Government
Institute for
Economic Research

Working Papers 55

Taxable Income Elasticity and the Anatomy of Behavioral Response: Evidence from Finland

Tuomas Matikka

Working Papers 55 | February 2014

VATT WORKING PAPERS

55

Taxable Income Elasticity and the Anatomy of Behavioral Response: Evidence from Finland

Tuomas Matikka

Valtion taloudellinen tutkimuskeskus
Government Institute for Economic Research
Helsinki 2014

Many thanks to Jarkko Harju, Markus Jäntti, Jani-Petri Laamanen, Seppo Kari, Tuomas Kosonen, Kaisa Kotakorpi, Teemu Lyytikäinen, Jukka Pirttilä, Marja Riihelä, Friedrich Schneider, Håkan Selin, Jeffrey Smith, Roope Uusitalo and Trine E. Vattø for their useful comments and discussion. I also thank the participants at many conferences and seminars for their helpful comments. All remaining errors are my own. Funding from the Academy of Finland, the Finnish Cultural Foundation, the Nordic Tax Research Council, the Emil Aaltonen Foundation and the OP-Pohjola Group Research Foundation is gratefully acknowledged.

Government Institute for Economic Research, tuomas.matikka@vatt.fi

ISBN 978-952-274-108-0 (PDF)

ISSN 1798-0291 (PDF)

Valtion taloudellinen tutkimuskeskus
Government Institute for Economic Research
Arkadiankatu 7, 00100 Helsinki, Finland

Edita Prima Oy
Helsinki, February 2014

Cover design: Niilas Nordenswan

Taxable Income Elasticity and the Anatomy of Behavioral Response: Evidence from Finland

Government Institute for Economic Research
VATT Working Papers 55/2014

Tuomas Matikka

Abstract

This paper uses extensive Finnish panel data from 1995–2007 to analyze the elasticity of taxable income (ETI). I use individual changes in flat municipal income tax rates as an instrument for the overall changes in marginal tax rates. This instrument is not a function of individual income, which is the basis for an exogenous instrument in the taxable income model. In general, instruments used in previous studies do not have this feature. Furthermore, I estimate behavioral responses using smaller subcomponents of taxable income, such as working hours, fringe benefits and tax deductions. This "anatomy" of overall ETI has rarely been studied in the literature. The results show that the average ETI estimate in Finland is 0.35–0.60, depending on the empirical specification and the degree of regional controlling. Subcomponent analysis suggests that neither work effort nor labor supply respond actively to tax changes. In contrast, it seems that fringe benefits and deductions from taxable income might have a larger effect.

A new version of this paper has been published in VATT Working Paper series: The Elasticity of Taxable Income: Evidence from Changes in Municipal Income Tax Rates in Finland, VATT Working Papers 69, 18.12.2015.

Key words: Personal income taxation, Elasticity of taxable income, Deadweight loss

JEL classification numbers: H21, H24, H31

Tiivistelmä

Tässä tutkimuksessa tarkastellaan verotettavan tulon joustoa (Elasticity of taxable income) Suomessa vuosina 1995–2007. Verotettavan tulon jousto on keskeinen tekijä verotuksen taloudellisen tehokkuuden ja veronmuutosten vaikutusten arvioinnissa. Verotettavan tulon jousto mittaa sitä, kuinka paljon tuloverotuksen veropohja eli verotettava tulo keskimäärin muuttuu, kun yhdestä lisäeurosta käteen jäävä osuus (1-rajaveroaste) muuttuu yhden prosentin. Verotettavan tulon jousto mittaa kattavasti tuloverotuksen aiheuttamaa hyvinvointitappiota. Eri tavat reagoida tuloverotukseen vaikuttavat kaikki sen taloudelliseen tehokkuuteen (Feldstein (1999)). Korkeampi rajaveroaste voi esimerkiksi vähentää tehtyjä työtunteja sekä lisätä verosuunnittelua ja verovähennysten käyttöä. Verotettavan tulon jousto huomioi eri kanavat joilla tuloverotukseen voidaan reagoida. Verotettavan tulon jouston lisäksi tässä tutkimuksessa tarkastellaan laajan rekisteriaineiston avulla sitä, mistä tekijöistä verotettavan tulon jousto Suomessa koostuu. Tutkimuksessa hyödynnetään kunnallisveroprosenteissa tapahtuneita henkilötason muutoksia veroastevaihtelun lähteenä. Kunnallisverotus tarjoaa hyvän vertailuasetelman, sillä kunnallisveroprosentit ovat muuttuneet eri tavalla eri puolella Suomea eri vuosina. Lisäksi kunnallisveroprosentti ei riipu henkilön tuloista, joten kunnallisveroprosentin muutokset aiheuttavat muutoksia rajaveroasteissa yli tulojakauman. Tulosten perusteella verotettavan tulon jousto on Suomessa keskimäärin 0.35. Tulosta voidaan tulkita siten, että tuloverotuksen kiristäminen (keventäminen) pienentää (kasvattaa) verotettavaa tuloa tilastollisesti merkitsevällä tavalla, mutta tuloverotuksen aiheuttama hyvinvointitappio on kokonaisuudessaan maltillinen. Tutkimustulokset antavat lisäksi viitteitä siitä, että työtunnit ja tuntipalkka eivät reagoi herkästi rajaveroasteen muutoksiin. Sen sijaan vaikuttaa siltä, että epäsäännöllisemmät tulot kuten luontoisedut sekä verovähennysten määrä, selittävät huomattavan osan verotettavan tulon joustosta.

Tästä tutkimuksesta on julkaistu uusi versio: The Elasticity of Taxable Income: Evidence from Changes in Municipal Income Tax Rates in Finland, VATT Working Papers 69, 18.12.2015.

Asiasanat: Tuloverotus, verotettavan tulon jousto, hyvinvointitappio

JEL-luokitus: H21, H24, H31

Contents

1 Introduction

The elasticity of taxable income (ETI) with respect to the net-of-tax rate (one minus the marginal tax rate) is a key tax policy parameter and an important element in the efficiency analysis of income taxation. The practical significance of ETI is straightforward: it measures how a one percent change in the net-of-tax rate affects taxable income. Intuitively, the more elastic taxable income is, the larger the behavioral response to a tax reform will be, in terms of a change in the tax base. From the efficiency point of view, a large ETI makes a tax increase relatively costly and a tax decrease less costly, and vice versa. Under general conditions, ETI has been shown to measure the marginal deadweight loss of income taxation (Feldstein (1995, 1999)). In addition to labor supply responses, ETI also covers changes in, for example, effort and productivity, deduction behavior, tax evasion and tax avoidance. All of these margins are (more or less) important when considering the overall efficiency of a tax system. Altogether, good knowledge of country-specific ETI is essential when deciding on national tax reforms.

Earlier empirical literature has focused on estimating the overall elasticity of taxable income. It is still largely unknown which of the behavioral margins are the most responsive components of the total elasticity. However, detailed knowledge of "the anatomy of behavioral response" (Slemrod (1996)) could also be useful when designing an income tax system and the detailed structure of tax reforms, especially in the light of minimizing the excess burden of income taxation.[1]

Furthermore, analysis of different subcomponents provides information on the actual economic nature of the response. It is rather difficult for the policymaker to influence deep individual utility arguments, such as the opportunity cost of working. However, for example, it is easier to influence tax deduction behavior even through minor adjustments to regulations. In addition to overall ETI, the rich register-based panel data I use in this study enables me to approximate the net-of-tax rate elasticities of the subcomponents of total taxable income, such as labor supply and deduction behavior.

The source of individual variation in net-of-tax rates and the endogeneity of the net-of-tax rate variable are the main issues to focus on when estimating ETI using panel data. Identification requires variation in income tax rates that is different for individuals with otherwise similar income trends. Also, due to the progressive income tax rate schedule, a valid instrument for the net-of-tax rate is usually necessary in order to derive a consistent elasticity estimator. In this study I use variation in municipal-level flat income tax rates for both purposes.

[1] In previous studies, Blomquist and Selin (2010) estimate the elasticity of the hourly wage rate. Using a Swedish data set, they find a significant wage rate response. Also, Kleven and Schultz (2013) report that capital income components of taxable income are more responsive than earned income in Denmark. Previous literature concerning tax reforms in the United States shows that a large proportion of the behavioral response of high-income individuals has been in the form of tax avoidance via income-shifting rather than real economic behavior (see for example Slemrod (1995, 1996), Gordon and Slemrod (2000), Goolsbee (2000), Saez (2004), and Saez, Slemrod and Giertz (2012))

Finnish municipal taxation has appealing features from the point of view of empirical ETI analysis. Firstly, the municipal income tax rate is proportional, which means that it is independent of individual income level. This is the basis for using changes in municipal tax rates as an instrument for changes in overall individual net-of-tax rates in the empirical ETI model. Recent literature highlights that frequently used predicted net-of-tax rate instruments are not necessarily consistent (see for example Blomquist and Selin (2010)). These instruments are functions of individual income in the base period, and thus possibly endogenous in a model where changes in taxable income are regressed with changes in the instrumented net-of-tax rate.

Another key feature of the variation in municipal tax rates is that different municipalities have changed their tax rates differently in different years. In other words, net-of-tax rates have changed differently for otherwise similar individuals who differ only in location. Moreover, as the municipal income tax rate does not depend on individual income, changes in municipal taxation have an effect on net-of-tax rates throughout the income distribution. This makes it possible to identify the average elasticity parameter while avoiding some of the usual difficulties in ETI estimation, namely non-tax-related changes in the shape of the income distribution and the mean reversion of income. These issues are particularly troublesome if tax rate variation is concentrated in a single part of the income distribution, such as in the case of tax reforms affecting only high income earners. Many earlier studies base their estimation strategy on tax rate variation that occurs only at a certain income level.

However, changes in municipal income tax rates are not randomly assigned. Municipalities might change their tax rates based on, for example, previous trends in average taxable income in their jurisdiction. This might affect the validity of the instrument. As a potential solution, the data include a variety of municipal characteristics that I use to control for municipal-level economic circumstances. In addition, I apply different combinations of year and regional fixed effects in the estimable equation, and study the effect of previous income trends on future tax changes in order to assess the exogeneity of the instrument.

To sum up, this study contributes to the empirical ETI literature in three ways: first, I use a net-of-tax rate instrument that is uncorrelated with individual income level. This enables the exogeneity of the instrument. Secondly, the differential tax rate variation used in this study covers the entire income distribution. This improves the identification of the average ETI, which is the parameter of main interest in this study. Also, the data I use include a variety of socio-economic variables such as age, marital status, education, gender, the size of the household and information on various social benefit programs. These enable rich controlling for both permanent and transitory elements of individual income. Third, I divide the behavioral effect of tax changes into smaller components. This subcomponent analysis provides information on what the most important behavioral margins are. Studying the structure of the elasticity also shows how much of the response is driven by changes in baseline real-term behavior (e.g. hours of work and work effort), and how much is accounted for by other margins (tax deductions, fringe benefits etc.).

I estimate the average intensive margin ETI in Finland to be 0.35-0.60, depending on the empirical specification and the degree of regional and municipal-level controlling. As in many earlier studies, the average ETI is larger for women than for men, and larger for high and low-income individuals than for middle-income earners. Analysis of the subcomponents of taxable income gives tentative evidence that both work effort and labor supply are not very responsive to tax rate changes. However, more irregular components such as fringe benefits and tax deductions seem to be more responsive. These imply that a large proportion of the overall ETI is not due to changes in labor supply behavior.

The empirical ETI literature has grown substantially following the pioneering studies by Feldstein (1995, 1999). Feldstein (1995) uses panel data to analyze behavioral responses to the 1986 tax reform in the US. He estimates ETI to be large, ranging from 1-3, depending on the specification used. Many studies following Feldstein (1995) focus on improving the elasticity estimation by paying more attention to net-of-tax rate instruments and non-tax-related changes in the income distribution. Along with these modifications, the elasticity estimates decreased markedly compared to those in Feldstein (1995). A wide range of studies report elasticity estimates ranging from 0 to 0.6. For example, the widely cited Gruber and Saez (2002) study reports the elasticity of taxable income to be 0.18 for mid-income earners and 0.57 for high-income earners in the US. An extensive review of earlier empirical results from the US can be found in Saez, Slemrod and Giertz (2012).

More recent papers further study the reliability and consistency of the estimation of ETI by utilizing different tax reforms and different net-of-tax rate instruments. This literature underlines that different tax reforms and more consistent estimation strategies do not necessarily yield estimates of a similar magnitude as in the seminal contribution of Gruber and Saez (2002). In particular, it has been shown that predicted net-of-tax rate instruments built on base-year income are not consistent due to potential endogeneity problems (see Blomquist and Selin (2010) and Weber (2013)). Many of the frequently cited studies, including Gruber and Saez (2002), build their estimators on these instruments.

A majority of earlier empirical studies estimate ETI using US data sets, while studies concerning European countries and other regions are less common. Particularly, there are practically no earlier Finnish ETI studies available to this day.[2] For other Nordic countries, Blomquist and Selin (2010) estimate ETI to be around 0.20 for males and 1 for females in Sweden. In addition, they document positive elasticity estimates for the hourly wage rate, and also find statistically significant income effects. For Denmark,

[2] Pirttilä and Uusitalo (2005) calculate approximate elasticity estimates for Finland. Their results suggest that the ETI is around 0.3.

Kleven and Schultz (2013) use an extensive panel data and many tax reforms to analyze ETI. In general, they obtain modest elasticity estimates, the upper bound of ETI being 0.3. Also, Chetty et al. (2011) report small elasticity estimates using Danish data. For Norway, Aarbu and Thoresen (2001) find only small responses to tax changes. Using a similar approach as Auten and Carroll (1999), they report that ETI is not significantly different from zero. In a more recent paper, Thoresen and Vattø (2013) report elasticities below 0.1 for Norway.

The rest of the paper is organized as follows: Section 2 presents the conceptual framework including the theoretical background and the empirical model. Section 3 describes the Finnish income tax system and recent changes in income taxation. Section 4 introduces the data and discusses identification issues. Section 5 presents the results and Section 6 concludes.

2 Conceptual framework

2.1 Taxable income model

The basic idea of the static taxable income model is that an individual receives positive utility from consumption c and negative utility from creating and reporting taxable income TI.[3] Following the model of Gruber and Saez (2002), the utility function $u(c, TI)$ is maximized under the budget constraint $c = TI(1-\tau) + R$, where $(1-\tau)$ is the net-of-tax rate on a linear segment of the tax rate schedule, and R denotes virtual income.

Maximization of the utility function with respect to the budget constraint gives supply functions of taxable income of the form $TI = TI((1-\tau), R)$. Next, consider a marginal decrease in $(1-\tau)$ (i.e. a marginal increase in τ). The decreased net-of-tax rate will have two effects: the uncompensated substitution effect which decreases the supply of taxable income, and a compensating income effect. Taking total differentials of the taxable income supply function and using the definitions of the substitution and income elasticities, we can write the change in taxable income as

$$\frac{dTI}{TI} = -\varepsilon^C \frac{d\tau}{(1-\tau)} + \eta \frac{dR - TId\tau}{TI(1-\tau)} \tag{1}$$

From now on I assume that there are no income effects, i.e. $\eta = 0$. Earlier literature shows that income effects are either insignificant or very small (see Saez, Slemrod and

[3]Within this study, taxable income is regarded as taxable earned income. Taxable earned income is defined as the sum of labor income and taxable non-labor income minus deductions (verotettava tulo). The legal distinction between earned income and capital income in the Finnish income tax system is described in the next section.

Giertz (2012)).[4] Thus in the empirical analysis, ETI is measured by regressing changes in taxable income with changes in the tax rate.

Some recent studies (e.g. Chetty (2012), Chetty et al. (2011), Kleven and Schultz (2013)) underline that optimization frictions have an effect on the estimated taxable income elasticity. In short, the theory of optimization frictions concludes that there are costs related to responding to tax changes (adjustment costs, job search costs, paying attention to tax code, filing deductions etc.), and these costs might attenuate the observed elasticities and make them less than the structural elasticities derived in a frictionless benchmark case. Obviously, frictions are more relevant when changes in the tax schedule are small. Small tax rate changes might induce only small utility benefits from changing behavior, and this utility gain might be smaller than the associated (fixed) costs. Thus small changes in tax rates tend to lead to smaller changes in observed behavior (on average).

Differential tax rate variation has been rather small in Finland over the last 20 years, at least when compared to many other countries. Therefore, assuming that adjustment costs or other frictions matter, we would expect to get smaller ETI estimates in this study. This line of thought also implies that elasticities derived using small changes in tax rates represent only the lower bound of the structural long-term tax responsiveness. However, if adjustment costs decrease over time, we would expect larger estimates when longer time horizons are studied.

2.2 The marginal excess burden of income taxation and the components of taxable income

As shown in Feldstein (1999), all behavioral responses reflect the inefficiency of the tax system. The marginal deadweight loss of income taxation can be expressed in terms of the elasticity of taxable income and the relevant income tax rate even when individuals make various decisions in response to income taxation, such as hours of work, work effort, deduction behavior, education choices and so on. This result holds when agents do not make optimization errors and income taxation or taxable income do not impose any externalities.

Following Chetty (2009), consider an individual who makes a vector of decisions $\{x_1, .., x_n\}$ that all affect total taxable income linearly, additively and separately. In this framework, overall taxable income can be presented as the sum of all behavioral choices, $\Sigma x_i = TI$. Assume further that each choice x_i has a convex and increasing cost function $g_i(x_i)$.

Each individual maximizes a quasi-linear utility function of the form $u(c, \Sigma x_i) = c - \Sigma g_i(x_i)$ with respect to $c = \Sigma x_i(1-\tau) + R$, where c is consumption, R is virtual income

[4] However, Blomquist and Selin (2010) report statistically significant income effects in their study using Swedish data. Nevertheless, in their study the inclusion of the virtual income term has a negligible effect on the parameter of interest, the compensated elasticity of taxable income

and τ is the common marginal tax rate for each subcomponent of taxable income. As before, I assume no income effects.

I follow the standard approach in the deadweight loss literature and compare the marginal excess burden caused by responses to a tax rate change to a benchmark case without any behavioral responses. The social welfare function W used for this purpose is presented as the sum of individual utility (in the curly brackets) and government tax revenue

$$W = \Big\{(1-\tau)\sum x_i + R - \sum g_i(x_i)\Big\} + \tau \sum x_i \tag{2}$$

Next, consider a small tax increase $d\tau$. As the individual has optimized his/her bundle of x_i, we can write the marginal excess burden of income taxation in the following form[5]

$$DWL = \frac{dW}{d\tau} = \tau \sum_{i=1}^{n} \frac{dx_i}{d\tau} = \tau \frac{dTI}{d\tau} \tag{3}$$

Most of the earlier studies focus on estimating the overall average elasticity of taxable income. As underlined in Feldstein (1999), the substitution elasticities for different choices contributing to TI are not needed in order to analyze the marginal deadweight loss of income taxation, as long as individuals behave such that $g_i'(x_i) = \tau$ for all i. However, I argue that knowledge of $dx_i/d\tau$ is useful when designing the income tax system and future tax reforms. As pointed out in Blomquist and Selin (2010) and Saez (2003), this information would be valuable if we assume that taxable income itself is directly controlled by the government, which is in fact the case in practical tax policy. The endogenous choice of the tax base is analyzed more thoroughly in Slemrod and Kopczuk (2002) and Kopczuk (2005).

Analysis of the subcomponents of taxable income is more relevant when the assumption of the common income tax rate τ is relaxed. In the extreme case, when different tax rates are applied to all different x_i, equation (3) can be expressed as

$$DWL = \sum_{i=1}^{n} \tau_i \frac{dx_i}{d\tau_i} \tag{4}$$

where τ_i represents the tax rate for each x_i.

Abstracting from administrative costs and putting aside tax evasion and tax avoidance, there is no explicit reason to be restricted to a single income tax rate $\tau_i = \tau$ for all of

[5] Assuming that the individual makes optimal choices for each x_i and that there are no externalities implies that $g_i'(x_i) = \tau$ for all i (Chetty 2009). Thus, based on the envelope theorem, there are no second-order effects on the individual's utility. Originally, the main idea of Chetty (2009) is to show that with weaker assumptions the marginal excess burden is a weighted sum of the total earnings elasticity and the taxable income elasticity. This result holds when the marginal social cost does not equal the tax rate for some x_i. As highlighted in Chetty (2009), this might be the case in the presence of tax avoidance with transfer costs. Specific theoretical or empirical analysis of this type of framework is, however, out of the scope of this paper.

the components of taxable income. Following the assumptions presented so far, in order to minimize the deadweight loss, tax increases should be targeted at choices that are less responsive. On the other hand, the largest economic effects can be achieved when changing the tax rate on the x_i associated with the largest elasticities. In addition to overall ETI estimates, the responsiveness of different types of subcomponents comprising taxable income are in this case the parameters of interest when designing an effective income tax system.

In addition to this Ramsey-type welfare motivation[6], analysis of the anatomy of taxable income elasticity sheds more light on the actual economic nature of the behavioral response. Distinguishing between, for example, real income creation and tax avoidance has important implications for the evaluation of an income tax system (see Slemrod (1995, 1996)). Real responses such as hours of work and work effort reflect deep individual utility parameters, whereas tax avoidance and tax evasion signal an ineffective and poorly designed tax system. Estimating real and "non-real" subcomponents separately helps to distinguish between the importance of the two in the sense of the marginal excess burden of income taxation.[7]

Finally, a thorough analysis of different subcomponents of taxable income would perhaps call for separate theoretical and empirical frameworks for all of them. However, for the sake of clarity and comparability, I abstract from separate modeling of the different components and approximate them in a single ETI framework, both theoretically and in the empirical model.[8]

2.3 Empirical model

This section briefly describes the general empirical methodology of estimating ETI using tax reforms and individual-level panel data.[9] In short, the idea is to measure how the net-of-tax rate affects the taxable income of an individual. Econometrically, this relationship can be described as

$$ln(TI)_{t,i} = \beta ln(1-\tau)_{t,i} + ln(\mu)_{t,i} + ln(\lambda)_i + ln(\delta)_t + ln(\varepsilon)_{t,i} \quad (5)$$

where i denotes the index for individual and t for time. TI is taxable income and $(1-\tau)$ is the net-of-tax rate. $\mu_{t,i}$ denotes other time-variant individual characteristics that

[6] In short, the well known Ramsey rule (Ramsey (1927)) suggests that goods should be taxed in inverse proportion to their elasticities of demand.

[7] As emphasized in many recent US studies (see for example Gordon and Slemrod (2000), Goolsbee (2000), Saez (2004) and Saez et al. (2012)), a large proportion of the response to recent income tax reforms at the top of the income distribution seems to be due to income-shifting or re-timing of reported income.

[8] For example, see Blomquist and Selin (2010) for methodological details of the wage rate estimation.

[9] For a comprehensive discussion of ETI estimation, including cross-sectional approaches, see Saez et al. (2012). See Saez (2010) and Chetty et al. (2011) for a discussion on identifying ETI locally using the distribution of taxable income and the kink points in the marginal income tax rate schedule.

affect the income level differently at different times, and λ_i is a matrix of time-invariant individual characteristics. δ_t is the general time trend and $\varepsilon_{t,i}$ is the individual error term, including the transitory income component.

In practice, it is difficult to identify the average effect of the net-of-tax rate on taxable income (parameter β) using equation (5). Innate ability and many other time-invariant individual characteristics are unobserved, and at the same time are correlated with the progressive tax rate τ. Therefore, in the presence of an income tax reform, one practical approach is to use a first-differences estimator of the form

$$\begin{aligned} ln(TI)_{t+k,i} - ln(TI)_{t,i} =& \alpha_t + e(ln(1-\tau)_{t+k,i} - ln(1-\tau)_{t,i}) + \\ & (ln(\mu)_{t+k,i} - ln(\mu)_{t,i}) + (ln(\varepsilon)_{t+k,i} - ln(\varepsilon_{t,i})) \end{aligned} \tag{6}$$

where e is the average elasticity of taxable income. In equation (6), time-invariant individual characteristics are canceled out by definition.

There are many issues that need to be considered before we can achieve a reliable estimate of ETI using equation (6). These are widely discussed in the empirical ETI literature. First, the net-of-tax rate is still endogenous. There is a mechanical correlation between $(ln(1-\tau)_{t+k,i} - ln(1-\tau)_{t,,i})$ and $(ln(\varepsilon)_{t+k,i} - ln(\varepsilon)_{t,i})$ due to the progressive nature of the tax rate schedule (i.e. higher taxable income is taxed at higher marginal tax rates). Also, a positive income shock in year t tends to be followed by lower income in the next period $t+k$, and vice versa. This so-called mean reversion of income combined with the progressive tax rate schedule might bias the elasticity estimate. Secondly, non-tax-related changes in the shape of the income distribution need to be taken into account. In particular, if differential variation in tax rates is concentrated only in a certain part of the income distribution, differential income growth trends in different parts of the distribution must be carefully controlled for.

Endogeneity of the net-of-tax rate can be corrected by using instrumental variable estimators. This obviously requires a valid instrumental variable. Non-tax-related changes in $\mu_{t,i}$ are usually controlled for by adding variants of lagged taxable income and other individual-level controls to the model. Rich individual panel data sets might also allow for controlling the transitory elements of income (see for example Kleven and Schultz (2013)). I discuss all of these issues in more detail in Section 4.

To recap, a usual estimable equation for ETI when using individual-level panel data is of the following form:

$$\triangle ln(TI)_{t,i} = \alpha_0 + e\triangle ln(1-\tau)_{t,i} + \alpha_1 ln(B)_{t,i} + \triangle ln(\varepsilon)_{t,i} \tag{7}$$

where $\triangle$ denotes the difference in the variables between $t+k$ and t, and $(1-\tau)$ is the instrumented net-of-tax rate. In this study, I apply the changes in proportional municipal tax rates as instruments. $B_{t,i}$ is a matrix of individual base-year control variables. Here the base-year controls include income controls. One common approach is to use taxable income spline variables for richer income controlling (see Gruber and Saez (2002)).

2.4 Components of total taxable income

In addition to overall taxable income, I also estimate the elasticities of various behavioral choices $\{x_1, ..., x_n\}$ that comprise the overall elasticity of taxable income. The estimable behavioral margins include overall wages, monthly wage rates, fringe benefits, monthly working hours and two specific tax deductions, namely a commuting deduction and a work-related expense deduction. The data on all margins are register-based. A more detailed description of the components is presented in Table 5 in the Appendix.

The wage rate measures work effort in a broad sense. Separate analysis of fringe benefits examines whether possible effort responses are driven by irregular and non-monetary components of wages rather than regular cash payments.[10] As a comparison, I also estimate the traditional labor supply response in the form of working hours elasticity. This estimate together with the wage rate elasticity sheds light on the extent of real economy responses to income tax rate changes.

The analysis of tax deductions partly reveals the responsiveness of tax planning. A decrease in the net-of-tax rate increases the gains received from decreasing taxable income, and thus increases the incentives to file more deductions than before. Both of the deductions examined in this study are not automatically accounted for in individual taxation. In other words, in order to be eligible for the commuting or expense deductions, a taxpayer needs to fill a tax form and substantiate the desired amount of the deduction.

The list of subcomponents included in the analysis is not exhaustive. This means that I cannot fully construct the total elasticity of taxable income with the (weighted) sum of all the margins estimated in this study. Furthermore, register-based data on hours and wage rates might not be fully reliable, and non-random measurement errors probably occur. Thus the analysis of the subcomponents is only intended for approximating what the most relevant parts of the behavioral response are in the sense of marginal excess burden. In general, similar econometric requirements for the net-of-tax rate variation and the net-of-tax rate instrument also apply to all behavioral margins. Therefore, municipal net-of-tax rate instruments are also used in the subcomponent analysis.

[10] Fringe benefit responses can also be considered a type of tax avoidance activity. For example, taxable benefits from the use of a company car are in many cases below the actual opportunity cost of having and driving one's own car. However, the relative advantage of fringe benefits is very case-specific in the Finnish tax system.

3 Finnish income tax system and recent tax reforms

3.1 Institutional setting

In this study I focus on analyzing the behavioral effects of changes in earned income taxation that occurred between 1995-2007. In the main analysis I focus on studying the elasticity of taxable earned income. In Finland, earned income is taxed according to a progressive tax rate schedule.[11] In general, the Finnish income tax system follows the principle of individual taxation. The income of a spouse or other family member does not affect the tax rate of an individual. However, some tax deductions and received social security depend on the total income of the household.

In Finland there are three levels of earned income taxation: central government (or state-level) income taxes, municipal income taxes and mandatory social security contributions. All taxes and social security payments are administered centrally by the Finnish Tax Administration.

The central government income tax rate schedule is progressive. The nominal central government income tax rate varies from 0 to 32 per cent[12], depending on (taxable) income. Social security contributions are proportional. Social security contributions include, for example, mandatory pension contributions and unemployment insurance payments. The average rate of social security contributions is around 5 per cent. Social security contributions are deductible from taxable income. Table 7 in the Appendix presents the schedule for employee social security contributions in 1995-2007.

Municipal income tax rates are flat. The average nominal municipal tax rate is 18.45 per cent. All regular income earners are subject to municipal income taxation, with the exception of individuals with very low earned income who are exempt from all taxes.

There are currently 320 municipalities in Finland (in 2013).[13] Municipalities have autonomous authority to levy income tax. Municipal council elections are held in every four years at the same time throughout the country, and each democratically elected municipal council decides and announces the municipal income tax rate on an annual basis.

There are certain legislative duties and public services each municipality has to offer and fulfill. These include, for example, public health care and social services. These commitments are partly financed by municipal income taxation.[14]

[11] Since 1993, Finland has applied the principle of Nordic-type dual income taxation, where earned income (wages, fringe benefits, pensions etc.) and capital income (interest income, capital gains, dividends from listed corporations etc.) are taxed separately. The capital income tax rate is flat. As is typical in a dual income tax system, the top marginal tax rate on earned income (54%) is much higher than the flat tax rate on capital income (28%). Harju and Matikka (2013) present an ETI analysis of capital income and dividend taxation of Finnish business owners.

[12] All tax rates presented in this Section are from 2007 if not stated otherwise.

[13] Figure 5 in the Appendix presents a map of Finnish municipalities and counties in 2007.

[14] In addition to municipal income tax revenue, the less well-off municipalities also receive benefits

The structure and framework of municipal income taxation, including the flatness of the tax rate and the tax deductions and allowances, are regulated at the central government level. Apart from the need for a certain amount of municipal tax revenue for legislative duties and the limitations to alter the frame rules of municipal taxation, municipalities can set their income tax rates freely. As a demonstration of this argument, there is a 5 percentage-point difference between the highest (21%) and lowest (16%) municipal income tax rate in the data.

3.2 Recent changes in income tax rates

Central government income taxation From the mid-1990s onwards, there has been a general decline in central government income tax rates in Finland. Central government tax rates have decreased almost every year in all income classes more or less similarly. Figure 1 illustrates the changes in average marginal tax rates between the years 1995, 2001 and 2007. These marginal tax rates are calculated with the average municipal income tax rate in the year in question. Table 6 in the Appendix presents the marginal tax rate schedule of central government income taxation in 1995-2007.

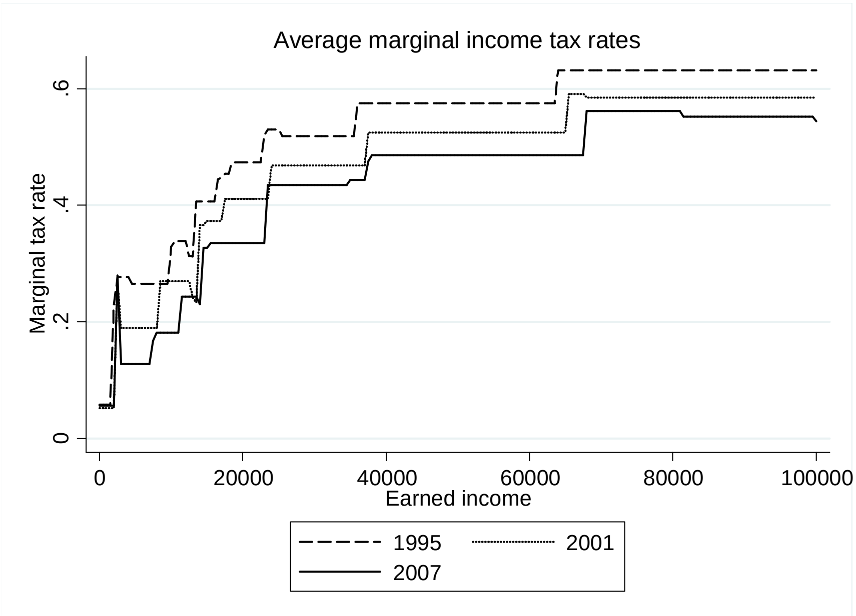


Figure 1: Average marginal tax rates in 1995, 2001 and 2007 (calculated with the average municipal tax rate in the year in question)

From the point of view of identification in the empirical ETI model, variation of this

through local tax-sharing and grants from central government. These are not directly related to the municipal tax rate in the municipality in question. For example, the degree of tax-sharing depends on the industrial and demographic structure of the municipality. Within certain limits, municipalities can also charge usage fees for statutory public services and assign low real estate taxes. In addition, part of the corporate tax revenue collected by central government is assigned to municipalities.

sort is not ideal. Although there have been significant changes in central government marginal tax rates, the generally declining nature of tax rates does not provide much differential marginal tax rate variation.

Municipal income taxation Compared to central government income taxation, changes in municipal income tax rates have been different in nature. In Finland, municipal tax rates have changed differently in different municipalities in different years.

Table 1 below presents the descriptive statistics of municipal-level tax rate changes in each year. Depending on the year, 10-30 per cent of all municipalities have changed their tax rates. On average, every fifth municipality has changed its tax rate in each year. In all of the years in 1995-2007, at least one municipality has decreased its tax rate and one has increased it.

Municipal-level tax rate changes vary from -1 to +1.5 percentage points. The average absolute change is approximately 0.5 percentage points. In general, municipal tax rates increased within the time period of 1995-2007. The average municipal income tax rate increased from 17.5% in 1995 to 18.45% in 2007.

There have also been a number of mergers (or consolidations) of two or more neighboring municipalities. Within a merger, the merged municipalities form a new municipality and decide on a new municipal tax rate. As a consequence of mergers, the total number of municipalities decreased from 455 to 416 in 1995-2007. A more detailed discussion on using the *individual-level* municipal income tax rate variation in the empirical analysis is deferred until Section 4.2.

Year	Mean absolute change in municipal tax rate (%points)	Std. Dev.	Min change (% points)	Max change (% points)	Percent of municipalities with a change in tax rate	Average municipal income tax rate
1995	0.4125	0.16554	- 1	0.5	8.9	17.53
1996	0.4954	0.21983	-1	1	12.0	17.51
1997	0.5573	0.20672	- 1	1	21.2	17.42
1998	0.5478	0.22496	- 0.5	1	21.9	17.53
1999	0.5581	0.24177	- 1	1	21.9	17.60
2000	0.5326	0.20822	- 1	1	10.3	17.65
2001	0.5647	0.2194	- 0.5	1.5	25.0	17.67
2002	0.5511	0.2004	- 0.5	1	20.8	17.78
2003	0.4811	0.15387	- 0.25	1	11.9	18.04
2004	0.5533	0.2073	- 0.25	1	31.4	18.12
2005	0.5858	0.21700	- 0.5	1	31.1	18.29
2006	0.5758	0.26601	- 0.5	1.5	27.0	18.39
2007	-	-	-	-	-	18.45
Overall	*0.5484*	*0.22010*	*- 1*	*1.5*	*18.7*	*17.84*

Table 1: Municipal income tax rate changes $((t+1)-t)$, 1995-2007

4 Data and identification

4.1 Data

The data set I use is an individual-level panel from 1995-2007, provided by Statistics Finland. The data set consists of approximately 550,000 observations per year, which covers roughly 10% of the Finnish population.[15] The data contains a wide variety of individual-level variables from different statistics. The variables are register-based. The main statistics used in this study are the personal tax record information provided by the Finnish Tax Administration, the Structure of Earnings statistics collected by Statistics Finland and municipal-level background statistics.

The data set contains all the necessary information to study the elasticity of taxable income, plus a substantial amount of individual and municipal-level control variables. Moreover, the data allow for estimating the tax elasticity of more narrow margins, such as the elasticity of working hours and wage rates based on the Structure of Earnings statistics. Table 9 in the Appendix presents the summary statistics of the key variables used in this study for individuals between 25-60 years of age. Table 9 also includes the descriptive statistics for the key municipal-level variables.

[15]In Finland, this register-based data set is sometimes unofficially referred to as the Jäntti-Pirttilä data.

4.2 Individual tax rate variation

One of the key issues in identifying the elasticity of taxable income is the source of variation in net-of-tax rates. In short, differential variation in net-of-tax rates for otherwise similar individuals is needed when estimating ETI using reduced-form methods and individual panel data. This study uses changes in municipal income tax rates as the main source of this variation. In the Finnish context, changes in municipal income tax rates are the main source of tax rate variation, as central government income tax rates have decreased rather similarly in all income classes.[16]

Compared to many of the earlier ETI studies, municipal tax rate variation has some very appealing features. First, municipal tax rate changes occur in all of the years in the data (1995-2007). There are also both increases and decreases in municipal tax rates in all of the years.

Importantly, changes in municipal tax rates affect individuals throughout the income distribution. Thus, in all income classes there are some individuals whose municipal income tax rate has changed, and some individuals faced no changes in municipal income taxation. This alleviates the potential problems associated with non-tax-related changes in the income distribution, which are critical in many earlier studies. If the shape of the income distribution varies independently of tax reforms, the analysis of behavioral responses to tax changes might give inaccurate results if this variation cannot be properly taken into account.[17] As changes in municipal income tax rates are not concentrated in a certain income class or classes in any of the years, non-tax-related changes in the income distribution do not bias the elasticity estimates (at least after including appropriate covariates in the model). If nothing else, this bias is certainly much smaller than in many of the earlier studies. Furthermore, tax rate variation across the whole income distribution identifies the parameter of main interest in this study, the average elasticity of taxable income.

Figure 2 presents the actual individual marginal income tax rates at different income levels, highlighting the regional variation in marginal income tax rates. As can be seen from this figure, individuals with the same level of income face different marginal tax rates depending on the municipality of residence. Moreover, with regard to identification, individuals with the same income level face different *changes* in overall marginal tax rates due to differential changes in municipal tax rates over time.

[16] To my knowledge, Pirttilä and Uusitalo (2005) first proposed the use of municipal income tax rate changes as a source of differential income tax rate variation in Finland.

[17] In Finland, the overall income distribution polarized between 1995-2007 (see Riihelä, Sullström and Suoniemi (2008)). However, changes in the distribution are mostly driven by changes in capital income, not by changes in earned income, which I focus on in this study. Changes in the income distribution are also relatively modest compared to, for example, the US in the 1980s.

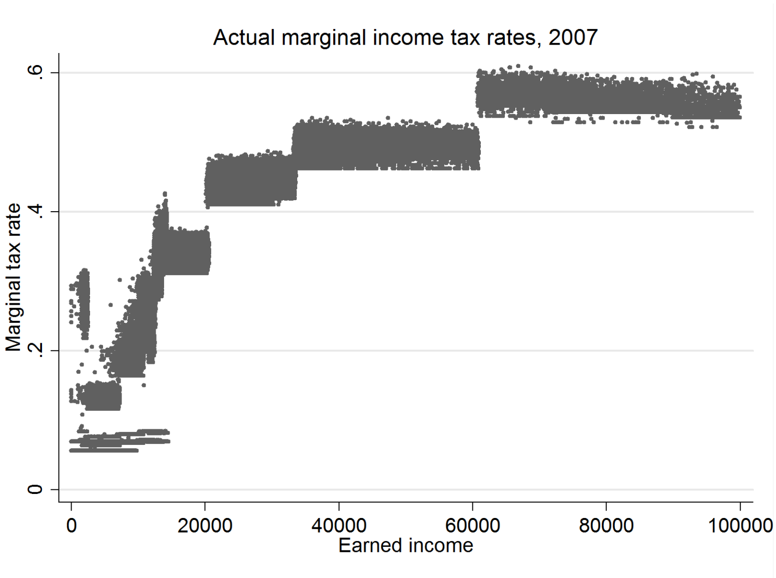


Figure 2: Actual marginal tax rates in 2007, including individual municipal income tax rates

Year	Mean absolute change in municipal tax rate (%points)	Std. Dev.	min change of munic. tax rate (% points)	max change of munic. tax rate (% points)	Percent of individuals with a change in municipal tax rate
1995	0.533	0.3314	-3.25	3.75	9.6
1996	0.508	0.2504	-3.25	3.5	22.2
1997	0.632	0.2724	-3	2.75	24.2
1998	0.601	0.2888	-3	3.5	20.4
1999	0.564	0.3065	-3.25	3.75	17.5
2000	0.608	0.3411	-3.75	3.5	11.7
2001	0.605	0.2912	-3.25	3.25	23.4
2002	0.716	0.3007	-3	3.5	30.6
2003	0.581	0.2428	-2.75	3.0	17.7
2004	0.634	0.2464	-3.5	3.25	29.7
2005	0.596	0.2597	-3.5	3	22.2
2006	0.599	.03160	-4.25	3.75	15.2
Overall	*0.608*	*0.2880*	*-4.25*	*3.75*	*18.7*

Table 2: Individual-level tax rate variation $((t+1)-t)$, 1995-2007

Table 2 describes the individual variation in municipal income tax rates. Table 2 includes individuals who faced a change in their municipal tax rate as a result of a change in their municipality of residence, or as a consequence of consolidation of two or more neighboring municipalities.[18] In the data set, 3.3% of individuals changed their municipality of residence between t and $t+1$ (on average). This number does not include mergers of municipalities.

As can be seen from Table 2, approximately every fifth individual experienced a change in his/her municipal income tax rate each year. On average, the absolute change in the municipal tax rate was 0.6 percentage points for those individuals who faced a change in their municipal tax rate. There is a more distinctive difference between the smallest negative (-4.25 percentage points) and largest positive (3.75 percentage points) change in the municipal tax rate. The largest absolute changes are caused by changes in the municipality of residence, or as a consequence of mergers of municipalities.

Individual changes in municipal income tax rates are not very large in size. The majority of changes are between +/- 0.25-1 percentage points. When the whole net-of-tax rate is accounted for (municipal taxes + central government taxes + social security contributions), most of the changes are around +/- 1-10 as a percentage. The largest changes in municipal tax rates correspond to changes in overall net-of-tax rates of +/- 5-15%.

As noted in the theoretical section, very small net-of-tax rate changes might not trigger a behavioral response because the utility gain from changing individual behavior might be small on average (Chetty (2012)). In particular, the presence of large optimization frictions might attenuate the observed elasticity estimates below the underlying structural long-term response.[19] This is a valid point in this setup, as the variation in overall net-of-tax rates is relatively small, at least when compared to many earlier studies.

On the other hand, small tax rate changes have high policy relevance. Usually income tax reforms are not particularly large. Most of the recent reforms in industrialized countries can be regarded more or less as fine-tuning of the tax systems. Therefore, a careful study of smaller-scale tax reforms might have greater practical relevance than analysis of more extensive and unique reforms, such as the tax rate cut of 1986 in the US.

In addition, it might be that the short-run response to a small change in the net-of-tax rate differs significantly from the longer-run effect, especially in the case of adjustment or search costs. Adjustment to a new level of income tax rate might easily take more than 1-3 years, particularly if the short-run gains from the behavioral response are relatively small. In the empirical part, I also test the effect of changing the time horizon in the elasticity estimate.[20]

Finally, as highlighted by Kopczuk (2005), changes in the tax base and the definition of

[18] I discuss the implications of individuals changing their municipality of residence in the next subsection.

[19] Using Danish data, Chetty et al. (2011) and Kleven and Schultz (2013) show evidence that the observed elasticity estimate depends positively on the size of the change in the net-of-tax rate.

[20] However, as noted in Gruber and Saez (2002), theoretical prediction of the effect of the time window on the elasticity estimate is not clear. It might also be the case that individuals react to tax changes actively in the short run, and then return to their original level of taxable income in the longer run (see for example Goolsbee (2000)). Gruber and Saez (2002) find no significant time horizon effects in their study. In contrast, Giertz (2010) reports that elasticity tends to increase as the time horizon increases.

taxable income probably affect the ETI estimate. In Finland, the definition of taxable earned income has remained relatively constant between 1995-2007. Furthermore, the minor changes in the tax base are, at least to some extent, unrelated to the main source of differential tax rate variation. This is due to the fact that the tax base and basic rules of municipal income taxation, including tax deductions and allowances, are regulated at the central government level.

4.3 Net-of-tax rate instrument

In a progressive income tax rate schedule, the marginal income tax rate increases as taxable income increases. Therefore, a change in taxable income endogenously defines the change in the net-of-tax rate. Thus the elasticity coefficient in equation (6) is very unlikely to capture the actual behavioral response to a tax rate change without using an instrumental variable estimator, and therefore a valid instrumental variable for $(1 - \tau)$ is required.

A common strategy in the earlier literature has been to simulate predicted or synthetic net-of-tax rates, and use them as instruments for the actual net-of-tax rate changes (see for example Gruber and Saez (2002)). The basic structure of a predicted net-of-tax rate variable is the following: take base year t income and use it to predict the net-of-tax rates for $t + k$ by using the post-reform tax legislation in $t + k$. The synthetic net-of-tax rate instrument is then the difference between the actual net-of-tax rate in t and the net-of-tax rate calculated with income in t and the tax law for $t + k$. The intuition behind this strategy is that the predicted difference describes the exogenous change in tax liability caused by changes in tax legislation, while ignoring any behavioral effects by keeping taxable income constant.

However, the predicted net-of-tax rate variable is a function of individual taxable income in year t. As discussed in recent ETI literature, there is no proof that this instrument is exogenous in the empirical model. Following Blomquist and Selin (2010) and Moffit and Wilhelm (2000), it is unlikely that the predicted net-of-tax rate instrument is correlated similarly with both $\varepsilon_{t+k,i}$ and $\varepsilon_{t,i}$ in equation (7), as taxable income in year t defines the marginal tax rate in both t and $t+k$. In addition, there is no general proof that the usually added controls, mainly base-year taxable income and other individual characteristics, correct this endogeneity problem, as discussed in Weber (2013). All in all, there is concern about the validity of instruments that are explicit functions of the dependent variable.[21]

[21] Blomquist and Selin (2010) introduce a strategy where taxable income and other individual characteristics at the middle year of the difference (i.e. $(t + t + k)/2$) are used to derive the instrument. The middle year characteristics are used to define imputed taxable income for both t and $t + k$ (from which the net-of-tax rate instrument is then calculated). Blomquist and Selin (2010) show that this strategy produces exogenous instruments under relatively general assumptions about the autoregressive structure of the transitory income component. However, the validity of this type of predicted net-of-tax rate instrument is still dependent on the serial correlation pattern of $\varepsilon_{t,i}$. Nevertheless, this problem

In this study I use an instrument for the net-of-tax rate changes which is not a function of taxable income, namely changes in proportional municipal income tax rates. As the municipal income tax rate is flat, the tax rate is the same in all income classes within each municipality. In other words, at the individual level, the only determinant of the municipal income tax rate is the municipality of residence.[22]

Compared to previous studies, I do not have to make assumptions about the time structure of the individual transitory income component in order to ensure the exogeneity of the instrument. In addition, as municipal income tax rates affect the net-of-tax rates in all income classes, I do not have to explicitly control for the non-tax-related changes in the income distribution in order to guarantee the causality of the behavioral parameter. Furthermore, mean reversion does not pose a serious problem when deriving the average elasticity estimate, as yearly fluctuation in individual income does not affect the instrument.

Even though the municipal tax rate instrument is not a direct function of the dependent variable in any period, there are concerns that the instrument is not exogenous as such. The main reason for this is the possible policy endogeneity of municipal tax rate changes. In other words, municipal tax rate changes are probably not randomly assigned in the population.

In order to alleviate potential policy endogeneity, the data enable me to include various municipal-level covariates to the model, such as municipal-level unemployment and employment rates, net migration and the level of net debt. All of these variables have a presumable effect on total taxable income within a municipality, as well as average individual taxable income. For example, municipalities might increase tax rates when future tax revenue losses are predicted. This can be caused by decreased employment in the jurisdiction. Because low employment might also decrease individual taxable income (on average), the elasticity estimate may be upward-biased. By including a set of municipal-level covariates and other regional controls in the model, I can, at least to a reasonable extent, separate the possible municipal-level effects from the individual-level behavioral responses.

Another cause for concern is the possibility that individuals select into the "treatment" by changing their municipality of residence. First, we might worry that individuals consistently move to municipalities with lower (or higher) tax rates. However, with regard to identification in the ETI model, this is not very relevant in itself.[23]

---

attenuates when k is large.

[22]The earned income tax allowance in municipal taxation depends (inversely) on earned income. This mainly affects low-income individuals. The effect of the allowance on the effective overall net-of-tax rate is trivial for taxable income over 14,000 euros. An income cut-off of 20,000 euros is used in the estimations. The earned income tax allowance in municipal taxation is described in detail in Table 8 in the Appendix. More details on the income cut-off and other sample restrictions are provided in the next subsection.

[23]For example, if an individual moves to a municipality with a lower tax rate but does not change his/her current job (or more precisely, taxable income does not change), the ETI for this individual will

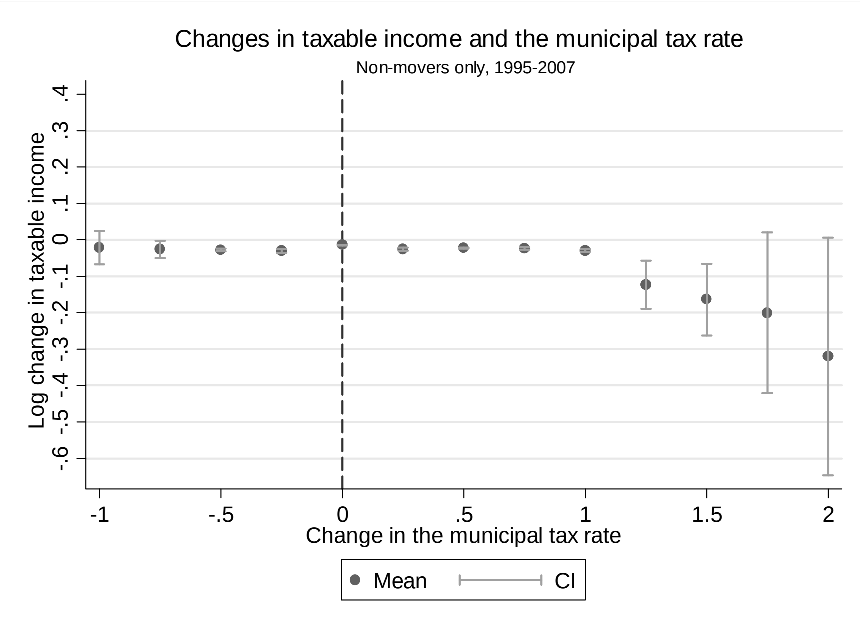
A more serious concern would be that changes in taxable income are systematically correlated with the moving decision, and especially with the municipal tax rate in the destination municipality (i.e. the tax rate instrument is correlated with the transitory income component). For example, a new, better paid job might be a good reason for moving to another city or area. At the same time, it could be that municipalities or areas with a lot of open highly paid vacancies have a relatively low or high municipal tax rate, which would cause bias in the elasticity estimate. This is a relevant concern in the Finnish case, as the municipal income tax rates are below the average in high-wage regions such as the capital city area (Helsinki-Espoo-Vantaa). Therefore, in the baseline empirical specification, I drop individuals who change their municipality of residence between t and $t+k$ in order to avoid any mechanical correlation between the instrument and the transitory income component.[24]

4.4 Descriptive statistics

Figure 3 describes the connection between changes in individual taxable income and changes in municipal tax rates. In the Figure, I calculate and plot mean changes in log taxable income by different changes in the municipal tax rate between $t+1$ and t. Plotting mean changes in taxable income by changes in municipal tax rates is feasible as changes in municipal tax rates occur in 0.25 percentage point intervals (0.25, 0.5, 0.75 etc.). For example, the point on the dash-line in the Figure denotes the average log change in taxable income between $t+1$ and t for those individuals who faced no changes in their municipal tax rate in the same time period.

be zero by definition even though the total taxes paid are now lower than before. Thus, this kind of purely tax-motivated migration is not an issue in this framework. Also, we might suspect that there is a classical selection problem in equation (5). The conceivable selection bias comes from the possibility that individuals who prefer low income taxation choose to reside in a municipality with a low tax rate. This preference for low income taxation is likely to be positively correlated with taxable income, causing the elasticity estimate to be biased. However, as the empirical model in question is identified by individual changes in both municipal tax rates and taxable income, this is not a very serious concern in this setup.

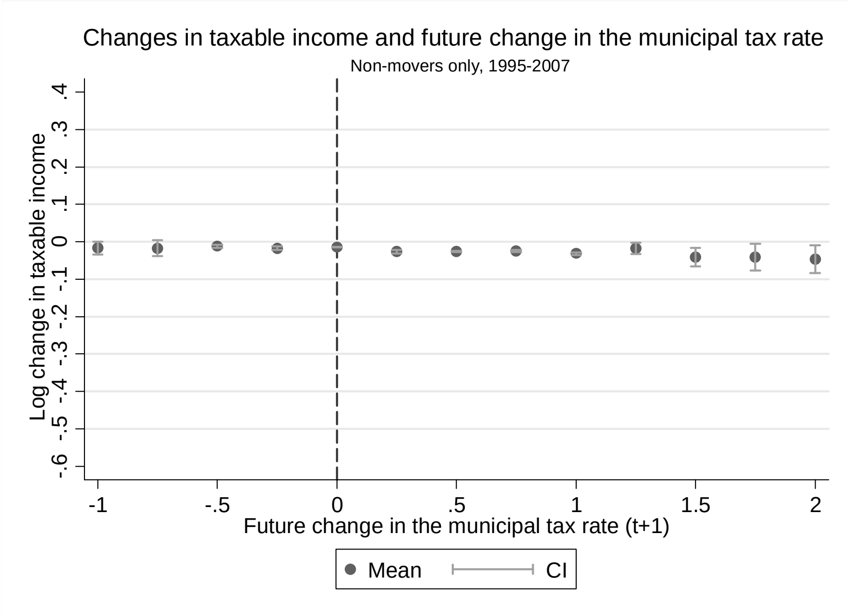
[24] In order to test the effect of moving individuals, I also estimate the model with the movers included. In this case, I add an individual moving dummy to the estimable equation, along with the interaction terms of the moving dummy and the destination county. This controls for the average effect of moving to a certain region on individual income (given other individual characteristics).



Notes: The baseline sample includes observations where base-year taxable income is above 20,000 euros. Pensioners, disabled persons and people under the age of 24 and over the age of 60 are not included in the sample. Also, the sample is limited to individuals whose absolute change in log taxable income between t and $t+1$ is below 8.5, and whose marital status is unchanged between the two years. For more details, see Section 4.5.

Figure 3: Changes in taxable income and changes in municipal tax rates

From Figure 3 we can see that relative changes in taxable income are, on average, more negative the larger the positive changes in municipal tax rates are. In other words, positive changes in municipal tax rates induce negative changes in taxable income on average. This reduced-form type description suggests that individuals respond to incentives created by changes in municipal tax rates.



Notes: The baseline sample includes observations where base-year taxable income is above 20,000 euros. Pensioners, disabled persons and people under the age of 24 and over the age of 60 are not included in the sample. Also, the sample is limited to individuals whose absolute change in log taxable income between t and $t+1$ is below 8.5, and whose marital status is unchanged between the two years. For more details, see Section 4.5.

Figure 4: Changes in taxable income and future changes in municipal tax rates

Figure 4 shows the mean changes in log taxable income with respect to future changes in the municipal tax rate (i.e. changes in the municipal tax rate between $t+2$ and $t+1$) . Intuitively, if municipalities respond to a decrease in taxable income in the past by increasing the municipal tax rate in the future, we should see that future tax increases are more common when there is a decreasing trend in average taxable income (and vice versa). Figure 4 does not support this policy endogeneity channel. There is no statistical difference between the changes in taxable income with respect to future changes in municipal tax rates, which suggests that future tax changes are not a (direct) function of past changes in individual taxable income. However, in order to more carefully analyze possible policy endogeneity, I add municipal-level covariates in the estimable equation in some specifications.

Figures 3 and 4 include the baseline estimation sample where individuals who change their municipality of residence between t and $t+1$ are dropped out.[25] Figure 6 in the Appendix shows a similar picture for the sample including the movers. The range of changes in municipal tax rates is naturally wider when movers are included. The Figure including the movers delivers similar conclusions as before. The left-hand side of Figure 6 shows that tax increases lead to a negative change in mean taxable income, and vice versa. Also, from the right-hand side of Figure 6 we can see that endogeneity based on

[25]The sample includes individuals whose municipality of residence changed due to a merger of municipalities.

past changes in average taxable income is not the driving force behind the results.

4.5 Estimable equation

Following Gruber and Saez (2002), I estimate different variations of the following equation using a two-stage least squares estimator (tsls)

$$\begin{aligned}\triangle ln(TI)_{t,i} =& \alpha_0 + e\triangle ln(1-\tau)_{t,i} + \alpha_1 f(lnTI)_{t,i} + \\ & \alpha_2 B_{t,i} + \alpha_3 M_{t,m} + \sum_j \alpha_{4j} YEAR_j + \triangle \varepsilon_{t,i}\end{aligned} \tag{8}$$

In equation (8), $\triangle ln(TI)_{t,i}$ is the change in taxable income between t and $t+k$ (taxable income in municipal taxation[26]) for individual i. $\triangle ln(1-\tau)_{t,i}$ is the change in the net-of-tax rate instrumented with the change in the municipal net-of-tax rate. Thus e is the coefficient of interest, the average elasticity of taxable income with respect to the net-of-tax rate.

Despite the fact that in this setup the non-tax-related changes in the income distribution and mean reversion are not as problematic as in many earlier studies, I add a ten-piece base-year taxable income spline variable (denoted by $f(lnTI)_{t,i}$) into the model in some specifications. This income control serves as a proxy for individual unobserved heterogeneity in income growth, which is correlated with the time trend (Blomquist and Selin (2010)).

$B_{t,i}$ is a matrix of other base-year individual control variables. Base-year variables control for observed individual heterogeneity affecting changes in taxable income. $B_{t,i}$ includes age, age squared, county of residence, sex, level of education (highest degree), marital status[27], size of the household and dummy variables indicating whether the individual has received any taxable social security benefits[28] in the base year. I also include interaction terms of sex and other controls in the model (age, education, household size and marital status). Importantly, I also add county-year fixed effects, which control for different income trends in different parts of the country at different times.

To control for the possible policy endogeneity of the net-of-tax rate instrument, I add municipal-level (m) characteristics $M_{t,m}$ to the estimable equation in some specifications. $M_{t,m}$ includes base-year values of municipal-level employment, unemployment, net migration and net loan positions. These variables reflect the actual publicly available information that the decision-making bodies in each municipality have on the local economy. Finally, I add year dummies to control for time.

[26] In Finland, the tax bases in municipal and central government earned income taxation differ slightly. Changing the tax base to the central government income tax base does not change the results in any significant way.

[27] The marital status dummies include married couples, unmarried couples, singles, divorced singles and widows/widowers.

[28] These include unemployment benefits, sickness benefits, parental leave benefits and study grants.

I limit the analysis to observations where base-year taxable income is above 20,000 euros. First, the income cut-off is needed in order to eliminate any notable effect of the municipal earned income tax allowance on the net-of-tax rate instrument. Secondly, the focus of this analysis is on the intensive margin behavioral responses, which emphasizes the need for an income cut-off. Many of the social security benefits in Finland (e.g. unemployment benefits and sickness benefits) are regarded as taxable income, which creates relatively low but positive taxable income also for individuals fully or partly outside the labor force. In addition, I drop pensioners, disabled persons and people under the age of 24 and over the age of 60 out of the sample. Also, the analysis is limited to individuals whose absolute change in log taxable income between t and $t+k$ is below 8.5, and whose marital status is unchanged between the two years. Finally, in the baseline analysis, I drop individuals who change their municipality of residence between t and $t+k$. However, the sample includes individuals whose municipality of residence changed due to a municipality merger.[29]

The baseline time horizon used is three years, which is customary in the literature. In order to be able to separate this middle-term elasticity from the shorter-run effects, I drop all the observations where the individual municipal income tax rate also changed between $t+1$ and $t+2$, or $t+2$ and $t+3$. Finally, as a sensitivity check, one and five-year difference models are also estimated along with other alternative specifications.

Equation (8) is also used to estimate the subcomponents of overall taxable income. The subcomponents include overall wage income, monthly wage rates, taxable fringe benefits, hours of work and two particular itemized tax deductions (commuting cost and work-related expense allowances). The same set of controls and sample limitations are also applied in the estimation of these margins.

5 Results

5.1 Taxable income elasticity

Table 3 offers the results for the three-year difference model with different specifications.[30]

[29] As a sensitivity check, I also estimate the model with movers included. For the models including the movers, $B_{t,i}$ also contains a dummy variable denoting whether an individual has changed his/her municipality of residence between t and $t+k$, and the interaction terms of the moving dummy and the county of residence in $t+k$.

[30] The F-statistics for the first stage of the tsls routine are large (>100) and highly significant in all specifications. The first-stage result for the baseline specification is presented in Table 10 in the Appendix.

VARIABLES	(1) dTI	(2) dTI	(3) dTI	(4) dTI
Elasticity	0.665***	0.452***	0.424***	0.350**
	(0.193)	(0.136)	(0.144)	(0.159)
Year F.E.	Yes	Yes	Yes	Yes
County F.E.	No	Yes	Yes	Yes
County-Year F.E.	No	No	No	Yes
Base-year income spline	No	Yes	No	No
Other base-year controls	No	Yes	Yes	Yes
Municipal-level controls	No	No	No	Yes
Observations	339,700	339,035	339,389	338,848

Robust and municipal-level clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 3: ETI estimates

First, column (1) shows the ETI estimate with only year fixed effects included in the regression. This estimate is approximately 0.66 and statistically significant at the 1% level.[31] Adding controls in columns (2)-(4) decreases the point estimate. In column (2), the ETI estimate is 0.45 and statistically significant when the 10-piece base-year income spline variable and individual base-year controls are included.

In column (3) I do not include the individual base-year income spline in the equation. Without income splines the estimate is very close to that with the splines included (0.42). Firstly, this implies that income controlling does not have much effect on the ETI estimate in this particular case in which the net-of-tax rate instrument is unrelated to individual income. This can also be seen as tentative evidence that non-tax-related changes in the income distribution do not affect the elasticity estimates when tax rate variation occurs at all income levels. Secondly, base-year income is not an exogenous variable in the first-differences setup, and thus not an optimal choice as a control variable. Therefore, there are no explicit reasons why these variables need to be added to the ETI model in this case, and thus I prefer a specification in which income splines are not included.

Column (4) in Table 3 shows the preferred empirical specification with extensive regional controlling. Firstly, I add the interactions of county and year fixed effects to control for different income trends in different years in different regions. Furthermore, I add base-year municipal-level variables to the equation. As mentioned before, there might be reasons to suspect that municipal tax rate variation is not randomly assigned across individuals in different municipalities (given other individual characteristics). Therefore, controlling for municipal-level characteristics $M_{m,t}$ might be needed in order to alleviate

[31] The standard errors are clustered at the municipal level in every specification. Clustering is needed because the error terms might be correlated between individuals residing in the same municipality. However, clustering has only a small increasing effect on the standard errors. Results without clustering are available from the author upon request.

this potential policy endogeneity.

After adding county-year fixed effects and municipal controls, the ETI estimate is 0.35 and statistically significant at the 5% level. This estimate is broadly in line with many previous ETI studies, although it is larger than the average ETI in most recent papers from other Nordic countries (Kleven and Schultz (2013), Chetty et al. (2011), Thoresen and Vattø (2013)). One of the reasons for the larger point estimate might be the different identification strategy. Instead of using predicted net-of-tax rate instruments, I use regional flat tax rate variation as an instrument, which decreases the potential bias caused by the standard net-of-tax rate instrument being correlated with base-year income.

5.2 Subcomponents of taxable income

The results for subcomponents of overall taxable income are presented in Table 4. All of the models include year, county and county-year fixed effects, individual base-year controls and municipal controls.

VARIABLES	(1) Wage income	(2) Monthly wage	(3) Monthly hours	(4) Fringe benefits	(5) Work related expenses	(6) Commuting expenses
Elasticity	0.735***	-0.155	0.094	0.977	-0.222	-1.314
	(0.267)	(0.140)	(0.161)	(1.366)	(0.141)	(1.951)
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
County F.E.	Yes	Yes	Yes	Yes	Yes	Yes
County-Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Base-year income spline	No	No	No	No	No	No
Other base-year controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipal-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	313,419	191,806	189,707	108,051	312,654	98,894

Robust and municipal-level clustered standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Elasticity estimates for subcomponents of taxable income

First, column (1) shows the elasticity estimate for the overall yearly wage income. The wage income information comes from the Finnish Tax Administration.[32] Yearly wage

[32] The separation of wage income and other earned income is important in the Finnish tax system. For example, some tax deductions are only based on wage income and not other types of earned income such as taxable social benefits.

income includes fringe benefits and other irregular earnings categorized as compensation for working. The elasticity of wage income is relatively large (0.74) and statistically significant, which implies that wage income as a whole responds to the income tax rate.

Columns (2) and (3) show the elasticity estimates for monthly wage rates and monthly hours. The information on monthly wages and monthly hours comes from the Structure of Earnings statistics collected by Statistics Finland. Monthly wage rates include both regular and irregular earnings as well as fringe benefits. Monthly working hours include regular hours and overtime working hours. The point estimates for both the wage rate and monthly hours are small and statistically insignificant. These estimates imply that both work effort and labor supply are not responsive to income taxation, suggesting that the real-term responses are negligible.

There is a slight conflict between the estimates in column (1) and columns (2) and (3). It seems that while yearly wage income is responsive to taxes, both the wage rate and working hours are not. There are plausible data-driven explanations for this finding. Firstly, information on monthly wages and monthly hours are only collected for a selected sample of full-time workers in companies with more than five workers. This might affect the results if part-time workers or workers in smaller firms can respond more flexibly to tax incentives. This assumption is also supported by the data. The ETI estimate for the subgroup with non-missing monthly hours is 0.27 (0.13), which is lower than the baseline estimate in column (4) of Table 3 above. Also, the estimate for overall wage income decreases to 0.62 (0.29) for this group. These indicate that individuals included in the Structure of Earnings statistics have, on average, lower responsiveness to tax incentives.

Furthermore, wage rates and working hours are mainly based on the situation in October in each year, which might not reflect the actual yearly responses, especially with respect to more irregular components such as fringe benefits or overtime hours. In addition, working hours and wage rates are reported by employers, and thus they might not precisely measure the actual wage rates or working hours of each individual worker, especially if wages are not directly based on actual hours worked (i.e. workers with a fixed monthly salary with no implicit overtime compensations). Nevertheless, given the limitations of the Structure of Earnings data, I find no evidence of extensive effort or labor supply responses to tax changes. Based on this evidence, it seems that more irregular and flexible components of taxable income and total wage income might drive the results.

To further study the potential effects of other components, I estimate separate elasticities for fringe benefits and two specific tax deductions, the work-related expenses deduction (tulonhankkimisvähennys) and commuting expense deduction (työmatkavähennys). Both these deductions are not automatically accounted for in personal income taxation, and need to be itemized by the taxpayer in order to qualify for the deduction (for more details, see Table 5 in the Appendix). The data on taxable fringe benefits and tax deductions come from the Finnish Tax Administration.

Column (4) of Table 4 presents the elasticity estimate for taxable fringe benefits. The responsiveness of fringe benefits seems to be relatively large, although the effect is imprecisely measured. Thus this evidence weakly supports the view that the response might come through more irregular earnings channels.

Columns (5) and (6) show the estimates for the deductions. Both deductions seem to be rather responsive to tax rate changes, although the commuting deduction response in particular is very imprecisely measured (mostly due to the relatively small number of observations in the data). The signs of the responses are intuitive, however. Basic taxable income theory predicts that the amount of tax deductions will increase as the net-of-tax rate decreases, and vice versa. This evidence together with the relatively large fringe benefit response tentatively implies that the overall ETI is driven by tax deduction behavior rather than changes in labor supply or work effort.

5.3 Alternative specifications and sensitivity checks

Table 10 in the Appendix presents the results for alternative specifications and sensitivity checks for the average ETI model. First, column (1) in Table 10 shows the estimate for the baseline specification including individuals who move from one municipality to another between t and $t+3$. This model also includes a dummy variable denoting whether an individual has changed his/her municipality of residence between the years. I also include destination county indicators for individuals who move.

The ETI estimate increases to over 0.60 when the movers are included in the sample. This implies notable effects for individuals who changed their municipality of residence. As mentioned in Section 4.3, the elasticity estimate might be larger for movers due to possible mechanical correlation between the instrument and transitory income that cannot be fully taken into account with the available covariates.[33] On the other hand, the smaller point estimates in Table 3 might also indicate that costs and benefits related to optimization behavior matter, and individuals do not respond as actively to smaller changes in marginal tax rates. Individuals who move face larger changes in their net-of-tax rates (on average), which provides greater incentives to alter their behavior as well (see Saez (2010), Chetty et al. (2011) and Kleven and Schultz (2013)).

Column (2) shows the elasticity estimate for gross earned income subject to taxation, which is a broader income concept than taxable income. The point estimate for gross earned income is slightly lower (0.32) than for taxable income. This is an expected result

[33] As a further robustness check, I also estimate the model without individuals who move to the largest county in Finland, which includes the capital city area (Uusimaa). The point estimate for this model is 0.47, which is lower than the estimate when all movers are included. This supports the view that mechanical correlation between the lower-than-average municipal tax rates and higher wage levels in larger cities might bias the results when moving individuals are included to the model.

because, for example, taxable income is subject to more deductions than gross earned income. Column (3) shows the elasticity estimate with income weights. The income-weighted point estimate (0.36) does not significantly differ from the unweighted baseline estimate.

Columns (4) and (5) present the estimates separately for men and women. The results show that the point estimate for men (0.28) is smaller than for women (0.65). Blomquist and Selin (2010) get a similar result when studying ETI using Swedish data. Columns (6)-(8) present the estimates for three different income levels: low income (10k-25k euros), middle income (25k-40k euros) and high income (over 40k euros). The results show that low-income (point estimate 0.38) and high-income (0.87) individuals seem to be more responsive to income taxes than middle-income individuals (0.29). This tentatively suggests that the elasticity follows a U-shaped curve in which low and high-income individuals have the largest elasticities. However, it should be noted that the separate point estimates for both middle and high-income individuals are not statistically significant at the 10% level.

Column (9) shows the baseline estimate without including individuals in the capital city area (Helsinki, Vantaa, Espoo and Kauniainen). Average income levels and income growth are higher in the capital city area, and it also might be that individuals in this area respond differently to tax changes. However, dropping the capital city area form the estimation sample does not affect the point estimate (0.35).

Columns (10)-(12) study different time horizons. Column (10) presents the ETI estimate for the one-year difference model (0.45), which is slightly larger than the baseline three-year estimate. Column (11) shows the estimate for the five-year model. In general, the five-year model produces very imprecise results, the point estimate being -0.19. The reason for this is the chosen identification strategy where I have dropped all individuals whose municipal income tax rate has also changed between $t+1$ and $t+2$, or $t+2$ and $t+3$ in the baseline three-year model. Extending this condition to the five-year setup drastically reduces the number of observations available, and produces a selective sample of individuals in municipalities with only a few tax rate changes in 1995-2007.

Alternatively, in order to estimate a longer-run response, I pool two six-year differences (2001-1996 and 2007-2002) together and estimate the model without dropping individuals with changes in municipal tax rates in the middle of the differences. Column (12) shows that the point estimate for this regression is 0.73 and statistically significant. Thus it might be that the longer-run response is larger than the short-run, although the point estimate from this particular model is a mixture of both long and short-run responses.

Column (13) shows the estimate when using the standard Gruber and Saez (2002) type predicted net-of-tax rate instrument discussed above in Section 4.3. Similarly as in Blomquist and Selin (2010), I get a negative point estimate when applying this instrument. This implies that there might be a bias in the ETI estimate when using the predicted net-of-tax rate instrument. This is especially plausible in the Finnish setting. For example, on average, net-of-tax rates increased in all income classes in 1995-2007. However, the relative growth in net-of-tax rates was larger for middle and low-income earners compared to high-income earners (see for example Table 6 in the Appendix). Thus we might get biased estimates if high-income earners have even slightly faster non-tax-related income growth which we cannot fully control for with the available controls.

Finally, columns (14)-(16) show the OLS, first-stage and reduced-form results, respectively. First, column (14) shows that the OLS estimate for the ETI model provides highly counterintuitive results, which highlights the need for a valid instrumental variable. Column (15) shows that the first-stage results are strong. The first-stage estimate implies that a 1% increase in the municipal tax rate accounts for an approximately 1.4% increase in the overall net-of-tax rate. In levels, a 1 percentage point increase in municipal tax rate accounts for a 0.85 percentage point increase in the overall net-of-tax rate. Given the general pattern of the central government tax rate changes and the three-year time window, these estimates are reasonable in size. Also, as mentioned before, the F-statistics for the first-stage models are large and highly significant in all specifications (824 in column (15)). Column (16) shows the results for the reduced-form model where the log change in taxable income is regressed directly with the log change in the net-of-municipal tax rate. The results show that, on average, individuals respond to municipal tax changes actively, which is also illustrated above in Figure 3.

6 Conclusions

In this study I analyze the key tax policy parameter, the elasticity of taxable income, using a large Finnish panel data set from 1995-2007. In addition to overall ETI estimates, I also outline the responsiveness of various subcomponents of taxable income.

I use individual variation in flat municipal income tax rates as an instrument for the changes in overall net-of-tax rates. The flat municipal income tax rate is not a function of individual taxable income in any period, and thus I do not need to make assumptions about the time structure of the transitory individual income component. Also, changes in municipal income tax rates occur in all income classes in all years and in both directions. Therefore non-tax-related changes in the shape of the income distribution are not problematic, as the net-of-tax rates vary differently throughout the income distribution.

My preferred estimate for the average ETI in Finland is 0.35. This estimate is in line with many previous studies from other countries. Interestingly, the estimate is somewhat larger than recent results from other Nordic countries (see for example Kleven and Schultz (2013)). This might be partly due to different estimation strategies. It is possible that the net-of-tax rate instruments used in previous studies provide estimates that are more or less biased.

The ETI of 0.35 suggests that the welfare losses of income taxation are moderate at most. For example, increasing the marginal income tax rate does not substantially decrease the tax base via behavioral responses, and vice versa. At the average point, the ETI estimate implies a marginal excess burden of around 0.20 (see Section 2.2), which is in line with most of the recent ETI studies. Intuitively, this implies that income taxation in Finland induces non-negligible but not extensive efficiency losses.

The subcomponent analysis suggests that real behavioral margins, such as working hours and wage rates, respond less than tax deductions and irregular forms of compensation such as fringe benefits. The results show no significant responses to register-based monthly hours and monthly wages, whereas the point estimates for tax deductions and fringe benefits are large, although imprecisely measured. This implies that the overall behavioral response does not stem from profound economic parameters such as the opportunity cost of working. Thus even though the average ETI estimate is not trivial, changing the income tax rate seems to have only a limited effect on labor supply and work effort, especially for full-time workers in larger firms.

However, the results from the subcomponent analysis need to be interpreted with caution. It is possible that register-based data on working hours and wage rates are not sufficient to adequately measure real behavioral margins. Thus, in future work, we need richer data on various behavioral margins in order to provide more accurate conclusions on the effect of different types of behavioral changes on the overall elasticity of taxable income.

References

[1] Aarbu, K. and T. Thoresen. (2001). Income responses to tax changes – Evidence from the Norwegian tax reform. National Tax Journal, 54(2): 319–334.

[2] Auten, G. and C. Carroll. (1999). The effect of income taxes and household behavior. Review of Economics and Statistics, 81(4): 681–693.

[3] Blomquist, S. and H. Selin. (2010). Hourly wage rate and taxable labor income responsiveness to changes in marginal tax rates. Journal of Public Economics, 94: 878–889.

[4] Chetty, R. (2012). Bounds on elasticities with optimization frictions: A synthesis of micro and macro evidence on labor supply. Econometrica, 80(3): 969–1018.

[5] Chetty, R. (2009). Is the taxable income elasticity sufficient to calculate the deadweight loss? The implications of evasion and avoidance. American Economic Journal: Economic Policy, 1(2): 31–52.

[6] Chetty, R., J. Friedman, T. Olsen and L. Pistaferri. (2011). Adjustment costs, firm responses, and micro vs. macro labor supply elasticities: Evidence from Danish tax records. Quarterly Journal of Economics, 126(2): 749-804.

[7] Feldstein, M. (1999). Tax avoidance and the deadweight loss of the income tax. Review of Economics and Statistics, 81: 674–680.

[8] Feldstein, M. (1995). The effect of marginal tax rates on taxable income: A panel study of the 1986 Tax Reform Act. Journal of Political Economy, 103: 551–572.

[9] Giertz, S. (2010). The elasticity of taxable income during the 1990s: New estimates and sensitivity analyses. Southern Economic Journal, 77(2): 406–433.

[10] Goolsbee, A. (2000). What happens when you tax the rich? Evidence from executive compensation. Journal of Political Economy, 108: 352–378.

[11] Gordon, R. and J. Slemrod. (2000). Are 'real' responses to taxes simply income shifting between corporate and personal tax bases?, in J. Slemrod (ed.), Does Atlas Shrug? The Economic Consequences of Taxing the Rich. New York: Harvard University Press and Russell Sage Foundation, 2000, 240–280.

[12] Gruber, J. and E. Saez. (2002). The elasticity of taxable income: Evidence and implications. Journal of Public Economics, 84: 1–32.

[13] Harju, J. and T. Matikka. (2013). The elasticity of taxable income and income-shifting between tax bases: What is “real” and what is not? Oxford University Centre for Business Taxation Working Paper 13/13.

[14] Kleven, H. and E. Schultz. (2013). Estimating taxable income responses using Danish tax reforms. Forthcoming American Economic Journal: Economic Policy.

[15] Kopczuk, W. (2005). Tax bases, tax rates and the elasticity of reported income. Journal of Public Economics, 89: 2093–2119.

[16] Moffit, R. and M. Wilhelm. (2000). Taxation and the labor supply decisions of the affluent. In J. Slemrod (ed.), Does Atlas Shrug? The Economic Consequences of Taxing the Rich. New York: Harvard University Press and Russell Sage Foundation, 2000, 193–234.

[17] Pirttilä, J. and R. Uusitalo. (2005). Veronalennukset vähentävät verotuloja. Kansantaloudellinen aikakauskirja, 4/2005 (in Finnish).

[18] Ramsey, F.P. (1927). A contribution to the theory of taxation. Economic Journal, 37: 47–61.

[19] Riihelä, M., R. Sullström and I. Suoniemi. (2008). Tax progressivity and recent evolution of the Finnish income inequality. Government Institute for Economic Research Discussion Papers 460.

[20] Saez, E. (2010). Do taxpayers bunch at kink points? American Economic Journal: Economic Policy, 2(3): 180–212

[21] Saez, E. (2004). Reported income and marginal tax rates, 1960-2000: Evidence and policy implications. NBER Working Paper 10273.

[22] Saez, E. (2003). The effect of marginal tax rates on income: A panel study of 'bracket creep'. Journal of Public Economics, 87: 1231–1258.

[23] Saez, E., J. Slemrod and S. Giertz. (2012). The elasticity of taxable income with respect to marginal tax rates: A critical review. Journal of Economic Literature, 50(1): 3–50.

[24] Slemrod, J. (1996). High income families and the tax changes of the 1980s: The anatomy of behavioral response. In Feldstein M. and J. Poterba (eds). Empirical Foundations of Household Taxation. Chicago: University of Chicago Press, 1996, 169–192.

[25] Slemrod, J. (1995). Income creation or income shifting? Behavioral responses to the Tax Reform Act of 1986. American Economic Review Papers and Proceedings, 85(2): 175–180.

[26] Slemrod, J. and W. Kopczuk. (2002). The optimal elasticity of taxable income. Journal of Public Economics, 84: 91–112.

[27] Thoresen, T. and T. Vattø. (2013). Validation of structural labor supply model by the elasticity of taxable income. Statistics Norway Research Department Discussion Papers No. 738

[28] Weber, C. (2013). Toward obtaining a consistent estimate of the elasticity of taxable income using difference-in-differences. Unpublished Working Paper.

Appendix

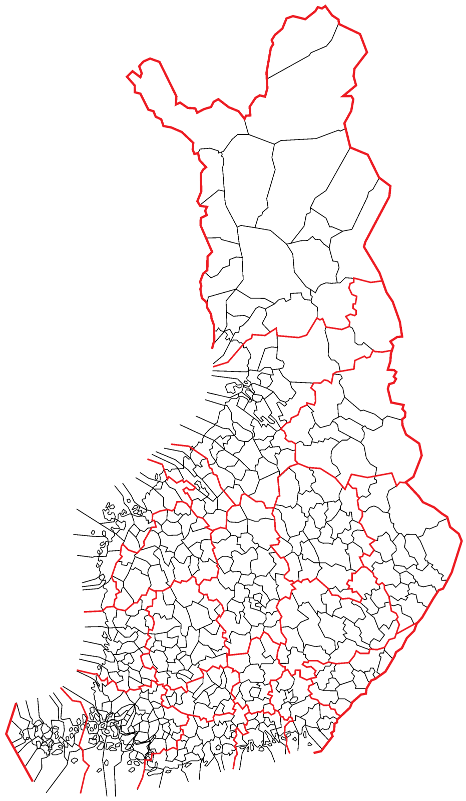


Figure 5: Finnish municipalities and counties in 2007 (Source: National Land Survey of Finland)

Variable	*Description*
Yearly wages (Palkkatulot)	Income regarded as wages in the definition of the Finnish Tax Administration. Includes wages from primary and secondary jobs, as well as fringe benefits and other income components regarded as compensation for working.
Monthly wage rate (Kuukausiansio)	Monthly earnings for full-time workers. Includes wages from regular working hours and overtime work and other additional wage income, as well as taxable fringe benefits.
Monthly working hours (Kokonaistyöaika)	Working hours for full-time workers. Includes regular working hours (4.35*regular weekly hours) and overtime hours.
Fringe benefits (Luontoisedut)	Taxable fringe benefits for a tax year, including realized options. Fringe benefits include, for example, company cars, phones, apartments, and meals provided by the employer. Usually, the value of taxable fringe benefits is less than the face value of the good, for example in the case of luncheon vouchers provided by the employer. Detailed guidelines are provided by the Finnish Tax Administration on an annual basis.
Work-related expenses (Tulonhankkimisvähennys)	The approved amount of tax-deductible work-related expenses for a tax year. Work-related expenses are deductible from gross earned income. Usual work-related expenses include, for example, the purchasing price of equipment or tools such as computers and professional literature, and office costs if a working space is not provided by the employer. Detailed guidelines are provided by the Finnish Tax Administration on an annual basis.
Commuting expenses (Kodin ja työpaikan välisten matkakustannusten vähennys)	The approved amount of tax-deductible commuting expenses for a tax year. Commuting expenses are deductible from gross earned income. Only the amount exceeding a fixed sum can be deducted (600 euros in 2012). The amount of the deduction is dependent on the mode of transport (public transport, private vehicle or a combination of the two). Detailed guidelines are provided by the Finnish Tax Administration on an annual basis.

Notes: Monthly wage rate and monthly working hours are from the Structure of Earnings statistics (Palkkarakennetilasto), and yearly wages, fringe benefits, work-related expenses and commuting expenses are from the tax statistics produced by the Finnish Tax Administration. The structure of Earnings statistics are based on a sample collected by Statistics Finland. Structural statistics on wages and salaries describe hourly and monthly earnings and the formation and distribution of employees' wages and salaries. The sample includes both private and public sector workers. The private sector includes only workers in companies with five workers or more. The working hours and wage rate information is mainly based on the situation in October each year. Information on wages and working hours is provided by employers. For more details, see http://tilastokeskus.fi/til/pra/index_en.html (28.10.2013).

Table 5: Subcomponents of taxable income

Year	Taxable income	Tax rate
1995	7,063-9,754	7
	9,754-12,110	17
	12,110-17,155	21
	17,155-26,910	27
	26,910-47,934	33
	47,934-	39
1998	7,737-10,428	6
	10,428-13,119	16
	13,119-18,500	20
	18,500-29,096	26
	29,096-51,466	32
	51,466-	38
2001	11,100-14,296	14
	14,296-19,678	18
	19,678-30,947	24
	30,947-54,661	30
	54,661-	37
2004	11,700-14,500	11
	14,500-20,200	15
	20,200-31,500	21
	31,500-55,800	27
	55,800-	34
2007	12,400-20,400	9
	20,400-33,400	19,5
	33,400-60,800	24
	60,800 -	32

Note: Finnish marks converted to euros before 2002.

Table 6: Central government income tax rate schedules in 1995, 1998, 2001, 2004 and 2007

	Mandatory pension insurance contributions	Unemployment insurance contributions	Health insurance payments
1995	4.0%	1.87%	1.9% (3.8% for income > 13,455e)
1998	4.7%	1.4%	1.5% (1.95% for income > 13,455e)
2001	4.5%	0.7%	1.5%
2004	4.6%	0.25%	1.5%
2007	4.3% (5.6% if older than 53 years)	0.58%	1.28%

Notes: Pension and unemployment insurance contributions are levied on wage income. Health insurance payments are paid on the basis of taxable income.

Table 7: Social security contributions in 1995, 1998, 2001, 2004 and 2007

	Phase-in threshold 1	Phase-in threshold 2	Phase-out threshold	Phase-in rate 1	Phase-in rate 2	Phase-out rate	Max. allowance
1995	3,364	-	13,455	0,05	-	0,05	336
1998	2,523	-	7,232	0,2	-	0,02	925
2001	2,523	-	12,614	0,35	-	0,035	1,648
2004	2,500	7,230	14,000	0,47	0,23	0,04	3,550
2007	2,500	7,230	14,000	0,49	0,26	0,04	3,250

Notes:

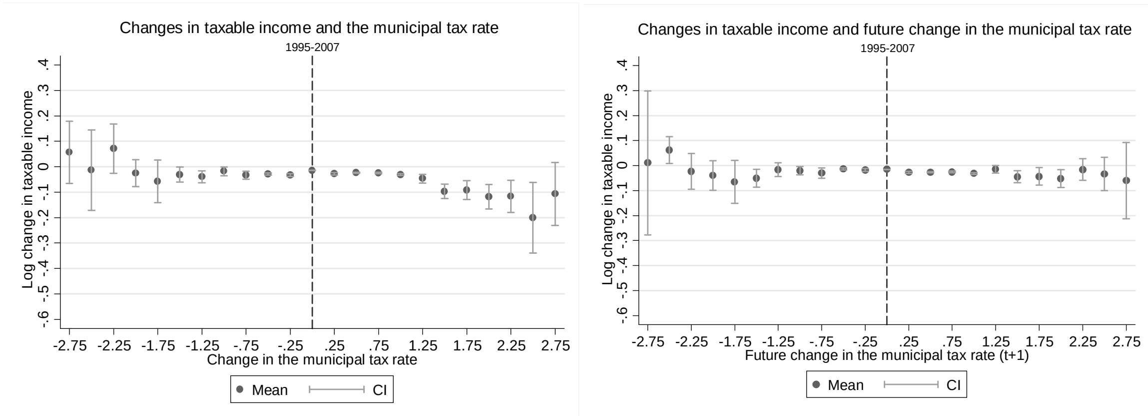
Before 2002 (example year 1998): for all wage income earners, a certain amount is deducted from adjusted gross income (gross earned income minus expense deductions) in municipal income taxation as an earned income tax allowance. The allowance is 20% (Phase-in rate 1) of income above 2,523 euros (Phase-in threshold 1). The maximum amount of the allowance is 1,648 euros (Max allowance). For income above 7,232 euros (Phase-out threshold), the allowance decreases by 2% (Phase-out rate). *After 2002 (example year 2004):* the allowance rate is 47% (Phase-in rate 1) of income between 2,500 euros (Phase-in threshold 1) and 7,230 euros (Phase-in threshold 2). The allowance rate is 23% (Phase-in rate 2) of income above 7,230 euros. The maximum amount of the allowance is 3,550 euros (Max allowance). For income above 14,000 euros (Phase-out threshold), the allowance decreases by 4% (Phase-out rate).

Table 8: Earned income tax allowance in municipal taxation in 1995, 1998, 2001, 2004 and 2007

Individuals					
Variable	Obs.	Mean	Std. Dev.	Min	Max
Taxable earned income	3,116,040	20,892.73	28275.61	0	1.88e+07
Gross earned income	3,116,040	24,726.47	29134.99	0	1.89e+07
Total taxable income (earned+capital income)	3,116,040	22,079.89	48116.18	0	3.35e+07
Wage income	3,123,447	20,287.43	29522.76	0	1.88e+07
Commuting expense deduction	3,111,906	332.59	859.5715	0	7,000
Work-related expense deduction	3,111,906	107.35	699.1165	0	268,425.7
Fringe benefits	3,123,447	447.52	19635.25	0	1.87e+07
Monthly wage	1,398,846	2,320.19	1233.828	0	221,091.3
Monthly working hours	1,397,291	156.01	32.7746	0	249.97
Age	3,127,819	42.06	9.4572	25	60
Female	3,127,819	0.50	0.5	0	1
Size of the household	3,105,782	3.56	1.645	1	25
Municipal tax rate	3,127,340	17.95	0.7747	16	21
Marginal tax rate	3,127,340	0.393	0.1328	0	0.668
Municipalities					
Variable	Obs.	Mean	Std. Dev.	Min	Max
Municipal income tax rate	5,733	18.29	.7686526	16	21
Average individual taxable income	5,734	12,933.40	2868.847	5,508.5	56,055.1
Net loans position (per capita)	4,690	1,925.73	2102.402	-1	30,453
Employment rate	5,734	0.617	.0746028	0.391	0.840
Unemployment rate	5,726	0.141	.0620199	0.004	0.400
Net migration	5,676	-0.003	.01092	-0.074	0.061

Notes: Income variables in 2007 euros. Individual statistics are calculated for individuals aged 25-60. The average taxable income within a municipality includes all individuals.

Table 9: Summary statistics, 1995-2007



Notes: The baseline sample includes observations where base-year taxable income is above 20,000 euros. Pensioners, disabled persons and people under the age of 24 and over the age of 60 are not included in the sample. Also, the sample is limited to individuals whose absolute change in log taxable income between t and $t+1$ is below 8.5, and whose marital status is unchanged between the two years. For more details, see Section 4.5.

Figure 6: Log changes in taxable income and changes in municipal tax rates, movers included

	(1) Movers included	(2) Gross earned income	(3) Income-weighted	(4) Men	(5) Women	(6) Low income (10k-25k)	(7) Mid. income (25k-40k)	(8) High income (>40k)
Elasticity	0.618***	0.318**	0.357**	0.282	0.654**	0.376***	0.285	0.870
	(0.172)	(0.141)	(0.162)	(0.180)	(0.296)	(0.144)	(0.206)	(0.620)
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Base-year income spline	No	No	No	No	No	No	No	No
Other base-year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipal-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	349,691	338,846	338,848	234,541	104,307	551,759	149,575	53,608

	(9) Without capital city area	(10) 1-year	(11) 5-year	(12) 1996-2001 and 2002-2007	(13) Gruber and Saez instrument	(14) OLS	(15) First-stage	(16) Reduced-form
Elasticity	0.354*	0.450***	-0.193	0.726**	-0.283***	-3.013***		
	(0.198)	(0.102)	(0.309)	(0.334)	(0.030)	(0.014)		
d(1-municipal tax rate)							1.415***	0.529**
							(0.044)	(0.188)
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Base-year income spline	No	No	No	No	No	No	No	No
Other base-year controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipal-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	237,490	769,292	128,031	90,817	349,686	537,047	338,495	338,495

Robust municipal-level clustered standard errors in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Notes: The dependent variable is log change in taxable income if not mentioned otherwise. The dependent variable in (2) is gross earned income subject to taxation. The capital city area in column (9) includes Helsinki, Espoo, Vantaa and Kauniainen. Column (12) shows the results for the pooled regression of two six-year differences (1996-2001 and 2002-2007). The estimation sample in column (13) follows the baseline sample where individuals with municipal tax rate changes in the middle of the difference are not included. The dependent variable in (15) is the change in the overall net-of-tax rate. The F-test statistic in (15) is 824.45 (0.000).

Table 10: Alternative specifications

VALTION TALOUDELLINEN TUTKIMUSKESKUS
STATENS EKONOMISKA FORSKNINGSCENTRAL
GOVERNMENT INSTITUTE FOR ECONOMIC RESEARCH

Valtion taloudellinen tutkimuskeskus
Government Institute for Economic Research
P.O.Box 1279
FI-00101 Helsinki
Finland

ISBN 978-952-274-108-0 (PDF)
ISSN 1798-0291 (PDF)