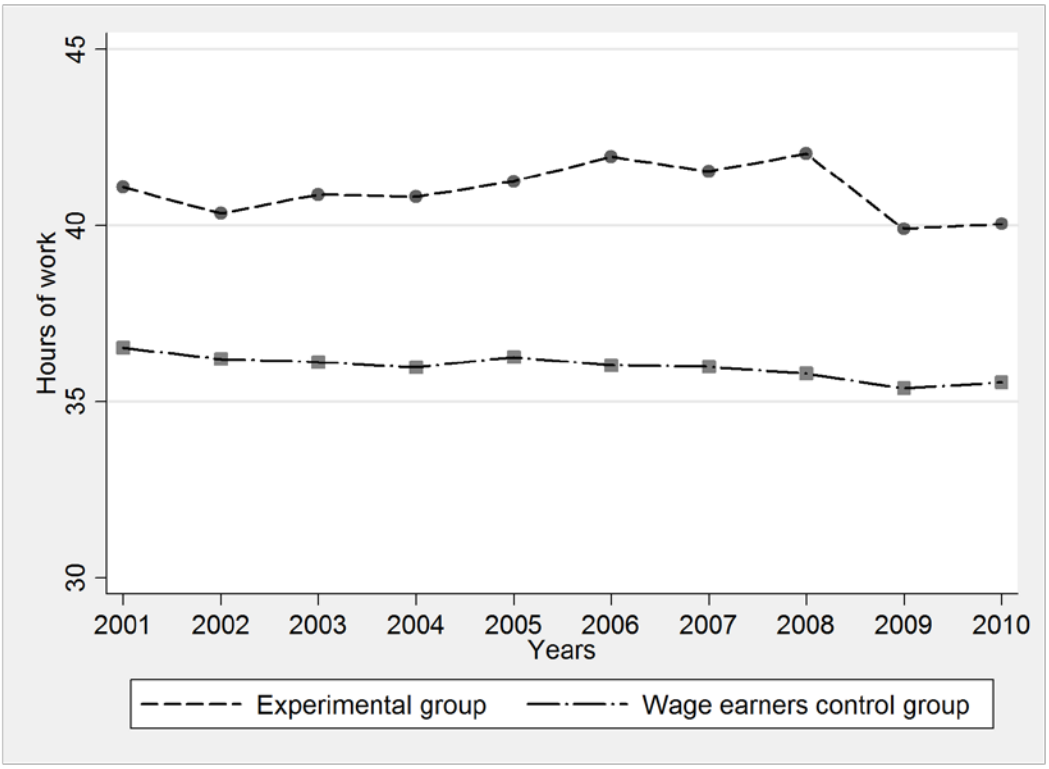

Figure A.4. Difference in average working hours between the treatment group and the control group. Wage earners and self-employed in control group

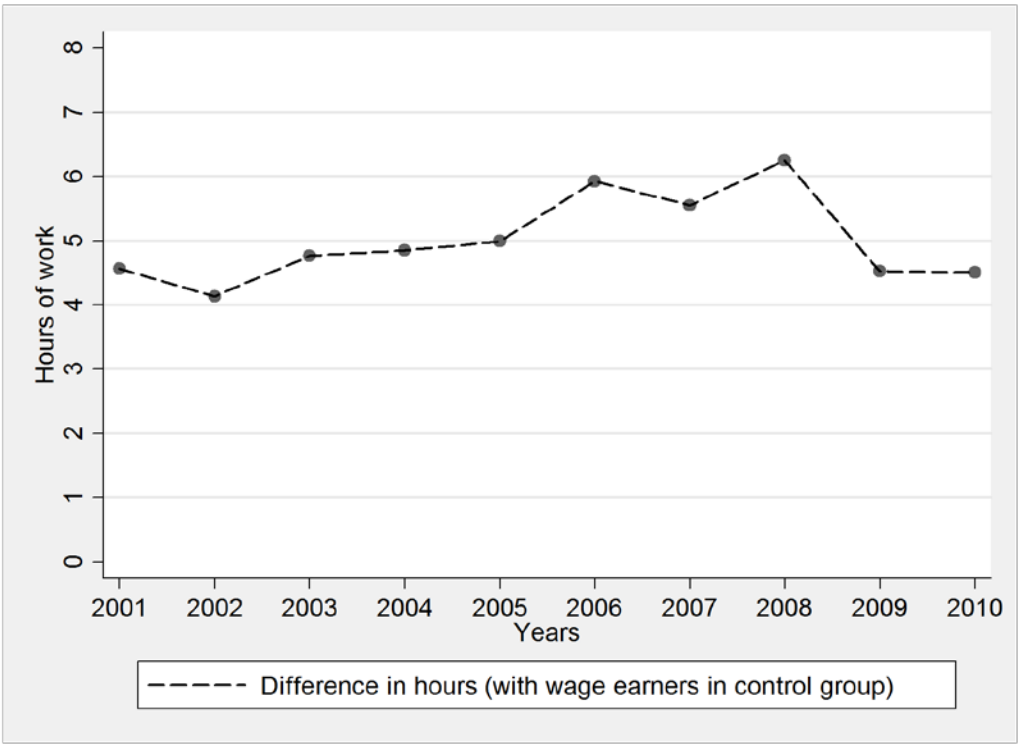

Table A.5. Placebo-test, using comparison of 2001 and 2002 versus 2004 and 2005 in the identification of the response in working hours

	(1) Level	(2) Log	(3) Level, large control group	(4) Log, large control group
Tax treatment	-0.571	-0.015	0.181	0.003
	(0.860)	(0.022)	(0.539)	(0.014)
Treated	0.412	0.012	3.782***	0.087***
	(0.591)	(0.015)	(0.357)	(0.009)
Constant	31.812***	3.460***	38.737***	3.660***
	(5.516)	(0.140)	(1.089)	(0.031)
Elasticity	-0.152	-0.165	0.049	0.031
N	1,763	1,763	30,501	30,501

Additional control variables: age, age squared, dummy variables for male, children, married, Norwegian born, dummies, educational field, length of education, county and years. Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

A.3 Expenditure data

Table A.6. Average income and food consumption, self-employed and wage earners, 2003–2007

	Self-employed		Wage earners		Self-employed individuals
	Income	Food consumption	Income	Food consumption	
	Mean	Mean	Mean	Mean	Number
2003	472,001	49,013	454,463	44,432	99
	(239,176)	(25,259)	(250,193)	(23,896)	
2004	494,889	51,956	484,997	43,204	95
	(220,883)	(24270)	(779,194)	(22,739)	
2005	680,560	52,252	508,431	46,586	77
	(967,065)	(28047)	(478,743)	(25,987)	
2006	542,039	57,406	503,499	47,970	83
	(270,838)	(32358)	(266,367)	(28,095)	
2007	653,805	60,977	550,958	51,493	90
	(440,945)	(41758)	(285,587)	(30,057)	

Standard deviations in parentheses.

Table A.7. Descriptive statistics for control variables used in the estimation of the tax evasion equation

	Self-employed Mean	Wage earners Mean
Male	0.75	0.71
Age	46.8	46.1
Number of children under 7	0.35	0.38
High school	0.52	0.49
Higher education	0.30	0.36
Geographical area:		
South	0.13	0.14
West	0.19	0.17
East	0.30	0.29
North	0.10	0.13
Centre	0.13	0.11

A.4 Organizational shifts

Table A.8. Average income and average net-of-tax rate for business owners who have shifted organizational form, 2001–2010

	1 year difference		2 year difference		3 year difference	
	Reported income	Net-of-tax rates	Reported income	Net-of-tax rates	Reported income	Net-of-tax rates
	Mean	Mean	Mean	Mean	Mean	Mean
2001	-	-	-	-	444,254	0.544
					(450,510)	(0.073)
2002	-	-	446,307	0.553	434,569	0.556
			(444,379)	(0.076)	(361,171)	(0.076)
2003	435,131	0.561	441,696	0.560	460,684	0.557
	(342,879)	(0.076)	(352,901)	(0.077)	(362,801)	(0.077)
2004	475,294	0.557	501,147	0.553	502,460	0.554
	(394,847)	(0.076)	(422,634)	(0.076)	(445,025)	(0.077)
2005	527,857	0.570	537,242	0.568	536,059	0.569
	(454,809)	(0.067)	(577,083)	(0.067)	(574,669)	(0.067)
2006	534,519	0.587	561,280	0.584	565,636	0.583
	(672,008)	(0.051)	(682,917)	(0.051)	(639,809)	(0.051)
2007	617,470	0.576	624,409	0.574	675,159	0.574
	(659,741)	(0.052)	(682,356)	(0.052)	(939,840)	(0.052)
2008	625,217	0.576	676,382	0.574	652,925	0.574
	(616,047)	(0.052)	(689,165)	(0.052)	(571,878)	(0.052)
2009	672,478	0.581	643,848	0.580	638,629	0.579
	(654,334)	(0.053)	(578,687)	(0.053)	(507,689)	(0.053)
2010	640,147	0.579	667,399	0.577	-	-
	(669,822)	(0.052)	(586,281)	(0.052)		
2011	691,551	0.580	-	-	-	-
	(564,110)	(0.053)				

Standard deviations in parentheses.

Table A.9. Summary statistics for business owners who have shifted organizational form

	1 year difference Mean	2 year difference Mean	3 year difference Mean
Male	0.84	0.82	0.82
Age	45.7	44.4	44.0
Children	0.54	0.54	0.56
Married	0.53	0.52	0.54
Birth country	0.93	0.92	0.92
Length of education	Percentage	Percentage	Percentage
No education	0.1	0.1	0.1
Primary school	0.1	0.1	0.1
Secondary school	12.9	12.9	12.4
High school, started	17.3	16.4	17.4
High school, completed	31.4	33.2	33.5
High school, supplement	3.7	3.9	3.7
University, undergrad	20.4	18.8	18.3
University, postgrad	11.9	11.9	11.9
Research degree	0.6	0.5	0.5
Unknown	1.7	2.2	2.0
Educational field			
General	23.1	22.4	21.9
Humanities and arts	4.3	4.2	4.1
Teaching	2.4	2.5	2.5
Social science and law	4.2	3.8	3.7
Business and administration	16.2	14.9	14.9
Science, crafts and technology	31.0	32.7	33.2
Health, social and sports	7.8	8.4	8.7
Agriculture and fishery	4.4	3.7	3.6
Transport, security and services	4.5	4.8	5.0
Unknown	2.3	2.7	2.4

A.5 Tax base shifts

Table A.10. Average income and net-of-tax rate, individuals with high capital income, 2001–2010

	Reported income Mean	Capital income Mean	Net-of-tax rates Mean	Individuals Number
2001	852,065	308,591	0.499	2,060
	(1,079,629)	(1,370,927)	(0.059)	
2002	820,416	401,615	0.506	2,060
	(840,738)	(1,087,694)	(0.066)	
2003	836,990	584,113	0.507	2,060
	(796,559)	(1,480,621)	(0.064)	
2004	982,620	599,099	0.482	2,007
	(842,372)	(2072016)	(0.029)	
2005	1,122,599	702,232	0.522	2,037
	(1,402,704)	(4,026,147)	(0.052)	
2006	1,079,232	249,110	0.549	2,020
	(421,270)	(927,780)	(0.040)	
2007	1,085,802	312,576	0.545	2,038
	(1,380,178)	(1,073,619)	(0.039)	
2008	1,059,292	341,540	0.546	2,060
	(1,041,310)	(1,802,044)	(0.041)	
2009	980,989	229,444	0.549	2,060
	(1,047,123)	(1,047,123)	(0.043)	
2010	1,015,565	419,871	0.550	2,060
	(1,125,656)	(2,334,001)	(0.044)	

Standard deviations in parentheses.

Table A.11. Average income and net-of-tax rate, individuals with high taxable income (surtax base), 2001–2010

	Reported income Mean	Capital income Mean	Net-of-tax rates Mean	Individuals Number
2001	739,011	85,320	0.489	9,787
	(612,401)	(658,599)	(0.044)	
2002	788,113	100,654	0.482	9,787
	(522,742)	(463,077)	(0.033)	
2003	864,755	144,844	0.482	9,787
	(482,658)	(733,068)	(0.033)	
2004	916,140	95,294	0.481	9,761
	(526,157)	(811,522)	(0.033)	
2005	950,512	137,497	0.509	9,762
	(772,833)	(1,793,101)	(0.034)	
2006	960,457	66,185	0.539	9,733
	(832,186)	(478,417)	(0.027)	
2007	1,013,969	91,821	0.534	9,731
	(848,912)	(495,475)	(0.027)	
2008	1,012,546	90,316	0.536	9,787
	(678,156)	(583,147)	(0.052)	
2009	1,000,615	62,706	0.539	9,787
	(608,657)	(499,489)	(0.033)	
2010	1,015,800	154,494	0.540	9,787
	(707,409)	(2,081,587)	(0.035)	

Standard deviations in parentheses.

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