Problematic response margins in the estimation of the elasticity of taxable income

Kristoffer Berg & Thor O. Thoresen

Statistisk sentralbyrå
Statistics Norway

PROBLEMATIC RESPONSE MARGINS IN THE ESTIMATION OF THE ELASTICITY OF TAXABLE INCOME[§]

by Kristoffer Berg* and Thor O. Thoresen**

Abstract

The elasticity of taxable income (ETI) holds the promise of representing 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, since there are response margins that can cause biases in the estimation of the elasticity, this paper warns against neglecting information about the composition of the behavior summarized by the ETI. When using responses of the Norwegian self-employed to the tax reform of 2006 for illustration, we discuss how three different response margins relate to the overall ETI: working hours, tax evasion, and shifts in organizational form. We provide empirical illustrations of effects of each of these margins and argue that the standard procedure for estimating the ETI produces a biased estimate due to the organizational shift margin.

Keywords: elasticity of taxable income, self-employed, tax evasion, organizational shift
JEL codes: H24, H26, H31, J22

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 of the empirical strategy, 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

[§] This work is part of the research carried out at Oslo Fiscal Studies, which is supported by the Research Council of Norway. The authors thank Odd Erik Nygård for providing the consumption data. We have benefited from comments by Wiji Arulampalam, Spencer Bastani, Evelina Gavrilova, Laurence Jacquet, Katharina Jenderny, Andrea Papini, Terje Skjerpen, Stefan Tübbicke, Trine Vattø, and seminar participants of the ETI workshop in Mannheim (August 2015), Skatteforum 2015 (Bergen, September 2015), the Norwegian-German Seminar (Munich, November 2015), the OFS workshop "Self-Employment/Entrepreneurship and Public Policy" (Oslo, September 2016), and the 73rd Annual Congress of the International Institute of Public Finance (Tokyo, August 2017).
* Oslo Fiscal Studies (Department of Economics, University of Oslo), email: kristoffer.berg@econ.uio.no
**Statistics Norway, Oslo Fiscal Studies (Department of Economics, University of Oslo), and CESifo (Munich), email: tot@ssb.no

can be derived by standard econometric tools, obtaining 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).

In the case when private and social costs of changes in the marginal tax rate are equal, the ETI is considered to be 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 the measurement, and the ETI represents a summary measure of tax efficiency costs. One should, however, be cautious in the practical implementation of the approach. 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 arise because the ETI captures valuable activities, as charitable giving, or because it reflects detrimental activities, as tax evasion. Nevertheless, the ETI literature includes contributions on how ETI estimates still can be used to measure tax efficiency effects in the presence of behavioral diversities with different social costs, see Chetty (2009) and Slemrod and Gillitzer (2014).[1]

Further, it is well established that the ETI is a function of the environment from which it is derived, and it is therefore subject to policy control (Slemrod, 1996; Slemrod and Kopczuk, 2002; Giertz, 2009; Fack and Landais, 2016). This means that policy-makers often have a 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.[2]

In the present study we 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. There are well-known econometric challenges concerning the identification of the ETI, given that net-of-tax rate depends on income and therefore is clearly endogenous. Several studies have evidently contributed to how the practitioner still may proceed despite these difficulties, confer Auten and Carroll (1999), Moffitt and Wilhelm (2000), Gruber and Saez (2002), Kopczuk (2005), and Weber (2014). However, here we draw attention to the possibility that response margins cause bias in the estimation of the ETI.

In the following we discuss empirical evidence of three separate response dimensions – working hours, tax evasion, and organizational shifts – arguing that the latter margin likely is a source of bias, given the conventional method to derive ETI estimates. Contributions in the literature have considered measurement problems in estimating effects of reforms originating from changes of

[1] Chetty (2009) differentiates between tax sheltering as transfers to other agents in the economy and real resource costs.

[2] See Doerrenberg, Peichl and Siegloch (2017) on the use of the ETI as a sufficient statistic in the presence of deduction possibilities.

organizational form, see Slemrod (1996; 1998), Gordon and Slemrod (2000) and Saez (2004).[3] Here, we set the potential bias into the perspective of the measurement of the overall ETI. Thus, the main message of the present study is that the behavioral anatomy of the ETI may matter as there are response margins that can 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 the tax reform of 2006 in the identification. The behavior of the self-employed is interesting as it is typically assumed that they have wider scope for behavioral response than the wage earners (Heim, 2010).[4] Although the share of self-employed in proportion to the total workforce is low in Norway, around 7 percent (Parker, 2009; OECD, 2019),[5] their role in the economy receives considerable attention, as illustrated by the considerations in the design of the tax system (which we soon will return too).[6]

Before explaining further why some response dimensions may represent sources of 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,[7] 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 to be absorbed by the agents, it is standard to use a three-year span 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 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, using a two-stage-least-squares (2SLS) procedure.

[3] In the US context, after TRA 1986, one saw that taxpayers moved from Subchapter C, which includes corporate income tax on profits, toward Subchapter S, implying that profits are taxed directly at the individual level (Saez, 2004).

[4] 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 (2010), Kleven and Schultz (2014) and Matikka (2018) for Norway, Sweden, Denmark, and Finland, 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 in the identification.

[5] Some simplified calculations based on income statistics (Statistics Norway, 2014) suggest that approximately 4–5 percent (measured both at the household level and at the individual level) of total (gross) income comes from business income.

[6] Although self-employment rates are higher in many other countries, they have been falling in most countries over time (OECD, 2019).

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

It follows from the standard data selection criteria of the ETI framework that data on the self-employed are established by conditioning on being self-employed in both periods, *t* and *t*+3. This is an innocuous sample selection condition if the tax changes do not induce taxpayers to move out of the personal income tax base. However, several studies, as Slemrod (1995; 1996; 1998), Gordon and Slemrod (2000), Goolsbee (2000), Saez (2004), Thoresen and Alstadsæter (2010), Edmark and Gordon (2013) and Harju and Matikka (2016) advise against ignoring organizational shifts when discussing tax responses.

Moreover, 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, as shown by Thoresen and Alstadsæter (2010). They show that in particular high-income business owners moved out of self-employment and took advantage of the lower taxation of dividend income. 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 increased taxation of dividends and capital gains, the composition of the self-employed in the data used to estimate the ETI is likely influenced by the reform. In other words, as high-income taxpayers were overrepresented among those who shifted out of self-employment prior to the reform (Thoresen and Alstadsæter, 2010), and as the reform reversed these incentives, we get a non-random change in the treatment group because of self-selection – a case of incidental truncation. If not adequate measures are taken, we are in danger of erroneously attributing increases in income to standard income responses to lower marginal tax rates, whereas it is a sample selection effect and therefore should be characterized as a source of bias in the estimation of the ETI.

We are able to investigate effects of organizational shifts on the ETI because of the richness in the data we have available. 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 from an unbalanced panel of self-employed over the period from 2001 to 2010 are used in the 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 has moved out of self-employment to be an employee and shareholder in the same firm. We consider a difference in the patterns of these movements from the pre-reform to the post-reform period as corroborative evidence of a measurement problem in the estimation of the ETI, expected to cause biased estimation results.

In contrast, a change in working hours represents a conventional component of the ETI and causes no bias. We estimate a working hours tax elasticity by employing repeated cross-sectional data, derived from the Labour Force Surveys. Correspondingly, we categorize tax evasion as a standard component of the ETI, and 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, using consumption and income data in combination.

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 reform of 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 tax reform of 1992. Thus, as the system involves separate rate schedules for different income components, there are certainly incentives for a variety of behavioral effects when reforming the system, as in the 2006-reform.

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 involved a system for mitigating corporate double taxation of dividends which effectively eliminated the personal dividend tax. The capital gain tax system exempted gains attributable to retained earnings taxed at the corporate level. Given the low flat tax rate on 28 percent on capital and corporate income and an additional progressive schedule on high labor income, there were 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:[8] the split model involved rules for dividing business income into capital and labor income by imputing a return to business assets and attributing the residual income to labor. 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

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

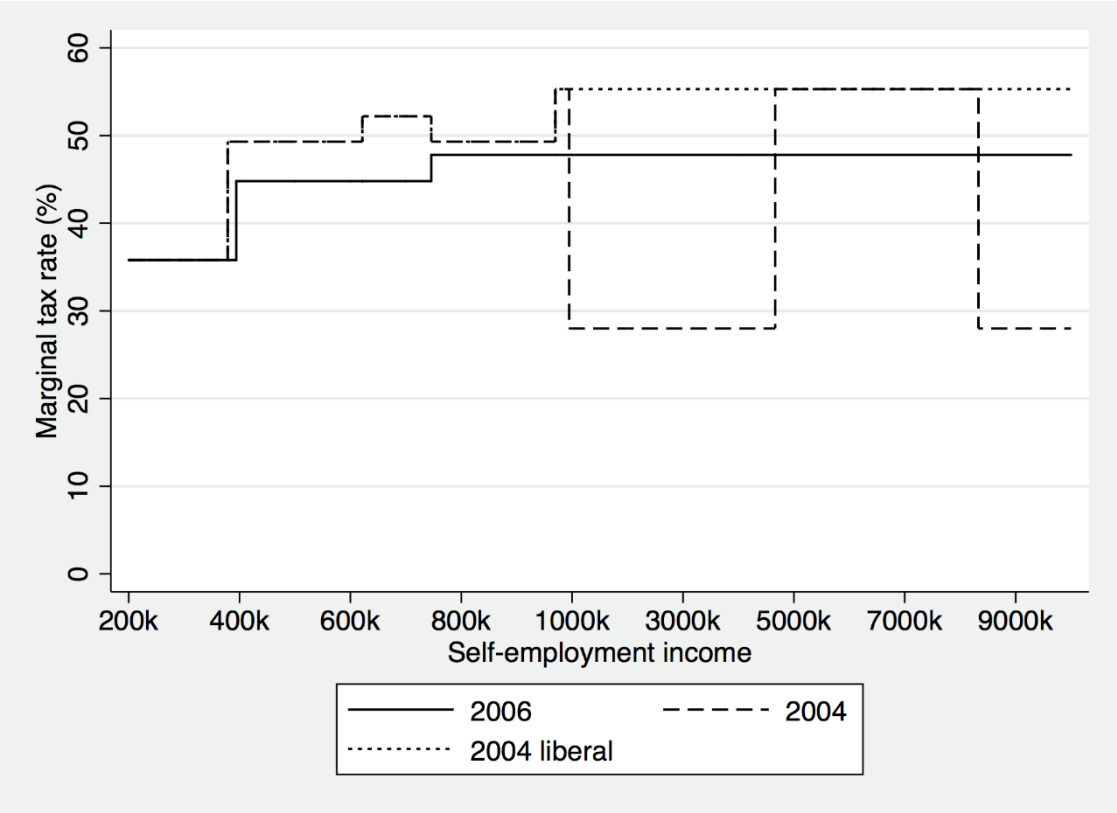
(the last year before the reform) in Figure 1, with 55.3 percent at the maximum.[9] Thus, as the self-employment labor income, for large income intervals, was taxed by more than 50 percent at the margin, a substantial number of taxpayers moved out of the "split model" and established their firm under an incorporated form, to take advantage of the lower tax on dividends and capital gains (Thoresen and Alstadsæter, 2010). Recall that it is the reduced incentives to incorporate after the 2006-reform, which in the present study is expected to create bias in the estimation of the ETI.

The 1990s saw increasing pressure on the dual income tax system, resulting in numerous "patches".[10] For example, a distinction in the tax treatment between liberal professions (lawyers, dentists, doctors and other independent contractors delivering services to the public) and other professions was introduced, and kept as part of the tax schedule until the split model was eliminated in 2004.[11] In Figure 1, which describes schedules before and after the reform, the remarkable system for non-liberal professions prior to the reform in 2006 is also described.[12] Note that 2005 is not treated as a pre-reform year, as the tax reform was phased in that year.

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 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 the wage part, see Figure 1. This tax cut represents an increase in the net-of-tax rate for most taxpayers and is the tax change we use to derive ETI estimates for the self-employed here. Business income from a sole proprietorship activity in excess of the risk-free return allowance, calculated on the invested capital, is taxed as imputed wage income. The other initiative to curb the incentives to shift income comes from increases in the taxation of dividends and capital gains. The combination of the corporate tax and the personal capital income tax means that dividends and capital gains are taxed at 48.2 percent at the maximum after the reform in 2006, above a rate-of-return allowance, that is, on profits above a risk-free rate of return.[13]

[9] Use 1$ = 6.42 Norwegian kroner (NOK) and 1€ = 8.05 NOK to convert to US dollars and Euros.
[10] Christiansen (2004) sees this as resulting from political games motivated in part by the concerns of politicians of various colors with special interest groups.
[11] This particular schedule represents a separate opportunity for identification of response to tax changes, but, as seen in the figure, it only applies to very large incomes.
[12] In 2000 the share of the self-employed belonging to the liberal profession was 42 percent (Ministry of Finance, 2003).
[13] Thus, this is a clear example of policy-makers having access to several tools in the tax optimization – recall that the ETI in this perspective can be seen as controlled by the policy-makers (Slemrod and Kopczuk, 2002).

Figure 1. Marginal tax rates for the self-employed in 2004 (liberal and non-liberal businesses) and 2006



Note: There is a break in the horizontal axis at 1,000,000 NOK (1 mill. NOK ≈ $ 156,000, ≈ € 124,000, in 2006). The "liberal" professions include lawyers, dentists, doctors and other similar professions.

3. Problematic responses?

3.1 Estimation of the overall ETI

In this section, we discuss to what extent various response margins reflected in the overall ETI represent sources of estimation bias, or if they can be seen as 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 4) 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), Kopczuk (2005) and Weber (2014).[14] Recall that

[14] Note that there is another acronym too: Goolsbee (1999) refers to studies in this field as belonging to the "New Tax Responsiveness" (NTR) literature.

in the estimation of the elasticity, $e = \frac{1-\tau}{x}\frac{\delta x}{\delta(1-\tau)}$ (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. Using three-year differences, the estimated equation can be specified as

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

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. β and ρ are parameters, whereas θ and η are vectors of parameters and the error term, ε_{it}, is assumed to be independently and identically distributed.

As already noted, 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, see Equation (3.1).

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 mean reversion and (exogeneous) developments in the income distribution, while Kopczuk (2005) suggests including splines in the lagged base year income and in the deviation of lagged base year income from base year income to separately estimate the mean reversion and exogenous trend components. These approaches can be seen as

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

in the Gruber and Saez specification, and

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

in the Kopczuk version. It follows that μ, ϕ and π are vectors of parameters.

Finally, Weber (2014) criticizes the use of first-year income as basis for the instrument,[15] and suggests using higher lags of base year income instead. The main argument is that an instrument constructed from the appropriate lag is orthogonal to the error term, which in turn renders the mean reversion control superfluous. Consequently, we show estimation results for a version where $\log\left(\frac{1-\tau_{i,t+3}}{1-\tau_{it}}\right)$ is instrumented by income of the year preceding the base year. In addition to estimations results of the latter specification, in Section 4, we shall present ETI estimates based on equations (3.1), (3.2), and (3.3), using 2SLS and 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. As we soon will return to, we shall use data for the period 2001–2010 in the estimation, thus employing observations from outside the reform period too. But in terms of the conventional ETI framework, when the last pre-reform year (2004) is used to establish the tax change variable, consistent estimation of the ETI relies on the people experiencing no or small changes in net-of-tax rates, in the present case mostly taxpayers with low and median income, representing a valid control group for the main targets of the reform.

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

3.2 Working hours response

Let us start with what we believe is a less problematic response margin – the response in working hours. To obtain empirical evidence about this response margin is usually challenging. Scarcity of data sets with a panel dimension on working hours partly explains why we see fewer studies (along the same lines as described here) with changes in working hours as the dependent variable.[16]

[15] Blomquist and Selin (2010) also address this problem.

[16] An important reason for income being the preferred measure is that it reflects the overall efficiency costs of taxation, as made clear by Feldstein (1995; 1999).

However, cross-sectional data can also 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 elasticity estimate, $e_h = \frac{1-\tau}{h}\frac{\delta h}{\delta(1-\tau)}$, derived from repeated cross-sections. Given that we have access to information about working hours through cross-sectional data (2001–2010), the identification strategy relies on assigning individuals to the treatment and control groups, exploiting that all observations in the repeated cross-sections are linked to the panel income data. An instrument (grouping variable) for the net-of-tax rate change is obtained to predict the net-of-tax rate in a first stage of a 2SLS regression. This is done by letting pre-reform income, income over the period 2002–2004, be taxed by the tax-laws of 2004 and 2007, obtaining a dummy variable, D_i, that differentiates between taxpayers exposed to an increase in the net-of-tax rate or not. When also introducing a dummy variable for the post reform period, Q_t, the variable $D_i Q_t$ is the excluded variable in the first stage. This means that we essentially estimate a cross-sectional difference-in-differences model. The main regression can be seen as

$$\log h_{it} = \alpha + \lambda_t + \gamma D_i + \delta(1-\tau_{it}) + B_i'\theta + M_{it}'\eta + \omega_{it}, \tag{3.4}$$

where h_{it} is working hours for individual i in the cross-section at time t, and $(1-\tau_{it})$ is the variable predicted by the first stage. α is a constant and λ_t symbolizes calendar year. As for the estimation of the overall ETI (see Section 3.1), 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. It follows that the identification of the effect of net-of-tax rate on working hours benefit from the tax treatment variable being detached from the dependent variable.[17]

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. The self-employed are known to be disproportionately more involved in tax evasion than wage earners, which have lead Heim (2010) to distinguish between an income reporting effect and real effects in the discussion of the ETI for the self-employed. In fact, in many studies the identification of the tax evasion component relies on wage earners not evading tax, while the self-employed do. But are there reasons to caution against tax evasion dimension in terms of estimation inconsistency? We

[17] There are likely mean reversion effects in work, as people have temporarily high income in the year used to measure the change in the net-of-tax rate due to the reform (in 2004), because they have high working hours. But such effects are expected to be equally present pre- and post-reform and should therefore not bias estimates.

argue that the tax evasion response does not represent a source of bias. In the following we show how we identify this component of the ETI.

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,[18] 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 reasoning in the self-employment ETI literature (Heim, 2010; Doerrenberg and Duncan, 2014) is based on 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 a reduction in the marginal tax rate.[19] We obtain an estimate of the tax evasion component by addressing estimates of tax evasion before and after the 2006-reform, using the so-called expenditure approach (Pissarides and Weber, 1989). This method 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 household income.[20] A standard assumption is that underreporting takes place at a constant fraction, such that $Y_h^* = kY_h$, where Y_h is the reported income, and there is underreporting if $k > 1$. Here, as in Engström and Holmlund (2009), the following reduced form specification is employed,[21]

[18] 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.

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

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

[21] 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 (2019).

$$\log C_h = Z_h'\psi + \mu \log Y_h + \kappa SE_h + u_h, \tag{3.5}$$

where SE_h is a dummy for being self-employed and u_h is the error term. 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 tax evasion component of the ETI.

3.4 Organizational shifts generate measurement problem

Now, we direct attention to how we obtain information about a dimension that potentially imposes bias in the estimation of the ETI, namely organizational shifts. As already discussed in the Introduction, we expect that the panel data of the self-employed reflect that individuals likely have responded to the tax changes by changing their incorporation decision. 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 the 2006-reform substantially reduced incentives to incorporate, a different set of business owners remain in the self-employment data sample after the reform (compared to counterfactual, with no changes in incorporation incentives).[22] We interpret the evidence presented in Papini (2018) in support of this, as he finds clear effects of tax induced organizational shifts after the 2006-reform, when using the differentiated payroll tax schedule of Norway in the identification. Then, the sample attrition is a result of non-random self-selection, or incidental truncation, and the organizational shift response margin is a source of bias in the identification of the ETI. This effect has been addressed in several studies from the U.S. 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. as it gave substantial reductions in the top marginal tax rate, numerous shifts of business income from so-called C corporations to so-called S corporations are reported (Slemrod, 1996; Saez, 2004; Gordon and Slemrod, 2000).[23] Here, we go further and relate our findings explicitly to the measurement of the overall ETI.

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, individuals are linked to companies, in terms of ownership, employment and transfers of dividends. In turn, these data are used to distinguish between

[22] One may employ a balanced panel of self-employed individuals for the whole time period 2001–2010 in the empirical investigation, but this would not eliminate the bias from sample selection.

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

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 business as an incorporated firm.

In practice, we measure the effects of changes in the patterns of organizational shifts by introducing weights in the calculation of the ETI, where the weights are derived from an estimation of the probability to leave self-employment. We employ inverse probability weighting, which is an alternative to the Heckman approach for handling nonrandom selection, see Wooldridge (2002; 2010). Thus, we estimate a Probit model for incorporation, letting it be explained by marginal tax rates faced by the individual (as self-employed), wage income, capital income and other observable characteristics (as education, gender, birth country, etc.). The probability of incorporation can be seen as,

$$s_{it} = a_t + \xi\tau_{it} + \rho Q_t\tau_{it} + \zeta\tau_{it-1} + \sigma w_{it-1} + \chi c_{it-1} + Z'_{it}\varphi + \upsilon_{it}, \tag{3.6}$$

where s_{it} is a dummy for shifting to an incorporated business in year t, α_t is the time specific effect, τ_{it} and τ_{it-1} are the income tax rates faced by the self-employed in year t and $t-1$, respectively, Q_t is a dummy variable for the after-reform period, which is interacted with τ_{it} to allow for the effects of the income tax to differ before and after the tax-reform. Further, w_{it-1} and c_{it-1} are wage income and capital income in year $t-1$, respectively, Z'_{it} is a group of other potential predictors of shifting, including gender, age, education, county and birth country. υ_{it} is the error term and ξ, ρ, ς, σ, χ, and φ are parameters.

The consistency of the inverse probability weighting estimation hinges on the variables included in the shifting equation predicting shifting sufficiently well, such that conditional on these variables, shifting is independent of the unobservables affecting the tax response in Equation 3.1. We cannot be fully confident that this assumption holds in the present context, but, nevertheless, use our estimates for the empirical illustration of the impact of the organizational choice dimension without further qualification. Wooldridge (2002; 2010) provide more details on the assumptions required for consistency of this technique.

4. The overall ETI and its components

4.1 The ETI of the Norwegian self-employed

As already noted, 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.[24] 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.[25]

In the present study, we benefit from having access to large administrative data sets, close to 60,000 self-employed each year, based on information from income tax returns (Statistics Norway, 2005) and other administrative registers. Self-employment is defined by conditioning on both self-employment income being higher than wage income and yearly income being larger two "basic amounts", where the basic amount is a concept of the Norwegian Social Insurance Scheme, corresponding to 62,161 NOK in 2006 ($9,700; €7,700).[26] 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. Thus, there is no clearly identified control group of this analysis, also because the identification relies on differential tax changes for the treated taxpayers.

The main issue 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.

Table 1 presents estimation results for four different specifications – the first three, columns (1)–(3), corresponding to equations (3.1)–(3.3), see Section 3. Recall that we also estimate the model when defining the tax change instrument based on period $t-1$ income, as suggested by Weber (2014), see Column (4).[27] The table demonstrates that results to some extent are sensitive with

[24] 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.

[25] Of course, one should not necessarily find similar response estimates across countries and across studies. One obvious source of 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, one should take a closer look at explanations in the future. See also Kleven (2014).

[26] Also, those with higher negative self-employment income than other types of income are included amongst the self-employed.

[27] Note that the specification behind the results of Column (4) also includes a mean reversion control, to control for possible heterogeneity in income developments across groups. Note also that in the preferred specification of Weber (2104), the instrument was based on 2-, 3- and 4-year lags, whereas a 1-year lag is used here.

respect to the mean reversion control technique used. However, all estimates point to relatively small effects, in the range from 0.10 to 0.17. 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. We use findings of Thoresen and Vattø (2015) as evidence for the tax responsiveness of Norwegian wage earners (for the tax same tax reform) – their main ETI estimate for wage earners is 0.06.

Table 1. ETI estimation results

	(1)	(2)	(3)	(4)
Net-of-tax rate	0.126***	0.103***	0.169***	0.173***
	(0.017)	(0.018)	(0.018)	(0.015)
Age	0.010***	0.009***	0.006***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Male	0.085***	0.080***	0.062***	0.060***
	(0.001)	(0.002)	(0.003)	(0.003)
Children	0.019***	0.018***	0.017***	0.017***
	(0.002)	(0.002)	(0.002)	(0.002)
Married	0.015***	0.014***	0.016***	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)
Norwegian born	0.023***	0.021***	0.016***	0.016***
	(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	X
Number of observations	406,375	406,375	347,196	337,329

Note: Estimation based on instrumental variable estimation (using 2SLS), with three-year differences, corresponding to equation 3.1, 3.2 and 3.3. In Column (4) the instrument is based on lagged income (period $t-1$), as suggested by Weber (2014). Additional control variables in all regressions: age squared, 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

4.2 Estimation results for working hours

As explained in Section 3.2, due to constraints in the access to information about hours of work for the self-employed, estimates of this response component is 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 overall ETI.

Recall that estimates of responses in working hours are obtained by using an instrument for the net-of-tax rate based on dividing the sample into treatment and control groups.[28] The relation is estimated using data for three pre- and post-reform years, 2002–2004 and 2007–2009. In one of the

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

specifications we also include wage earners (who experience 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.2. Both figures provide some support for a common trend prior to the reform and some increases in the hours of work among the treated after the reform, but the the graphical evidence is unclear.[29]

Table 2. Estimation results for working hours and net-of-tax rate regression

	(1) Small control group (self-employed)	(2) Large control group
Net-of-tax rate	0.198	0.234*
	(0.193)	(0.131)
Treated	0.038	0.126***
	(0.024)	(0.017)
Constant	3.445***	3.687***
	(0.114)	(0.057)
Age	0.009**	-1.10×10^{-3}
	(0.004)	(0.001)
Male	0.160***	0.103***
	(0.012)	(0.004)
Number of children	-0.023**	-0.017***
	(0.010)	(0.002)
Married	-0.001	-0.015***
	(0.009)	(0.002)
Norwegian born	0.048**	0.011***
	(0.020)	(0.003)
Number of obs.	3,664	64,900

Note: Estimation based on difference-in-differences technique, see equation 3.4. Additional control variables: age squared, 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

Table 2 presents response estimates for the two alternative specifications, dependent on the definition of the control group. As explained in Section 3.2, δ in Equation (3.4) is the working hours elasticity estimates that we compare to the overall ETI. The estimated response ranges from 0.20 to 0.23, but only the tax treatment estimate in column (2) is significantly different from zero. In other words, only when adding wage earners to the control group do 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 (1), is almost identical to this estimate.

The lack of clear identified effects on working hours denies us from making any strong statements about the relationship between the hours of work elasticity and the overall ETI. However, we note that the point estimates for working hours are close to the overall ETI estimates, suggesting that a large part of the ETI reflects hours of work adjustments to the tax changes.

[29] We may conjecture that the reform is too small to see very strong effects by visual inspection. See also Chetty (2012) on how adjustment frictions and the size of the reform may influence elasticity estimates.

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.[30] 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 reduction in k when moving from the pre-reform to the post-reform tax schedule.[31] Note that the difference in the estimate of *k* is not significant, even though we observe a clear reduction in the self-employment parameter estimate.[32] 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, which is approximately ¼ of the overall ETI estimate. 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 multiplying and dividing with the (calculated) tax evasion and income reported before the reform, respectively.

This suggests that the tax evasion response is smaller than the working hours response, but again, as the reduction in tax evasion is not statistically significant, one should be cautious in putting too much emphasis on the estimate of the tax evasion component. However, we find it believable that the tax evasion represents a positive component of the ETI, when the estimation of the ETI is obtained from a reduction in tax.

[30] 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.
[31] 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 done in Nygård, Slemrod and Thoresen (2019).
[32] We use the delta method to calculate standard errors for k, based on parameter estimates of κ and μ.

Table 3. Estimation results for parameters used to calculate 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)
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**
Number of observations	2,221	2,041

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

4.4 Implications of organizational shifts

Recall that, in contrast to responses in working hours and in terms of changes in tax evasion, we assert that organizational shifts represent a source of bias in the estimation of the ETI.[33] 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 data set, 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, thereby representing a source of estimation bias.

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. Table 4 presents the number of self-employed in year t who in year $t+3$ run an incorporated business.[34] The definition of self-employed in year t is the same as in the ETI estimation. The taxpayer is included among those who

[33] See Papini (2018) for a more thorough analysis of effects of the tax reform of 2006 on organizational shifts.
[34] Three-year shifts allow us to estimate inverse probability weights for all years 2001–2010.

have shifted organizational form if, conditional on being assigned to self-employment in year t, is observed in year $t + 3$ with ownership to more than 50 percent of the shares in an incorporated business, in combination with higher wage income or shareholder income than self-employment income. 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*+3, 2001–2010

T	Number	Percent of self-employed
2001	1,784	2.06
2002	1,845	2.06
2003	2,416	2.83
2004	2,913	3.17
2005	3,257	3.43
2006	2,415	2.61
2007	2,162	2.34
2008	1,993	2.24
2009	2,469	2.82
2010	2,198	2.55

As expected, the figures of Table 4 show that there are large yearly changes in the incorporation rates. As explained in section 3.4, to illustrate to what extent the estimates of the ETI are biased, we obtain estimates of the ETI when accounting for weights, where the weights are derived from an estimation of the probability to leave self-employment, see Equation (3.6). Results for both OLS and Probit estimations are shown in Table 5. We see that higher income tax rate as self-employed is associated with a higher probability of incorporating. Further, we also observe there is a separate effect on taxation of the self-employed after the reform.

Table 5. Estimation results for organizational shift probability model

	OLS	Probit
Self-employed tax rates	0.108***	2.074***
	(0.005)	(0.084)
Self-employed tax rates in *t-1*	0.117***	2.101***
	(0.004)	(0.748)
Post- v. pre-reform self-employment tax rates	0.059***	1.131***
	(0.007)	(0.123)
Capital income in *t-1*	7.76×10^{-10}	5.49×10^{-9}
	(5.61×10^{-10})	(4.35×10^{-9})
Wage income in *t-1*	4.05×10^{-8}***	3.83×10^{-7}***
	(4.00×10^{-9})	(5.04×10^{-8})
Number of observations	432,357	432,357

Note. Other variables included in the regression, but not shown in the table are: age, year dummies, dummies for educational level and educational field, male, marriage, children and Norwegian born.
* p<0.10, ** p<0.05, *** p<0.01

Next, we use the estimated probabilities from this model to reweight the sample by inverse probability weighting to estimate a "shift-robust" ETI. By correcting for the selection bias by inverse probability weighting, our estimates are informative about the tax response without shifting effects. The results of these estimations are presented in Table 6. We see that the estimated ETI is lower for

all specifications when accounting for the weights reflecting probabilities for incorporation. Although, the difference between the unweighted and the weighted estimates are small, the difference in the Weber-specification is significant at the 10 percent level (according to a simple *t*-test). As the selection model is simple, this represent corroborative evidence of the ETI being smaller when accounting for the change in shift incentives. We therefore conclude that the ETI estimates of Table 1 likely are biased upward due to organizational shift patterns.

Table 6. Estimates of the ETI, unweighted and weighted by inverse probabilities of incorporation

	Unweighted (as in Table 1)			Weighted		
	Gruber/Saez mean reversion	Kopczuk mean reversion	Weber instr./Kopczuk mean revers.	Gruber/Saez mean reversion	Kopczuk mean reversion	Weber instr./Kopczuk mean revers.
Net-of-tax rate	0.103***	0.169*	0.173***	0.096*	0.139***	0.124***
	(0.018)	(0.018)	(0.015)	(0.025)	(0.025)	(0.021)
Number of observations	405,152	345,441	335,906	406,375	347,196	337,329

Note: See Section 3 for further details behind the different specifications. The weighted estimations account for the fact that the weights are estimated.
* p<0.10, ** p<0.05, *** p<0.01

5. Conclusion

The sufficient statistic interpretation of the ETI has received a lot of attention in applied public finance. 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 some responses can create biases in the estimation of the ETI. 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, providing empirical estimates of margins assumed to be standard components of the ETI and a dimension, organizational shift, which we expect to cause problems.

The ETI estimates for the self-employed obtained here are relatively small, in the range from 0.10 to 0.17, 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, our estimates suggest that effects on working hours is the dominant response margin summarized by the ETI, but we also attribute some of the overall tax response to tax evasion, for the latter effect obtaining evidence in support of tax evasion increasing in the marginal tax rate.

However, the main message of the present study is that such estimates are in danger of being misleading if not controlling for confounding factors in the identification of the ETI. We see large changes in incentives for incorporation after the 2006-reform, and thereby in the composition of the self-employed, which we argue represents a source of upward bias in the ETI. When we derive weights for the probability to change organizational form and exploit these weights in the estimation

of the ETI, we find lower ETI estimates. For example, according to one of the specifications, we see a reduction in the ETI estimate from 0.17 to 0.12 after the changed shifting patterns have been controlled for. Thus, this suggests a sizable bias in the naïve ETI estimation.

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. We have illustrated that some behavioral margins are more problematic than others, which suggests that one should carefully investigate which responses are involved. 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 addressing problematic response margins.

References

Aarbu, Karl O., Thor O. Thoresen (2001). "Income Responses to Tax Changes – Evidence from the Norwegian Tax Reform", *National Tax Journal*, 54(2), 319–338.

Allingham, Michael, Agnar Sandmo (1972). "Income Tax Evasion: A Theoretical Analysis", *Journal of Public Economics*, 1, 323–338.

Aukrust, Inge, Per Aurdal, Magne Bråthen, Tonje Køber (2010). "Registerbasert sysselsettingsstatistikk. Dokumentasjon", Notater 8/2010, Statistics Norway.

Auten, Gerald, Robert Carroll (1999). "The Effect of Income Taxes on Household Income", *Review of Economics and Statistics*, 81(4), 681–693.

Bastani, Spencer, Håkan Selin (2014). "Bunching and Non-Bunching at Kink Points of the Swedish Tax Schedule", *Journal of Public Economics*, 109, 36–49.

Blomquist, Søren, Håkan Selin (2010). "Hourly Wage Rate and Taxable Labor Income Responsiveness to Changes in Marginal Tax Rates", *Journal of Public Economics*, 94, 878–889.

Blow, Laura, Ian Preston (2002). "Deadweight Loss and Taxation of Earned Income: Evidence from Tax Records of the UK Self-Employed", Institute for Fiscal Studies Working Paper WP 02/15.

Chetty, Raj (2009). "Is the Taxable Income Elasticity Sufficient to Calculate Deadweight Loss? The Implications of Evasion and Avoidance", *American Economic Journal: Economic Policy*, 1(2), 31–52.

Chetty, Raj (2012). "Bounds on Elasticities with Optimization Frictions: A Synthesis of Micro and Macro Evidence on Labor Supply", *Econometrica*, 80(3), 969–1018.

Christansen, Vidar (2004). "Norwegian Income Tax Reforms", *CESifo DICE Report* 3/2004, 9–14.

Christansen, Vidar, Matti Tuomala (2008). "On Taxing Capital Income with Income Shifting", *International Tax and Public Finance*, 15(4), 527–545.

Clotfelter, Charles T. (1983). "Tax Evasion and Tax Rates: An Analysis of Individual Returns", *Review of Economics and Statistics*, 65(3), 363–373.

Doerrenberg, Philipp, Denvil Duncan (2014). "Experimental Evidence on the Relationship between Tax Evasion Opportunities and Labor Supply", *European Economic Review*, 68(May), 48–70.

Doerrenberg, Philipp, Andreas Peichl, Sebastian Siegloch (2017). "The Elasticity of Taxable Income in the Presence of Deduction Possibilities", *Journal of Public Economics*, 151, 41–55.

Edmark, Karin, Roger H. Gordon (2013). "The Choice of Organizational form by Closely-Held Firms in Sweden: Tax versus non-Tax Determinants", *Industrial and Corporate Change*, 22(1), 219–243

Engström, Per, Bertil Holmlund (2009). "Tax Evasion and Self-Employment in a High-Tax Country: Evidence from Sweden", *Applied Economics*, 41(19), 2419–2430.

Fack, Gabrielle, Camille Landais (2016). "The Effect of Tax Enforcement on Tax Elasticities: Evidence from Charitable Contributions in France", *Journal of Public Economics*, 133, 23–40.

Feldstein, Martin (1995). "The Effect of Marginal Tax Rates on Taxable Income: A Panel Study of the 1986 Tax Reform Act", *Journal of Political Economy*, 103(3), 551–572.

Feldstein, Martin (1999). "Tax Avoidance and the Deadweight Loss of the Income Tax", *Review of Economics and Statistics*, 81(4), 674–680.

Freire-Serén, María J., Judith Panadés (2013). "Do Higher Tax Rates Encourage/Discourage Tax Compliance?" *Modern Economy*, 4, 809–817.

Giertz, Seth H. 2009. "The Elasticity of Taxable Income: Influences on Economic Efficiency and Tax Revenues, and Implications for Tax Policy". In Alan D. Viard (Ed.), *Tax Policy Lessons from the 2000s*, AEI Press, 101–36.

Goolsbee, Austan (1999). "Evidence on the High–Income Laffer Curve from Six Decades of Tax Reforms", *Brookings Papers on Economic Activity* No. 2 (1999), 1–47.

Goolsbee, Austan (2000). "What Happens when You Tax the Rich? Evidence from Executive Compensation", *Journal of Political Economy*, 108(2), 352–378.

Gordon, Roger H., Joel B. Slemrod (2000). "Are 'Real' Responses to Taxes Simply Income Shifting Between Corporate and Personal Tax Bases?" In Joel Slemrod (Ed.), *Does Atlas Shrug? The Economic Consequences of Taxing the Rich,* Harvard University Press, 240–281.

Gorodnichenko, Yuriy, Jorge Martinez-Vazquez, Klara S. Peter (2009). "Myth and reality of flat tax reform: micro estimates of tax evasion response and welfare effects in Russia", *Journal of Political Economy*, 117(3), 504–554.

Gruber, Jon, Emmanuel Saez (2002). "The Elasticity of Taxable Income: Evidence and Implications", *Journal of Public Economics*, 84(1), 1–32.

Hansson, Ann-Kristin (2007). "Bedrifts- og foretaksregisteret. Regler og rutiner for ajourhold av Bof", Notater 2/2007, Statistics Norway (in Norwegian).

Harju, Jarkko, Tuomas Matikka (2014). "The Elasticity of Taxable Income and Income-Shifting: What is "Real" and What is Not?", *International Tax and Public Finance*, 23(4), 640–669.

Heim, Bradley T. (2010). "The Responsiveness of Self-Employment Income to Tax Rate Changes", *Labour Economics*, 17(6), 940–950.

Holmøy, Aina, Magnar Lillegård (2014). "Forbruksundersøkelsen 2012. Dokumentasjonsrapport". Notater 2014/17. Statistics Norway (in Norwegian).

Joulfaian, David, Mark Rider (1998). "Differential Taxation and Tax Evasion by Small Business", *National Tax Journal*, 51(4), 675–687.

Kleven, Henrik J. (2014). "How can Scandinavians Tax So Much?" *Journal of Economic Perspectives*, 28(4), 77–98.

Kleven, Henrik J., Martin B. Knudsen, Claus T. Kreiner, Søren Pedersen, Emmanuel Saez (2011). "Unwilling or Unable to Cheat? Evidence from a Tax Audit Experiment in Denmark", *Econometrica*, 79(3), 651–692.

Kleven, Henrik J., Esben A. Schultz (2014). "Estimating Taxable Income Responses Using Danish Tax Reforms", *American Economic Journal: Economic Policy*, 6(4), 271–301.

Kopczuk, Wojciech (2005). "Tax Bases, Tax Rates and the Elasticity of Reported Income", *Journal of Public Economics*, 89, 2093–2119.

Kuka, Elira (2014). "EITC and the Self-Employed: Real Effects or Reporting Effects?", *Public Finance Review*, 42(6), 691–719.

le Maire, Daniel, Bertel Scherning (2013). "Tax Bunching, Income Shifting and Self-Employment", *Journal of Public Economics*, 107, 1–18.

Lindsey, Lawrence B. (1987). "Individual Taxpayer Responses to Tax Cuts: 1982-1984: With Implications for the Revenue Maximizing Tax Rate", *Journal of Public Economics* 33(2), 173–206.

Matikka, Tuomas (2018). "Elasticity of Taxable Income. Evidence from Changes in Municipal Income Tax Rates in Finland", *The Scandinavian Journal of Economics*, 120(3), 271–301.

Ministry of Finance (2003). Skatteutvalget. Norges offentlige utredninger 2003:9 (in Norwegian).

Moffitt, Robert A., Mark O. Wilhelm (2000). "Taxation and Labor Supply Decisions of the Affluent". In J. Slemrod (Ed.), *Does Atlas Shrug? The Economic Consequences of Taxing the Rich*, Russell Sage Foundation, 93–234.

Nygård, Odd E., Joel Slemrod, Thor O. Thoresen (2019). "Distributional Implication of Joint Tax Evasion", *The Economic Journal*, 129 (620), 1894–1923.

OECD (2019). Self-employment rate (indicator). https://www.oecd-ilibrary.org/employment/self-employment-rate/indicator/english_fb58715e-en

Papini, Andrea (2018). "Tax Incentives and Choice of Organisational Form of Small Businesses. Identification Through a Differentiated Payroll Tax Schedule". Manuscript, University of Oslo.

Parker, Simon C. (2009). *The Economics of Entrepreneurship*, Cambridge University Press.

Pissarides, Christopher A., Guglielmo Weber (1989). "An Expenditure-Based Estimate of Britain's Black Economy", *Journal of Public Economics*, 39, 17–32.

Saez, Emmanuel (2001). "Using Elasticities to Derive Optimal Income Tax Rates", *Review of Economic Studies*, 68(1), 205–229.

Saez, Emmanuel (2004). "Reported Incomes and Marginal Tax Rates, 1960–2000: Evidence and Policy Implications". In James M. Poterba (Ed.), *Tax Policy and the Economy*, Vol. 18, MIT Press, 117–74.

Saez, Emmanuel (2010). "Do Taxpayers Bunch at Kink Points?", *American Economic Journal: Economic Policy*, 2(3), 180–212.

Saez, Emmanuel, Joel Slemrod, Seth H. Giertz (2012). "The Elasticity of Taxable Income with Respect to Marginal Tax Rates: A Critical Review", *Journal of Economic Literature*, 50(1), 3–50.

Slemrod, Joel (1995). "Income Creation or Income Shifting? Behavioral Responses to the Tax Reform Act of 1986", *American Economic Review: Papers & Proceedings*, 85(2), 175–180.

Slemrod, Joel (1996). "High-Income Families and the Tax Changes of the 1980s: The Anatomy of Behavioral Response". In Martin Feldstein and James Poterba (Eds.), *Empirical Foundations of Household Taxation*, University of Chicago Press, 169–192.

Slemrod, Joel (1998). "Methodological Issues in the Measuring and Interpreting Taxable Income Elasticities", *National Tax Journal*, 51(4), 773–788.

Slemrod, Joel, Christian Gillitzer (2014). *Tax Systems*, MIT Press.

Slemrod, Joel, Wojciech Kopczuk (2002). "The Optimal Elasticity of Taxable Income", *Journal of Public Economics*, 84(1), 91–112.

Statistics Norway (2003). "Labour Force Survey 2001", *Official Statistics of Norway.*

Statistics Norway (2005). "Income Statistics for Persons and Families 2002–2003", *Official Statistics of Norway.*

Statistics Norway (2014). http://www.ssb.no/en/inntekt-ogforbruk/statistikker/i_us/aar/2014-12-17?fane=om#content.

Statistics Norway (2015). http://www.ssb.no/en/virksomheter-foretak-og-regnskap/statistikker/aksjer/aar-forelopige/2015-06-26.

Sørensen, Peter B. (2005). "Neutral Taxation and Shareholder Income", *International Tax and Public Finance*, 12(6), 777–801.

Thoresen, Thor O., Annette Alstadsæter (2010). "Shifts in Organizational Form under a Dual Income Tax System", *FinanzArchiv: Public Finance Analysis*, 66(4), 384–418.

Thoresen, Thor O., Trine E. Vattø (2015). "Validation of the Discrete Choice Labor Supply Model by Methods of the New Tax Responsiveness Literature", *Labour Economics*, 37, 38–53.

Weber, Caroline (2014). "Toward Obtaining a Consistent Estimate of the Elasticity of Taxable Income Using Difference-in-Differences", *Journal of Public Economics*, 117, 90–103.

Wooldridge, Jeffrey M. (2002). "Inverse Probability Weighted M-Estimators for Sample Selection, Attrition, and Stratification", *Portuguese Economic Journal*, 1(2), 117–39.

Wooldridge, Jeffrey M. (2010). "*Econometric Analysis of Cross Section and Panel Data",* Second Edition, MIT Press.

Wu, Shih-Ying (2005). "The Effect on Taxable Income from Privately Held Businesses", *Southern Economic Journal*, 71(4), 891–912.

Yitzhaki, Shlomo (1974). "A Note on Income Tax Evasion: A Theoretical Analysis", *Journal of Public Economics*, 3, 201–202.

Appendix. Summary statistics

A.1 Income data

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

	Reported income	Net-of-tax rate	Self-employed individuals
Year	Mean	Mean	Number
2001	322,751	0.573	59,491
	(321,121)	(0.074)	
2002	340,197	0.580	60,415
	(301,468)	(0.074)	
2003	342,212	0.586	59,996
	(304,839)	(0.073)	
2004	372,889	0.582	61,611
	(326,168)	(0.074)	
2005	396,224	0.592	61,965
	(409,372)	(0.064)	
2006	430,018	0.600	63,053
	(436,778)	(0.050)	
2007	467,953	0.594	64,038
	(438,840)	(0.052)	
2008	477,578	0.595	63,582
	(405,790)	(0.052)	
2009	477,194	0.598	63,547
	(412,038)	(0.052)	
2010	493,658	0.598	63,528
	(445,654)	(0.051)	

Note: 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	0.76	No education	0.1	General	32.9
Age	46.3	Primary school	0.1	Human. and arts	4.3
Children	0.59	Secondary school	19.3	Teaching	2.1
Married	0.58	High school, started	25.1	Social science and law	3.6
Norwegian born	0.93	High school, completed	28.5	Business and administration	9.0
		High school, supplement	2.3	Science, crafts and technology	24.4
		University, undergrad	13.0	Health, social and sports	11.3
		University postgrad	10.0	Agriculture and fishery	5.8
		Research degree	0.3	Transp., security and services	5.6
		Unknown	1.3	Unknown	1.8
Number of obs.			578,884		

A.2 Working hours data

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

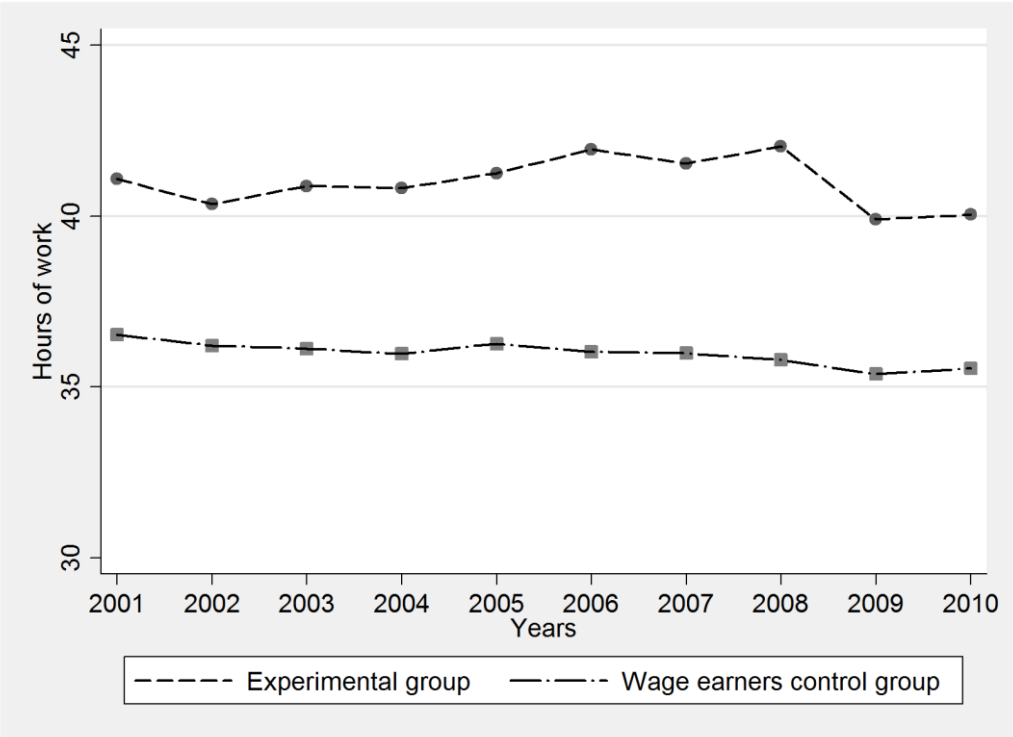
	Treated		Small control group		Large control group	
	Hours of work	Net-of-tax rate	Hours of work	Net-of-tax rate	Hours of work	Net-of-tax rate
Before reform, 2002–2004	41.3	0.517	42.2	0.618	36.2	0.625
	(9.1)	(0.055)	(9.6)	(0.053)	(6.3)	(0.047)
After reform, 2007–2009	40.7	0.558	41.0	0.615	35.7	0.624
	(9.1)	(0.043)	(9.7)	(0.044)	(6.6)	(0.038)
Number of obs.	2,462		1,360		45,466	

Notes. Standard deviations in parentheses.

Table A.4. Descriptive statistics for control variables involved in the working hours estimation, 2002–2009

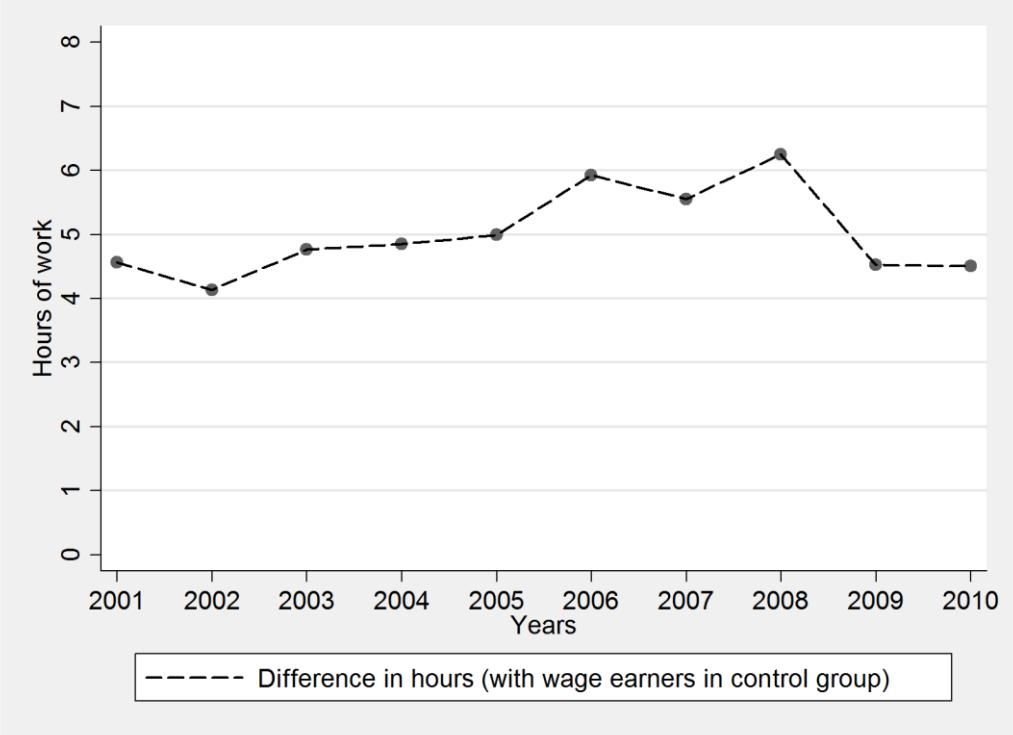
	Treated	Small control group	Large control group
	Mean	Mean	Mean
Male	0.80	0.78	0.49
Age	48.0	47.3	40.9
Child	0.63	0.61	0.57
Married	0.61	0.62	0.50
Norwegian born	0.93	0.95	0.94
Length of education	Treated	Small control group	Large control group
	Percentage	Percentage	Percentage
No education	0.0	0.0	0.1
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	Treated	Small control group	Large control group
	Percentage	Percentage	Percentage
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
Number of observations	2,462	1,360	45,466

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



Note: Whereas the data used in the estimation of the working hours dimension are from 2002–2004 (pre-reform) and 2007–2009 (post-reform), some additional pre-reform and post-reform years are added here.

Figure A.2. Difference in average working hours between the treatment group and the control group. Both wage earners and self-employed in the control group



Note: Whereas the data used in the estimation of the working hours dimension are from 2002–2004 (pre-reform) and 2007–2009 (post-reform), some additional pre-reform and post-reform years are added here.

Table A.5. Placebo-test, using comparison of 2001 and 2002 versus 2003 and 2004 in the identification of the response in working hours

	(1) Log	(2) Log, large control group
Tax treatment	0.065	-0.074
	(0.318)	(0.224)
Treated	0.016	0.074*
	(0.052)	(0.009)
Constant	3.467***	3.626***
	(0.204)	(0.105)
Number of obs.	1,386	23,607

Note: 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
	Income	Food consumption	Income	Food consumption	individuals
	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)	

Note: 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
Number of observations	444	4896

A.4 Organizational shifts

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

	Reported income	Net-of-tax rates	Number of observations
	Mean	Mean	
2001	502,385	0.535	1,784
	(485,805)	(0.071)	
2002	481,508	0.545	1,845
	(324,073)	(0.075)	
2003	571,487	0.5742	2,416
	(434,606)	(0.076)	
2004	596,808	0.537	2,913
	(442,140)	(0.075)	
2005	621,724	0.555	3,257
	(504,011)	(0.065)	
2006	681,428	0.571	2,415
	(572,034)	(0.049)	
2007	738,690	0.563	2,162
	(719,009)	(0.050)	
2008	765,311	0.562	1,993
	(588,156)	(0.048)	
2009	737.201	0.569	2,469
	(609,355)	(0.051)	
2010	755,972	0.565	2,198
	(522,541)	(0.049)	

Note: Standard deviations in parentheses.

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

	Mean
Male	0.85
Age	44.4
Children	0.60
Married	0.53
Norwegian born	0.92
Length of education	Percentage
No education	0.1
Primary school	0.1
Secondary school	13.1
High school, started	14.9
High school, completed	35.5
High-school, supplement	3.7
University, undergrad	16.6
University, postgrad	14.4
Research degree	0.6
Unknown	1.2
Educational field	Percentage
General	20.5
Humanities and arts	3.7
Teaching	2.1
Social science and law	3.5
Business and administration	13.7
Science, crafts and technology	35.3
Health, social and sports	11.2
Agriculture and fishery	3.3
Transport, security and services	5.2
Unknown	1.7
Number of observations	23,452