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ABSTRACT

Volatile Top Income Shares in Switzerland? Reassessing the Evolution Between 1981 and 2009

We study the recent evolution of top incomes in Switzerland, analyzing both social security data on labor incomes and tax data on total income. The results show that in the last 20 years, the share of top incomes has risen, and the top 0.01 percent's share even doubled, putting Switzerland similar to European countries for the top 1 percent group but closer to the U.S. for higher top incomes. However, top incomes also exhibited large variations over the business cycle. Besides documenting the recent evolution of total top incomes, we close the gap in the data between 1993 and 2003, exploiting the fact that the Swiss cantons changed their tax system at different points in time. We compare the results with social security data on top labor incomes for which the top shares can be measured precisely over the whole time span. The comparison suggests that labor incomes have become more important among top income earners in Switzerland. This is in line with findings for other developed countries: especially in the U.S., but also in European countries like Germany or the Netherlands, labor incomes have been playing a major role in top incomes in recent decades.

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1 Introduction

The evolution of inequality in income and wealth has again attracted substantial attention in recent decades. In the aftermath of the financial crisis, distributional issues have been discussed even more intensively, trying to capture the relation between distribution and growth patterns. In line with public interest, the focus has been notably on the top of the earnings distribution, in particular because changes in the very top incomes account for a large part of overall inequality in quantitative terms.

The present paper studies the evolution of top incomes in Switzerland. The Swiss data are of interest because it is a major industrialized country with a large financial sector. Tax competition within Switzerland and the absence of wars have kept tax rates low and have not foreclosed possible wealth accumulation by rich households, unlike its European neighbors. Swiss top incomes are also worth studying because the Swiss social security system (AHV) has no upper income limit, which is different from most other industrialized countries. Hence, the AHV data cover all labor incomes, which makes it possible to study the evolution of top labor incomes and to compare their dynamics with the dynamics of overall top incomes.

The seminal study of Thomas Piketty (2001) on the evolution of top incomes in France using tax data and covering a time span not less than from 1901–1998 attracted wide interest and was followed by a range of similar studies on other countries. Internationally, top deciles and percentiles have experienced considerable changes in their total income shares during the 20th century. Until the end of the Second World War, most countries experienced a sharp drop in top income shares. For the second half of the 20th century, a 'U' shaped evolution can be observed, yet this varies considerably across countries. The Continental European countries—including Switzerland—and Japan experienced almost no or only a modest increase in top income shares from the 1970s onwards, while there was a remarkably strong increase in Western English speaking countries (Atkinson *et al.*, 2011). Atkinson and Piketty (2007, 2010) provide a collection of these studies. Dell *et al.* (2007) study top incomes in Switzerland. The data used in their study reach back into the 1930s. Unfortunately, the tax series stop in 1995/1996 when two major changes in the Swiss tax system took place. As is described in Section 2, not all cantons adopted the changes at the same time, thus no uniform

statistics for the full country exist for the transition period 1995–2003.

The first contribution of this paper is to close this large data gap. This is particularly relevant as the missing time period delineates a break with the former decades of steady growth rates and full employment. In the 1990s Switzerland experienced a decade of very low growth and a remarkable increase in the unemployment rate from 1.8 percent in 1991 to 4.3 percent in 1997, accompanied by ongoing immigration. As the data at the cantonal level are available for the whole transition period and also afterwards, we can estimate in Section 3 the distribution of taxable income in the missing years and continuing the series up to 2009, the latest year tax statistics are available so far. Schaltegger and Gorgas (2011) investigate the evolution of top incomes at a cantonal (i.e., state) level and the possible effects of different tax strategies adopted by the 26 Swiss cantons. The change in the tax system and the problem of missing data for the seven-year transition period is not addressed in their study.

Our second contribution is the use of income data from the old age pension statistics (AHV) to estimate the distribution of (top) labor earnings in Switzerland, covering the period from 1981 to 2008. Our results suggest that the increase in top labor incomes is instrumental in explaining the rise in top total incomes, as the increase of top income shares follows the observed increase in top shares in labor incomes. The AHV data have the additional advantage that the individual values are available, which allows calculating the top quantiles precisely and judging the accuracy of the Pareto approximation widely used in the study of top incomes. The results show how precise this method is indeed in estimating top income shares.

The remainder of the paper is organized as follows. Section 2 gives a short introduction to the Swiss tax system and describes the data used to estimate the top income shares in Section 3. Section 4 presents the results on top income shares for total incomes. The role of labor incomes at the top is assessed in Section 5 along with estimates of the concentration of wealth. Section 6 concludes.

2 Data and Methodology

2.1 On the Use of Tax Data for Economic Research

The study of Piketty (2001) on top income shares in France in the long run initiated a new wave of research on the dynamics of top incomes in different countries (for a collection of these studies see Atkinson and Piketty, 2007, 2010). The crucial

innovation compared to earlier studies on income distribution is the use of long time series going back to the beginning of the twentieth century. This is an important feature as "structural changes in income and wealth distribution often span several decades." (Piketty and Saez, 2006, p.200). To study long time periods, tax data are the only reliable data available, as household income surveys did not exist for a long time, differ in frequency or suffer from incomparability, and fail to capture the whole income distribution. Tax data have the advantage that they cover a much larger population sample than household survey data, in some cases, the entire population.

The use of tax data, however, does not come without drawbacks. The main concern is misreporting of income, as there are incentives for tax evasion, to do so. With a strongly progressive tax system, misreporting and tax avoidance is more attractive for higher incomes. However, when using data from household surveys, one should also be concerned about non-response, sampling errors, and top-coded incomes. These problems particularly affect top income earners (see for example Brewer *et al.*, 2008 for the UK, and Burkhauser *et al.*, 2012 for the U.S; on the peculiarities of survey data in general, see Victoria-Feser, 2000, and Diekmann, 2004). When turning to the estimation of top income shares and inequality measures, these disadvantages lead to erroneous results. For the U.S., Atkinson *et al.* (2011) estimate that CPS survey data fail to capture about one-half of the overall increase in inequality measured by the Gini coefficient, confirming previous results by Alvaredo (2011). The latter further shows that the Gini coefficient estimated with income survey data not only underestimates the changes in income inequality when compared to that estimated with tax data, but the trends in inequality measured by Gini coefficients may even diverge, as is the case for Argentina.

The second disadvantage of tax data often mentioned is its definition of income. As the data are collected as part of an administrative process, the definitions of income and income units are not tailored to their corresponding definitions in economic theory and practice. This also implies that substantial changes in the tax laws, such as income splitting for married couples, have to be taken into account when attempting to construct homogeneous time series. The concrete limitations emerging from the definition of income imposed by the tax system in Switzerland are discussed in the next section.

2.2 The Swiss Tax System Over Time

In Switzerland, personal income taxes are levied at the federal, the cantonal, and the communal level. The cantons are responsible for the collection of the taxes at all three levels. For what follows, however, only the federal income tax system and data are of relevance.

In the mid-1990s a fundamental change in the Swiss tax system took place by switching from the two-years based *praenumerando* taxation to the one-year based *postnumerando* taxation.[1] The phrase "*praenumerando* method" refers to the fact that the assessment period and the fiscal period do not coincide under such a tax system: the assessment period precedes the fiscal period (Eidgenössische Steuerverwaltung ESTV, 2003). The tax liability for a fiscal period was thus calculated from an estimated income stream based upon past income, and taxes were only adapted to a new income situation or changed living conditions (marriage, birth of a child, etc.) in the next fiscal period. In order to adapt to significant changes in taxable income, often a betwixt assessment (called *Zwischenveranlagung* or *taxation intermédiaire*) became necessary.

In 1990 the change to the *postnumerando* taxation with a one-year assessment basis was enacted, yet allowing for a transition period of several years, during which each canton could choose when to adopt the new system. This is the reason why during the transitional period from 1995 to 2002 there is no uniform tax data published at the Swiss level: only data at the cantonal level is available. Table B1 in Appendix B shows the time schedule of the adoption of the new taxation method by canton. Basel-City was the only canton which had always used the one-year based *postnumerando* taxation method to levy its cantonal taxes. All other cantons had to adapt their tax systems.

The transition caused a gap in the assessment of the incomes and taxes. The following example for Zurich shows the nature of this gap. Under *praenumerando* taxation, incomes realized in the 1995/96 assessment period are recorded and published in the 1997/98 fiscal period. The crucial difference in the *postnumerando* taxation is that the assessment period equals the fiscal period, so that for the fiscal periods 1999 and 2000, when the new system was in place, the tax base was the income earned in 1999 and 2000, respectively. This means that due to this change, the income realized in 1997/98 was never taxed and does not show up in any

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[1]The difference between the two taxation principles and the steps of the reform are described in detail in Appendix B.

statistics. To avoid loopholes in the tax system, transitory provisions had been enacted, but these differed among cantons.[2] Table 1 below illustrates the transition for a fictitious tax unit.

[TABLE 1 HERE]

2.3 The Swiss Tax Statistics

2.3.1 The Grouped Tax Data

The Swiss tax statistics are published in grouped form according to income brackets containing the total number of tax units and the total income within each bracket.[3] The cantons are the administrative unit in charge of the collection of the tax returns and the taxes. This mechanism ensures that information on incomes is available at the cantonal and national levels at the same time and in the same format. The definitions of tax units and incomes tabulated in the tax statistics have remained fairly stable over time, allowing comparisons over time and between cantons.[4]

However, the change from *praenumerando* to *postnumerando* taxation had one substantial impact on the tax statistics. The years indicated in these statistics refer to the fiscal period, which means that under the *praenumerando* method, reported incomes were realized in the two preceding years, but after the change, the reported incomes were realized in the year reported. As a consequence, data on realized incomes is missing for the period preceding the change.

With respect to inequality measures and top income shares, the change from the biennial to the annual tax schedule would be expected to make a difference, due to the averaging effect of the biennial tax assessment. Yearly fluctuations in earned income, which alter the measured inequality of a distribution, are dampened when income is measured only once every two years.

2.3.2 Tax Units Covered in the Statistics

Every permanent resident in Switzerland who has completed the age of 18 years (20 years prior to 1996)[5] is subject to income taxation and has to fill out a tax

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[2]For further information on these transitory provisions see Eidgenössiche Steuerverwaltung ESTV (2003).

[3]Available from the Federal Tax Administration Eidgenössische Steuerverwaltung (ESTV), www.estv.admin.ch

[4]In recent years, officially published tabulations have been less detailed, with a top income bracket of only CHF 200,000 and excluding the "special cases" (*Sonderfälle*). However, more detailed tabulations, as used in the present study, are still available upon request from the Federal Tax Administration.

[5]Art. 14 ZGB

return every year (or every two years before the change in the tax system). In order to include all tax units filing a tax return, not only the "normal cases" (*Normalfälle*), but also the "special cases" (*Sonderfälle*) must be considered.[6] The latter not only include cases where a betwixt assessment was necessary (see Section 2.2), but also high net wealth individuals taxed according to their expenditures (*Besteuerung nach dem Aufwand*) and are thus highly relevant in the top income groups.[7] Married and officially registered couples are subject to joint tax liability and show up as one single unit in the tax statistics. This means that a tax unit is not always an individual nor does one necessarily correspond to the concept of a household.

Even though according to the definition above every permanent resident is subject to income taxation, the rate of filers covered is below 100 percent. There are, namely, three different groups of individuals not covered in the statistics. The first group consists of those whose taxable income was not high enough to surpass the amount of exemption. Thus, even though tax units with no or very little incomes have to hand in a tax return, they do not show up in the statistics if their tax liability is zero. As the purpose of the present paper is to study incomes at the top, this is only a minor problem. The second group not covered in the statistics is that of individuals taxed at the source. These are foreign nationals living in Switzerland but with only a yearly or any other temporary resident permit. Only when their income exceeds a certain threshold (around CHF 120,000 in 2012) are they required to file a tax return *ex post*, which ensures that top earners are nevertheless included in the statistics. The third special category of residents is the international organizations' staff based in Switzerland, which is exempted totally or partially from personal income taxation. This applies to no less than 24 organizations, 22 of them located in Geneva. These individuals as well as their incomes are therefore not covered in the statistics.

It is important to note that, apart from these three groups who do not show up in the statistics due to their special legal status or low income, people who simply do not hand in their tax return, even though they are required to do so, i.e., "true non-filers," do in fact show up in the statistics.[8] In such cases, cantonal

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[6]Schaltegger and Gorgas (2011) include normal cases only from 1971 onwards, so our results are not directly comparable to theirs.

[7]See Appendix B for further details.

[8]The Canada Revenue Agency gives the following definition: "A non-filer is an individual, a corporation, or a trust who fails to file a tax return as required by legislation." (http://www.oag-bvg.gc.ca) This is what we refer to as "true non-filers."

tax administrations simply attribute to these individuals an income based on older tax returns and on employers' information about their income. True non-filers are then taxed according to this imputed income without any deductions and are in addition subject to a fine.

2.3.3   Definition of Income

All incomes from employment and self-employment as well as capital income and transfer payments such as old age pensions are subject to the personal income tax. House owners living in their own house in addition have to report the value of an estimated rent (the so-called *Eigenmietwert*).[9] Realized capital gains on private assets on the other hand are excluded from the definition of income. Over all, no distinction between labor and capital income is made. This implies some limitations for analyses carried out with the Swiss tax data for, as (Piketty and Saez, 2006, p. 200) state, economic mechanisms can be very different for the distribution of labor and capital income. However, we try to circumvent this limitation with the analysis of top labor incomes using social security data in Section 5.

Expenditures related to the realization of income, as well as health insurance premia and mortgage interest payments, are subject to deductions. As the tax liability for a married or officially registered couple is calculated on their common income, these tax subjects have a further claim for a deduction if both contribute to the household's income. Additional deductions can be made for children and other dependents living with the family. In the tax statistics used for the present work, the personal deductions have been added to the taxable income so that the reported income corresponds more or less to some notion of "gross income."[10] Most importantly, this income definition has remained stable over time.

2.4   Total Income Denominator and Total Tax Units

Because not all tax units residing in the country are covered in the statistics, the same is true for the totality of incomes earned in a given period. The extent of underestimated total income in the tax statistics can be assessed by relating

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[9]This clause aims at equalizing the treatment of homeowners and tenants, as returns from other assets are fully taxed.

[10]Due to lack of detailed information on all deductions made and because some income sources are tax-free, the definition of income does not correspond exactly to the gross income. The statistical nomenclature used by the Swiss statistical publications is *revenu net* or *Reineinkommen* (literally "net" or "pure income"). For detailed information, see the tax statistics' appendix with explanations: http://www.estv.admin.ch/dokumentation/00075/00076/00701/

the total of declared incomes to an exogenous measure of total income in the economy, such as net national income reported in the national accounts. The ratio of reported tax income to the net national income starts at around 72 percent in 1981 but then falls over time to a low of 60 percent in 2006, rising again afterwards. It is thus necessary to accurately estimate the total personal income, which is then used as the denominator to calculate the top group's income shares. We closely follow the approach adopted by Dell *et al.* (2007), assigning the tax units not covered in the statistics 20 percent of average personal income reported in the tax statistics, i.e., 20 percent of the average *Reineinkommen*. This reasonable assumption further guarantees a high level of comparability with the existing series, so that the update should not cause a break in the series. See Appendix B for further details.

The income denominator containing the imputed incomes for non-filers fluctuates somewhere between 65 percent and 74 percent. These results are in line with those reported by Dell *et al.* (2007). This remaining gap can be at least partly explained by tax evasion, which according to a study by Feld and Frey (2002) varies between 12.6 percent in 1978 and 35.1 percent in 1990, and lies somewhat above 20 percent on average. There are also considerable cantonal differences which change from year to year (between 1970 and 1995). The average across all cantons in 1995 is 22.3 percent. However, we have reason to believe that the behavioral patterns of tax evasion remained relatively stable among the top groups over time (see Section 4.2.2).

To accurately calculate the percentage shares of the top income groups, the same argument as for the total income applies: as not all tax units are contained in the tax statistics, it is necessary to calculate the total tax units in the country. Formally, the total number of tax units covers the adult population minus one-half of the married adult population. We construct this number using register data, which is available on a yearly basis at the federal as well as at the cantonal level for the time span considered in the present study.[11]

We follow the same approaches to construct the number of total tax units and the total income denominators at the cantonal level. Only, the number of married adults at the cantonal level is interpolated linearly, as data on married adults is not available on a yearly basis.

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[11]This approach differs slightly from the one adopted by Dell *et al.* (2007), who use decennial census data and linear interpolation for the years in between. See Appendix B for further details.

3 Estimating top income shares in Switzerland from 1981/82 to 2009

3.1 Pareto Interpolation

Since tax data are given in absolute income brackets, the income of a given quantile must be estimated by falling back on parametric assumptions about the income distribution. There is ample empirical evidence that incomes at the top of the distribution are approximately Pareto distributed.[12]

Assuming that incomes are Pareto distributed, the cumulative distribution function $F(s)$ is given by

$$1 - F(s) = (k/s)^a \qquad \text{with } k > 0, a > 1,$$

where the parameters a and k have to be estimated. Consequently, the probability density function takes the form $f(s) = ak^a/s^{a+1}$. As $f(z \mid z \geq s) = f(z)dz/(1 - F(s))$, the average income $\bar{y}(s)$ of tax units with income larger than or equal to s is then given by

$$\bar{y}(s) = \int_s^\infty z \cdot f((z \mid z \geq s))dz = \frac{a}{a+1} \cdot s$$

This is a central characteristic of the Pareto distribution: expected income above a given threshold s is a factor $b = a/(a-1)$ times the threshold s; the factor is constant and independent of the threshold s itself. It is possible to estimate the parameter a if one knows the number of tax units above a given threshold s and their average income $\bar{y}(s)$.

To estimate the top shares, we follow the approach suggested by Piketty (2001) and adopted by Dell *et al.* (2007) in their study on top income shares in Switzerland from 1933 onward, thus guaranteeing comparability of the series. Using the local Pareto distribution parameters a and k, the income thresholds to belong to a certain top group, and their average and total incomes are estimated. The latter is used to calculate the share in total income for the corresponding top group. Details on the estimation procedure are outlined in Appendix B.

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[12]Gabaix (2008) presents theoretical motivations for the emergence of a Pareto distribution at the top for income and wealth. In the context of CEO pay, Gabaix and Landier (2008) present a model where matching, combined with extreme value theory for the initial firm size and the distribution of talent among CEOs, can explain the emergence of a power law. For an overview of popular variants of Pareto's models, the reader is referred to Arnold (2008).

3.2 Cantonal Top Shares

In years where data at the federal level are available, we can directly calculate the top income shares for Switzerland using Pareto interpolation. However, federal tax data are missing for the period between 1993/94 and 2003 because of the changes described in Section 2.2 above. Our approach is to estimate the national income shares using data at the cantonal level, as the latter are available throughout that period with the exception of the years before the cantonal change from the *postnumerando* to the *praenumerando* method.

Figure 1 shows the income shares for the top 10 percent group and for the top 1 percent group in Switzerland and several cantons from 1981/82 to 2008. Cantons which changed their tax system at the same date are pooled together (these are Zurich and Thurgau (ZH, TG); Vaud, Valais and Ticino (VD, VS, TI); Basel-City (BS); and the group of the remaining 20 cantons). So instead of speaking of cantonal series, what follows is based upon series for geographical areas that do not need to comprise only one canton. An advantage of these aggregated series is that they are less sensitive to both changes in the composition of the underlying population and to idiosyncratic changes of individual top incomes. Note how BS, a small canton in terms of population, exhibits higher volatility in its top income shares.

In the years where national data are available, the cantons reveal similar trends as trends at the national level. Note that the top shares within the cantons correspond to total cantonal income, i.e., to the income distribution within each canton. So even though the Swiss distribution clearly depends on the distribution within each canton, the Swiss top shares cannot be obtained by simply averaging cantonal top shares. The next step is to accurately estimate the values for these missing years.

[FIGURE 1 HERE]

3.3 Estimating top income shares for the transition period

Figure 1 reveals the structure of the data that is now used for the estimation of the missing years at the national level. Using OLS with cantonal fixed effects, we estimate the relation between the national and cantonal top income shares for the

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years 1981–2008. Using linear forecasting (i.e., using the estimated coefficients), the missing values for the Swiss series are estimated from the cantonal series. For each year, we regress the series for Switzerland on the maximum number of cantons available. Table B2 in Appendix B shows the different models estimated for each year. The last row indicates the years for which each model was used to obtain the predicted values. The detailed regression results of all models for all the top shares estimated are reported in Table C1 in Appendix C.

An alternative to the estimation via OLS is the synthetic control method of Abadie and Gardeazabal (2003). Their original motivation for the use of synthetic controls was to estimate the effects of a policy or a policy change compared to the absence of such a policy. The idea is to compare the evolution of an outcome variable in a certain region to its hypothetical evolution if the policy intervention had not taken place. Instead of just comparing the region of interest to a similar control region, a synthetic control region is constructed out of a whole set of potential control regions (for more details see Abadie and Gardeazabal, 2003; Abadie *et al.*, 2010). Similar to the analysis of the evolution of an outcome variable after a policy change, here the question is: what would we have observed if we had the tax data for Switzerland as a whole? The predicting variables used are all top groups' income shares, the corresponding income level thresholds, and the average income above a threshold. In addition, GDP and population growth rates, GDP per capita, and the unemployment rate are included. For details on the predictors and weights used, see Tables C2 and C3 in Appendix C.

A third alternative is to exploit the variation in top shares which emerges when excluding the missing cantons in years where they were still available ('imputation'). Comparing this value to the value when including all cantons shows the influence of the excluded canton on the Swiss series, and the variation can then be used to impute the missing years. As the gap is ten years and different cantons are available in different years, the imputation is done in a consecutive way and based on different cantonal series.[13]

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[13]Note: In their study of cantonal top shares, Schaltegger and Gorgas (2011) try to fill in the gap in the data by averaging incomes over two years from the yearly tabulations ex post. This however, is not equivalent to the tabulations according to the old system, as averaging income brackets over two years does not take into account any individual income mobility across brackets. Such averaging will therefore potentially decrease the estimated inequality at the top even more than the biennial assessment of incomes did.

4 Results: Top Income Shares in Switzerland

4.1 The Evolution Between 1981/82 and 2009

Figure 2 shows the estimated top income shares at the national level. The estimates from the OLS regressions are reported together with the estimates from the synthetic control method and the imputed values. We see that the estimates using the alternative methods (synthetic control and imputation) follow the same trend as our OLS estimates. We discuss the differences between the methods in subsection 4.2.1 below.

[FIGURE 2 HERE]

Main Findings: An Upward Trend
Figure 2 shows that the share of income going to the top income earners has overall been increasing from the 1980s to 2009, and the previously missing years 1993 to 2005 are no exception. Yet there are differences between the top groups, with larger increases further up in the income distribution. While the top 10 percent group experienced an increase of 13 percent over the whole period, the increase for the top 1 percent was 31 percent and added up to 117 percent for the richest 450 tax units belonging to the top 0.01 percent (see Table 2). This finding, that the top decile is a heterogeneous income group, has been pointed out in previous research by Atkinson and Piketty (2007, 2010) and Roine *et al.* (2009). The patterns above also suggest that higher percentiles in the income distribution tend to have more volatile earnings, which is confirmed by the variance of periodical growth rates reported in Table 2.

[TABLE 2 HERE]

Swiss top income shares are strongly correlated with the business cycle. The last recession covered in the data is the so-called "dot com" bubble in 2001. After a peak in 2000 we observe a drop in income shares for all top groups. The dynamics are slightly different at the very top than for the top decile as a whole. For the latter group, income shares fell for three years but then also recovered quickly: in 2006 they had reached before-recession levels and continued to rise. Further at the top, the drop seems to take place within only one to two years, which was then followed by a somewhat slower recovery than for the top decile as a whole.

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However, despite these differences, by the end of the time span covered, all groups reached shares in total income above any level reached before. Only the availability of more recent data will show how the top income shares in Switzerland reacted to the outbreak of the financial crisis in 2008/09.

Research on top incomes suggests that these have become more cyclical since the 1980s (Saez, 2013). Using a panel of 16 countries, Roine *et al.* (2009) find that growth benefits the top 1 percent group the most, while Guvenen *et al.* (2012), who use a large panel of individuals in the U.S. for 1978–2011, find that those belonging to the top 1 percent and top 0.1 percent experience, when entering a recession, the largest drop in earnings. In fact, their drop in earnings is larger than for those in the 90th percentile. Guvenen *et al.* (2014) further find that the top 1 percent in the U.S. have more volatile earnings than the rest of the population, but that this difference cannot be explained by business fluctuations alone. They find that the volatility varies by industry: the finance, insurance and real estate industry is the most cyclical for the top 1 percent earners.

This picture is in line with earnings distribution theories, which attribute a higher volatility to more disperse distributions, especially at the top (see (see Neal and Rosen, 2000, for an overview). Another possible explanation for the observed higher volatility at the very top lies in the relative importance of capital income combined with the different composition of the wealth at the very top compared to the top groups in the lower percentiles: the share of wealth held in corporate stock increases at the very top of the wealth distribution, while the share of other assets generating more stable returns, especially real estate, decreases with wealth, as shown by evidence from the U.S. (Kopczuk and Saez, 2004; Saez, 2006).

Long Run Development
As the series presented in this study are constructed following the approach of Dell *et al.* (2007), we can now combine our results with the latter to obtain series of the top income shares from 1933 to 2009. As the OLS estimation is our preferred specification, what follows is based on these results. As shown in Figure 3, top income shares have remained remarkably stable over this period. This is especially true for the two decades from the mid-1970s to the mid-1990s. Thereafter we observe a steady increase which made some top groups, such as the top 10 percent, reach, by the end of the last decade. the highest share in total incomes they had ever experienced.

[FIGURE 3 HERE]

The long term picture also provides further evidence for a steeper increase at the very top of the income distribution. Panel c) of Figure 3 shows how the top 0.1 percent outperformed neighboring groups, especially so in the last decade for which data is available. Figure 4 makes this point even more clearly by comparing the top 10 percent within the top 10 percent (i.e., the top 1 percent of the entire population as a share of the top 10 percent group) and within the top 1 percent group, respectively. While these within-group shares were more or less equal from 1933 to the beginning of the 1970s, the top 0.1 percent within the top 1 percent started to rise and drift away thereafter. Similarly, the ratio of the average income of the tax units of each top group relative to the total average income has been steadily increasing ever since the mid-1990s, after having reached its trough in the 1970s and 1980s. For the top 0.01 percent of tax units, i.e., the 450 richest households in Switzerland, average earnings have climbed up to 180 times the average earnings in the economy—an unprecedented level.

[FIGURE 4 HERE]

International Comparison

In comparison to the experience of other countries, top 1 percent income shares in Switzerland have remained fairly stable since the 1930s, with a dip at the end of the 1960s. When in the 1980s top income shares in the U.S. started to shoot up, Switzerland underwent an experience similar to its neighbors Germany and France: the latter experiencing an extremely stable evolution in top income shares. This picture changes when looking at the top 0.01 percent groups depicted in Figure 5b. This group comes much closer to the U.S. experience with a pronounced increase starting in the 1990s and reaching unprecedented levels in 2007.[14] We will come back to this divergent development in Section 5.4.

[FIGURE 5 HERE]

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[14]Due to a break in the German series, a comparison with Germany is problematic after 1998, as the later series include capital gains, making them much more volatile.

4.2 Robustness Checks

4.2.1 Robustness of the Estimation Results

The OLS Estimations for the Missing Years

Besides the estimation of top income shares through the Pareto interpolation method, the next thing to be assessed is the accuracy and sensitivity of the estimates for the Swiss shares in the missing years. Table C1 in Appendix C shows the detailed regression results of the fixed-effects OLS regressions used to predict the missing years. The overall fit of the different models for all the different series of top income shares is good and the share of explained variation is very high. Model I with Basel-City (BS) as the only regressor achieves the lowest R^2, but even there the values range between 0.84 for the top 10 percent group estimates and 0.90 for the top 0.1 percent group. In models II and III the coefficient for BS turns out to be insignificant except for the top 0.01 percent shares. The coefficients in models II and III are robust to the exclusion of BS. This makes sense considering Basel's small size and therefore little impact on the overall distribution of incomes. At the same time some of the richest entrepreneur families in Switzerland come from BS, the canton with the highest Gini coefficient in wealth distribution (0.91 in 2008, see Peters, 2011), as well as an above-average Gini coefficient in tax incomes (Jeitziner and Peters, 2009).

Prediction for Missing Years Using the Synthetic Control Method

While all the estimates based on the synthetic control method follow a similar pattern as the OLS estimates, there is one important difference: the peak emerging in 2000 is not observed in the synthetic control estimates, even though we observe such a peak in many (but not all) of the cantonal series. The evolution of the top income shares of labor income (see below) reveals a similar pattern with a peak around 2000; hence the OLS estimates producing this peak seem reasonable and are therefore preferred to the synthetic control method. With respect to the observed evolution in recent years, the synthetic control estimates would have predicted a steeper increase for the top 10 percent and 5 percent groups and a somewhat lower increase for the top 0.1 percent group. This is in line with the observation that groups at the very top experienced a pronounced increase in their total income shares. Another insight we gain from the synthetic control estimates is that the OLS estimates for 1995–1998, which are based on the data from BS only, do not seem to overestimate the top shares for this period.

Predicting Missing Years by Imputation

While the imputed values in Figure 2 follow a pattern very similar to the OLS estimates for the groups from the top 10 percent group to the top 1 percent group, the estimates further towards the top become very large and volatile. Especially for the top 0.1 percent and top 0.01 percent groups, the estimated values around the year 1999 become even larger than the estimates in 2008. Such an overshoot of top income shares, followed by a large decline just within a few years, does not seem plausible. So while imputation gives reasonable estimates for the top shares, this technique is not precise enough to impute values at the very top, as these series are more volatile than the ones for the lower top groups.

Accuracy of the Pareto Distribution Assumption

To check for the accuracy of the Pareto interpolation method, we make use of the old age insurance data (*AHV-Statistik*). For these labor incomes, we obtained the exact percentiles upon request (for details, see Section 5) together with tabulations with the same brackets as those reported in the tax statistics. This allows us to Pareto interpolate the AHV data in the same way as we did with the tax statistics. The resulting estimates of the top shares turn out to be very precise, with deviations between 0 and 0.5 percentage points. Similarly, the deviations of the estimated income thresholds from the true values range between a few Swiss Francs up to a couple of thousand Francs.[15] So even though grouped income data seem to be merely a relatively rough measure of the true income distribution, the Pareto interpolation method ensures highly precise results even for very small percentiles such as the top 0.5 percent group. Even more, the top 0.1 percent and 0.01 percent shares, which have been extrapolated whenever not contained in the top bracket, are as precise as the interpolated values.[16]

Pareto Interpolation Results in Comparison to Dell et al. (2007)

When comparing the results for 1981/82–1992/94 to those of Dell *et al.* (2007), the estimates are very similar although not exactly identical. This is for different reasons. First, our estimates of the total tax units in the country are based on yearly register data and not on linear interpolation between decennial censuses. Second, we also use a total in tax units that is slightly smaller than the one in Dell *et al.* (2007) (see Appendix B for details). Note, however, that differences in the denominator do not matter very much as the top shares calculated upon the

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[15]For the group of self-employed, for some single years, the deviations jump to CHF 100,000. We attribute these changes mainly to measurement errors in the data.

[16]This is the case for employees in the years after 2000 and for the self-employed over the whole period.

total reported tax income instead of the denominator that corrects for non-filers do not change a lot. Without the correction for total income, the income shares of the top 10 percent are overestimated by less than 2 percentage points and those of the top 0.01 percent by 0.07 percentage points, compared to the estimates where the correction for total incomes has been made. Overall, the differences between the estimates presented in our study and those reported by Dell *et al.* (2007) are very small, ranging between 0.006 and 0.347 percentage points or 0.6 percent and 7.4 percent. This is still in an acceptable range, for as (Atkinson *et al.*, 2010, p.26) put it in their meta study, "there is a wide confidence interval surrounding the estimates, reflecting not sampling error [...] but non-sampling error." They suggest an error margin of $\pm$ 20 percent.

4.2.2 Is it a Data Phenomenon? System Change and Tax Evasion

Change from Biennial to Annual System
As to the effects of the change from the biennial to the annual assessment of incomes, there does not seem to be a strong altering effect after the change. However, we cannot precisely estimate the impact of the change as we have no individual tax data. Yet there is no jump, and even though top shares started to rise after 1993, the rise was slow in the beginning and can be seen as the beginning of an era of increasing top income shares which became especially pronounced from the end of the 1990s onward.

Changes in Tax Evasion
A potential concern is that the observed increase in top income shares is driven by a decrease in tax evasion. This could be due to the prevalence of electronic payment systems or because top tax rates in Switzerland have been decreasing, thereby reducing the incentives to evade taxes. Several aspects speak against this conjecture. First, the fraction of non-filers was increasing over the period of our study. This is consistent with the findings in Feld and Frey (2002), according to which tax evasion varies between 12.6 percent in 1978 and 35.1 percent in 1990. Speaking to officials from different cantonal tax administrations confirmed our view that tax evasion has not decreased over time, some officials from the administration even suspecting an increase in tax evasion. While in some cantons the change to the *postnumerando* taxation was accompanied by the introduction of new IT systems allowing a better cross-checking of tax return data, the drawback of the yearly assessment seems to be that tax collectors have less time to investigate

suspicious cases. Yet all the officials we spoke to agreed that income tax evasion is an offense mostly committed by low and middle income groups. They argue that for top earners, the issue is more the evasion of wealth taxes and casual earnings (made abroad). Overall, it is not plausible that the observed increase in top income shares is due to more compliance.

5 What Drives the Top Income Shares? The Roles of Labor and Capital Incomes

The picture of top income shares we have obtained so far is based on overall earnings. To better understand the driving factors behind the observed patterns, the appropriate next step would be to decompose overall earnings into labor and capital income. The Swiss tax data do not allow such a distinction, but other sources do allow a closer look at the evolution of labor and capital incomes separately. For the former, we make use of the old age insurance statistics (*AHV-Statistik*), while for the latter we have to rely on estimates from wealth statistics. Note, however, that we do not know how labor and capital income are correlated, so the discussion below should be taken as an educated conjecture of how the income composition of the top groups has changed over time.

5.1 The Increasing Importance of Labor Incomes

The AHV statistics contain the full earnings information for all employees and self-employed on a yearly basis. Moreover, as contributions to the old age insurance are not limited by any upper threshold but are levied upon the whole income (including all wage components, like stock market shares for example), all labor incomes legally earned in Switzerland are covered. As the AHV statistics are a full sample, it is possible to obtain the percentile values of interest directly from the data, without estimations.[17] The obtained top income shares therefore correspond to the true shares within the labor income distribution (as opposed to total income in the case of the top shares estimated with tax statistics). An important difference between social security and tax statistics is that the former relies on individuals whereas the latter samples tax units. To the extent to which the correlation between top incomes and household structure did not change, the evolution of top labor incomes may be directly compared to the evolution of total

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[17]We owe thanks to the data team of the *Zentrale Ausgleichsstelle der AHV (ZAS)*, and especially Hans-Peter Naef, who extracted the data we needed.

incomes. Hence, if top labor incomes grew faster than total incomes, labor incomes grew to be relatively more important among the very top income earners.

Figure 6 shows the top labor income shares together with the top income shares from the income tax data. They clearly follow the same patterns, with the latter being higher for every top group at every point in time.

[FIGURE 6 HERE]

The AHV statistics further allow us to decompose labor income into wages paid to employees and income of the self-employed (Figure 7). Not surprisingly, the self-employed at the very top have very high shares of the total income generated by all self-employed, also because some businesses will generate only very low profits.[18] For both categories we observe again an upward trend starting in the mid-1990s, as well as an inverse 'U' pattern between 1999 and 2003, reflecting the boom and recession related to the "dot com" bubble in 2001. Similarly to what happened with the tax data covering all incomes, these patterns become more pronounced further up in the income distribution. This is even more so in the case of the self-employed, who suffer from stronger fluctuations as their incomes will clearly depend more on common economic trends than employees' incomes.

[FIGURE 7 HERE]

5.1.1 The Rise of Top Employees

Did the top self-employed and employees' incomes grow differently after 1981? This is depicted in Figure 8. While for the top 10 percent and (even though to a lesser extent) for the top 5 percent it is true that entrepreneurs performed best when it came to securing larger shares in total income, the increase in top employees' income share is stunning. For the top 0.01 percent it more than tripled over the observed period, compared to the top self-employeds' shares, which less than doubled. These changes over time are of course limited, as the shares themselves are bounded above. Nevertheless Figure 8 clearly shows how the distribution of

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[18]Note that in the old age insurance statistics, the main income source determines whether someone is classified as an employee or as self-employed, therefore making sure that the self-employeds' incomes are actually their main income, except possibly for incomes earned by other persons such as a spouse.

labor earnings in Switzerland has been undergoing some remarkable changes since the beginning of the millennium. While up to the mid-1990s the evolution of top incomes was similar for entrepreneurs and employees at the very top, employees benefited from a steady increase in their income shares. The top incomes of employees rose by more than 55 percent, whereas the total top incomes rose by only 30 percent. Taken together this implies that while there has been a general increase in earnings inequality at the top as top income shares have been on a steady rise, this increase has been steeper for employees' incomes than for the self-employeds' incomes and general incomes measured by the tax data.

[FIGURE 8 HERE]

All the comparisons of the top income shares made so far are based on the top shares within different distributions that are not directly comparable. The insight that the top 10 percent of the self-employed earn 44 percent of the total income of all the self-employed, compared to a share of 30 percent of the total employees' earnings accruing to the top 10 percent, does not tell much about how these two top groups relate to each other, because different denominators are used to obtain the shares. A way to correct for this is by using total labor income as the denominator and correcting for the relative size of the two groups of employees and entrepreneurs:

$$P_\alpha(P_{\rho g}) = \frac{Y_{\rho g}}{Y} \cdot \frac{N}{N_g}.$$

Here, $P_{\rho g}$ denotes the top ρth percentile of the group g of entrepreneurs or employees. $Y_{\rho g}$ is this top group's total income and N_g is the total number of persons in the group; N denotes the total number of working persons and Y stands for total labor income. Figure 9 shows the corresponding shares in total labor income for the top groups of the self-employed corrected for their size relative to the total working population together with their shares within the group of self-employed. Not surprisingly, their share in total labor income would be even higher if calculated that way. But note that for all top groups, the difference becomes smaller over time, therefore indicating again that top employees could secure larger shares of labor income than the self-employed.

[FIGURE 9 HERE]

Even though Figure 9 makes the shares comparable by normalizing them by the relative size of the group, the distributions themselves are still not directly comparable. The threshold for belonging to the top 10 percent of employees was roughly CHF 120,000 in 2008, while it was CHF 158,000 for belonging to the top 10 percent of the self-employed. In order to make comparisons across the different income distributions, the population shares above any threshold amount (expressed in CHF) are estimated. We might for example want to know the number of employees who have an income equal to or higher than the threshold of the top 10 percent of self-employed. As we have the data on each income distribution separately, we have to find the percentile α corresponding to this threshold value, while up to now we started with a percentile of interest and then calculated the corresponding threshold value. Rearranging the formula used for interpolation (see Appendix B) leads to

$$\alpha_g(T_\rho) = \left(\frac{k_{T,g}}{T_\rho}\right)^{\frac{b_{T,g}}{b_{T,g}-1}},$$

where T_ρ is the income threshold and $k_{T,g}$ and $b_{T,g}$ are the parameters obtained from the bracket whose lower bound is closest to the threshold income value T_ρ. For example, α_g expresses the percentage of employees who have an earned income above the income threshold of the top 10 percent of the self-employed. The trends in this figure say something about the relative evolution of top incomes for employees and the self-employed.

[FIGURE 10 HERE]

Figure 10 shows two things. First, the percentage of employees above the top 10 percent and 1 percent threshold of the self-employed remained stable until the second half of the 1990s. After that, the wages of employees at the top started to catch up with the top self-employed's earnings—even though it is far from being a full catch up, the self-employed at the top still have higher earnings than employees. Second, we observe again that earnings further at the top have become more volatile. The latter makes sense if we think of high self-employed earnings containing a risk premium, while for employees, wages can be seen as very predictable and stable. If now the increase at the top is partly due to more volatile salary components such as stock options and equity pay, the top paid employees

like CEOs will also bear part of the firm's risk. Note, however, that the upward trend still remains, as the declines are sharp but smaller than the increases. Such a pattern is also consistent with the empirical literature, showing that CEOs are paid for luck but are not punished for bad outcomes (Bertrand and Mullainathan, 2001).

The question, which remains open here, is why we observe such a surge only after the mid 1990s. On the one hand, the literature has proposed market driven explanations such as skill-biased technological change which has favored top earners (see e.g. Gabaix and Landier, 2008). Some others have claimed that it is the institutional setting which matters and which has changed after the Reagan/Thatcher epoch, which was followed by a wave of liberalizations in many spheres (Pontusson, 2005). Related to this institutional view is a broad literature considering the effects of tax rates on top incomes. Piketty *et al.* (2013) present an overview of the different effects from taxation on top incomes along with a model allowing different margins of behavioral responses to taxation. The innovation of their model is that it includes top earners' responses of bargaining-over-pay, in addition to the standard supply-side and tax avoidance responses to taxation.

5.2 Top Wealth Shares and Capital Incomes

Our estimates of the evolution of capital incomes are much cruder than the estimates of labor income. To at least gain an idea how the distribution of capital income evolved, we look at the evolution of wealth inequality. Assuming that returns to capital do not vary systematically among the top groups, the evolution of wealth inequality is a good proxy for the evolution of capital income inequality. Figure 11 presents the top wealth shares from Dell *et al.* (2007), updated to 2008. They were estimated analogously to the top income shares. Wealth recorded in the tax statistics is net (gross wealth minus liabilities) and relates to tax units (as in the case of incomes). Both panels of Figure 11 show that, as with the top income shares, top wealth shares started to increase again in the 1990s, with the increase becoming more pronounced in recent years and further up in the income distribution. If we disregard the spike in the late 1930s, which is most probably caused by an influx of wealthy immigrants fleeing from the Nazis (Dell *et al.*, 2007), the wealth shares of the top 1 percent groups and above had, by 2007, reached levels comparable to the maximum levels for the whole period after World War I. For the top 0.1 percent and the top 0.01 percent we even observe an unprecedented

concentration in wealth. The numbers have to be interpreted with care, however, as pension accounts are not taxed and therefore excluded. Their growth since their general introduction in 1984 leads to an underestimation of capital incomes and to an overestimation of the wealth concentration, over time and in international comparisons (the same is true for the Netherlands, see Salverda and Atkinson, 2007).

[FIGURE 11 HERE]

5.3 International Comparison of Different Income Sources at the Top

In the international context, the findings with regard to the relative importance of capital, wage and business income vary considerably between countries. In Germany, business income persists being substantial at the very top (Dell, 2007). A possible reason for this is that public corporations which pay dividends and employ a CEO were until recently quite rare in Germany, with other legal forms for societies being much more widespread due to favorable corporate and business tax laws (Dell, 2007, p.381). By decomposing income into different sources, Dell (2007) shows that wages have become more important over time for the bottom half of the top decile, while for the groups within the top 1 percent, business income has become the dominant income source. The relative importance of capital income has decreased for all top groups, so that in 1998 it was negligible for groups other than the top 1 percent. Similarly, the top income shares in the Netherlands show a remarkably flat evolution since the 1970s, but capital income shares have lost importance at the top. A decomposition shows that "[a]t the turn of the century wage earnings are the predominant category of income in each and every top share" (Salverda and Atkinson, 2007, p.450). The Dutch data further show a shift away from business income towards wages. First, we see a strong decline in self-employment from 18 percent of tax units in 1952 to 6 percent in 1999—a level similar to Switzerland in the 1981–2008 period. Second, other income sources, especially wages, have become more important and constituted 26 percent of the self-employed total income on average. This evolution is in line with the well documented impressive increase of top wages in the U.S. (Piketty and Saez, 2006; Saez, 2013). A third, often overlooked, reason for the increase in wage income for top tax units is the increase in double-earner households (Salverda and Atkinson,

2007). In Spain, where the observed increase in income concentration since 1981 is a phenomenon within the top 1 percent, wage income has been increasing slowly but persistently over the period 1981–2005 (Alvaredo and Saez, 2009). Top wealth shares further suggest that business is in a decline. Sweden is the only European country to our knowledge where wages have become less important at the top of the personal income distribution since the 1980s (Roine and Waldenstrom, 2010). But also here the role of business income has become negligible for all the top groups in recent years.

5.4   The Role of Taxation

The literature on top income shares so far has seen Switzerland as special case due to its very stable evolution of top income and wealth shares compared to other western democracies (Dell *et al.*, 2007; Atkinson *et al.*, 2011). This stable pattern, especially when compared to English-speaking western democracies, has been explained so far by the comparably low and stable marginal tax rates for the super-rich in Switzerland (Kopczuk and Saez, 2004; Dell *et al.*, 2007). The time series covering more recent years now document that Switzerland has seen an increase in top incomes shares as well. Interestingly, cantonal tax rates have also been falling over this period, which is in line with the hypothesis of an inverse correlation between top income shares and top marginal tax rates put forth by Saez *et al.* (2012) and Piketty *et al.* (2013).

6   Conclusion

In this paper, we investigated the evolution of top income and top labor income shares in Switzerland. In particular, we have closed the data gap between 1993 and 2003 which arose because the cantons changed their tax systems at different points in this time frame.

Our results show that top incomes shares in Switzerland have increased, with stronger increases at the very top: The top 1 percent income share rose from 8.5 percent in the late 1980s to 11 percent in the late 2000s, whereas the top 0.1 percent share increased from 2.9 percent to 4.2 percent in the same period. Together with the large increase, the very highest incomes also exhibited the largest volatility in the business cycle. Once the data is available, it will be interesting to see whether these patterns have outlived the recent financial and economic crisis.

We also compared the income data from the tax statistics with the labor income data from the social security statistics, for which we obtained the percentiles directly from the register data. We find that inequality among top labor income earners (employees and self-employed) rose sharply as well, with the same time trend as the estimated values for total top incomes. Thus, the latter finding confirms our estimates for the income inequality data series 1993–2003. Furthermore, labor incomes grew faster than total incomes at the top. In this respect, Switzerland follows the trends of other industrialized countries, where labor income has been found to have become more important among the top income earners.

Further research is needed to investigate the hypothesis that falling top marginal tax rates could partially explain the rise of incomes at the very top of the distribution. Falling tax rates, especially in a country with strong direct democratic institutions, might be correlated with more fundamental changes in values. If, following the Reagan/Thatcher epoch, more liberal, market-oriented values were adopted in politics and by the general public, this could also help explain trends in increasing pay at the top combined with the emergence of incentive-based remuneration schemes. Such schemes can both enhance efficiency and camouflage rent-seeking behavior. Using individual data it would be possible to investigate patterns of CEO compensation across industries over time in Switzerland. We leave these considerations for future research.

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Appendix A: Data Sources

Tax Statistics

Data set with grouped tax data provided by Raphaël Parchet, Università della Svizzera italiana USI [19]. Original source: Federal Tax Office. This data set contains variables for each of the cantons plus Switzerland for the tax periods 1983/84 up to 2009, except for period 1987/88 which is missing. The lower bounds of the income brackets for this dataset are 60,000 70,000 80,000 (up to year 2000) 90,000, 100,000, 120,000, 150,000, 200,000, 300,000, 400,000, 500,000, one million, and two million CHF, respectively. For each income bracket the total number of tax units (*Normal-* and *Sonderfälle*) and their total income within each bracket are reported.

Old Age Insurance Statistics (AHV-Statistik)

Data provided by Hans-Peter Naef, *Zentrale Ausgleichsstelle der AHV (ZAS)*, Geneva. We obtained tabulations with the requested percentile threshold values, the income sum above that threshold, the median within each threshold along with total incomes and the total of insured persons for each year for the groups of employees, self-employed and all insured working persons taken together. Additionally, we obtained grouped tabulations with the same income brackets as in the tax statistics.

Wealth Statistics

Grouped tax data of net wealth with income brackets from zero up to CHF 10 million and above. Data downloadable from the Federal Tax Administration's web site:

http://www.estv.admin.ch/dokumentation/00075/00076/00717/index.html?lang=de

Appendix B: Technical Notes on the Construction of Top Income Data Series

The Swiss Income Tax Reform of 1995

Before 1995, taxes were assessed upon a two-years basis and the praenumerando method was applied for levying the federal income tax. Within this system, fiscal

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[19]Before Université de Lausanne

period and assessment period do not coincide. Speaking in legal terms, the fiscal period (called *Steuerperiode* or *période fiscale*) is the time period for which the taxes are owed, while the assessment period (called *Bemessungsperiode* or *période de calcul*) is the time period during which the income was realized upon which the tax liability is calculated. The tax liability is calculated during the so-called taxable period (*Veranlagungsperiode* or *période de taxation*). So according to the praenumerando system, all incomes from the preceding two years constituted the basis for the tax liability arising in the next two-years fiscal period.[20] The notion praenumerando method refers to this fact that the assessment period and the fiscal period do not coincide under such a tax system, the assessment period precedes the fiscal period (Eidgenössische Steuerverwaltung ESTV, 2003). This implies that the incomes on which the taxes payable in fiscal period 1995/96 are based were realized in the assessment period 1993/94. The tax duty for a fiscal period was thus calculated from an estimated income stream based upon past income and unless income or living conditions changed substantially, taxes were only adapted to the new income situation in the next fiscal period.

This tax system was neither very transparent nor was it easy to handle. Due to the two-years basis, citizens needed to keep all kind of records for this period. Much more important, because the tax was calculated upon past income, often a betwixt assessment (called *Zwischenveranlagung* or *taxation intermédiaire*) was arranged. This procedure was necessary as a corrective whenever the actual income of a tax period differed substantially from the one realized and reported during the assessment period, due to certain predefined reasons (such as marriage, birth of a child, or occupational changes). In such a case, taxes were re-calculated afterwards upon the effectively realized income during the tax period, thereby actually following the postnumerando taxation method.

Under the newly introduced postnumerando method, fiscal period and assessment period are identical and correspond to a legal year. The taxable period follows the fiscal period so that taxes due for a certain year are calculated upon the effectively realized income in that year. Therefore, taxation can only take place in the following year, which is why the notion postnumerando taxation is used.

The reform process, which aimed at simplifying the tax system, adopt it to the internationally common one-year based taxation, and harmonize the cantonal

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[20]Note that the use of the praenumerando method does not include the necessity to assess incomes on a two-years basis, a yearly basis would be possible as well under such a tax system.

and communal taxation systems,[21] began in the 1980s. In 1990 the change to the postnumerando taxation with the one-year assessment basis was enacted with a transitional period of several years, during which each canton could choose when to adopt the new system.[22]

This cantonal freedom to choose the timing to switch to the new system is the reason why during the transitional period from 1995 to 2002, there is no uniform tax data published on the Swiss level but only data on the cantonal level is available. Table B1 shows the time schedule of the adoption of the new taxation method by canton. Basel City was the only canton which had always used the one-year based postnumerando taxation method to levy the cantonal taxes, but all the other cantons had to adapt their tax systems. This transition caused a gap in the assessment of the incomes and taxes. To avoid loopholes in the tax system, transitory provisions had been enacted but these differed among cantons.[23]

Table B1: Transition from Praenumerando to Postnumerando Taxation by Canton

1995	Basel-City (BS)
1999	Zurich (ZH), Thurgau (TG)
2001	Bern, Lucerne, Uri, Schwyz, Obwalden, Nidwalden, Glarus, Zug, Fribourg, Solothurn, Basel-Landschaft, Schaffhausen, Appenzell-Ausserrhoden, Appenzell-Innerrhoden, St. Gallen, Graubünden, Aargau, Neuchatel, Geneva, Jura
2003	Ticino (TI), Vaud (VD), Valais (VS)

Choice of Tax Units: Normal and Special Cases, Capital Gains

The tabulated tax statistics have remained stable over time so that the total number of tax units and total income are comparable over time. Nevertheless, attention has to be paid on the correct selection of these data. For the correct selection of the total of tax units, it has to be made sure that not only the normal cases but also the special cases (so-called *Sonderfälle* or *cas spéciaux*) are included. The latter include the high net wealth individuals taxed according to their expenditures (*Besteuerung nach dem Aufwand* or *imposition d'après la dépense*) and are highly relevant in the top income group.[24] On the other side, the cases declared as capital gains (*Kapitalgewinne*) and, in later years, capital payments from pension schemes (*Kapitalleistungen aus Vorsorge*), are not to be included, as these are only listed

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[21]Botschaft zum StHG sowie zum Bundesgesetz über die direkte Bundessteuer, DBG, BBl 1983 III 1ff.

[22]Bundesgesetz vom 14. Dezember 1990 über die direkte Bundessteuer (DBG; SR 642.11).

[23]For further information on these transitory provisions see Eidgenössiche Steuerverwaltung ESTV (2003).

[24]Note that to be eligible for the expenditure-based taxation no labour income can be earned in Switzerland. As tax statistics do not differentiate between labor and capital income, the inclusion of these special cases makes sense.

for illustrative purposes.[25] They are not in fact separate tax units and including them in the total amount of tax units leads to double counting. Including them in years prior to the tax period 1989/90 does not make a big difference, as numbers are small. But as since 1990 occupational pension funds can be used to acquire real estate, the number of these cases increases remarkably. This is why the inclusion of capital payments as separate cases after 1990 leads to an over-estimate of the number of filing tax units by 2 to 3 percent points.

The years indicated on the tax statistics refer to the fiscal period, so before the change to the postnumerando method, incomes reported do actually refer to the two preceding years. As a further consequence of the change to the postnumerando method, data on realized incomes is missing for the period preceding the change. Throughout the paper, the years in graphs and tables refer to the year in which the income was *realized*.

From the tax period 1995/96 onwards, i.e., for incomes realized in 1993/94 and later, the tabulations available online include the normal cases only. As mentioned above, the exclusion of the special cases leads to an underestimation of top income shares and therefore the data have to be requested from the Federal Tax Administration. This means, that also for further updates of the series one may have to request the data.

Tax Units

Everyone legally residing permanently in Switzerland and who has completed the legal age of 18 years (respectively 20 years prior to January 1 of 1996) is subject to the Direct Federal Income Tax and has to fill a tax return. Married and officially registered couples (in act since January 1 of 2007) are subject to joint tax liability, therefore they show up as one single case in the tax statistics.

Tax Units and Incomes Not Covered

Individuals and incomes missing in the tax statistics are the reason why we need to estimate a total income denominator as well as the total number of tax units in order to construct the relative income shares. The statistics do only report cases that were actually taxed, i.e., when taxable income was high enough to excess the amount of exemption of the federal income tax. The schedule of the federal

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[25]In the publication by Dell *et al.* (2007) these cases are included in the total number of tax units.

income tax is very progressive but with a low exemption level, therefore not many low-income tax units are missing.

Apart from this group, other groups possibly not showing up are those taxed at the source, international organization's staff and real non-filers. Last but not least some individuals may show up in the statistics but corresponding incomes reported are too low due to tax evasion. In the following, each of these groups is discussed.

Individuals Taxed at the Source

Foreign nationals officially living in Switzerland but with a yearly or any other temporary resident permit only, as well as non-residents earning income in Switzerland, e.g., cross-boarder commuters, are taxed at the source and do thus not fill a tax return. As the focus of the paper lies on the income distribution among Swiss residents, the latter cases are of no further concern.

Foreign residents with a temporary permit are required to fill a tax return ex post only if their total yearly income exceeds a certain threshold (around CHF 120 000 in 2012), in which case they will then be included in the tax statistics. As this threshold lies below the top 10 percent income threshold, this implies that these individuals and their incomes nevertheless do appear in the statistics. As for those taxed at the source but falling below this threshold, we can only make an educated guess about their incomes. We start assuming that the distribution of incomes for legal foreign residents should be somewhat similar to the one of permanent residents (although one could expect some sort of wage discrimination against immigrants in some industries). Then there are the mentioned income earners at the top, which are not taxed at the source while special groups such as foreign students are subject to taxation at the source. The latter typically earning below average incomes and the former having high incomes by definition, leaves us with a pool of below-average income earners not covered in the tax statistics. With regard to the extent to which taxation at the source is present, data from several cantons show a mixed picture, depending mainly on the geographical location of the canton. In all the cantons, however the number of individuals taxed at the source has been increasing over time, especially since the mid 1990s. By 2010 it reached over 20 percent of the population in some of the cantons exposed most to cross-border commuters, such as the cantons Schaffhausen (SH) and Basel-Landschaft (BL). In Zurich (ZH) and Basel-City (BS) the fraction lies around 15 percent of the population and it is substantially lower in cantons with no boundaries with

surrounding countries, such as in Bern (BE; 4 percent), or Aargau (AG; 7 percent).

International Organizations' Staff

International organizations' staff based in Switzerland is exempted totally or partially from personal income taxation.[26] No less than 24 organisations residing in Switzerland benefit from tax exemptions for their whole or part of their staff, all of them except for two located in Geneva (GE). Geneva does indeed have the lowest rate of filers, reaching an average of only 76 percent compared to the Swiss average of 86 percent for the period covered, reflecting the high percentage of residents who are not subject to personal income tax.

True Non-Filers

Even though it is the law to fill and hand in a tax return every year, there are people who fail to do so. In cases where individuals do not accomplish with their duty to fill out a tax return within due time, the tax administration attributes these individuals an income based on former tax returns and on employer's information about the income, so that these individuals do show up in the statistics, but their income is measured with some error. However, according to information from cantonal tax administrations, there are not many of these cases (around 4 percent for the canton of Bern in 2009).

Individuals Evading Taxes

While there are legal reasons why someone would not appear in the tax statistics, there is of course also the case of tax evasion. But while tax evasion has an effect on total reported income, its effect on the number of total tax returns handed in is much smaller. While it is possible not to declare certain incomes, it is much more difficult not to appear in the cantonal tax registers and not to fill out a tax return at all.

Estimation of Total Income

As the total income reported in the tax statistics does not take into account all incomes actually earned in a given period, it is necessary to accurately reconstruct total income, which is then used as denominator to calculate the top group's income shares.

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[26]At some of the organisations benefitting from a special treatment, Swiss citizens are not subject to the tax exemption.

For incomes simply not disclosed by the statistics as described above, we assume that their incomes are below average income. Following the approach adopted by Dell (2007) we assign the tax units not covered in the statistics 20 percent of average personal income reported in the tax statistics, i.e., 20 percent of per capita *Reineinkommen*. This seems a reasonable assumption and this method guarantees a high level of comparability with the existing series so that the update should not cause a break in the series.

In addition to estimate total personal income taxed one would like to relate these values to another, exogenous measure of total income in the economy, such as net national income reported in the national accounts. The ratio of reported tax income to the net national income starts at around 72 percent in 1981 but then falls over time to a low of 60 percent in 2006, rising again afterwards. Similarly, our income denominator containing the imputed incomes for the non-filers fluctuates somewhere between 65 percent and 74 percent. Even though the definitions of total income have changed over time due to revisions of the national accounting system, our results are in line with those reported by Dell *et al.* (2007). This remaining gap can at least partly be explained by tax evasion.

Estimation of Total Tax Units in the Country or Canton

To calculate the top income groups as percentage shares accurately, the same argument as for the total income applies: as not all tax units are contained in the tax statistics we need to calculate the total of tax units in the country. These have to be constructed either from census data or register data.

Dell *et al.* (2007) use decennial census data, which covers the whole 20th century. By linear interpolation between two consecutive censuses, the authors construct annual series for the total number of adults (which for their covered time span is 20 years and older), the total number of married adults and the total number of tax units, defined as the total number of adults minus half the married adults, for each year.

For the present study, a slightly different approach is adopted. As for the time span of our study register data on the federal as well as on the cantonal level are available on a yearly basis, we make use of this detailed information. This has the advantage, that migration shocks and population trends are better represented in the data. Especially migration shocks remain probably disregarded when interpolating linearly over a time span of 10 years. Another reason why we do

not follow the linear interpolation approach between census years is of a practical nature: the decennial census has been abolished after 2000 and is now replaced by a representative population sample combined with register data. Furthermore, the use of register data makes it easy to account for the reduction of the legal age from 20 to 18 years by January 1 of 1996. This reduction of the legal age led to an increase of the total amount of tax units in the country and by not accounting for this change one would overestimate the fraction of tax filers. So up to 1995 our total tax units refer to the total adult population minus half the married individuals aged 20 and above, while from 1996 onwards the same population groups but aged 18 and above are used.

When comparing the series of tax units constructed by Dell *et al.* (2007) using linear interpolation and those stemming from register data on Swiss level, two effects can be observed. On one hand, estimation of total population numbers by linear interpolation leads to slightly higher numbers of total individuals than those reported in register data for some periods, namely the 1980ies and the beginning of the 2000s (a period not covered in the reference study by Dell *et al.*, 2007). This would lead to a higher number of total tax units. On the other hand, the interpolation of married adults leads to higher values than those reported in register data (for some reason the decennial numbers from the census are higher than those from registers for corresponding years). A higher number of married individuals has a dampening effect on the total of tax units. As the effects go in opposite directions, it is a priori not clear which one predominates. A comparison of total tax units shows that for the time span 1981/82–1991/92, the total of tax units is slightly higher when using register data than when interpolating. The effect on the fraction filling and non-filers, respectively, remains small and lies between 0.9 and 2.25 percent points. Note however, that differences in the number of total tax units and the fraction of non-filers also lead to a slightly different total income denominator. But again, the differences are small and, most important, are even smaller when it comes to the estimation of top income shares.

Special notes on the calculations on the cantonal level

In principle, wherever possible the same procedures were carried out on cantonal level as on the Swiss level. Yet the lack of data availability makes it sometimes necessary to adopt a slightly different method. For the total number of tax units on cantonal level, the number of married individuals is linearly interpolated, as

no register data on the married individuals by age are available on cantonal level. A comparison of interpolated vs. actual yearly register data on the federal level shows that the interpolated series for the married individuals lead to estimates below the values reported from the registers (see above). Therefore we slightly overestimate the total of tax units and the fraction of non-filers on cantonal level, which in turn has a somewhat dampening effect on the total income denominators on cantonal level.

When relating the total income denominators on cantonal level to the cantonal net revenues, one has to be careful when it comes to interpretations of the values. First, cantonal net revenues reported in national accounts may suffer from some measurement errors, and second because on the cantonal level taxable income was probably not generated within the canton where it is taxed. This is so because it is possible to work in one canton and to live in another, but income is always taxed in the canton of residency.

Estimation of the top income shares using Pareto interpolation

The estimation of top income shares follows the approach adopted by Piketty (2001) and Dell *et al.* (2007). First, the local Pareto parameters b and k corresponding to the lower s bound of each income bracket in the tax statistics are calculated

$$b_s = \bar{y}_s/s$$

where y_s is the average income per tax unit above the threshold s. The original Pareto distribution coefficient is then $a_s = b_s/(b_s - 1)$. The parameter k_s is defined as

$$k_s = s \cdot p_s^{(b_s-1)/b_s} = s \cdot p_s^{1/a_s}$$

where $p_s = 1 - F(s)$ denotes the share of tax units with income larger than or equal to s. We use the local parameters corresponding to the income bracket s where the population share p_s is closest to the population share of interest ρ, e.g. closest to 10 percent of total tax units N. The income threshold T_ρ to belong to the top percentile ρ is then given by

$$T_\rho = \frac{k_s}{\rho^{(b_s-1)/b_s}} = \frac{k_s}{\rho^{1/a_s}}$$

The average income per tax unit above this income threshold, $\bar{y}_\rho$, reads

$$\bar{y}_\rho = T_\rho \cdot b_s.$$

Total income for each top group then is $y_\rho = \bar{y}_\rho \cdot (100 - \rho) \cdot N$. Total income of each top group divided by the total income denominator yields the income share of each group.

Estimation of Swiss top shares for the missing years

In order to estimate the values for the missing years we extrapolate them from the existing cantonal series using linear fixed effects OLS estimation. In order to make use of the maximum number of data points available, several linear regressions are carried out, always regressing the series for Switzerland on those of one or several regions as defined above. Table B2 shows the different models estimated for each year. Using linear forecasting, the missing values for the Swiss series are extrapolated from the cantonal series. The last row of Table B2 indicates the years for which each model was used to obtain the extrapolated values.

Table B2: Regression Models Used For Estimation of Swiss Top Income Shares

	Model		
	I	II	III
Independent variables:	BS	BS	BS
cantonal top shars	–	ZH and TG	ZH and TG
	–	–	20 cantons
Model used for extraplation in...	1995–1998	1999–2000	2001–2002

Dependent variable: top p percent group's income share on Swiss level

Appendix C: Detailed Results

Table C1: OLS Models Used To Estimate Swiss Top Income Shares in 1995–2002

	Model I	Model II	Model III
Top 0.01% shares			
Basel City (BS)	0.346***	0.163*	0.0337**
	(0.0396)	(0.0697)	(0.00877)
Zurich and Thurgau (ZH, TG)		0.589*	0.286***
		(0.204)	(0.0243)
Twenty Cantons			0.608***
			(0.0218)
Constant	0.00676***	0.00343*	0.000565*
	(0.000792)	(0.00130)	(0.000172)
R^2	0.884	0.940	0.999
Top 0.1% shares			
Basel City (BS)	0.406***	0.199*	0.0255
	(0.0426)	(0.0650)	(0.0163)
Zurich and Thurgau (ZH, TG)		0.608**	0.302***
		(0.171)	(0.0372)
Twenty Cantons			0.603***
			(0.0380)
Constant	0.0158***	0.00493	0.00189*
	(0.00193)	(0.00333)	(0.000648)
R^2	0.900	0.959	0.999
Top 0.5% Shares			
Basel City (BS)	0.486***	0.165	0.00959
	(0.0512)	(0.0766)	(0.0272)
Zurich and Thurgau (ZH, TG)		0.723**	0.344***
		(0.159)	(0.0601)
Twenty Cantons			0.617***
			(0.0622)
Constant	0.0284***	0.00392	0.00181
	(0.00422)	(0.00592)	(0.00174)
R^2	0.900	0.970	0.998

	Top 1% Shares		
Basel City (BS)	0.522***	0.135	0.00117
	(0.0565)	(0.0801)	(0.0335)
Zurich and Thurgau (ZH, TG)		0.774***	0.363**
		(0.149)	(0.0751)
Twenty Cantons			0.623***
			(0.0795)
Constant	0.0375***	0.00392	0.00135
	(0.00618)	(0.00724)	(0.00263)
R^2	0.895	0.974	0.997

	Top 5% Shares		
Basel City (BS)	0.574***	0.0319	-0.00846
	(0.0724)	(0.0654)	(0.0423)
Zurich and Thurgau (ZH, TG)		0.891***	0.413*
		(0.0999)	(0.139)
Twenty Cantons			0.597**
			(0.154)
Constant	0.0804***	0.00986	0.000815
	(0.0167)	(0.00968)	(0.00650)
R^2	0.863	0.986	0.995

	Top 10% Shares		
Basel City (BS)	0.573***	0.00559	-0.0121
	(0.0779)	(0.0544)	(0.0456)
Zurich and Thurgau (ZH, TG)		0.893***	0.509*
		(0.0790)	(0.180)
Twenty Cantons			0.476
			(0.208)
Constant	0.123***	0.0258*	0.00922
	(0.0257)	(0.0110)	(0.0116)
R^2	0.844	0.990	0.994
Observations	12	12	12

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C2: Synthetic Control Weights

Canton	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%
ZH	0.054	0.051	0.055	0.054	0.057
BE	0	0	0.001	0	0
LU	0.128	0.125	0.133	0.137	0.145
UR	0.011	0.007	0.002	0.002	0.002
SZ	0.028	0.03	0.029	0.025	0.028
OW	0.021	0.026	0.033	0.033	0.029
NW	0	0	0	0	0
GL	0	0	0.002	0.001	0.001
ZG	0	0	0	0	0
FR	0	0	0.001	0	0
SO	0	0	0.001	0	0
BS	0.135	0.129	0.112	0.105	0.092
BL	0	0	0	0	0
SH	0	0	0	0	0
AR	0	0	0	0	0
AI	0	0	0.001	0	0.001
SG	0.076	0.082	0.084	0.098	0.098
GR	0	0.001	0.002	0.001	0.001
AG	0.122	0.120	0.113	0.109	0.108
TG	0	0	0.001	0	0
TI	0.035	0.033	0.028	0.024	0.022
VD	0.364	0.366	0.366	0.372	0.376
VS	0	0	0	0	0
NE	0	0	0	0	0
GE	0.026	0.029	0.034	0.038	0.039
JU	0	0	0	0	0

Table C3: Synthetic Control Top Shares Predictor Means

	Switzerland	Synthetic Switzerland				
		Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%
Income share						
Top 10%	0.299	0.299	0.299	0.299	0.299	0.299
Top 5%	0.202	0.202	0.202	0.201	0.202	0.202
Top 1%	0.086	0.086	0.086	0.086	0.086	0.086
Top 0.5%	0.061	0.061	0.061	0.061	0.061	0.061
Top 0.1%	0.028	0.028	0.028	0.028	0.028	0.028
Average income (CHF)						
Top 10%	146 150	146 137	146 015	145 819	146 062	146 025
Top 5%	196 951	196 948	196 792	196 508	196 867	196 784
Top 1%	421 291	421 259	420 892	420 169	421 238	420 850
Top 0.5%	594 875	594 976	594 361	593 170	594 946	594 188
Top 0.1%	1 370 438	1370255	1 368 456	1 364 892	1 371 100	136 7561
Income threshold (CHF)						
Top 10%	85 307	85 165	850 77	84 971	85 089	85 101
Top 5%	109 571	109 397	109 293	109 130	109 256	109 242
Top 1%	213 191	213 061	212 923	212 662	212 952	212 954
Top 0.5%	294 934	294 805	294 538	294 064	294 558	294 599
Top 0.1%	641 495	644 268	643 593	641 595	642 358	641 881
GDP growth	0.05	0.048	0.048	0.048	0.048	0.049
Population growth	0.011	0.012	0.012	0.012	0.012	0.012
GDP p.c.	46999	46225	46110	45936	45915	45805
Unemployment rate	1.08	1.25	1.24	1.22	1.21	1.2

Tables and Figures

Table 1: The Transition from Praenumerando to Postnumerando Taxation

year x	1995	1996	1997	1998	1999	2000
realized income	100,000	105,000	110,000	115,000	120,000	125,000
tax base for the assessment period x	[incomes realized in 1993 and 1994]		$\frac{100\ 000 + 105\ 000}{2}$ = 102,500 p.a.		120,000	125,000
payment of the tax liability for year x	during 1995 and 1996		during 1997 and 1998		beginning 2000	beginning 2001

Table 2: Growth in Income Shares of Top Groups, 1981–2009

	Top 10%	Top 10-1%	Top 1%	Top 0.5%	Top 0.1%	Top 0.1%
growth	13.32%	6.27%	31.34%	39.65%	65.40%	116.85%
variance	2.478	0.898	21.277	33.259	83.511	325.745
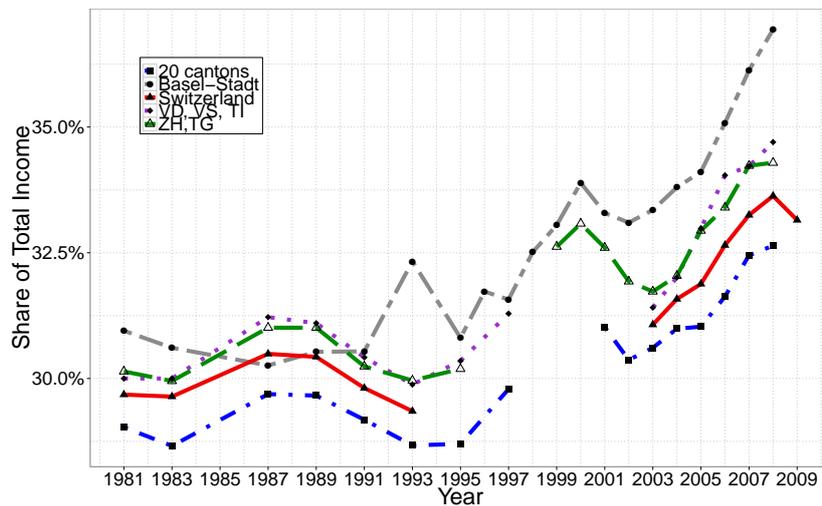
Figure 1: Top 1% Income Shares for Switzerland and Grouped Cantons

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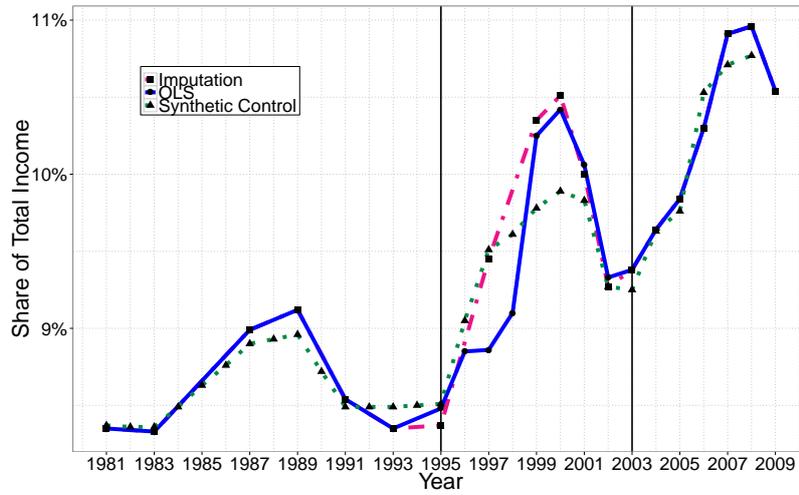
(a) Top 1% Income Shares
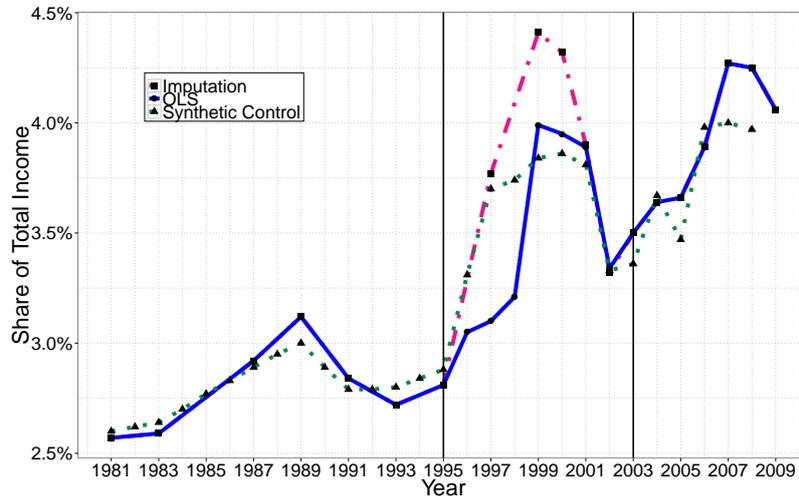
(b) Top 0.1% Income Shares
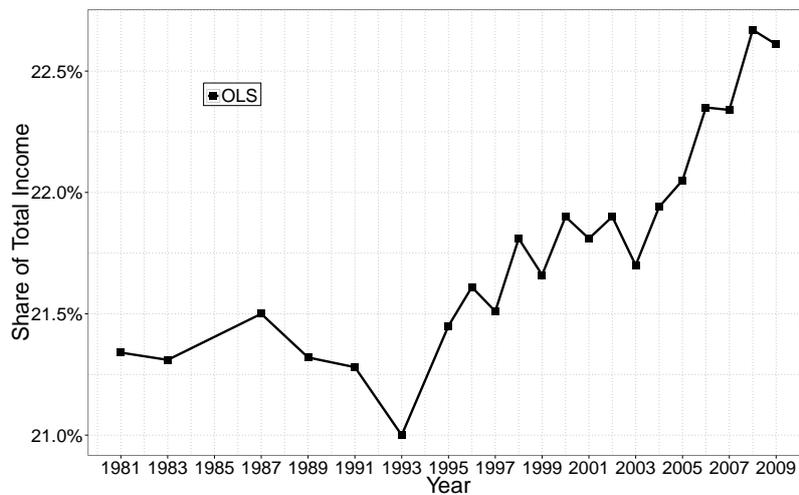
(c) Top 10-1% Income Shares

Figure 2: Swiss Top Income Shares, 1981–2009

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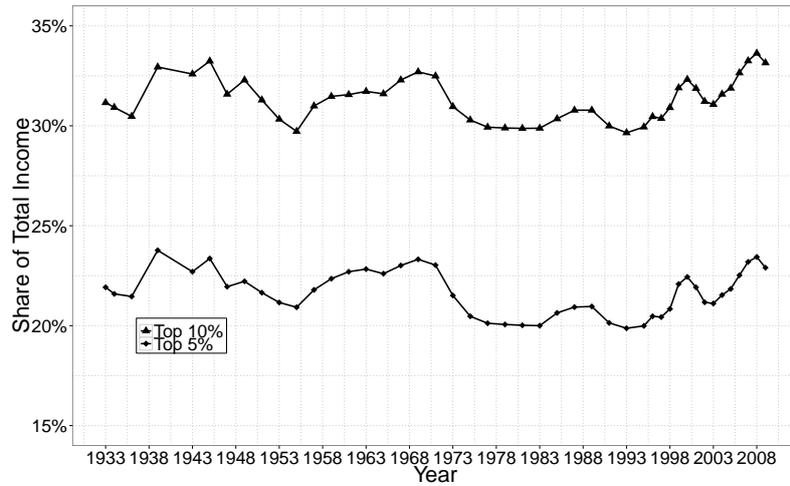
(a) Top 10% and Top 5% Groups
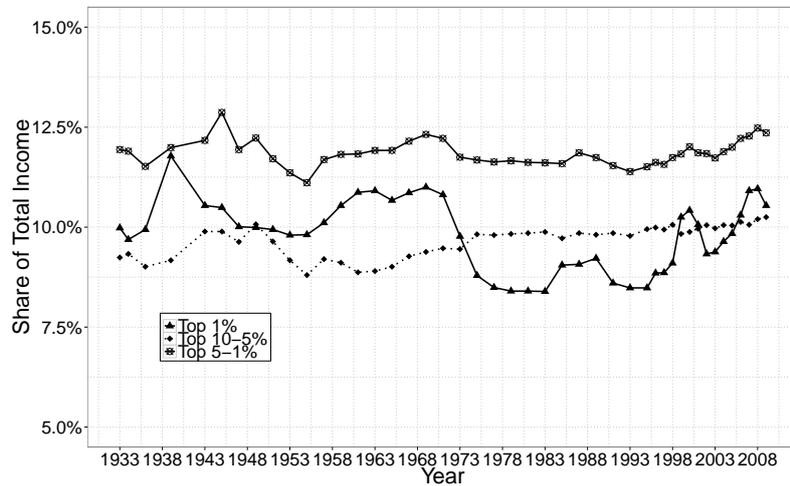
(b) Top 1%, Top 5-1%, and Top 10-5% Groups
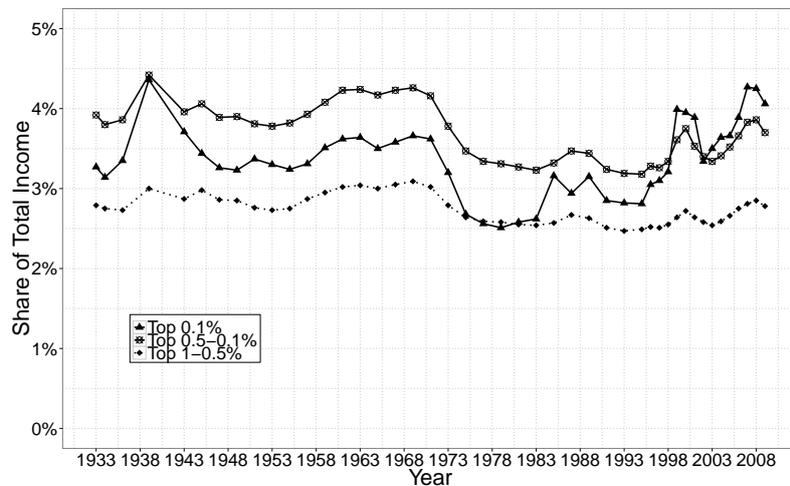
(c) Top 0.1%, Top 0.5-0.1%, and Top 1-0.5% Groups

Figure 3: Long Run Evolution of Top Income Shares in Switzerland, 1933–2009
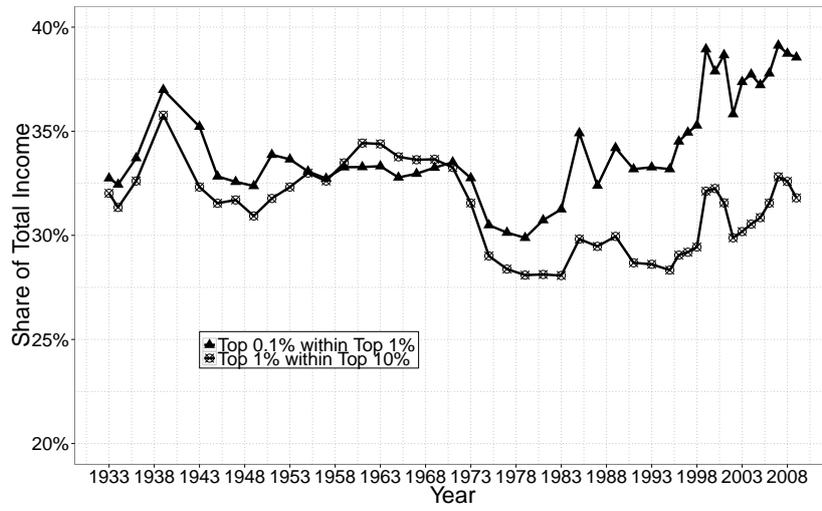
Figure 4: Shares Within Shares
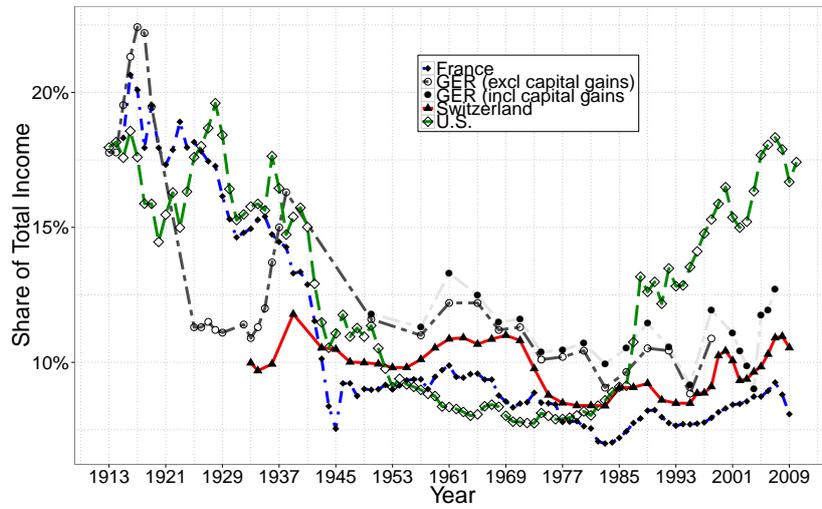
(a) Top 1% Groups in Four Developed Countries
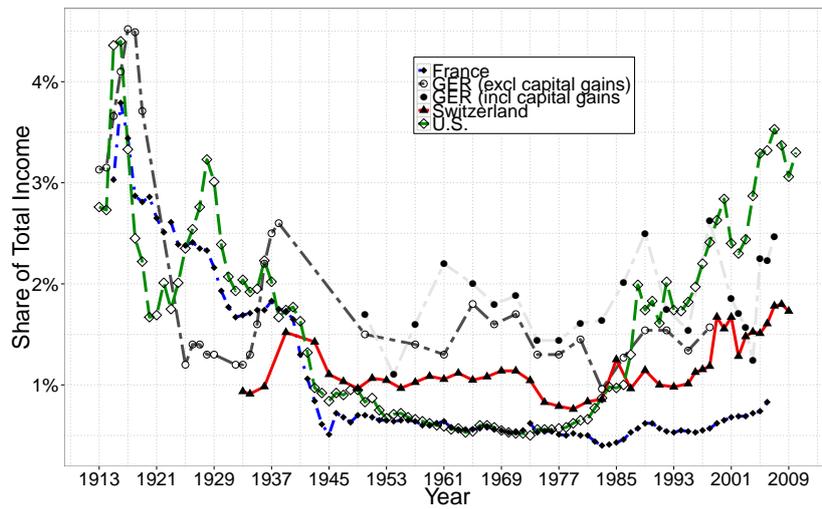
(b) Top 0.01% Groups in Four Developed Countries

Figure 5: Long Run Evolution of Top Income Shares in International Comparison

Source: The World Top Income Database, Alvaredo *et al.* (2014)
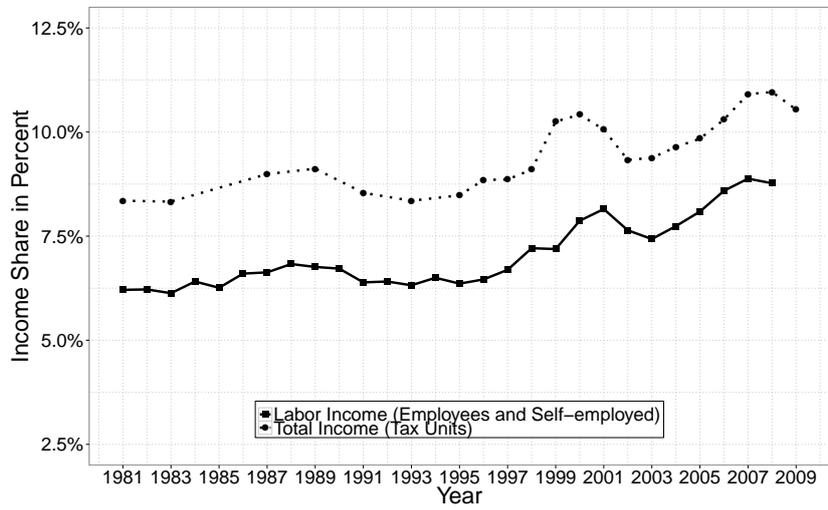
Figure 6: Top 1% Income Shares of Total Income and Labor Income, 1981–2008
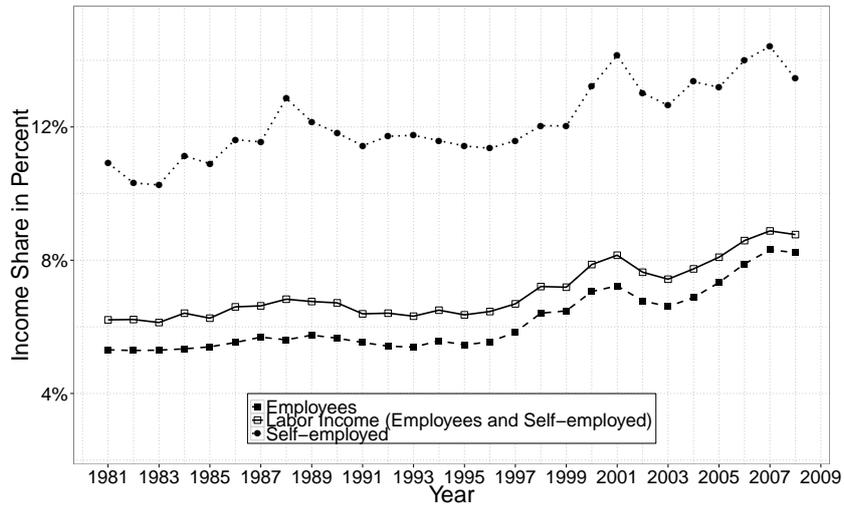
(a) Top 1% Income Shares of Employees and Self-Employed
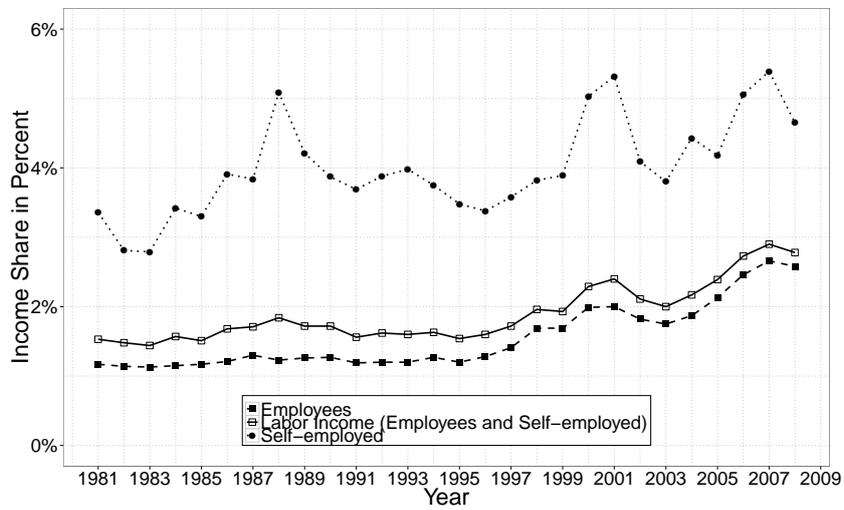
(b) Top 0.1% Income Shares of Employees and Self-Employed

Figure 7: Top Income Shares of Employees and Self-Employed
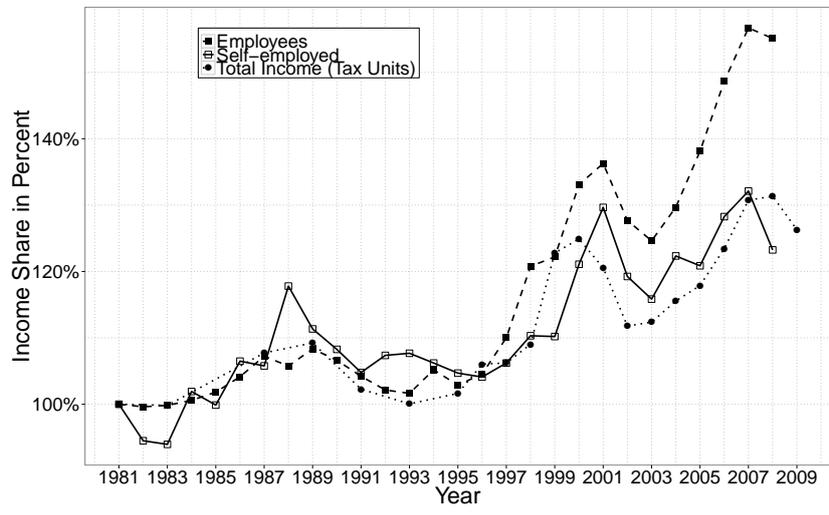
Figure 8: Growth in Different Top 1% Income Shares, 1981–2008
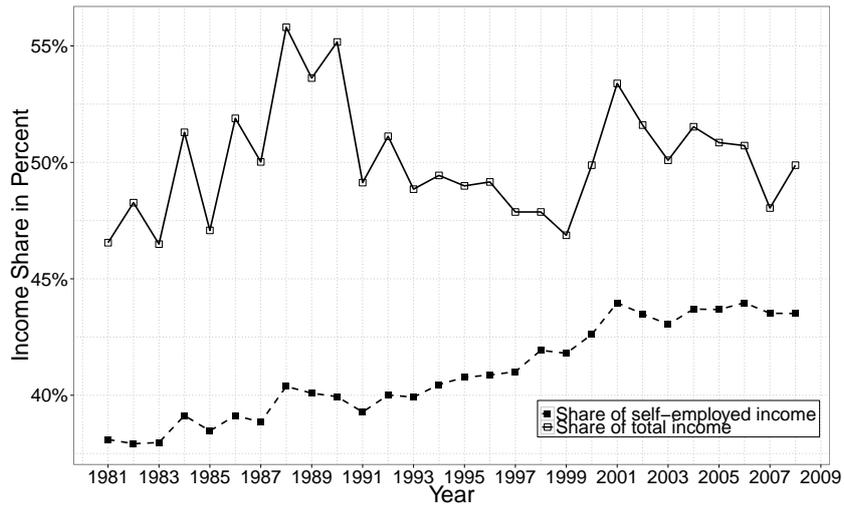
(a) Top 10% Share
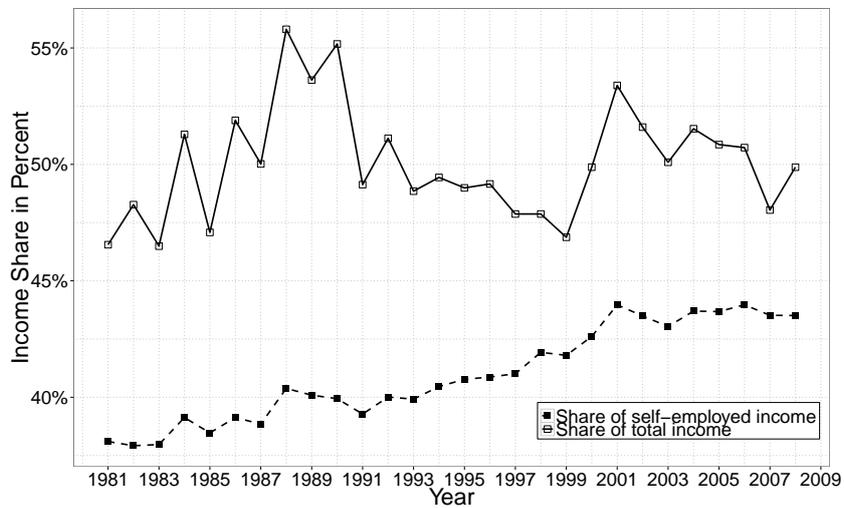
(b) Top 1% Share

Figure 9: Self-Employed Top Income Shares of Total Labor Income
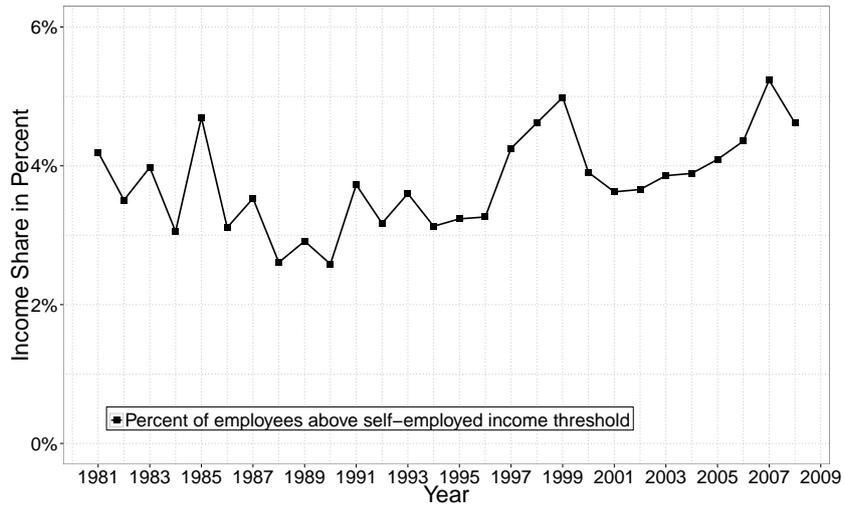
(a) Employees Above Top 10% Self-Employed Income Threshold
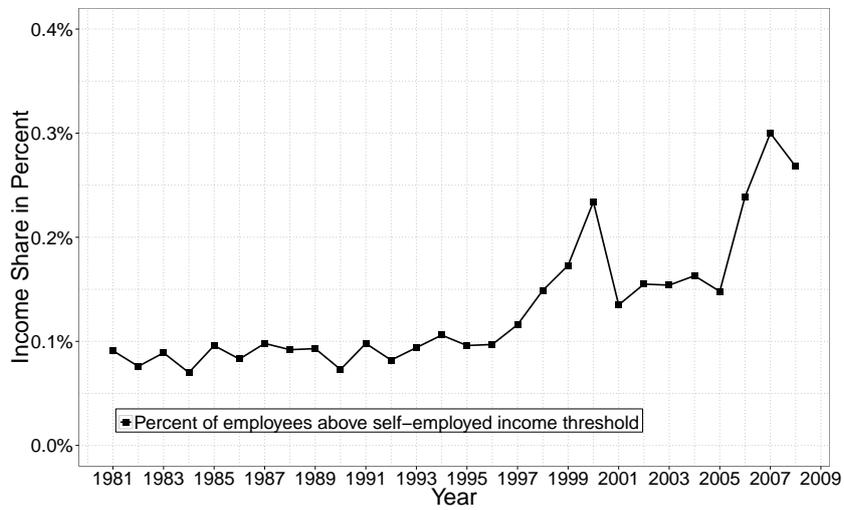
(b) Employees Above Top 1% Self-Employed Income Threshold

Figure 10: Percent of Employees Above Top Self-Employed Earnings Thresholds
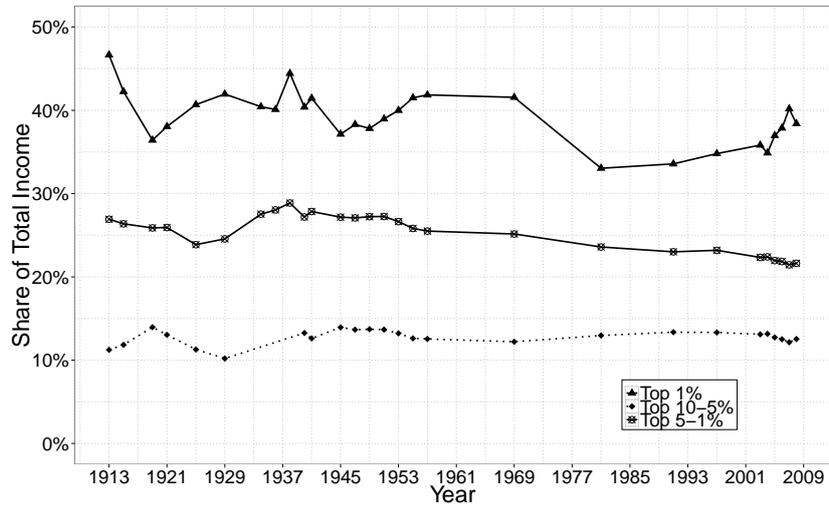
(a) Top 10-5%, Top 5-1%, and Top 1% Wealth Shares
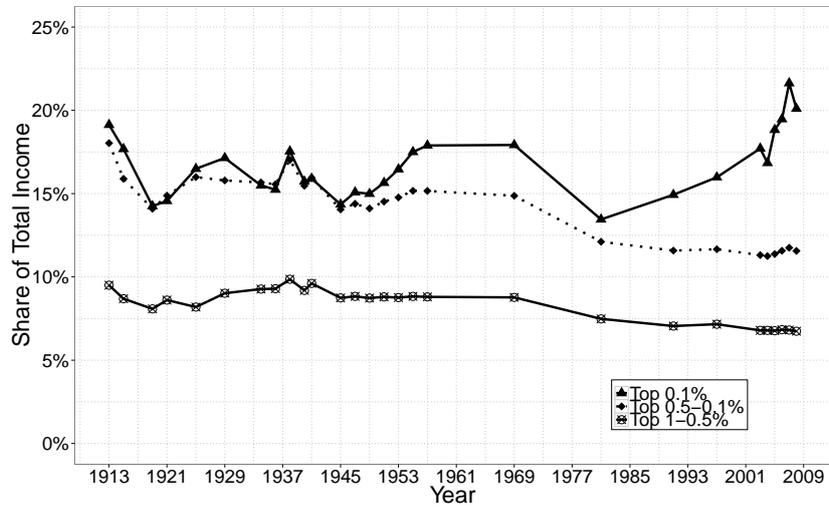
(b) Top 1-0.5%, Top 0.5-0.1%, and Top 0.1% Wealth Shares

Figure 11: Top Wealth Shares in Switzerland, 1913–2008