Beggar-Thy-Neighbour Tax Cuts: Mobility after a Local Income and Wealth Tax Reform in Switzerland*

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Abstract

Tax competition raises the question to which extent taxpayers respond to differences in income tax rates by migrating to low-tax areas. This paper analyzes a large, two-step tax reform in the canton of Obwalden in central Switzerland in 2006 and 2008. The canton first introduced a regressive income tax scheme with the explicit purpose of attracting affluent taxpayers, followed by a change to a flat rate tax, thereby lowering taxes for all taxpayers. Using individual tax data from the cantonal tax administration, I apply a 2SLS approach to estimate how responsive migration was to the tax reduction. I estimate an elasticity of the stock of rich taxpayers in the canton with respect to the average net-of-tax rate of 2.4 in the first two years after the reform, increasing to 3.5 over the five post-reform years. The corresponding elsticities of the inflow of rich taxpayers are even larger. These estimates are larger than what the few studies on tax induced mobility elasticity have found so far. I can further rule out that these results are due to an exogenous positive income shock to top incomes. DiD estimations comparing the share of rich taxpayers and net income per taxpayer in Obwalden to two neighboring cantons confirm that the reform was successful in increasing the canton's tax base. The large elasticities can be explained by two aspects. First, by the sizable pool of intentionally treated and the prevailing residence-based taxation, as opposed to source-based taxation. Through relocating to Obwalden, any Swiss and European citizen could take advantage of this tax scheme. Second, by the initially low share of rich taxpayers in and the small size of the canton.

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1 Introduction

In the presence of tax competition, governments are concerned about the drain of their tax base to other, low-tax regions. While in the 1990s the focus has been on capital income taxation, lately concerns are also about top income earners evading taxes by relocating to tax havens. The topic has gained large political attention, fueled by media coverage on prominent examples of sport stars, singers, and actors living in places like Switzerland or Florida, or, more recently, G√©rard Depardieu who officially moved from France to Russia in response to an increase in taxes in France.

These prominent examples focus on a very special group of 'workers', which are particularly mobile. From the literature on top incomes, however, we know that the group of the top 1% consists of more than just stars from the sports and entertainment world, but encompasses CEO's, self-employed, and high-earning professionals. On economic grounds little is known about the extent to which these taxpayers relocate to low-tax regions to benefit from low taxes. I address this question by analyzing a regressive income tax reform in central Switzerland, which explicitly aimed at attracting rich taxpayers.

Gaining a better understanding of the channels through which taxpayers respond to taxation is crucial for the design of optimal tax policies. Moreover, these questions will even gain importance in the future, since tax competition is likely to intensify in the future, as labor is becoming more mobile. This is due to continuing advances transportation and communication technologies, making it easier for people to live and work in different places, as well as to political reasons such as the European Integration, reducing migration costs.

I exploit quasi-experimental variation created by the regressive income tax reform in the Swiss canton of Obwalden in 2006, which provides an ideal setting to study tax-induced mobility of taxpayers. I present new evidence that the elasticity of the number of rich taxpayers with respect to the average net-of-tax rate is large, and that taxpayers are more responsive to tax competition than prior results suggested so far. In the present institutional setting we are able to observe such large effects partly because certain limitations on tax-optimizing behavior are absent. Mainly, the prevalence of residence-based taxation as opposed to source-based taxation allows taxpayers to shift their tax burden without shifting their economic activities.

In December 2005 the Swiss canton of Obwalden passed a tax reform by popular vote. As of January 1 2006, incomes were to be taxed progressively up to taxable incomes of 300,000 CHF, but then marginal tax rates started falling again. This regressive income

tax scheme affected roughly the top 1% of Swiss taxpayers. All that was needed to take advantage of the regressive income tax, was to relocate to the canton of Obwalden, since in Switzerland residence-based taxation applies. Furthermore, it is residency at the end of the year which determines the tax liability for the whole calendar year, such that taxpayers had about 12 months to relocate to Obwalden. Since the Swiss tax code does not draw any distinction between labor and capital incomes, high-paid employees could take advantage of the scheme as well as self-employed and rentiers.

I use individual income tax data from the canton of Obwalden for the period 2001-2010 to study taxpayers' responses to this reform.[1] Descriptive results show that the responses in terms of inflows have been of an immediate nature. Average and median income and wealth of those who moved-in immediately after the introduction of the regressive tax are higher than before, and average income and wealth of the incomers in this period were also higher than those of the residents.

I use a Two Stage Least Squares (2SLS) approach to estimate the elasticity of rich taxpayers in the canton to the average net-of-tax rate (this is: one minus the average tax rate). The observed tax rate change may be endogenous to the number of rich taxpayers, if the canton reduced taxes as a response to a few number of high income earners living in the canton.To isolate the effect of the reform on the number of rich taxpayers, I instrument the net of tax rate with the difference-in-differences (DiD) treatment interaction dummy. Treated taxpayers are those falling in the regressive part of the tax scheme. I define as control group rich taxpayers with taxable incomes slightly below the regressive threshold. In the second stage I regress the log of taxpayers on the log of the tax rate instrument. I find a short-run elasticity of 2.4 and a medium-run elasticity of 3.5 with respect to the stock of rich taxpayers. With respect to the flow I find an even larger short-run elasticity of 8 and a very large medium-run elasticity of 24. These estimates are very large, compared to Kleven *et al.* (2014), who find an elasticity of 1.5-2 for high-income foreigners working in Denmark.

Since these results are based on observations from the canton of Obwalden only, they may be susceptible to confounding factors. Especially, if the top 1% experienced a positive exogenous income shock which happened to coincide with the reform, my estimates would be upward biased. I address this potential threat by comparing the performance of Obwalden with two of its neighbors, Lucerne and Nidwalden. The former is a large canton with an urban center, but with tax rates similar to those in Obwalden

[1]This data has been made available by the cantonal tax administration of the Canton of Obwalden in Sarnen. Many thanks go to Marianne Nufer and Reto Achermann from the tax administration of the Canton of Obwalden, as well as to Ben Jann and Reto Foellmi, who helped obtaining the data for this project.

prior to the reform. Nidwalden on the other hand is, like Obwalden, a small canton with no big economic center, but tax rates in Nidwalden had always been lower than in Obwalden before the reform. With the reform, Obwalden matched Nidwalden's low tax rates.

I compare two outcomes using DiD estimations. First, I compare the share of rich taxpayers in a canton before and after the reform. Second, I compare net income per taxpayer across these cantons. While this reduced form DiD approach does not allow to estimate elasticities as in my main specification, it backs the finding that the reform in Obwalden had the intended effect. Compared to its neighbors, the share of rich taxpayers in Obwalden grew by 25-30%. This is also reflected by an estimated increase in net income per taxpayer of 16% as a result of the reform. Income growth, however, is concentrated among the rich taxpayers. The reform had no effect on net incomes of taxpayers below the regressive threshold.

This paper contributes to the literature on tax-induced mobility and local public finance. Even though the question of moving responses to taxation or the provision of public goods has been considered in the public finance literature ever since Tiebout's (1956) model of local provision of public goods, the empirical literature investigating tax-induced mobility has started to grow only recently with register data becoming available for research. The work by Kleven *et al.* (2013) and Kleven *et al.* (2014) is the only one to my knowledge that studies tax-induced mobility and and estimates corresponding elasticites. They both find large migratory responses of European football players and high-income foreigners in Denmark. These, however, are quite specific and special groups of workers. Young and Varner (2011) as well as Young *et al.* (2014), who use individual income tax data for the U.S., in contrast, only find minor evidence that the rich elites move due to lower taxes.

The present paper adds to this literature by looking at a tax reform meant to attract new taxpayers from within the country as well as from abroad, where no restrictions on citizenship or income source apply for eligibility of the tax scheme. I show that if the pool of intentionally treated is large and the region trying to attract rich taxpayers is relatively poor and small, the magnitude of the estimated elasticity is very large. In such a setting, even the introduction of a regressive income tax allows for potentially large gains for a region engaging in fierce tax competition.

Key to this finding, however, is the prevalence of residence-based taxation, as opposed to source-based taxation. This paper shows that in such a setting the responses by taxpayers are large, implying high costs for the jurisdictions which lose out on their

tax base. The resulting policy implication is that source-based taxation can close an important leakage of the tax base flowing to low-tax regions. Closing this channel can enhance efficiency gains by limiting potentially wasteful tax avoidance. This measure is relatively easy to implement and does not require extensive tax coordination among competing governments.

In addition, this is the first paper to use individual panel data from tax returns to address these questions in the Swiss context, where international as well as sub-national tax competition have a long tradition. Switzerland has proven to be an ideal laboratory to study effects of local tax changes due to its strong federal character. The findings of my study nevertheless have implications beyond Switzerland. Other federal nation states, such as the U.S., allowing for tax competition at the state level, giving rise to corresponding behavioral responses of the citizens. The European Union is another example of how economic integration and liberalization of labor markets and migratory policies on the one hand, may conflict with the fiscal power autonomous nation states have over their citizens on the other. Even though within the European context mobility costs are higher than within Switzerland, these considerations still matter for households living in border regions, and, more generally, for high income earners who are known to be more mobile–even those who are not sport stars or famous actors.

The remainder of this paper is organized as follows. Section 2 gives an overview of previous research on tax mobility. Section 3 describes the tax reform in Obwalden. In Section 4, I present a simple model of how individuals can react to local differences and changes in taxation. The data and descriptive results are presented in Section 5. Section 6.1 presents the estimation strategy and the elasticity results, followed by a robustness Section 7. Section 8 concludes.

2 Mobility of Individuals in Response to Taxation

A substantial body of the empirical literature on mobility responses to taxation is based on data from Switzerland, which due to its federal structure with substantial tax setting competences on the cantonal and municipal levels has long served as a natural laboratory to study tax related questions. Furthermore, its small size and well-developed infrastructure keep mobility costs and cultural differences—at least within cantons—low. Based on aggregate data, Kirchgässner and Pommerehne (1996), Feld and Kirchgässner (2001) and Schaltegger *et al.* (2011) find evidence supporting the hypothesis that there is income segregation across cantons or municipalities, respectively. This seems to be especially

true for high-income earners. While studies based on aggregate data give insights about the main correlates of the allocation patterns of households, they may suffer from reverse causality. A municipality with a large share of high-income households can implement a lower tax rate but still raise the same tax revenue per capita as a municipality with only a small share of high-income households.

To avoid this issue, Liebig *et al.* (2007) and Schmidheiny (2006) use individual level data from Switzerland. Both studies regress the moving probability of a household on different individual and municipality characteristics. The advantage of using individual data is that from the perspective of the individual, local tax rates can be seen as exogenously given, thereby circumventing potential endogeneity affecting the estimates based on aggregate data. Schmidheiny (2006) develops an extensive location choice model, which translates neatly into conditional and nested logit models for empirical estimation. He finds that for relocating households in the area of Basel in 1997, low tax levels attract high income individuals. This is only partly explained by progressivity. Rather the results suggest that the rich prefer low taxes to a greater extent than explained by the tax schedule and that households tend to choose locations close to similar households. He therefore finds the hypothesis of income segregation confirmed.

Liebig *et al.* (2007), who use data from the Swiss census in 2000, look more specifically into tax rate *changes* between 1995 and 2000 in the roughly 700 largest Swiss municipalities. However, they do not reach such a strong conclusion as Schmidheiny (2006). They find migratory responses to be small and concentrated among Swiss college graduates. The authors explicitly address the problem of potential endogeneity by first regressing out-migration from a municipality between 1995-2000 on tax changes in the period 1990-1995, and then regressing tax changes in 2000-2005 on the out-migration in the former five-year period. According to the authors, reverse causation seems negligible. A shortcoming of the census data is that income is not covered, a problem the authors try to overcome estimating Mincer-type wage regressions. This income measure is far from perfect, as the R^2 is about 56 percent and because capital incomes, which are taxed together with labor incomes, cannot be taken into account. It is of crucial importance, however, to include capital incomes, since households deriving income from capital rather than labor presumably face lower mobility costs. Another caveat of the census data is that it only reveals the place of residence in 1995 and 2000, not specifying the point in time of moving and whether the household has moved more than once.

One claim often made is that fiscal policy capitalizes in property prices, as suggested in the seminal paper of Oates (1969). Empirical studies find that capitalization of lower

tax rates into property prices is imperfect in Switzerland (Kirchgässner and Pommerehne, 1996; Schmidheiny, 2006; Schaltegger *et al.*, 2011). This is in line with the theoretical model by Stadelmann and Billon (2012), which predicts that full capitalization is only possible if the elasticity of supply in the housing market is zero. In a recent study based on Swiss data, Morger (2013) further shows that capitalization differs for different types of apartments and household groups, so that there is no "one true capitalization rate" (Morger, 2013, p.35). Especially for rich households with high incomes, moving to a low tax municipality pays off despite higher property prices.

Recent studies on migratory responses to tax changes from other countries rely on natural experiments. Young and Varner (2011) examine the migratory responses to a substantial ex post increase in the top marginal tax rate of 2.6 percentage points in the state of New Jersey in 2004. As New Jersey lies in the New York metropolitan area, it is easy to move to one of the three other states in the metropolitan area and still commute to the same job. Using a Difference-in-Differences (DiD) model of out-migration, they find only small migratory responses of the affected group and therefore conclude "that, at least in terms of the migration response to state income taxes, the rich are not different – they seem to have much the same non-response as the general population" (Young and Varner, 2011, p.278). In a follow-up study using nation-wide individual tax records with a panel dimension for the period 1999-2011, Young *et al.* (2014) test the two hypotheses of whether millionaires move around to get the cheapest tax rate, or whether they are embedded elites with location-dependent social capital they need to do business and make income against each other. They find limited evidence of millionaire tax flight across the US, and therefore conclude that rich taxpayers are part of the elite who possess valuable social capital which is location dependent. Millionaire migration is responsive to top income tax rates, but this effect is completely driven by Florida. A border-region analysis does not suggest that clustering happens on lower-tax side of the borders. Kleven *et al.* (2014) investigate the effects of a preferential tax scheme for high-income expats in Denmark. Similar as in the case I study here, tax cuts in Denmark where introduced to attract high income earners, but this was limited to foreigners. The authors find that the scheme had a very large effect on the number of high-income foreigners in the country and estimate an elasticity between 1.5 and 2. In another paper, Kleven *et al.* (2013) analyze the migratory responses of European football players between the top 14 leagues and find that differences in the tax regime plays an important role in the decision to move: "[t]he elasticity of the number of foreign players with respect to the net-of-tax rate on foreigners is around one, and even larger for the

highest-quality players" (Kleven *et al.*, 2013, p.1922). The authors argue that being an extremely mobile group of 'workers', these estimates should be interpreted as an upper bound on the tax-induced migratory responses in the labor market as a whole. My results show that this is not necessarily true and that mobility elasticities may well be larger, even for regular high income taxpayers.

3 Income and Wealth Tax Reform in Obwalden

In 2006, the canton of Obwalden introduced a regressive tax schedule with marginal rates declining at taxable incomes above 300,000 CHF, and at taxable wealth of 5 million CHF. The aim explicitly was to attract high-income and wealthy individuals and to keep up with the competitive tax rates of the neighboring cantons, especially Zug, Nidwalden and Schwyz, which have long been known for their low tax rates on high incomes and wealth (for a political map of Switzerland, see Figure B1 in the Appendix). Since 1999, Obwalden had been ranked among the high-tax regions for taxes on personal income and wealth, ranking first in the years 2002 - 2005.[2] In order to lower the overall tax load, the cantonal parliament suggested a two-step tax strategy. The first step was to strengthen its position by actively engaging in inter-cantonal tax competition for high-income taxpayers and firms. In a second step in the near future, the overall tax load was to be lowered.[3] The initial losses in tax revenue were to be financed over the first five years through exceptional payouts each canton had received from large gold sales by the Swiss National Bank in 2005. The introduction of the scheme had been decided by the cantonal parliament in October 2005 with 39 against 4 votes and the mandatory popular referendum to confirm the act was held on December 11 2005. The new tax scheme was accepted by clear majority of 86%. The scheme immediately became effective as of January 1 2006, but to take advantage of the low taxes it was sufficient to officially reside in Obwalden as of December 31 2006. This gave individuals from other cantons roughly 12 months to consider a relocation to Obwalden. This tax strategy was accompanied by improvements of spatial planning and lower rates for imputed rents to increase the attractiveness of real estate in Obwalden.

Starting in October 2005, the proposal and the introduction had gained large media attention in the whole country and this attention grew considerably once the introduction

[2]This was mainly due to the high tax load on low-income taxpayers, since there was no personal exemption and an additional per capita tax. Source: "Steuerbelastung nach Kanton, Gesamtindex 1999-2006", BfS.

[3]This argumentation was shared with the voters in the official information material for the popular referendum on the new tax law: "Abstimmungsbotschaft Kantonale Volksabstimmung vom 11. Dezember 2005", Kanton Obwalden.

had been decided upon.[4] Left-wing politicians all over the country protested heavily against this new tax law and took the matter to the Federal Court. The plaintiffs saw the principle of proportional taxation according to one's ability to pay, and the principle that taxes should be general and equal in nature, violated. The canonical view in the media and academia, however, was that the federal court had no say in this and was not going to rule, due to the large set of rights the constitution guarantees to cantons in taxation matters. Furthermore, in a similar case in the canton of Schaffhausen in 2004 (which had gone by surprisingly unnoticed) the court had rejected the appeal.[5] It therefore came as a surprise for many observers as well as for the President of the Cantonal Conference of Financial Directors[6] when on June 1 2007 the court essentially ruled in favor of the plaintiffs,[7] and the canton was obliged to change its schedule again. To guarantee legal certainty, however, the regressive schedule remained valid for the tax period of 2007. Keeping the promise of lowering taxes for everyone and offering attractive conditions for high-income households, the canton was the first to introduce a flat rate tax, with a general social exemption of 10,000 CHF, effective January 1 2008.[8] Again, it was sufficient for individuals to move to (or out of) Obwalden by December 31 2008, as it is residence on the last day of the year which determines individuals' income and wealth tax liability.

Panel a) of Figure 1 depicts the changes in marginal tax rates over time exemplarily for the municipality of Sarnen.[9] Income earners with incomes above 315,000 CHF gross income benefited substantially from the tax cut in 2006, while those with incomes below that threshold faced similar or slightly lower marginal tax rates than before the change. As Panel b) of Figure 1 shows, average tax rates were reduced for all taxpayers in 2006, also for those with incomes below 70,000 CHF. This is true for all municipalities in Obwalden (and especially for the municipality of Lungern), despite the differences in local tax multipliers (see Figures A2 and A3 in the Appendix for an overview of the

[4] In the large liberal newspaper *Neue Zürcher Zeitung NZZ* for example, there were 12 articles on taxes in Obwalden between January 1 2000 and October 15 2005, but 49 articles on regressive taxation in Obwalden between December 1 2005 and July 31 2007.

[5] See for example comments from Prof. Silvio Borner (University of Basel) and Charles Blankart (Humboldt University Berlin) in *NZZ* 24./25.12.2005, Georg Rich (honorary professor University of Bern and former chief economist Swiss National Bank) in *NZZ* 22.8.2006, and Prof. Pascal Hinny (University of Fribourg) in *NZZ* 22.1.2007

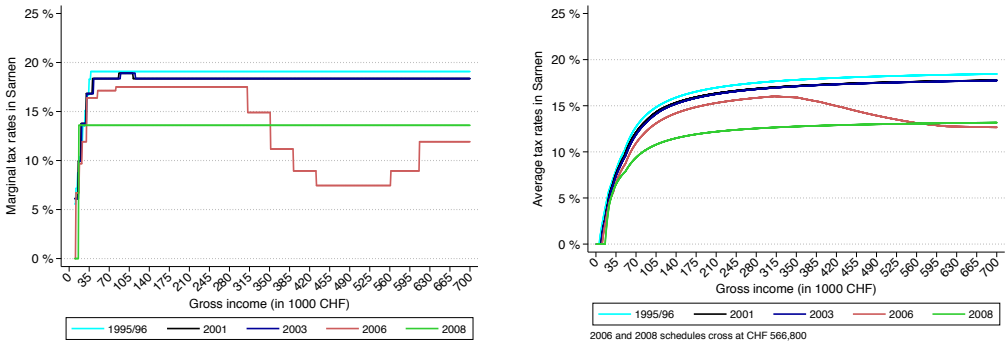
[6] Eveline Widmer-Schlumpf, *NZZ* 2./3.6.2007. One of the judges had argued that in his view the introduction of a regressive income tax was "alarming but acceptable" given its intended temporary nature on the way to lower overall taxes in the near future (*NZZ* 2./3.6.2007).

[7] BGE 133|206

[8] In September 2006, the Financial Director of Obwalden, Hans Wallimann, announced in an interview that the canton was planning on lowering taxes for low and middle incomes in 2009 (NZZ, 21.9.2006). The court ruling did therefore not alter the canton's original planning in a substantial way.

[9] The cantonal tax is multiplied by a municipality-specific tax multiplier, which is why taxes vary across municipalities. The peculiarities of cantonal and municipal level taxation in Switzerland are explained in the Appendix.

evolution of taxes by municipality). With the introduction of the flat rate tax in 2008, it were gross incomes below 350,000 CHF which saw a decrease in marginal rates, while incomes above that level where now again taxed at a higher rate than during the regressive period—but not as high as before the 2006 reform. This cut in marginal rates for low and middle incomes translated into lower average tax rates also for high income earners. In Sarnen the average tax rate in 2008 was only higher than in 2006 for incomes above CHF 566,800; in all other municipalities the break-even gross income was even higher with up to CHF 670,300 in Lungern.



(a) Effective marginal tax rates

(b) Effective average tax rates

Figure 1: Effective average and marginal tax rates after different cantonal tax reforms

Note: Marginal and average tax rates for gross income of a single taxpayer, multiplied by the cantonal and the local tax multipliers. Own calculations. See Figure A3 in the Appendix for an overview of the marginal tax rates in all municipalities of the canton.

4 Theoretical Model

Cutting local taxes affects the income distribution and the potential for raising revenue through two channels. First, individuals may decide to move to the area if the average tax is lower than in their current place of residence. Second, residents affected by the tax cut may adjust their taxable income as a reaction of lower marginal tax rates. This implies two different elasticities with respect to taxation, a mobility elasticity and a reported income elasticity (also elasticity of taxable income ETI). In the following, both behavioral responses are presented in turn, and then they are combined to describe the overall effect the tax change has on the canton's tax base.

4.1 The Elasticity of Reported Income

Tax Scheme. Assume there is a progressive, piecewise linear tax scheme in place, with a marginal tax rate τ_b which is constant within each income bracket $b = 1, \ldots, B$, but differs across brackets. Integrating the area under the tax curve $f(z)$ gives the amount of taxes due in a given canton j, $T_j(z)$. The average tax rate with respect to gross income y is defined as: $\bar{\tau} = T_j(z)/y$.

Utility Maximization. In each period t, individuals i living in canton j maximize a utility function

$$U^i_{jt}(c_t, z_t, \mu^i_{jt}) = c_t - h_i(z_t) + \mu^i_{jt}, \tag{1}$$

where c_t is consumption in period t, z_t is the individual's reported income, and $h_i(z_t)$ denotes the labor supply cost of earning z. This cost function $h_i(z_t)$ is increasing and convex, so that $h'_i(z_t) > 0$ and $h''_i(z) > 0$. $\mu^i_{jt} = \mu^i_{1t}, \ldots, \mu^i_{Jt}$ are preference parameters individuals have for each canton, and there are $j = 1, \ldots, J$ cantons to choose to move to, while keeping a given job and not moving out of the country. This is analogous to the location-choice framework in Kleven *et al.* (2013).[10]

The unobservable components μ^i_{jt} of this decision are assumed to increase the moving costs for the household.[11]

The budget constraint takes on the form

$$c_t = z_t - T_j(z_t) = z_t(1 - \tau_{jt}) + R_{jt}, \tag{2}$$

where $R_{jt} = (z_t\tau_{jt} - T_j(z_t))$ denotes virtual income from the non-linear tax schedule, arising from the fact that incomes below the tax bracket the individual is in are taxed at a different (usually lower) rate (for an illustration of the virtual income concept, see Gruber and Saez, 2002; Saez, 2013).

The Elasticity of Reported Income. Abstracting from income effects, the resulting "reported income supply function" reads as $z_{it}(1 - \tau_{jt})$.[12] This is the crucial function to

[10] An alternative interpretation of μ^i_{jt} would be that of the stochastic part in a random utility model (RUM) where individuals decide about moving, nested in the utility function (1).

[11] If μ^i_{jt} was zero so that the moving decision would be fully explained by the tax difference and the distance to the new location, this would imply unrealistically high tax-induced mobility. There are only very few unobserved factors presumably reducing mobility costs, e.g., the location of the workplace and duration of the commute. If however, commuting is not expensive, and given that commuting expenses can be deducted from taxable income, commuting reduces taxable income ceteris paribus.

[12] With the exception of Gruber and Saez (2002), the ETI literature usually abstracts from income effects, which considerably simplifies the presentation especially of efficiency effects. The reason is that empirical estimates suggest that income effects are small, especially in the case of reported income (see for example the estimates in Kleven and Schultz, 2014). Note that R is only a virtual income component arising from the tax scheme and therefore entering the individual's budget constraint, but it is not part of taxable income. For a discussion of the relevance of income effects in the estimation of the ETI the reader is referred to Gruber and Saez (2002) and (Saez *et al.*, 2012, especially pp.5–6); for an overview on income effects in labor supply models see Blundell and MaCurdy (1999).

determine the elasticity of reported income with respect to the net-of-tax rate, defined as

$$e = \frac{1 - \tau_{jt}}{z_{it}} \cdot \frac{\partial z_{it}}{\partial(1 - \tau_{jt})}. \tag{3}$$

4.2 The Mobility Elasticity

Migration Decision. From the reported income supply function, it is possible to determine the individually optimal reported income $z_{it}^{\star}$ for each location j. U_{jt}^{i} is the utility a tax unit i would enjoy in canton j. The household chooses the canton that yields the highest utility, so that moving to j is optimal if

$$U_{jt}^{i}(z_{i}^{\star}(1 - \tau_{jt})) + \mu_{jt}^{i} > \max\left\{U_{j't}^{i}(z_{it}^{\star}(1 - \tau_{j't})) + \mu_{j't}^{i}\right\}, \qquad \forall j' \neq j. \tag{4}$$

While for the moving decision alone what matters is the average tax rate, this solution takes into account that individuals can not only choose a location, but adjust to the prevailing marginal tax rates.

The Mobility Elasticity. The presented utility framework corresponds to a random utility model (RUM), where utility is decomposed into a deterministic and an unobservable part: $U_{jt}^{i}(c, z) = V_{jt}^{i}(c, z) + \mu_{jt}^{i}$ (for a detailed overview of RUMs, see Train, 2009). Assuming that the individual and unobserved term μ_{jt}^{i} follows some extreme value distribution it is possible to determine the probability of moving, P_{jt}^{i}. The elasticity of moving with respect to the net of tax rate is then given by:

$$\varepsilon_{jt}^{i} = \frac{\mathrm{d}\log P_{jt}^{i}}{\mathrm{d}\log(1 - \tau_{jt})}. \tag{5}$$

Location choice models, however, become increasingly complex when the choice set is large. In the present context, individuals theoretically have more than 2000 municipalities to choose from when deciding where to relocate. Furthermore, this approach would require to compute households' hypothetical tax load in each Swiss municipality in every year. Unfortunately, there is no tool comparable to the tax calculator TAXSIM by Feenberg and Coutts (1993), which allows computing marginal and average tax rates for all U.S. states, in the Swiss context. Instead, I rely on a Two-Stage Least Squares (2SLS) DiD approach to estimate the mobility elasticity in Section 6.

4.3 The Total Elasticity of the Canton's Tax Base

What has been presented so far, were the individual income elasticities and moving probabilities. Here I show how the two behavioral responses add up to the total elasticity of a canton's tax base into a part of real responses to taxation, e.g., labor supply responses,

and into a part of moving responses. Together, these elasticities determine how much a canton can increase its tax base by cutting taxes.

Rather than an individual's taxable income, let now z_{bt} be a canton's tax base, i.e., the sum of reported incomes in year t and tax bracket b. x_t denotes the sum of incomes in that bracket b that moved to the canton (potentially from a higher-tax canton) during period t, such that $z_t = z_{t-1} + \Delta z_{t-1} + x_t$. The term Δz_{t-1} accounts for changes in residents' taxable income and for losses in taxable income due to taxpayers moving out or dying.

Now assume there is one canton, l, which lowers its income tax by introducing a regressive schedule. Taking all other cantons' taxes as given, there will be a fraction of taxpayers residing in the surrounding cantons for whom $\tau_{jt} > \tau_{lt}$. They may consider moving to canton l and take their taxable income with them.

Individuals maximize utility along the lines set out above. Aggregating over all taxpayers in a given income bracket b after moving decisions and adjustments in taxable income have been made, one obtains the overall elasticity of reported income in canton l:

$$e = \frac{1-\tau_{lt}}{z_t} \cdot \frac{dz_t}{d(1-\tau_{lt})}. \tag{6}$$

This elasticity can be thought of as consisting of two components: the elasticity e_1 of reported income of former residents of canton l, and the elasticity of attractable income, e_2. The former residents of canton l have an elasticity of reported income of

$$e_1 = \frac{(1-\tau_{lt})}{z_{t-1}} \frac{dz_{t-1}}{d(1-\tau_{lt})}. \tag{7}$$

The part of taxable income attracted from other cantons due to the tax cut, $x_t = x_t(\tau_{jt} - \tau_{lt})$, is increasing in the tax rate difference $\tau_{jt} - \tau_{lt}$. $x(0) = 0$ as there is no reason to move away for tax reasons if tax rates are identical. Hence, $z_{lt} = z_{lt}(1-\tau_{lt}, \tau_{jt}) = z_{l,t-1}(1-\tau_{lt}) - x(\tau_{jt} - \tau_{lt})$ is increasing in the net-of-tax rate $(1-\tau_{lt})$ and the other cantons' marginal tax rates τ_{jt}.

Following the lines of Piketty *et al.* (2014), the moving elasticity of the tax base with respect to taxation can be defined as $e_2 = s \cdot e$. s denotes the fraction of the behavioral response of z_t to $\mathrm{d}\tau_{lt}$ due to individuals moving to the low-tax canton l for tax reasons.

$$s = \frac{dx/d(\tau_{jt} - \tau_{lt})}{dz_t/d(1-\tau_{lt}) + dx/d(\tau_{jt} - \tau_{lt})} = \frac{dx/d(\tau_{jt} - \tau_{lt})}{\partial z_t/\partial(1-\tau_{lt})},$$

and

$$e_2 = s \cdot e = \frac{1-\tau_{lt}}{z_t} \frac{dx}{d(\tau_{jt} - \tau_{lt})}. \tag{8}$$

By construction $(1-s)e = (z_{t-1}/z_t)e_1$ or $e = (z_{t-1}/z_t)e_1 + e_2$. Starting from a situation with no gains in the tax base due to tax-induced in-migration, $z_t = z_{t-1}$, the total elasticity is the sum of the standard labor supply elasticity and the tax-induced in-migration elasticity: $e = e_1 + e_2$.

5 Data and Descriptive Evidence

5.1 Data

I use individual income tax data from the Canton of Obwalden for the period 2001 to 2010.[13] The panel data contain the full information collected in the annual income tax returns such as all sources of income and all deductions applied as well as some basic information about the tax unit like age, nationality, marital status, and number of dependents. Most importantly, the records contain the exact date when a taxpayer registered with the municipality, along with their canton and municipality of origin, or the country of origin if they moved-in from abroad.

The data are limited to taxpayers with a tax liability in the canton of Obwalden during the period 2001 to 2010. Due to the federal character of tax collection, the personal identification is done at the cantonal level, not making it possible to link individual tax data from different cantons over time. Therefore, I lack information of wealth and incomes earned before moving to Obwalden or after leaving the canton, and I do not know the non-movers from other cantons.

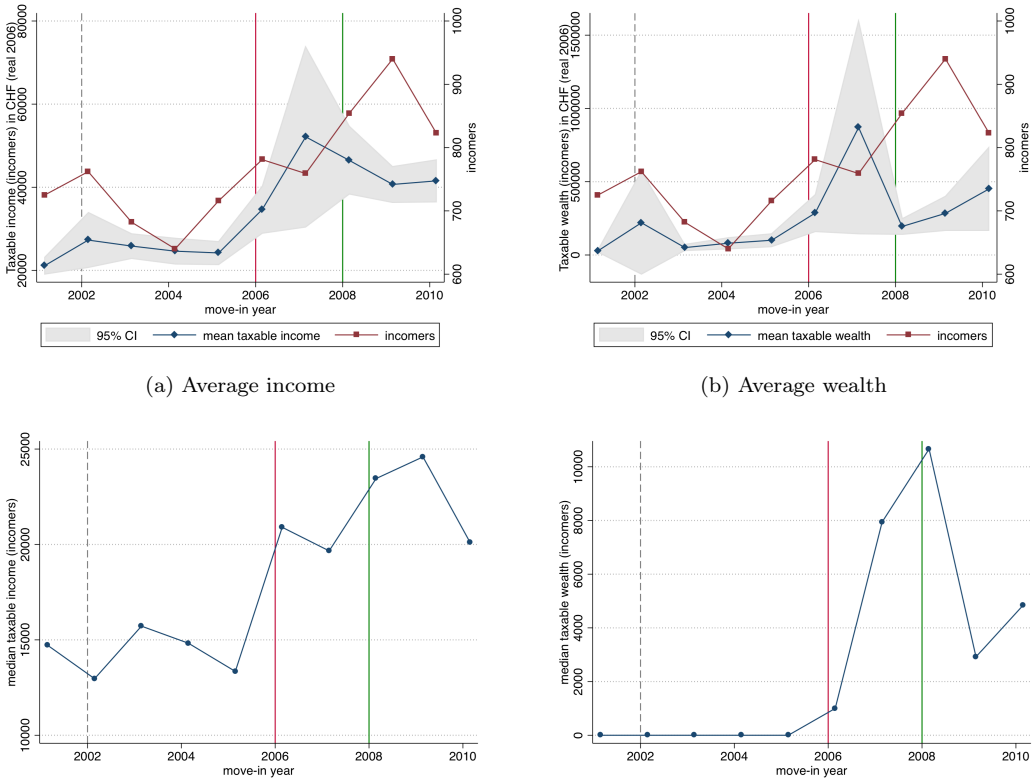
A final remark with respect to the sample size: the canton under consideration is rather small, with roughly 18,000 to 22,000 taxpayers each year. Since married couples file together, this corresponds to roughly 35,000 individuals in 2010, the total population of the canton, and 0.5% of the Swiss population. This small population size has its drawbacks when it comes to the analysis, but it has to be noted that all the cantons engaging successfully in tax competition by lowering their rates are small in terms of population and geographical area. This is not surprising, since a small, open economy has relatively large potential gains from cutting taxes as the tax base increases, but relatively small losses. This is in line with the small size of tax havens for off-shore wealth (for theory and evidence on asymmetric tax competition where countries differ in size, see Wilson, 1991,9; Winner, 2005; Habermacher and Kirchgässner, 2012), and Obwalden can be seen as representative in the case of competing over income taxes. Its proximity to the cities of Lucerne and Zurich harbors potential to attract high-income

[13] These data have been kindly provided by the Tax Administration of the Canton of Obwalden for this research project.

and wealthy taxpayers seeking a favorable place of residence with respect to taxes as well as centrality and natural amenities.

5.2 Descriptive Statistics

The data allow for a descriptive analysis of the characteristics of the new arriving taxpayers in the canton (the incomers or inmovers) before and after the reform. Figure 2 depicts taxable income and wealth of incomers (left scale) along with their number each year (right scale). Over the decade under consideration, the number of incomers has been increasing, but the increase started already before the 2006 tax cut on high incomes. Looking at incomers' average taxable income and wealth however, suggests that there has been a change in the type of incomers right after the tax cut: both income and wealth of incomers increased sharply right after the tax cut. In the years after, this increase was reverted somewhat but income and wealth both stayed above pre-reform levels. This is noteworthy, since there was a sharp economic downturn in 2008/2009 and one might expect a drop in average income and wealth of incomers. Median income and wealth (Panels c) and d) of Figure 2) follow similar patterns as the average, suggesting that the results are not driven by extreme outliers.



(a) Average income

(b) Average wealth

(c) Median income

(d) Median wealth

Figure 2: Incomers and their average and median taxable income and wealth in move-in year

Note: Taxpayers moving to Obwalden in year t pay taxes in Obwalden in that year. The red line 2006 marks the introduction of the regressive schedule, in 2008 (green line) the flat rate tax came into place; the grey dotted line marks the introduction of the AFMP with the EU.
Source: Personal income and wealth tax data Obwalden, 2001-2010.

The observed increase in average taxable incomes of new arriving taxpayers has been due to increases in both, mobile and immobile income sources (Figure 3). The strong increase in average mobile income per inmover is not very surprising. Taxpayers relying on incomes whose realization is independent of the canton of residence can be expected to be more responsive to changes in taxation. However, also the average labor incomes of inmovers were higher right after the cut. Although information on the location of the workplace is not available, assuming that the tax-cut did not create a substantial number of new, high-paying jobs taken by incomers rather than residents, this suggests that the canton of Obwalden has the potential to attract not only mobile capital income, but also more immobile labor incomes. As Figure 6 shows, indeed many incomers moved in from geographically close cantons, allowing to commute to the same job.

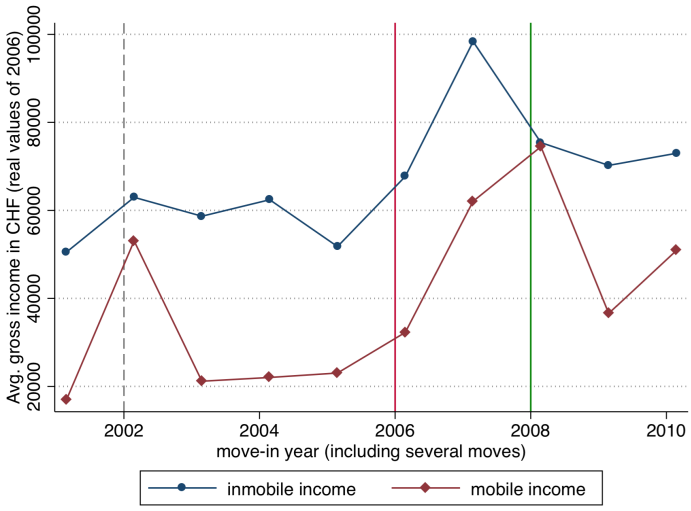


Figure 3: Incomers and their average in gross mobile and immobile income, 2001-2010

Note: All location-independent income sources are defined as mobile income, including all kinds of capital incomes such as interest income on bank accounts, dividends, returns on shares etc., as well as transfer incomes, such as unemployment benefits, alimony payments from ex-spouses etc. Labor income from employment and self-employment is classified as immobile income. Gross values before deductions.
The red line 2006 marks the introduction of the regressive schedule, in 2008 (green line) the flat rate tax came into place; the grey dotted line marks the introduction of the AFMP with the EU.
Source: Personal income and wealth tax data Obwalden, 2001-2010.

6 Responses to the Regressive Income Tax Reform in Obwalden

In this section, I first address how taxpayers responded to the tax reform and present estimates of the elasticity of rich tax payers in the canton with respect to the net-of-tax rate. Subsection 6.2 present estimates of the elasticity of taxable income.

6.1 Elasticity of Rich Taxpayers in the Canton using Difference-in-Differences

6.1.1 Defining a suitable control group

Presumably, the 2006 tax reform lead to an increase in the stock of rich taxpayers above the regressive threshold, since they benefit from a falling marginal and average tax rate. The increase can be due to and increased flow of newly attracted taxpayers, prevented out-migration from high-income and wealthy taxpayers to other low tax cantons, and (taxable) income adjustments of taxpayers already living in the canton. To test whether the reform affected the stock and flow of rich taxpayers into the canton, I define a control group not directly affected by the tax change and perform a set of DiD estimations.

One possible control group are taxpayers with income or wealth just below the regressive scheme kicks in (as in Kleven *et al.* (2013)). At this point, the important distinction between taxable and rate-determining income needs to be introduced. Especially for top earners, rate-determining income may differ from taxable income, since they often have different income sources which are taxed at source in other cantons or abroad. To avoid that these taxpayers benefit from an artificially low tax rate, their tax rate is based on their whole income, which reflects their true ability to pay. The obtained average tax rate is then applied to their income taxable in Obwalden only, the taxable income. Since it is rate-determining income which puts taxpayers in or just below the regressive part of the tax scheme, in the following graphs the treatment and control groups are defined according to their rate-determining income.

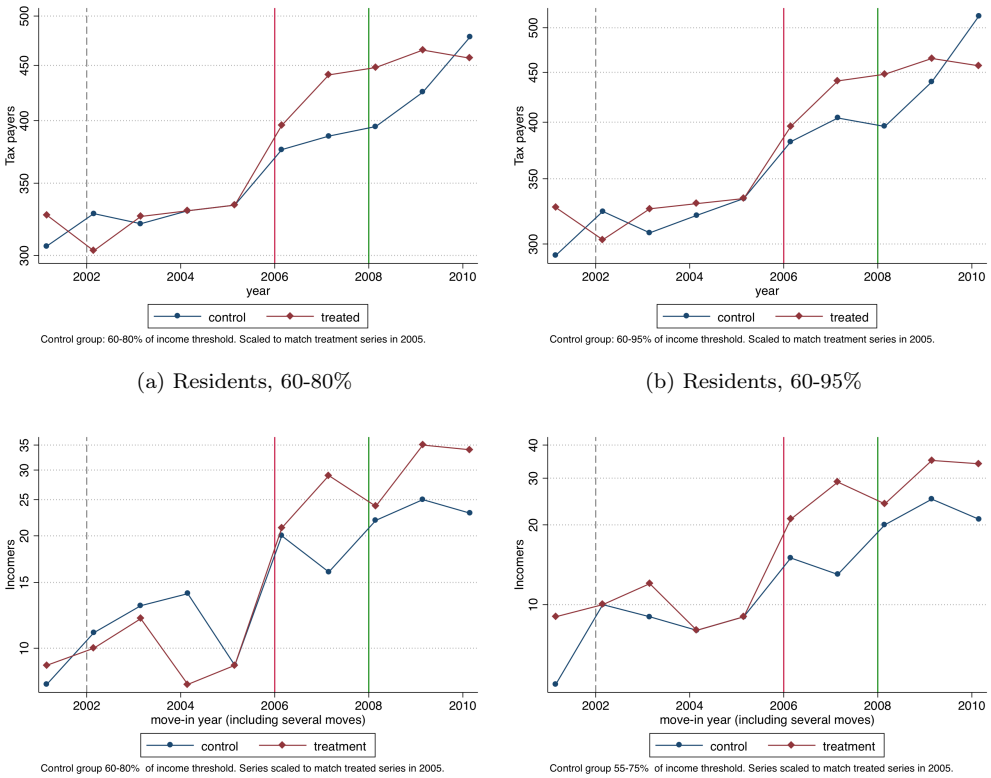
Figure 4 shows the evolution in the number of treated taxpayers compared to different control groups. Panels a) and b) depict the stock of all taxpayers living in a canton in a given year and falling into either the treatment or control category. The difference between Panel a) and Panel b) is that in the former the control group is defined as having a rate-determining income of 60-80% of the regressive threshold, while in Panel b) taxpayers with rate-determining income of up to 95% of the threshold, or 280,000 CHF, are in the control group. While the latter group is closer to the treated, it seems as if the control group could be responding to the treatment, as their number goes up too after the tax reform. Especially incomers from other cantons may have expected to have higher incomes in the future, or they their former canton of residence's income definition resulted in a higher taxable income than the taxable income they had according to Obwalden's tax laws.

As expected, both control groups seem to respond to the 2008 reform, while the number of originally treated taxpayers remains stable after 2007. This makes sense, since the 2008 reform implied large cuts in marginal and average tax rates for the control group, but not for the originally treated.

Panels c) and d) depict the flow of taxpayers moving to Obwalden in a given year. In Panel c) again the control group is defined as having rate-determining income of 60-80% of the regressive threshold. Again it seems that the control group responded to the treatment in 2006. Therefore, in Panel d) the control group is redefined as having a rate-determining income of 55-75% of the regressive threshold for comparison.

Overall the number of incomers in the treatment and control group is very small and therefore more noisy than the series of the total number of taxpayers. This is also affects the trends prior to the reform. While in all four panels of Figure 4 the common trend

assumption is clearly fulfilled, there is more noise in the case of the incomers compared to the full set of residents. The number of incomers depicted in Figure 4 is potentially downward biased. The register data only record the last move of a taxpayer. Since the data were exported in 2012 (when only tax records up to 2010 were definitively assessed), households who moved within the canton between 2006 and 2012 do not show up as incomer from outside anymore. In the stock of rich taxpayers, however, there are only a handful of observations with a moving date after 2005 and for which the canton of origin is Obwalden, thereby indicating that new arriving taxpayers did not move around substantially within Obwalden.



(a) Residents, 60-80%

(b) Residents, 60-95%

(c) Inmovers, 60-80%

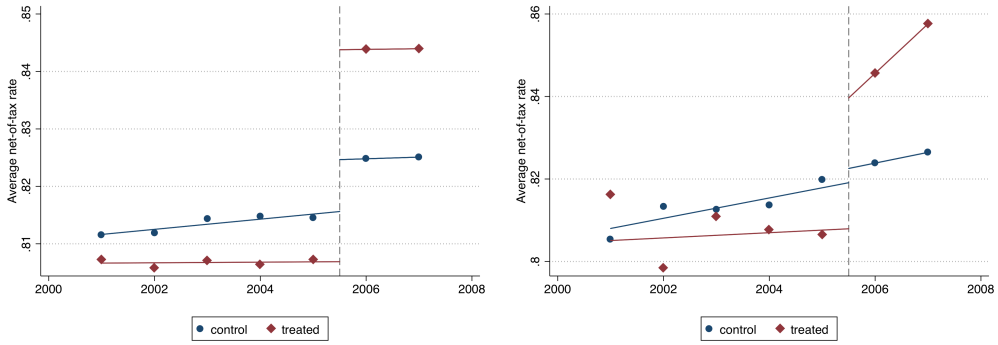
(d) Inmovers, 55-75%

Figure 4: Control vs. treatment groups, 2001-2010

Note: The percentages indicate how the control group is defined in each panel in terms rate-determining income relative to the regressive threshold of 300,000 CHF. 60-80% , for example, means that taxpayers with incomes of 180,000-240,000 CHF fall into the control group. The treatment group is always defined as taxpayers above the threshold of 300,000 CHF. *Source*: Personal income and wealth tax data Obwalden, 2001-2010.

Table 1 presents descriptive statistics for the treatment and control groups of both, the stock and the inflow of rich taxpayers, respectively. While treatment and control groups differ from the total flow and stock, respectively, they are similar to each other in most

characteristics. Taxpayers in the group of treated are more likely to be foreigners, and they depend more heavily on capital income and self-employment, but less on employment than the control group. These differences in the income composition, however, arise from how the treatment is designed. By aiming at top earners, the treatment group will almost by definition depend more heavily on capital than on labor incomes, since this is a feature we observe at the top of the income distribution across space and time in capitalist societies.



(a) Residents (b) Inmovers

Figure 5: Average net-of-tax rates in control and treatment groups, 2001-2008

Note: Control group defined as having rate-determining income of 180,000-240,000 CHF, corresponding to 60-80% of the regressive threshold. The treatment group are taxpayers above the threshold of 300,000 CHF. *Source*: Personal income and wealth tax data Obwalden, 2001-2010.

Figure 5 shows the variation in the average net-of-tax rates (i.e., 1-$\bar{\tau}$) created by the reform. While before the reform the treated had lower net-of-tax rates than taxpayers in the control group, this relation was reversed with the regressive income tax. The treated residents (Panel a) faced an increase of $\simeq$ 5% in their average net-of-tax tax rate. The upward sloping curves in Panel b) further suggest that inmovers selected into low-tax municipalities. Especially for the (small) group of treated inmovers the average net-of-tax rate was remarkably higher in 2007 than in 2006.

Figure 6 shows the distribution of taxpayers by their canton of origin. Most incomers lived in another Swiss canton before moving to Obwalden, yet still almost 15% of all incomers moved in from abroad (category A). While there are incomers from every canton in each year (not depicted in Figure 6), there are cantons from which a significantly higher share of incomers originated, such as Lucerne (LU), Nidwalden (NW) and Zurich (ZH). Not surprisingly, these cantons are either direct neighbors (LU and NW) or, in the case of Zurich and Aargau (AG) at least relatively close by and have a large total population.

Table 1: Characterisitics of Treatment and Control Groups, 2001-2010

	All Taxpayers			New Incomers			
	Treated	Control 60-80%	Total	Treated	Control 55-75%	Control 60-80%	Total
NTR ($t < 2006$)	0.807	0.814	0.879	0.807	0.815	0.813	0.876
	(0.01)	(0.01)	(0.048)	(0.008)	(0.009)	(0.011)	(0.046)
NTR ($t >= 2006^*$)	0.844	0.825	0.888	0.846	0.826	0.825	0.885
	(0.019)	(0.009)	(0.047)	(0.021)	(0.005)	(0.007)	(0.048)
Female	0.082	0.083	0.305	0.062	0.048	0.061	0.347
	(0.274)	(0.276)	(0.468)	(0.242)	(0.215)	(0.24)	(0.476)
Age	59.670	57.030	48.440	52.080	49.460	49.470	43.260
	(12.6)	(12.62)	(19.83)	(10.86)	(11.08)	(11.16)	(15.9)
Married	0.773	0.769	0.467	0.767	0.745	0.756	0.442
	(0.419)	(0.422)	(0.499)	(0.424)	(0.437)	(0.431)	(0.497)
Double earners	0.422	0.483	0.214	0.430	0.476	0.458	0.160
	(0.494)	(0.5)	(0.41)	(0.496)	(0.501)	(0.5)	(0.366)
Swiss citizen	0.865	0.919	0.929	0.696	0.705	0.678	0.853
	(0.342)	(0.273)	(0.257)	(0.462)	(0.458)	(0.47)	(0.355)
Moved-in from abroad	0.130	0.089	0.065	0.115	0.080	0.120	0.134
	(0.337)	(0.285)	(0.246)	(0.32)	(0.273)	(0.326)	(0.341)
Employment							
Employee	0.517	0.550	0.608	0.637	0.772	0.740	0.780
	(0.5)	(0.498)	(0.488)	(0.482)	(0.421)	(0.44)	(0.414)
Self employed	0.153	0.148	0.059	0.067	0.041	0.061	0.059
	(0.36)	(0.355)	(0.236)	(0.251)	(0.2)	(0.24)	(0.235)
Retiree	0.131	0.139	0.217	0.052	0.062	0.069	0.096
	(0.337)	(0.346)	(0.413)	(0.222)	(0.242)	(0.254)	(0.295)
Share of income from:							
emplyoment	0.317	0.440	0.580	0.455	0.613	0.590	0.681
	(0.349)	(0.378)	(0.685)	(0.394)	(0.362)	(0.369)	(0.969)
self-employment	0.185	0.144	0.038	0.131	0.118	0.130	-1.719
	(0.327)	(0.291)	(24.28)	(0.29)	(0.264)	(0.284)	(130.9)
capital	0.484	0.347	0.139	0.440	0.246	0.262	1.372
	(0.389)	(0.315)	(19.52)	(0.441)	(0.292)	(0.3)	(91.75)
Major income source:							
employment	0.297	0.453	0.592	0.460	0.655	0.641	0.683
	(0.457)	(0.498)	(0.491)	(0.5)	(0.477)	(0.481)	(0.465)
self-employment	0.169	0.130	0.047	0.121	0.099	0.108	0.041
	(0.442)	(0.41)	(0.272)	(0.372)	(0.363)	(0.379)	(0.264)
capital income	0.443	0.279	0.062	0.368	0.127	0.131	0.082
	(0.533)	(0.498)	(0.321)	(0.526)	(0.517)	(0.504)	(0.357)
Observations	3,827	3,150	235,867	193	145	131	7,682

Means and standard errors (in parentheses). NTR: average net-of-tax rate, i.e. $(1 - \bar{\tau})$.
*: years 2006 and 2007; in the following years the NTR is virtually identical for everyone.

In the case of the latter two the share of treated incomers is larger than the total share of inmovers over the period 2001-2010.

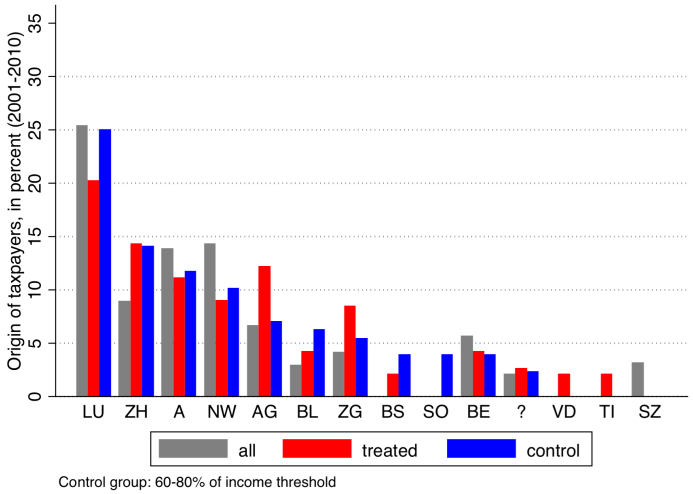


Figure 6: Origin of taxpayers who moved to Obwalden, 2001-2010

Note: A stands for incomers coming from abroad. Origin is irrespective of the nationality, so coming from A is not mean foreigners, and incomers from other cantons are not necessarily Swiss nationals. The origin is only recorded for the last move, such that the origin before first moving to Obwalden gets lost once taxpayers move within the canton. Taxpayers who have Obwalden as origin are excluded, as they were either born in Obwalden or moved within Obwalden.
Source: Personal income and wealth tax data Obwalden.

Table B1 in the Appendix further shows the distribution of the origin of taxpayers in control and treatment group before and after the treatment. While overall there where no shifts in the origin of taxpayers (last two columns of Table B1), the composition of the treatment and the control experienced some changes. In the treatment group the share of taxpayers coming from Zurich, Bern (BE), and from abroad, has increased in the post-reform years, while the share of incomers from of the closest neighbors Lucerne, Nidwalden, and Zug, has decreased. This suggests that the reform did not just attract taxpayers living close by, but also those coming from further away, including those from abroad.

6.1.2 Estimation and results

Table 2 presents elasticity and reduced form estimates for the total number of rich taxpayers (corresponding to Panels a) and b) of Figure 4), and the number of rich taxpayers moving to Obwalden (corresponding to Panels c) and d) of Figure 4).

The elasticities are estimated using a 2SLS approach (following Kleven *et al.*, 2014). Collapsing the data into year t, group $i = 0, 1$ cells allows for a simple DiD model of the

form:

$$\log N_{i,t} = \alpha + \varepsilon \cdot \log(1 - \tau_{i,t}) + \beta \cdot TR + \gamma_t + \epsilon_{i,t} \quad , \tag{9}$$

where $N_{i,t}$ denotes the number of taxpayers in group $i = 0, 1$, and $(1 - \tau_{i,t})$ is the net-of-tax rate for that group. Depending on the specification, I estimate the elasticity ε with respect to the average or the marginal tax rate. $TR = \mathbb{1}[i = 1]$ is the treatment group dummy and γ_t are year dummies. I instrument for the net-of-tax rate with the treatment interaction dummy $DiD = TR \cdot \mathbb{1}[t \geq 2006]$. In addition, Columns 1 and 2 in table 2 present the reduced form estimates from the following DiD estimation:

$$\log N_{i,t} = \alpha + \beta \cdot (TR \cdot \mathbb{1}[t \geq 2006]) + \gamma \cdot TR + \delta \cdot \mathbb{1}[t \geq 2006] + \epsilon_{i,t} \tag{10}$$

Here, β is the DiD estimator on the average increase in the number of residents or incomers, respectively, after the introduction of the tax reform in 2006.

Since the control group was affected by the introduction of the flat rate tax in 2008, in the main specification only years up to 2007 are considered. With seven years of observations, five pre- and two post-reform, and two groups, this leads to 14 group-year cells which are reweighted by the number of taxpayers in each cell.[14]

The results for the stock of rich taxpayers are reported in Panel A of Table 2. The reduced form estimates suggest that in the first two years after the introduction of the regressive tax the number of taxpayers increased by 37, or 6.5%. The corresponding short run elasticities with respect to the marginal and average net-of-tax rate are 0.78 and 1.98 (Columns 3 and 4), respectively. The medium-run elasticity with respect to the average net-of-tax rate, estimated up to the year 2010, is 1.54 and therefore somewhat smaller. This is somewhat surprising, because one would expect the effect to accumulate over time. One possible explanation could be that from 2008 onward, the control group arguably has responded to the introduction of the flat rate tax (see Figure 4). Due to the contamination of the control group after 2008, this estimate therefore represents a lower bound. Columns 5 and 6 of Table 2 finally show how the definition of the control group can influence the resulting estimates. In correspondence with Panel b) of Figure 4, the control group is redefined containing taxpayers with rate-determining income of 180,000-285,000 CHF (or 60-95% of the regressive income threshold). The corresponding estimates are all larger and, the medium-run elasticities are substantially larger than the short-run elasticity estimates. Since ths control group seems to have responded even more to the 2006 and especially the 2008 reforms, this estimates have again to be taken

[14] Estimates and standard errors remain virtually unchanged when the regression is not weighted.

as lower bounds, even though they are already large. For all IV regressions, the first stage is highly significant and strong, with large R-squared and Chi-squared statistics.

Panel B of Table 2 reports the results for the annual flow of taxpayers moving into Obwalden each year. The reduced form estimates in Columns 1 and 2 suggest that roughly 8 rich taxpayers arrived in each of the two post reform years 2006 and 2007. While this may seem negligible, this corresponds to an increase in the number of rich inmovers of almost 37% when estimated in logs. The corresponding elasticities are very large, which is due to the small number of taxpayers in each year-group cell. One additional attracted rich taxpayer corresponds to and increase of 10% in 2005. Therefore, the elasticities should be taken with a grain of salt. They are the result of the small size of the canton and residency-based taxation (as opposed to taxation at the source). Also, with the Agreement on Free Movement of Labor with the European Union the pool of potential inmovers to Obwalden is large. The estimates serve as a reference point for other, small jurisdictions, especially within border regions, in a setting of residence-based taxation and no restrictions on migration. They show that given the absence of restrictions, workers willingness to relocate is high.

Table 2: Difference-in-Differences of Taxpayers

	(1) Reduced (level)	(2) Reduced (log)	(3) 2SLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
Panel A						
Stock of taxpayers (all residents and incomers)						
Control group	*60-80%*				*60-95%*	
DiD	37.390***	1.065***				
	(0.490)	(0.002)				
ε_τ (2006-07)			0.780***		0.941***	
			(0.017)		(0.015)	
$\varepsilon_{\bar{\tau}}$ (2006-07)				1.981***		2.406***
				(0.043)		(0.036)
ε_τ (2006-10)			0.880***		1.918***	
			(0.049)		(0.054)	
$\varepsilon_{\bar{\tau}}$ (2006-10)				1.537***		3.509***
				(0.086)		(0.085)
Panel B						
Flow of taxpayers (incomers only)						
Control group	*60-80%*				*55-75%*	
DiD	8.478***	1.376***				
	(0.707)	(0.065)				
ε_τ (2006-07)			4.112***		5.854***	
			(0.654)		(0.420)	
$\varepsilon_{\bar{\tau}}$ (2006-07)				8.326***		11.889***
				(1.228)		(0.634)
ε_τ (2006-10)			12.703***		14.325***	
			(2.259)		(1.604)	
$\varepsilon_{\bar{\tau}}$ (2006-10)				23.927***		24.116***
				(4.181)		(1.994)

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Observations weighted by number of taxpayers in each cell.
All regressions include year dummies, a treatment dummy and a constant.

6.2 The Elasticity of Taxable Income at the Top

Following the panel approach by Gruber and Saez (2002), I estimate the elasticity of taxable income for taxpayers with real incomes above 300,000 CHF, since for these income groups the tax cuts were remarkably large, not only in 2006 but also with the introduction of the flat rate tax in 2008. Abstracting from income effects leads to the following baseline

panel specification

$$\log(z_{it_2}/z_{it_1}) = e \cdot \log[(1-\tau_{t_2})/(1-\tau_{t_1})] + \upsilon_{it}, \tag{11}$$

where z_{it_1} and z_{it_2} is reported income in year t_1 and t_2, respectively, and e is the ETI. Note that OLS estimates of (11) are biased, as the term capturing the tax rate change is correlated with the error term υ_{it}. If there is a positive shock to income ($\upsilon_{it} > 0$), then, due to progressivity, the marginal tax rate τ increases mechanically. Gruber and Saez (2002) propose as a natural instrument the predicted net-of-tax rate change if income does not change from year 1 to year 2, i.e., $\log(1-\tau_{t_2}(z_1))$.

Such an IV-estimation is still susceptible to bias, due to mean reversion (because of transitory incomes) and exogenous changes in the income distribution. Both result in a correlation between z_{it_1} and υ_{it}.[15] The solution proposed by Auten and Carroll (1999) and adopted in Gruber and Saez (2002) is to include a large set of base year (i.e., t_1) income controls. However, as Weber (2013) shows, base year incomes are still correlated with the error in a panel setting. She therefore suggests to use lagged base year income controls, z_{it_1-s}. Having many years of data, it is possible to add a rich set of such controls, as the effects from mean reversion and changes in the income distribution are probably not linear. Therefore, in addition to log income in period $t_1 - s$, a 10-piece spline in lagged log base year income (i.e., a spline for each decile of the gross income distribution in $t_1 - s$) is included (Gruber and Saez, 2002). Because the endogeneity of z_{it_1} also affects the tax rate instrument, I use a lag of base year income to mitigate potential endogeneity bias (Weber, 2013).

I further include a vector of individual controls, $\mathbf{x_{it}}$, containing the age of the main taxpayer and a set of dummies for married, dependents, double-earners (married taxpayers only), retirees and self employed. Time dummies λ_t control for period effects. Including all these covariates in equation (11), the econometric model reads as follows:

$$\begin{aligned} \log\left(\frac{z_{it_2}}{z_{it_1}}\right) &= \alpha_0 + e \cdot \log\left[\frac{1-\tau_{t_2}(z_1)}{1-\tau_{t_1}(z_1)}\right] + \mathbf{x_{it}}\boldsymbol{\beta} \\ &+\alpha_1 \log(z_{it_1-s}) + \sum_{k=1}^{10} \alpha_{2k} SPLINE_k(z_{it_1-s}) + \lambda_t + \upsilon_{it} \end{aligned} \tag{12}$$

This identification strategy relies on the assumption that mean reversion or changes in inequality are not correlated with year-specific tax changes, so that the relationship between z_{it_1} and υ_{it} remains constant over time (see Gruber and Saez, 2002, p.12). Since

[15] For an extensive discussion on consistent ETI estimates, circumventing the problems of mean reversion and exogenous income trends, see Weber (2013).

I am interested in the effect of the regressive income tax reform on the reported income, I restrict the sample to taxpayers who had rate-determining income larger than 300,000 CHF at least once in the sample period. Descriptives of the sample used for regression can be found in Table B2 in the Appendix.

Table 3: ETI: GMM IV Regressions of Taxable Income on Net-of-Tax Rate

	Baseline		Base-year		Splines	
Taxable income	(1)	(2)	(3)	(4)	(5)	(6)
$\ln \Delta(1-\tau)$	1.899	1.477	0.132	0.0174	0.127	0.246
	(2.325)	(2.429)	(1.667)	(1.518)	(1.646)	(1.446)
Log lagged base-year inc. ($\Delta = 3$)			-0.0588***	-0.172***	-0.268***	-0.251
			(0.0116)	(0.0512)	(0.104)	(0.212)
Married			0.0564	*omitted*	0.0402	*omitted*
			(0.0480)		(0.0489)	
Double earners			0.0755	0.412***	0.0925*	0.422***
			(0.0477)	(0.124)	(0.0481)	(0.124)
HH with children			-0.0239	0.00736	-0.00391	0.0161
			(0.0470)	(0.0983)	(0.0479)	(0.0977)
Self employed			0.0655	0.213	0.0466	0.222
			(0.0448)	(0.227)	(0.0471)	(0.222)
Retiree			-0.0450	-0.0872	-0.0599	-0.116
			(0.0673)	(0.140)	(0.0683)	(0.136)
Age			-0.00110	-0.0458	-0.000531	-0.0424
			(0.00195)	(0.0598)	(0.00192)	(0.0596)
Municipality dummies	N	N	Y	*omitted*	Y	*omitted*
Year dummies	N	N	Y	Y	Y	Y
10-piece income splines	N	N	N	N	✓	✓
Individual fixed effect	N	Y	N	Y	N	Y
Constant	0.00465		0.581***		2.042***	
	(0.0447)		(0.211)		(0.785)	
Observations	2,558	2,488	2,275	2,204	2,275	2,204
R-squared		-0.020	0.028	0.042	0.037	0.048
N_clust	534	464	509	438	509	438
Rank	2	1	21	12	30	21

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Sample restricted to taxpayers who have an income $> 300,000$ CHF at least once in 2001-2010.

Table 4: ETI: GMM IV Regressions of Rate-determining Income on Net-of-Tax Rate

	Baseline		Base-year		Splines	
Rate-determining income	(1)	(2)	(3)	(4)	(5)	(6)
$\ln \Delta(1-\tau)$	3.187	3.776	0.598	0.741	0.492	0.156
	(2.513)	(3.098)	(1.586)	(1.442)	(1.220)	(0.996)
Log lagged base-year inc. ($\Delta = 3$)			-0.144***	-0.322***	-0.182**	-0.457***
			(0.0256)	(0.0582)	(0.0786)	(0.122)
Married			-0.0543	*omitted*	-0.0425	*omitted*
			(0.0459)		(0.0462)	
Double earners			0.134***	0.404***	0.166***	0.398***
			(0.0434)	(0.0954)	(0.0445)	(0.0942)
HH with children			0.0769**	0.0662	0.0907**	0.0766
			(0.0378)	(0.0712)	(0.0380)	(0.0709)
Self employed			0.0666*	0.154	0.0502	0.154
			(0.0383)	(0.128)	(0.0379)	(0.126)
Retiree			-0.0208	-0.241**	-0.0124	-0.210**
			(0.0574)	(0.0992)	(0.0562)	(0.0987)
Age			0.00123	0.00818	0.00153	-0.000351
			(0.00159)	(0.0483)	(0.00159)	(0.0473)
Municipality dummies	N	N	Y	Y	Y	Y
Year dummies	N	N	Y	Y	Y	Y
10-piece income splines	N	N	N	N	Y	Y
Individual fixed effect	N	Y	N	Y	N	Y
Constant	-0.0955**		1.600***		2.114**	
	(0.0441)		(0.328)		(0.866)	
Observations	3,090	3,024	3,039	2,975	3,039	2,975
R-squared		-0.100	0.059	0.080	0.079	0.099
N_clust	593	527	589	525	589	525
Rank	2	1	21	17	30	26

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Sample restricted to taxpayers who have an income $> 300,000$ CHF at least once in 2001-2010.

Tables 3 and 4 report different specifications to estimate the elasticity of taxable and rate-determining income, respectively. Table 3 reports the baseline ETI estimates (Colmuns 1 and 2), along with estimates including a set of individual controls and base-year income (Columns 3 and 4), and including 10-piece income splines (Columns 5 and 6). Even columns additionally include individual fixed effects. Point estimates are in the lower range of what other studies have found (see Gruber and Saez, 2002; Kleven *et al.*, 2014), and are all statistically insignificant. The coefficient on lagged base year-income on the other hand is significant in three out of four specifications, implying that there is mean-reversion in the income generating process at the top. The dummy for the top spline (not reported) is statistically significant and positive in models without fixed effects, but becomes insignificant once fixed effects are included. What is striking is the large and statistically significant coefficient on the dummy for double earners in the fixed effects models. This indicates that large adjustments happen for the second earners or, possibly, through changed marriage behavior. Especially for high income

earners, mandatory joint tax filing of married couples is a disincentive to get married. With regressive tax rates at least high-income couples may benefit from marriage, and the discrimination of marriage vanishes completely with the introduction of the uniform flat rate tax in 2008. That second earners respond strongly to taxation is a channel which has found to be important in the literature on labor supply and taxation (Meghir and Phillips, 2010; Crossley and Jeon, 2007; Eissa and Hoynes, 2004). This moving from mandatory joint filing to individual taxation of married couples may therefore have large positive labor supply effects, given that the observed adjustments are the result of increased labor supply.

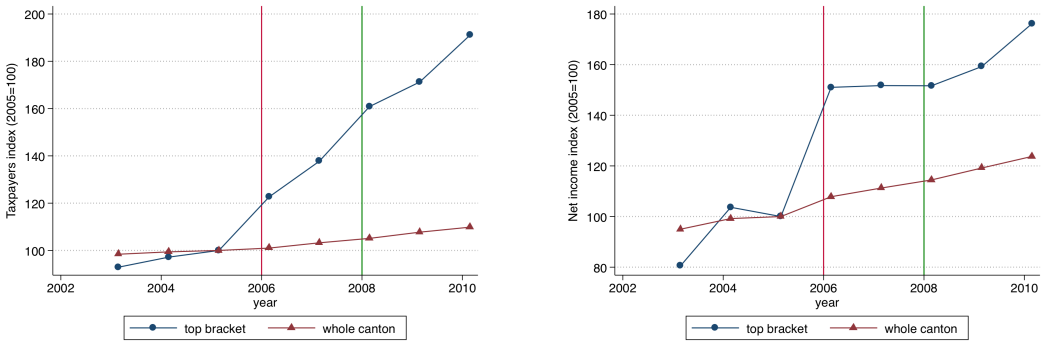
Table 4 presents the same set of specifications, but with changes in rate-determining income as dependent variables. Due to the distinction between taxable and rate-determining income, taxpayers an incentive to adjust rate-determining income even more than taxable income. Indeed, point estimates for rate-determining income are higher, yet they remain statistically insignificant and are sensitive to specification. The described effect of double earner married couples remains large and statistically significant, even excluding individual specific fixed effects. Adjustment behavior of the household through the second earner therefore seems to be a particularly strong channel, much more than for example self-employment. This is somewhat surprising since the latter have usually been found to have particularly large behavioral responses to taxation. Also, in the estimation sample of top earners, around 20% of taxpayers are self-employed, about three times as many as in the whole population of taxpayers.

All these results, however, should be interpreted with prudence. Despite careful considerations of the specification, the identification strategy has turned out to be very sensitive. That the estimated elasticities remain statistically insignificant can be explained by the small sample size. This limitation, however, lies within the nature of the canton of Obwalden itself. Specifications including large parts of the population delivered statistically significant estimates, yet these were often completely out of range of what we might think of as a reasonable ETI and often had the wrong sign.

7 Comparison with the Neighbors Nidwalden and Lucerne

7.1 Federal Income Tax Data and Descriptives

The observed increase in rich taxpayers and in incomes of both, residents and newly arriving taxpayers could be due to spurious correlation, with the increase stemming from a positive income shock affecting the top 1% in the whole country. The federal income tax



(a) Evolution of taxpayers

(b) Income evolution

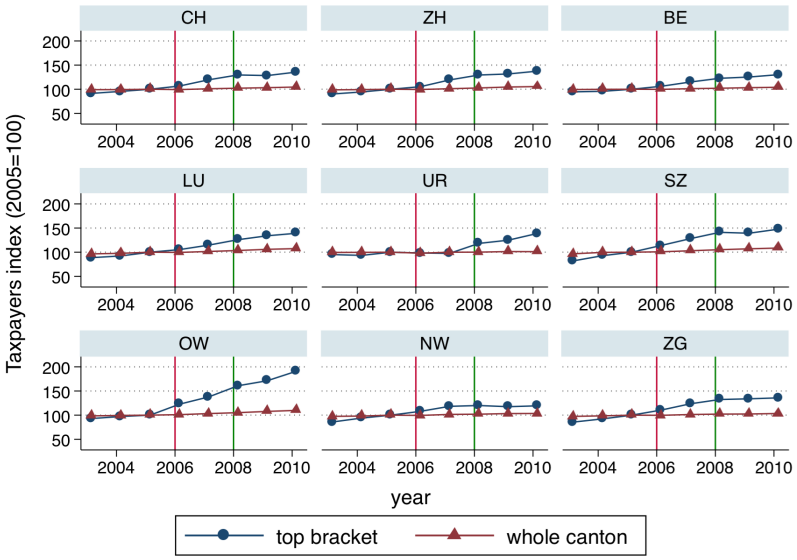
Figure 7: Evolution of net income and taxpayers in Obwalden, top bracket and overall

Note: Tax base: net income as defined by federal income tax (*Revenu net*).
Source: ESTV, Federal income tax statistics, 2003-2010.

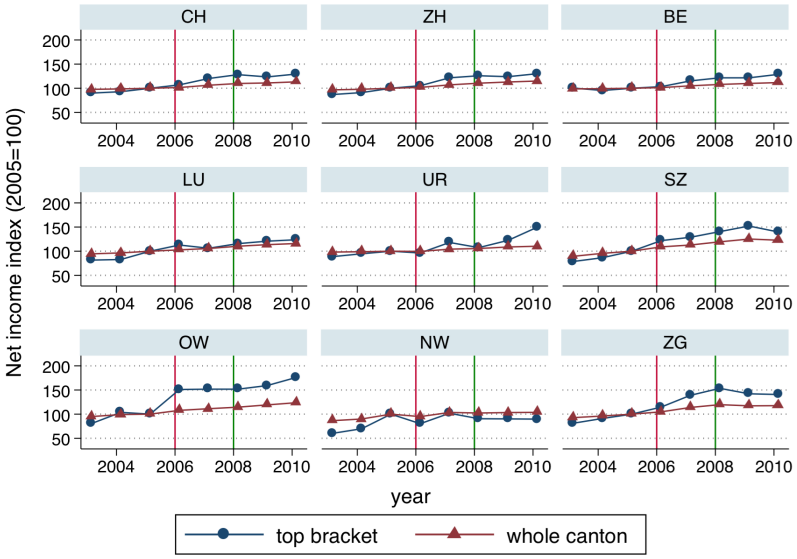
statistics allow comparing the evolution of the tax base in Obwalden to the one in other cantons across time. While cantonal taxable income definitions differ, the definition of taxable income for the federal income tax is the same across cantons, and has remained stable over the period 2001-2010.

Descriptive inspection of the number of taxpayers and the income arising from the top bracket of the federal income tax statistics (200,000 CHF and more) suggests, that Obwalden indeed experienced a large increase in rich taxpayers. Figure 7 shows indices for taxpayers (Panel a) and net income (Panel b) of the top bracket and the whole canton (2005 = 100). Obwalden has experienced a steady increase in tax units, but this has been much steeper in the top bracket than overall: from 2005 to 2006, the share of taxpayers in the latter group increased by 20%. (Figure 7.a). While the increase in taxpayers has been steady, the increase of net income in the top bracket is characterized by an increase of 50% from 2005 to 2006 (Figure 7.b). This suggests that top incomes have increased remarkably, especially since there are only some 200 to 250 taxpayers (in 2005 and 2006, respectively) in this bracket in the federal statistics.

Comparing these experiences to neighboring and near-by cantons with the largest inflows (see Figure 6) shows that while except Nidwalden, all the low-tax neighbors experienced a slight increase in their tax base at the top after 2006, in none of them was the increase characterized by such a sharp jump as in Obwalden. This indicates that the increase in Obwalden may indeed have been triggered by the large tax cut for top incomes.



(a) Evolution of taxpayers



(b) Income evolution

Figure 8: Evolution of taxpayers and net income in selected cantons, top bracket and overall

Note: Tax base: net income as defined by federal income tax (*Revenu net*).
Source: ESTV, Federal income tax statistics, 2003-2010.

7.2 DiD Estimates of Relative Performance

As a robustness check to the estimates presented in Section 6, in the following different reduced form estimates from DiD estimations comparing Obwalden with its direct

neighbors Nidwalden and Lucerne are presented. Nidwalden is a useful control group since it's geographic characteristics and location are very similar to that of Obwalden, making commuting times to all major cities in the area, namely Lucerne, Zurich, and Zug, comparable. Lucerne is Obwalden's major neighbor and the closest urban center. All three cantons share the same local labor market.

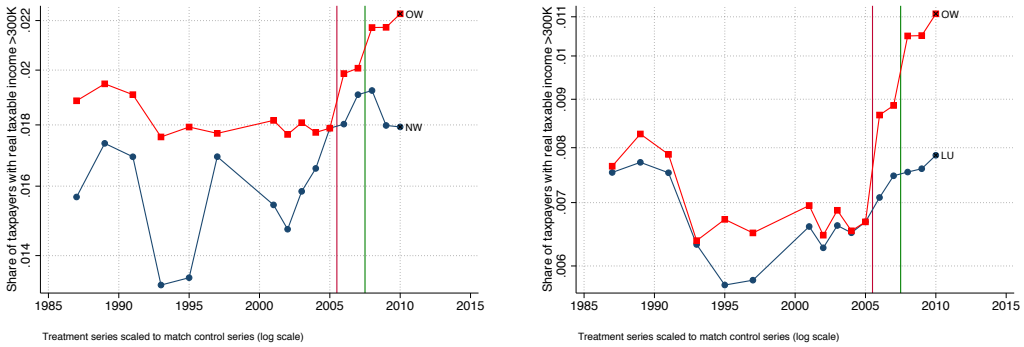
A major difference between the cantons are the average tax rates. Nidwalden has always had lower taxes than Obwalden, Lucerne, especially the city, has always had a higher tax burden. Nidwalden was one of the cantons Obwalden wanted to challenge by meeting or even undercutting Nidwalden's tax rates for high incomes and wealth levels. This can be seen in Figure B2 in the Appendix, which shows the evolution of tax rates in the two cantons for different gross income levels for comparison. It is apparent that the reform aimed at undercutting the traditional low-tax canton at high incomes only. Even after the flat rate tax introduction in 2008, the average tax rate is higher in Obwalden for Married taxpayers without children with a modest gross income of 60,000 CHF. Figure B3 compares the corresponding evolution of tax rates in Lucerne and Obwalden. Here, tax rates have moved fairly parallel. In fact, Lucerne adoped major tax cuts in 2008 and 2010, hoping to attract rich taxpayers as well. Summing up, the 2006 reform in Obwalden reduced tax rates for everyone, but the tax cuts were by far largest for high incomes. Due to the shifting effect of tax multipliers, the effect of the 2008 reform was small for high incomes, but comparatively large for middle incomes.

When comparing Obwalden to its neighbors, two outcomes are of particular interest: (i) the share of rich, defined as taxpayers with federal taxable income above 300,000 CHF, in percent of the total of taxpayers; and (ii) net income per taxpayer. These outcomes are aggregated at the municipality level. This results in seven treated municipalities in Obwalden, eleven control municipalities in Nidwalden, and 83 control municipalities in Lucerne.

7.2.1 Outcome 1: Share of rich taxpayers

Figure 9 depicts the share of taxpayers in Lucerne (LU), Nidwalden (NW) and Obwalden (OW), respectivel, with taxable income above 300,000 CHF.[16] The series are scaled such that Obwalden matches the control canton in 2005. In reality, before the tax reform Obwalden's share of rich taxpayers was lower than in Nidwalden and Lucerne. Both Panels a) and b) show how the share of rich taxpayers increased steeply after the reform in Obwalden. Especially in comparison with Lucerne, the increase was dramatic.

[16]This is federal taxable income, which generally exceeds cantonal taxable income as deductions at the federal level are less generous than at the cantonal level.



(a) Nidwalden vs. Obwalden

(b) Lucerne vs. Obwalden

Figure 9: Share of rich taxpayers with federal taxable income $> 300,000$ CHF

Note: Treatment series scaled to match control series in 2005 (log scale).

Table 5 shows different specifications of the corresponding DiD estimates of the log share in rich taxpayers with taxble income above 300,000 CHF in each canton. Top Panel A presents results for the comparison with Nidwalden, estimates in Panel B at the bottom of the table stem from the comparison with Lucerne. The estimated baseline increase in the share of rich taxpayers in Obwalden due to the tax reform is 29% when compared to Nidwalden, and 24% when compared to Lucerne. These estimates are robust to the inclusion of year and municipality fixed effects (Columns 3 and 4, respectively), although in the case of Nidwalden, they become statistically insignificant. Adding a time trend rises the estimates above 35% in both comparison scenarios. When using Lucerne as control group, the inclusion of a canton-specific time fixed effect (Column 5) increases the estimate even more and suggests that the reform in Obwalden doubled the share of rich taxpayers compared to the counter factual scenario. Overall, coefficients are comparable when estimated with either Nidwalden or Lucerne as a control group. Given that the comparison with Lucerne satisfies the parallel trends assumption in a more satisfactory way than Nidwalden, estimates from the comparison with Lucerne should, however, be more trustworthy.

Table 5: DiD Estimates of Log Share of Rich in the Canton

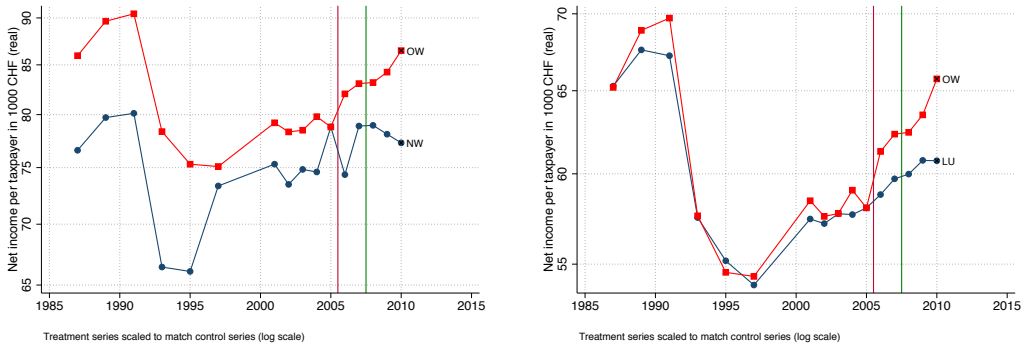
	(1) Baseline	(2) Canton trend	(3) Year FE	(4) Municip. FE	(5) Canton-time FE
	Panel A: Nidwalden				
DiD	1.298*	1.364*	1.298	1.298	1.343
	(0.192)	(0.214)	(0.197)	(0.196)	(0.288)
Canton-specific trend	N	Y	N	N	N
Year FE	N	N	Y	Y	N
Municipality FE	N	N	N	Y	N
Canton-specific time FE	N	N	N	N	Y
Observations	288	288	288	288	288
R-squared	0.126	0.128	0.137	0.165	0.141
No. of clusters	18	18	18	18	18
F	6.206	12.22	.	9.437	.
	Panel B: Lucerne				
DiD	1.240*	1.352***	1.242*	1.259**	2.006***
	(0.135)	(0.108)	(0.136)	(0.137)	(0.507)
Canton-specific trend	N	Y	N	N	N
Year FE	N	N	Y	Y	N
Municipality FE	N	N	N	Y	N
Canton-specific time FE	N	N	N	N	Y
Observations	1,411	1,411	1,411	1,411	1,411
R-squared	0.012	0.013	0.022	0.084	0.025
No. of clusters	110	110	110	110	110
F	11.01	16.2	5.925	7.216	.

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses, clustered at the municipality level. Coefficients are exponentiated, such that the reported coefficients can be interpreted as percentage changes. All regressions include a constant, a post-treatment dummy ($t > 2005$), and a treatment group dummy. DiD denotes the interaction of the post-treatment with the treatment group dummy, hence the DiD estimator.

7.2.2 Outcome 2: Net income per taxpayer

The evolution of net income per taxpayer is plotted in Figure 10. Again pre-treatment trends are most similar for Obwalden and Lucerne. The dip in taxable income per taxpayer in the mid 1990s is mainly data driven. The number of taxpayers escalates from 1991 to 1993, thereby increasing the denominator. The reason for this is unclear,

but is most probably related to changes in reporting tax statistics by the Federal Tax Administration. Therefore (and as can be seen from the graphs) it affects all cantons equally, such that it should not pose a threat to identification. While the increase in Obwalden in income per taxpayer is not as dramatic as the increase in the share of rich taxpayers, it is still apparent how income growth in Obwalden was steeper than in its neighboring cantons.



(a) Nidwalden vs. Obwalden

(b) Lucerne vs. Obwalden

Figure 10: Net income per taxpayer

Note: Treatment series scaled to match control series in 2005 (log scale). Net income is *"Reineinkommen"* as defined by the federal income tax.

The corresponding regression results are presented in Table 6. Column 1 presents baseline DiD estimates, in Column 2 a canton-specific time trend and a set of control dummies are added. Since the regressions are run at the municipality level, adding controls increases the number of cells and thereby number of observations reported.[17] The characteristics controlled for are dummies for self-employed and retirees (with employees as reference category), and married, single parents, and married with children (with single taxpayers with no dependents being the reference category).[18] The estimates suggest, that in the five years after the reform, taxable income per taxpayer increased by roughly 16% more in Obwalden than it would in absence of the large tax cuts. Controlling for municipality and time fixed effects, however, makes the effect vanish. The coefficients in Column 3 are close to one and statistically insignificant. In Columns 4 and 5 finally, I split the sample into taxpayers with taxable incomes smaller than 300,000 CHF, and therefore falling below the regressive threshold, and into those with incomes above the threshold. As expected, the reform did not have an effect on average income of taxpayers below

[17]Note that all regressions are unweighted, because the number of taxpayers within each cell is not constant within a panel. This violates a requirement for weighted panel fixed effects regressions.

[18]The detailed results can be found in Tables B4 and B5 in the Appendix.

the threshold. For taxpayers above the threshold, however, net income per taxpayer rose significantly. The comparison with Nidwalden (Panel A) suggests a substantial increase in net income of rich taxpayers of 26%. The estimates from the comparison with Lucerne are merely half this size. One reason for the large estimate when using Nidwalden as a control group, is that potentially some rich taxpayers from Nidwalden moved to Obwalden, thereby inflating the estimate. I address this concern in Section 7.3. The takeaway from these estimates is, that the reform had a positive effect on net incomes per taxpayers, which concentrated among the rich. Stated differently, not only did the pool of rich taxpayers in Obwalden get larger, but also richer. That there is no effect among the unaffected taxpayers suggests that the reform did probably not trigger economic growth or job creation (which also was not the aim of the reform).

Table 6: DiD Regressions of Net Income per Taxpayer

	(1) Baseline	(2) Canton trend	(3) Municip. FE	(4) Sample: $< 300K$	(5) Sample: $> 300K$
	Panel A: Nidwalden				
DiD	1.169*	1.166**	1.001	0.991	1.262**
	(0.095)	(0.070)	(0.065)	(0.013)	(0.110)
Time trend	N	N	N	N	N
Canton-specific trend	N	Y	N	N	N
Time FE	N	N	Y	Y	Y
Municipality FE	N	N	Y	Y	Y
Canton-specific time FE	N	N	N	N	N
Canton-specific time FE	N	N	N	N	N
Control dummies	N	Y	Y	Y	Y
Observations	288	10,264	10,264	1,203	1,002
R-squared	0.121	0.166	0.251	0.926	0.299
No. of clusters	18	18	18	18	18
	Panel B: Lucerne				
DiD	1.052	1.155***	1.037	0.995	1.137*
	(0.074)	(0.063)	(0.059)	(0.012)	(0.076)
Time trend	N	N	N	N	N
Canton-specific trend	N	Y	N	N	N
Time FE	N	N	Y	Y	Y
Municipality FE	N	N	Y	Y	Y
Canton-specific time FE	N	N	N	N	N
Control dummies	N	Y	Y	Y	Y
Observations	1,748	46,001	46,001	7,193	36,44
R-squared	0.025	0.227	0.287	0.868	0.245
No. of clusters	115	115	115	115	110

*** p<0.01, ** p<0.05, * p<0.1 Standard errors clustered at the municipality level. Coefficients are exponentiated, such that the constant represents the baseline conditional geometric mean of the outcome and the reported coefficients can be interpreted as percentage changes

7.3 Robustness

The presented results are robust to variations in the model specification, such as the inclusion of linear time trends or canton-specific fixed effects. All the presented models are estimated in logs, and results tend to be less significant when estimated in levels. However, since the levels of the series differ quite substantially between Obwalden and

the cantons used as controls, the specification in logs is more appropriate. Changes over time are made comparable despite the level differences. Additionally, the specification in logs allows for a straightforward interpretation of the results as percentage changes.

A potential threat to identification is movement into treatment, if taxpayers from Nidwalden and Lucerne moved to Obwalden in response to the treatment. I address this concern in the following subsection. In addition, I run a set of placebo estimations, placing the reform at different points in time in the pre-treatment period.

Movement into treatment by cross-cantonal movers

If rich taxpayers moved from Nidwalden and Lucerne, respectively, to Obwalden because of the treatment, these control groups were in fact negatively treated by the reform. In that case, the estimates presented in Table 5 are upward biased. To account for this fact, I correct the number of treated taxpayers in each of the control cantons by adding the number of treated taxpayers who moved to Obwalden after 2005 back to their municipality of origin, and subtracting them from their municipality of destination in Obwalden. The information about the movers is obtained from the individual tax data from the Cantonal Tax Administration of Obwalden. For the very few cases, where only the canton but not the municipality of origin is recorded, I still deduct the taxpayers from the municipalities in Obwalden. However, I am not able to assign them to a specific municipality in their canton of origin. The obtained estimates should now represent a lower bound of the effect, because part of the response to the reform is shut down. This is especially true since Lucerne is one of the cantons from which the largest number of taxpayers is attracted (see Figure 6).

Table B3 in the Appendix presents the estimates corrected for cross-cantonal movers. The results show that in the case of Nidwalden, the effect of the reform is not statistically significant anymore (Panel A). Interestingly, however, the estimated coefficients are larger than without the correction, and in the comparison with Lucerne, they all remain significant. Again, the results are comparable between the two control scenarios across different specifications. I conclude that the estimated increase in the share of rich taxpayers is therefore not driven by movement into treatment.

In the case of net income per taxpayer, it is unfortunately not possible to correct for cross-cantonal movers in a satisfactory way with the data at hand. The problem is that I only observe moving patterns in the data from the canton of Obwalden, but not in the federal tax data used for these estimations. Because I cannot match the data sets, it is not possible to correct for those incomes that are now reported in Obwalden, but were

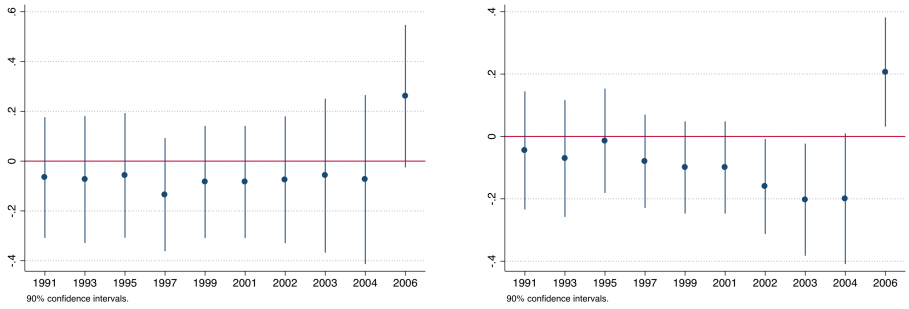
originally reported in Nidwalden or Lucerne.

Placebo estimates

The federal income tax data are available since 1987 and therefore cover a long pre-treatment period. This allows to conduct placebo tests of all the presented DiD estimates, by artificially specifying any year in the pre-treatment period as reform year. Under the hypothesis, that the DiD estimates presented so far capture the true effect of the reform, the same estimates placing the reform in any year before 2006 (and excluding all periods after 2005 affected by the true reform), should be statistically insignificant. The results of these placebo tests are presented in the following graphs.

The placebo estimates for the log share of rich taxpayers in Obwalden compared to its neighbors are depicted in Figure 11. The estimates from the comparison with both neighbors show how prior to the actual reform Obwalden would have had a lower share of rich taxpayers. Note further that estimates for 2006 are corrected for cross-cantonal movers. The graphs show that while in the case of Nidwalden (Panel a) the point estimate becomes statistically insignificant when correcting for movers, this is only marginally true. The difference between true reform estimate and the placebo estimates is substantial and stable over the whole pre-treatment period.

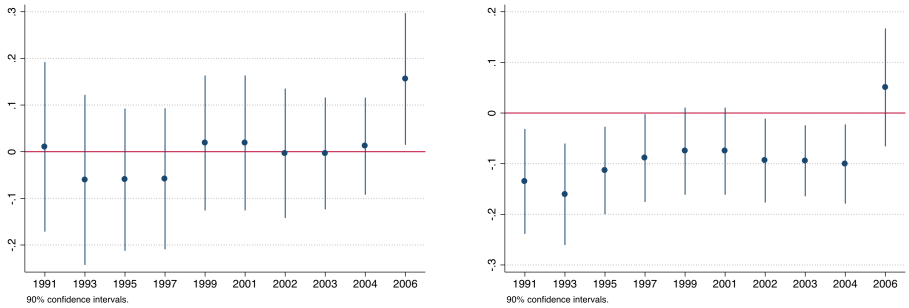
Similarly, the estimates of the change in real net income per taxpayer (Figure 12) are all close to zero or even negative in the comparison with Lucerne (Panel b) in the pre-treatment period. This confirms that the reform substantially increased income per taxpayer, presumably through inflows of taxpayers as well as adjustments in reported income. I find the same patterns from placebo estimates for a large range of different specifications, from baseline estimates to the inclusion of time trends an canton-specific time fixed effects.



(a) Nidwalden vs. Obwalden (b) Lucerne vs. Obwalden

Figure 11: Placebo estimates for the log share of rich taxpayers

Note: The plots depict the DiD estimates of the log share of rich taxpayers in a municipality, corrected for cross-cantonal movers, including municipality and year fixed effects, analogous to Column 4 in Table B3.



(a) Nidwalden vs. Obwalden (b) Lucerne vs. Obwalden

Figure 12: Placebo estimates for net income per taxpayer

Note: The plots depict the simple reduced form DiD estimates of the log net income per taxpayer in a municipality, analogous to Column 1 in Table 6.

8 Conclusion

In this paper I studied how responsive migration is to income and wealth tax cuts at the top. I try to answer this question using quasi-experimental variation created by a two-step tax reform in the Swiss Canton of Obwalden. The aim of the reform explicitly was to first attract rich taxpayers, in order to afford an overall lower level of taxation in a second step. The descriptive results suggest that the responses in terms of inflows of high-income and high-wealth taxpayers have been immediate and remarkable, given the small size of the canton. Average and median income and wealth of those who moved-in immediately after the introduction of the regressive tax are higher than before, and average income and wealth of the incomers in this period were also higher than those of

the residents.

I estimate an elasticity of the stock of rich taxpayers in the canton (i.e., those above the regressive threshold) with respect to the average net-of-tax rate of 2-2.4 in the first two years after the reform. The corresponding elasticity of the inflow of rich taxpayers is even larger, ranging between 8.3-11.9. Whether and by how much the inflows have increased in the long-run can only be answered once new data is made available. Arguably, these elasticities are very large and they are partly due to the small size of the canton, where a small increase in the number of incomers corresponds to a large relative change. It lies in the nature of tax competition, and is in line with theory, that small jurisdictions will be more prone to engage in tax competition because their relative gains are large. The paper at hand highlights the importance of the institutional setting influencing moving elasticities of taxpayers. Given a residency-based income tax system, and that taxpayers are free to relocate to take advantage of low income taxes, they will try to do so to a larger extent than what we may have believed so far. On the other hand, taxing incomes at the source may help prevent drain of the tax base to low tax regions. This insight may further explain why in some settings the elasticity has found to be small, such as in Young and Varner (2011); Young *et al.* (2014) in the US context. Not only are US states are large and distances long. In addition, only some states have reciprocal agreements, allowing to tax individuals in their place of residency, resulting in source-based labor income taxation in most instances.

The extensive comparison with the neighboring cantons Nidwalden and Lucerne further shows, that the findings are not driven by an overall positive income shock benefiting the top 1% in the whole country. Difference-in-differences estimates show that the reform increased the share of rich taxpayers in Obwalden by 25-30%. At the same time, also real net income per taxpayer in the canton increased. This increase is concentrated among the group of the top earners in Obwalden, implying that the group of rich in Obwalden became larger and richer as a result of the reform. Placebo estimates placing the reform in earlier periods further show that effects are only at play in 2006, the year of the reform, but not in earlier years.

The large tax changes for top earners created by the regressive schedule and the later introduction of the flat rate tax in 2008 further may have triggered adjustments in taxable income of the resident population as well. To know whether this is the case or not, I estimate the elasticity of taxable income (ETI) with respect to the marginal net-of-tax rate using a panel approach. The estimates are in range of what earlier studies have found for the US, and vary between 0.13 and 0.75. However, the estimates are statistically

insignificant and sensitive to specification. An alternative approach for future research, which could help improving the estimates, would be to estimate the ETI with data aggregated by municipality and tax bracket level. All the ETI estimates presented here indicate that especially married double earners respond strongly to taxation, a channel which has found to be important in the literature on labor supply and taxation. This suggests that moving from joint to single tax filing of married couples may have large positive labor supply effects.

It remains an open question how much a jurisdiction can gain from lowering its taxes, through both, in-migration and behavioral incentives. For the jurisdiction the cut can be beneficial, as long as the inflow of affluent taxpayers is large enough to compensate for the revenue losses from rich residents, and therefore reach a new equilibrium. If in addition reported incomes of residents increase in response to the tax cut, this is another channel to make up for initial losses. It is an exciting question for future research to assess whether the tax strategy of the canton of Obwalden paid off and helped the canton to reach a new, revenue-neutral equilibrium with lower taxes, and if so, whether this was mainly due to rich incomers or to taxable income responses of former residents.

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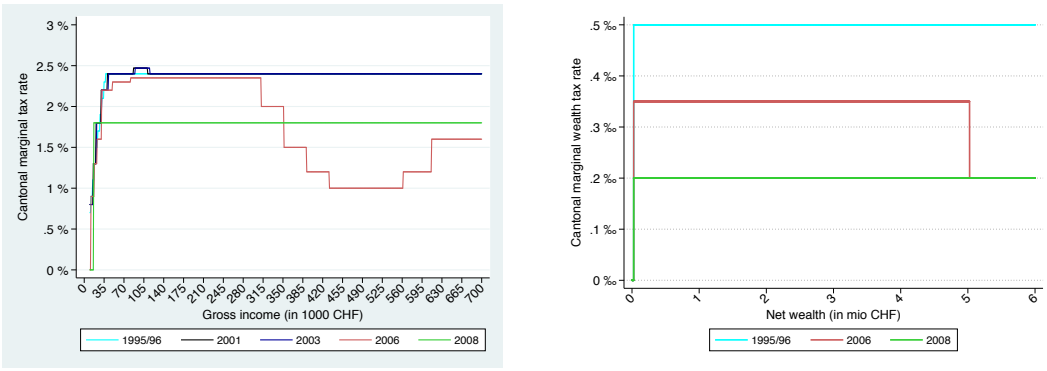
Appendix A Cantonal and Municipality Income and Wealth Taxation in Switzerland

The Swiss tax system is characterized by a strong degree of decentralization, and income is taxed at three levels: at the federal level, at the cantonal and the municipality level. This federal system gives cantons and municipalities large autonomy in taxing residents' income and wealth (the latter is not taxed at the federal level). Each canton therefore has its own tax code and taxable income definitions, where especially deductions differ across cantons. The cantonal taxable income also constitutes the tax base for municipality taxes.

The cantonal and municipality income and wealth taxes are determined in two steps. The cantonal law stipulates marginal tax rates which determine the so-called "simple tax". The effective cantonal and municipality taxes are then obtained by multiplying the simple tax by a cantonal and a municipality multiplier, respectively. This system allows cantons and municipalities regular adjustments to their revenue needs without need of going through the cumbersome work of adjusting the tax scheme. Figure A1 illustrates the changes in the marginal rate of the simple income and wealth tax for a single taxpayer between 1995 and 2010 in the canton of Obwalden. The next Figure A2 depicts the changes in the cantonal and municipality multipliers, and Figure A3 finally shows the effective marginal income tax rates in all seven municipalities of the canton, after applying the cantonal and municipal multipliers.[19] Married couples constitute a single tax unit, their incomes are therefore pooled together and no splitting factor is applied in Obwalden. There is only a married-specific and a double-earner deduction of taxable income as means to reduce the tax burden for these taxpayers.

[19] The procedure for the wealth tax is analogous.



(a) Income tax (b) Wealth tax

Figure A1: Simple income and wealth tax rates ("*Einfache Steuer*") in the Canton of Obwalden, 1995-2010

Note: Marginal tax rates for gross income / wealth of a single taxpayer. Own calculations.

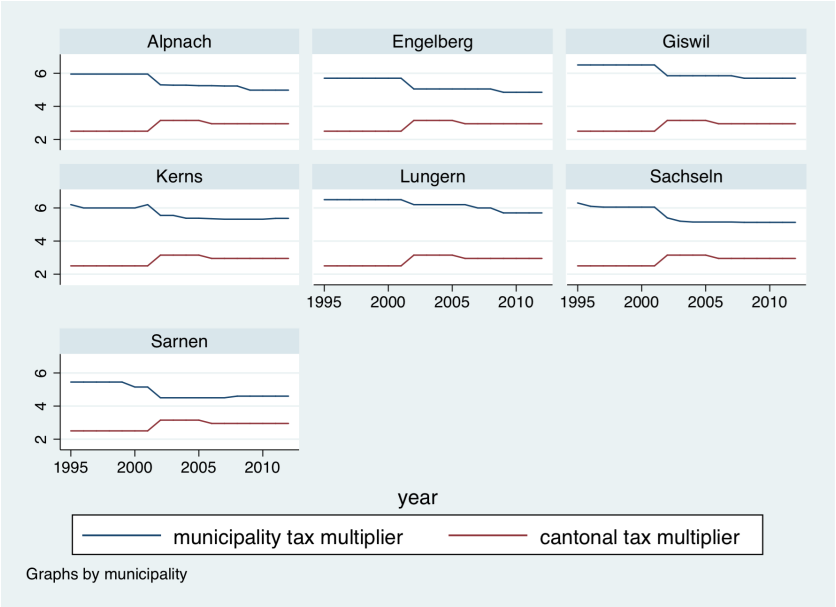
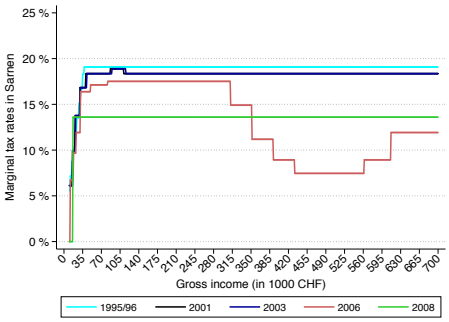
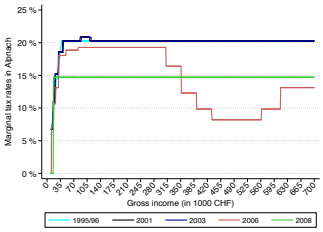


Figure A2: Municipaltiy multipliers and cantonal tax multiplier OW, 1995-2013

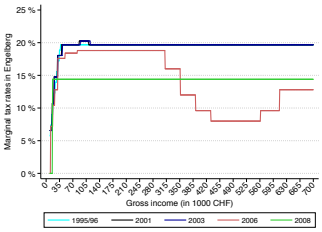
Source: Federal Tax Administration ESTV and Parchet (2012)



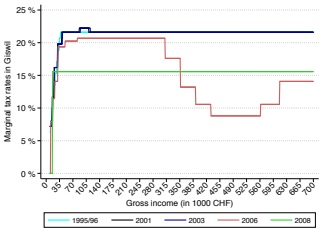
(a) Sarnen



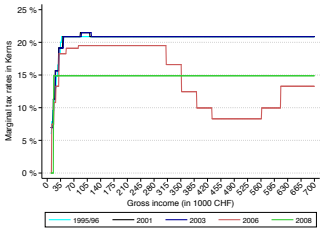
(b) Alpnach



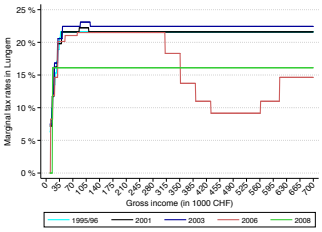
(c) Engelberg



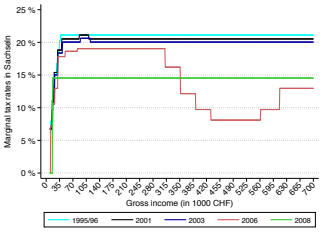
(d) Giswil



(e) Kerns



(f) Lungern



(g) Sachseln

Figure A3: Effective marginal tax rates across municipalities in OW, 1995-2010

Note: Marginal tax rates for gross income of a single taxpayer, multiplied by the cantonal and the local tax multipliers. Own calculations.

Appendix B Additional Tables and Figures

B.1 Additional Tables

Table B1: Origin of Incomers before and after 2006 Reform (in %)

	Treatment		Control		Total	
Origin	before 2006	after 2006	before 2006	after 2006	before 2006	after 2006
ZH	11.63	15.17	21.62	10.99	8.33	9.35
BE	2.33	4.83	2.70	4.40	5.55	5.81
LU	23.26	19.31	18.92	27.47	25.93	24.99
UR	2.33				1.78	1.35
SZ		2.07		1.10	3.14	3.16
NW	13.95	7.59	8.11	10.99	13.64	14.92
GL					0.12	0.17
ZG	11.63	7.59	5.41	5.49	4.35	4.12
FR				1.10	0.42	0.27
SO			5.41	3.30	2.05	1.64
BS	4.65	1.38	5.41	3.30	1.51	1.33
BL	2.33	4.83	5.41	6.59	3.08	2.77
SH					0.30	0.36
AR		0.69			0.18	0.24
AI		0.69			0.03	0.17
SG	2.33		2.70		1.99	1.69
GR		0.69		2.20	1.42	1.47
AG	16.28	11.03	8.11	6.59	6.55	6.80
TG					0.81	0.80
TI	2.33	2.07	2.70	1.10	0.66	0.92
VD		2.76			0.30	0.77
VS					0.97	0.67
NE		0.69			0.09	0.27
GE		2.07	2.70		0.24	0.31
JU		0.69			0.03	0.10
Abroad	6.98	12.41	10.81	12.09	14.13	13.62
Unknown		3.45		3.30	2.35	1.95
Total	100.00	100.00	100.00	100.00	100.00	100.00

Note: Control group defined as those having rate-determining income of 60-80% of the threshold.

Table B2: ETI estimation sample descriptives

Variable	Mean	SD
Log change in NTR (lagged)	0.015	0.060
Rate-determining income (in 1,000 CHF)	498	1,418
Taxable income (in 1,000 CHF)	197	974
Rate-determining wealth (in 1,000 CHF)	3,120	13,897
Taxable wealth (in 1,000 CHF)	8,092	25,877
Log change in taxable income	0.066	0.953
Log of lagged taxable base-year income ($\Delta = 3$)	10.630	2.118
Log change in rate-determining income	-0.035	0.895
Log of lagged rate-determining base-year income ($\Delta = 3$)	12.490	1.061
Married	0.709	0.454
Double earners	0.409	0.492
Children (dummy)	0.388	0.487
Self employed	0.204	0.403
Retiree	0.104	0.306
Age	57.000	12.660
Engelberg	0.428	0.495
Giswil	0.036	0.185
Kerns	0.076	0.264
Lungern	0.031	0.172
Sachseln	0.086	0.280
Sarnen	0.264	0.441
Observations	5,381	

Table B3: DiD Estimates of Log Share of Rich in the Canton, Corrected for Movers

	(1) Baseline	(2) Canton trend	(3) Year FE	(4) Municip. FE	(5) Canton-time FE
	Panel A: Nidwalden				
DiD	1.343	1.378*	1.334	1.298	1.637
	(0.243)	(0.234)	(0.237)	(0.213)	(0.542)
Canton-specific trend	N	Y	N	N	N
Year FE	N	N	Y	Y	N
Municipality FE	N	N	N	Y	N
Canton-specific time FE	N	N	N	N	Y
Observations	291	291	291	291	291
R-squared	0.123	0.125	0.136	0.174	0.143
No. of clusters	18	18	18	18	18
F	4.856	9.354	.	9.620	.
	Panel B: Lucerne				
DiD	1.392*	1.564***	1.390*	1.230*	2.140***
	(0.233)	(0.208)	(0.231)	(0.130)	(0.541)
Canton-specific trend	N	Y	N	N	N
Year FE	N	N	Y	Y	N
Municipality FE	N	N	N	Y	N
Canton-specific time FE	N	N	N	N	Y
Observations	1,419	1,419	1,419	1,419	1,419
R-squared	0.017	0.018	0.027	0.085	0.030
No. of clusters	110	110	110	110	110
F	9.771	12.12	5.801	7.310	.

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses, clustered at the municipality level. Coefficients are exponentiated, such that the reported coefficients can be interpreted as percentage changes. All regressions include a constant, a post-treatment dummy ($t > 2005$), and a treatment group dummy. DiD denotes the interaction of the post-treatment with the treatment group dummy, hence the DiD estimator. The number of taxpayers who moved to Obwlden after 2005, as identified in the individual tax data from the Cantonal Tax Administration of Obwladen, was subtracted from the municipality of destination in Obwalden and added back to the municipality of origin in Nidwalden or Lucerne, respectively.

Table B4: DiD Regressions of Net Income per Taxpayer, Detailed Results Canton Nidwalden

	(1) Baseline	(2) Canton trend	(3) Municip. FE	(4) Sample: <300K	(5) Sample: >300K
DiD	1.169*	1.166**	1.001	0.991	1.262**
	(0.095)	(0.070)	(0.065)	(0.013)	(0.110)
Treated	0.729**	1.629e+12***	1.175***	1.113***	1.168***
	(0.091)	(1.379e+13)	(0.022)	(0.005)	(0.045)
Period $t > 2005$	0.974	1.072***	1.132**	0.980	0.938
	(0.038)	(0.024)	(0.058)	(0.014)	(0.079)
Non-working		0.526***	0.506***	1.084***	1.065
		(0.047)	(0.043)	(0.011)	(0.141)
Retiree		0.854***	0.829***	0.973	1.112
		(0.022)	(0.021)	(0.019)	(0.106)
Self-employed		0.937	0.923*	1.033	1.031
		(0.036)	(0.036)	(0.024)	(0.053)
Married		1.698***	1.701***	1.880***	0.917
		(0.067)	(0.066)	(0.050)	(0.099)
Single parents		1.352***	1.336***	1.427***	0.896
		(0.070)	(0.072)	(0.029)	(0.155)
Married with children		1.808***	1.798***	2.067***	0.791
		(0.068)	(0.066)	(0.030)	(0.111)
Constant	90.926***	0.011	35.328***	36.623***	422.224***
	(9.935)	(0.083)	(1.242)	(0.814)	(65.186)
Observations	288	10,264	10,264	1,203	1,002
R-squared	0.121	0.166	0.251	0.926	0.299
Time trend	N	N	N	N	N
Canton-specific trend	N	Y	N	N	N
Time FE	N	N	Y	Y	Y
Municipality FE	N	N	Y	Y	Y
Canton-specific time FE	N	N	N	N	N
No. of clusters	18	18	18	18	18

*** p<0.01, ** p<0.05, * p<0.1 Standard errors clustered at the municipality level. Coefficients are exponentiated, such that the constant represents the baseline conditional geometric mean of the outcome and the reported coefficients can be interpreted as percentage changes .

Table B5: DiD Regressions of Net Income per Taxpayer, Detailed Results Canton Lucerne

	(1) Baseline	(2) Canton trend	(3) Municip. FE	(4) Sample: <300K	(5) Sample: >300K
DiD	1.052	1.155***	1.037	0.995	1.137*
	(0.074)	(0.063)	-0.059	-0.012	-0.076
Treated	1.056	1.561e+09***	1.448***	1.248***	1.782***
	(0.066)	(5.840e+09)	-0.024	-0.005	-0.093
Period $t > 2005$	1.083***	1.085***	1.138***	0.981*	1.006
	(0.014)	(0.012)	-0.024	-0.01	-0.044
Non-working		0.546***	0.512***	1.051***	1.038
		(0.019)	-0.015	-0.008	-0.039
Retiree		0.755***	0.742***	0.992	1.067
		(0.014)	-0.011	-0.009	-0.045
Self-employed		1.073***	1.060***	0.994	1.028
		(0.012)	-0.012	-0.01	-0.027
Married		1.805***	1.802***	1.950***	1.067
		(0.021)	-0.021	-0.025	-0.048
Single parents		1.529***	1.493***	1.557***	0.966
		(0.023)	-0.025	-0.023	-0.083
Married with children		2.131***	2.132***	2.299***	0.967
		(0.023)	-0.023	-0.022	-0.048
Constant	62.822***	37.928***	30.624***	32.062***	425.964***
	(1.289)	(0.725)	-0.516	-0.395	-24.155
Observations	1,748	46,001	46001	7193	3644
R-squared	0.025	0.227	0.287	0.868	0.245
Time trend	N	N	N	N	N
Canton-specific trend	N	Y	N	N	N
Time FE	N	N	Y	Y	Y
Municipality FE	N	N	Y	Y	Y
Canton-specific time FE	N	N	N	N	N
No. of clusters	115	115	115	115	110

*** p<0.01, ** p<0.05, * p<0.1 Standard errors clustered at the municipality level. Coefficients are exponentiated, such that the constant represents the baseline conditional geometric mean of the outcome and the reported coefficients can be interpreted as percentage changes .

B.2 Additional Figures

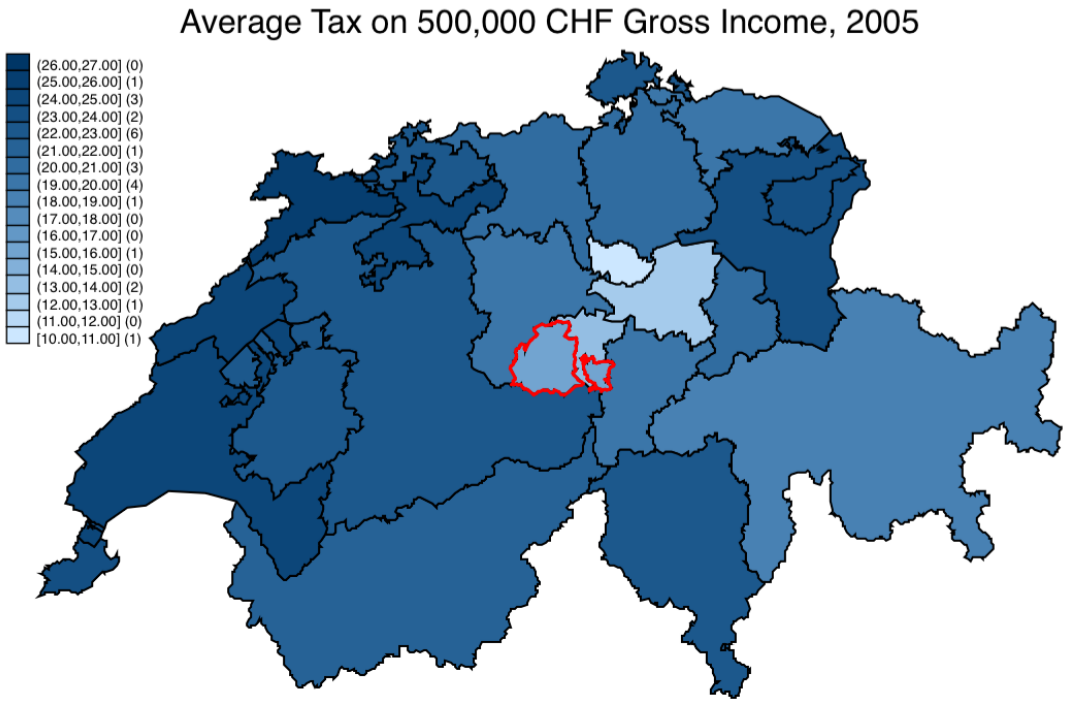


Figure B1: Average income tax rates for single taxpayer with gross income of 500,000 CHF

Note: Gross labor income net of social security contributions. Average tax load from cantonal, municipality and church taxes in the canton's main city. Obwalden is the canton in the center marked by a red line.
Source: Federal Tax Administration, own calculations.

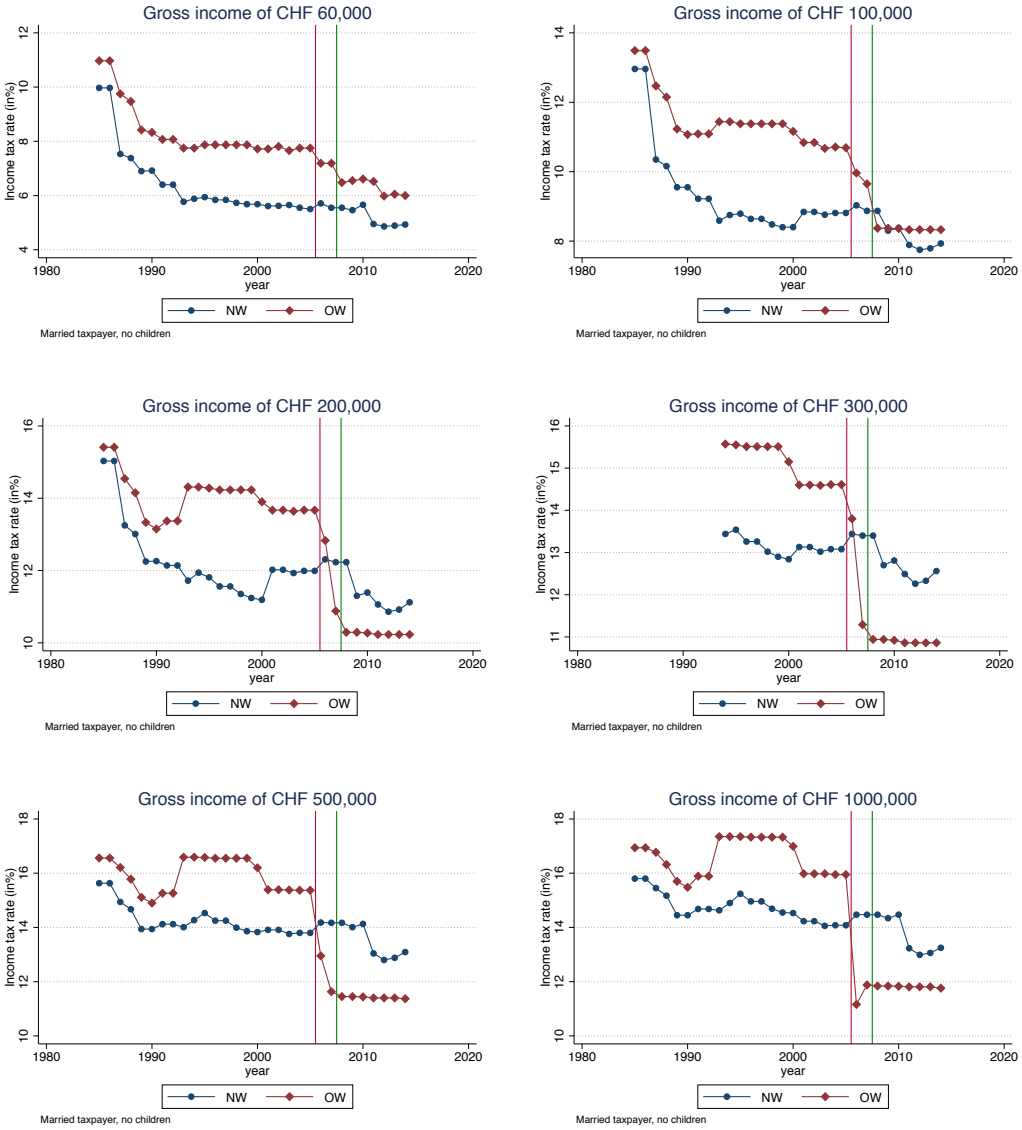


Figure B2: Average income tax rates at gross income levels in Obwalden and Nidwalden

Note: Average tax rates on gross income for a married couple with no children as published by the Federal Tax Administration ESTV, Bern. Tax rates refer to the the average cantonal and municipality tax in the main city of each canton, i.e. Sarnen in Obwalden and Stans in Nidwalden.

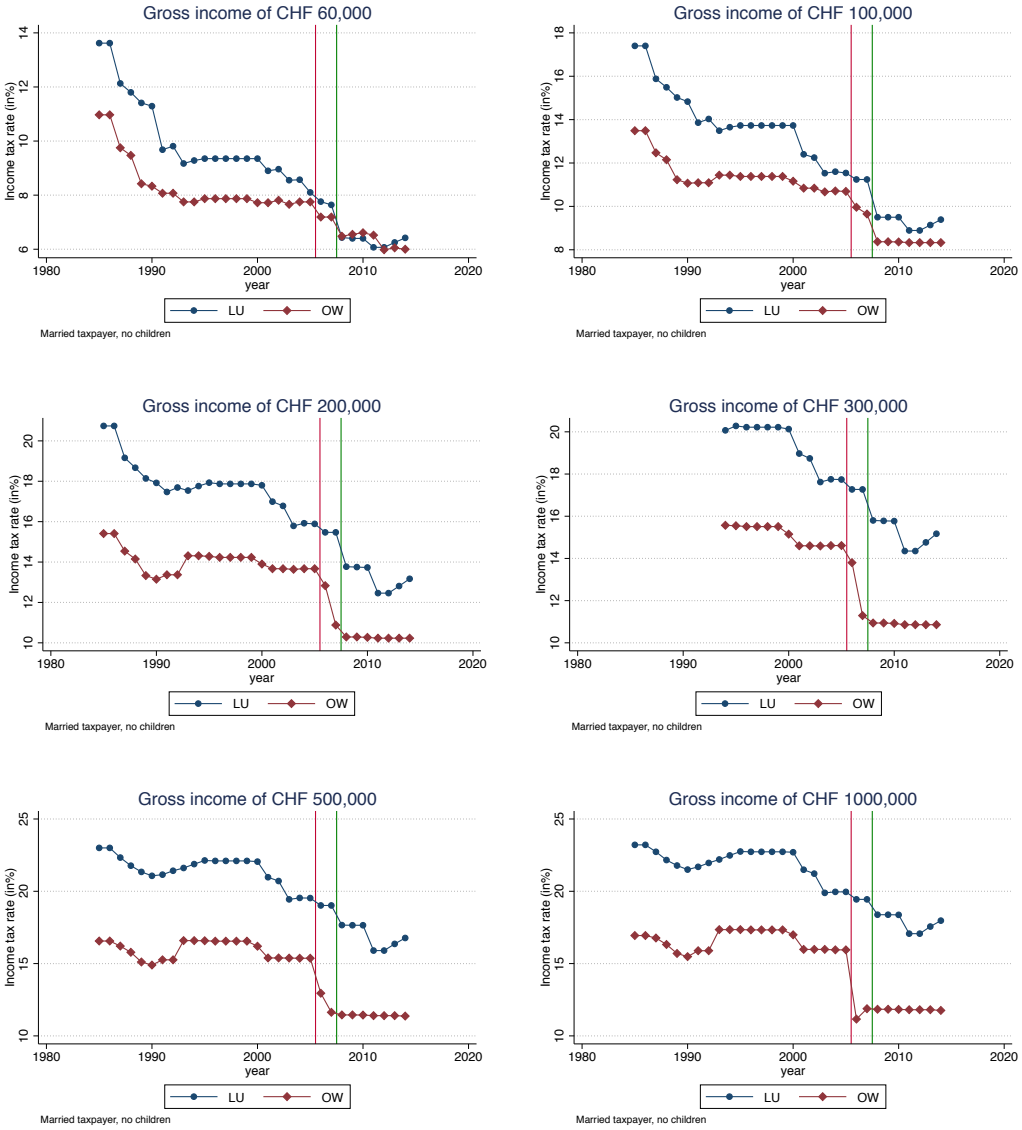


Figure B3: Average income tax rates at gross income levels in Obwalden and Lucerne

Note: Average tax rates on gross income for a married couple with no children as published by the Federal Tax Administration ESTV, Bern. Tax rates refer to the the average cantonal and municipality tax in the main city of each canton, i.e. Sarnen in Obwalden and Lucerne in Lucerne.