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Reassessing the Evolution Between 1981
and 2008

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Abstract

We study the recent evolution of top incomes in Switzerland. We close the data gap between 1993 and 2005 exploiting the fact that cantons changed their tax system at different points in time which allows us to use the non-changing cantons as control group. The results show that the share of top incomes has risen, the top 0.01% share even doubled in the last 20 years. However, top incomes exhibited large variation in the business cycle. 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 confirms our initial findings and suggests that labor incomes have become more important among top income earners.

Keywords

Income inequality, wealth inequality, labor incomes, distribution and volatility

JEL Classification :

O15, D31, O52.

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1 Introduction

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

The seminal study of 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. Evidence shows that the 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, among which there is also one on Switzerland (Dell et al., 2007). Data used in this study reach back into the 1930s, thus a considerably long time series is available. Unfortunately, this series stops in 1995/1996 when two major changes in the Swiss tax system took place. As is described in section 2 not all cantons adopted it at the same time thus no uniform statistics for the full country exist for the transition period. The contribution of this paper is to close this large data gap, which is not only of interest in order to complete the series constructed by Dell et al. (2007). The time period for which data is missing delineates a break with the former decades of steady growth rates and full employment. In the 1990s Switzerland experienced a decade of “stagflation” and a remarkable increase in the unemployment rate from 1.8% in 1991 to 4.3% in 1997,¹ accompanied by ongoing immigration. As the data on the cantonal level are available for the whole transition period and also afterwards, it is possible to estimate the distribution of taxable income in the missing years through extrapolation and continuing the series up to 2008, the last year tax statistics are available so far (section 3). Recently, Schaltegger and Gorgas

¹ OECD standardized quarterly unemployment rates.

(2011) have carried out a similar study on cantonal level. In their work, however, the focus lies mainly on the 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 years transition period is not addressed in their study.

Additional to the estimates based on tax data, the present paper is the first to use income data from the old age pension statistics (AHV) to estimate the distribution of labor earnings in Switzerland, covering the period from 1981 to 2008. These data have the additional advantage that the individual values are available which allows to calculate the top quantiles precisely and to judge the accuracy of the Pareto approximation. 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 remainder of the paper is organized as follows. Section 2 gives a short introduction in 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 as well as for labor incomes along with estimates of the wealth concentration. Section 5 concludes.

2 Data and Methodology

2.1 *On the use of tax data for economic research*

Piketty's (2001) study 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 (see Atkinson and Piketty, 2007, 2010, for a collection of these studies). The crucial innovation compared to earlier studies on income distribution was 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: 200). For this purpose tax data are the only reliable data available for long periods, as household income surveys do not exist for a long time, they differ in frequency or suffer from comparability. Tax data have the further advantage that they cover a much larger population sample than household survey data, in some cases tax statistics indeed relate to the whole population.

The use of tax data, however, also has some drawbacks. The main concern of economic researchers is the misreporting of incomes, as there are incentives for tax evasion to do so. Especially, one would not expect such a misreporting to be uniform for all income groups yet to depend on the tax structure. With a strongly progressive tax system misreporting and tax avoidance is more attractive the higher incomes are. However, when using data from household surveys one should also be concerned about non-response or sampling errors. These problems may affect particularly top income earners (see for example Brewer et al., 2008, for the UK and Burkhauser et al., 2009, for the US). Although household surveys do not involve any financial incentives for misreporting personal income, people still often do so due to lack of confidence in the anonymity of the data. Sometimes misreporting might just happen unintentionally as well as coding errors may creep into the data (on the peculiarities of survey data see Victoria-Feser, 2000, and Diekmann, 2007). One might further expect top income earners to be systematically underrepresented in such samples due to the fact that they are usually not so easily reached by phone or mail because of higher privacy protection. Furthermore, because of stronger time constraints top income earning businessmen face, they might not be willing to respond to the usually long interviews of population and income surveys. When turning to the estimation of top income shares and inequality measures, this deficit leads to erroneous results. For the US, Atkinson et al. (2011) estimate that CPS survey data fail to capture about half of the overall increase in inequality measured by the Gini coefficient, confirm-

ing previous results by Alvaredo (2010). The latter further shows that the Gini coefficients estimated with income survey data not only underestimate the changes in income inequality when compared to those estimated with tax data, but the trends in inequality measured by Gini coefficients may even diverge, as it is the case for Argentina.

The second disadvantage of tax data often evoked is the income definition. 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 like the income splitting for married couples have to be accounted for when attempting to construct homogeneous time series. The concrete limitations emerging from the income definition imposed by the tax system in Switzerland will be discussed in the next section.

Another peculiarity of tax statistics is that these data are published in the form of grouped data according to defined income brackets only. Usually tabulations report for a large number of such brackets the corresponding number of taxpayers and their total income. This makes interpolation necessary to estimate top percentiles income shares. But as will be shown in section 3 this problem is manageable with econometric methods.

Despite the drawbacks just mentioned, tax data are nevertheless a valuable information source to assess questions related to income dynamics that cannot be handled with other available data. Like other data, tax statistics will measure with some error the variable of interest, namely personal income. This is a challenge arising in every empirical study in social sciences. It is thus astonishing in some sense that it took such a long time to make use of these data again. Some of the most influential early studies on top incomes were based on tax data, including the seminal work of Vilfredo Pareto (1895, 1896) or Simon Kuznets (1953). The former contributed to insights on top income distributions while the latter laid the cornerstone for what should become known as the Kuznets Curve, an empirical foundation of the postulated hump-shaped relationship between inequality and growth. Changing trends in income inequality gave rise to a reassessment of the linkage between these two dimensions (see for example Barro, 2000, and Forbes, 2000). Still it was only with the work of Piketty (2001) who resumed and developed further Kuznets' approach when the use of tax data became fashionable again in income distribution research.

2.2 *The Swiss Tax System over time*

In Switzerland, personal income taxes are collected on three levels: the federal, the cantonal and the communal level. However, this has not always been the case. Up to 1915, the federal state did not levy any taxes on personal income but financed itself mainly through tariff revenue. Only with the outbreak of World War I, followed by the Great Depression and World War II the Swiss Federal state had the necessity as well as the political power to tax personal incomes. This historical background of the Direct Federal Income Tax (*Direkte Bundessteuer*) as it is called nowadays, was reflected up to 1985 in its naming as Federal Tax for the National Defense (*Eidgenössische Wehrsteuer*). For what follows, only the system and data of income taxation on the federal level is of relevance.

2.2.1 *The change from praenumerando to postnumerando taxation in the 1990s*

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. 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 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 this system, all incomes (as defined above) from the preceding two years constituted the basis for the tax liability arising in the next two-years fiscal period. This implies that the incomes on which the taxes payable in fiscal period 1995/96 are based, were actually 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 if income changed substantially, taxes were only adapted to the new income situation in the next fiscal period. The notion praenumerando method is due 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 (ESTV, 2003). Note that the use of the praenumerando method does not include the necessity to assess incomes on a two-years basis.

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, be-

cause 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 due to certain pre-defined reasons (such as marriage, birth of a child, or occupational changes) from the one realized and reported during the assessment period before. In such a case, taxes were re-calculated afterwards upon the effectively realized income during the tax period.

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. So the taxation can only take place in the following year which is why the notion postnumerando taxation is used.

Already in the 1980s a reform process began which aimed to ease the tax system and adopt it to the internationally common one-year based taxation as well as to harmonize the cantonal and communal taxation systems.² 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.³ This is the reason why during the transitional period from 1995 to 2003 there is no uniform tax data published on the Swiss level but only data on the cantonal level is available. Table B1 in the Appendix 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.⁴

With respect to inequality measures and top income shares, the change from the biennial to the annual tax schedule is expected to have an altering effect. The reason lies in 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 on a two-yearly basis.

² Botschaft zum StHG sowie zum Bundesgesetz über die direkte Bundessteuer, DBG, BBl 1983 III 1ff.

³ Bundesgesetz vom 14. Dezember 1990 über die direkte Bundessteuer (DBG; SR 642.11).

⁴ For further information on these transitory provisions see ESTV (2003).

2.3 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.⁵ The cantons are the administrative unit in charge with the collection of the tax returns and the taxes. This mechanism has the positive side effect that information on incomes is available on the cantonal and national levels at the same time and in the same format. Fortunately, the tabulated tax statistics have remained very stable over time so that the total number of tax units and total income reported are comparable over time and cantons.

The change from prae- to postnumerando taxation had 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 while 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. For Zurich and Thurgau for example, the incomes realized in the 1995/96 assessment period are recorded and published in the 1997/98 fiscal period under to the praenumerando taxation. 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 the income realized in 1997/98 was never taxed and does therefore not show up in any statistics.⁶ The following fictive example illustrates the matter.

Table 1: The change from prae- to postnumerando taxation in practice

year x	1995	1996	1997	1998	CHANGE	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)		$(100'000 + 105'000)/2 = 102'500$ per year			120'000	125'000
payment of the tax liability for year x	during 1995 and 1996		during 1997 and 1998			beginning of 2000	beginning of 2001

Note: Incomes realized in 1995 and 1996 are the tax base for the tax due in 1997 and 1998. This tax is then paid in the fiscal period 1997/98. After the change in the system, the tax base for the tax due in 1999 is the income earned in 1999. The consequences are that the income earned in 1997 and 1998 is never taxed and that under the new system the payment of the tax liability takes place after the tax period is completed. Note that the individual still has a tax liability in each year considered.

⁵ Available from the Federal Tax Administration *Eidgenössische Steuerverwaltung* (ESTV), www.estv.admin.ch

⁶ This omission of a tax period led to loopholes in the tax system, which were regulated differently in all 26 cantons, see above.

In order to keep things simple, the years in graphs and tables of the present paper refer to the year in which the income was *realized*.

2.3.2 Tax units covered in the statistics

Every permanent resident in Switzerland and who has completed the age of 18 years (respectively 20 years prior to 1996) is subject to income taxation and has to fill a tax return every year (or every two years before the change of the tax system). In order to include all tax units filling a tax return, not only the normal cases (*Normalfälle*) but also the special cases (*Sonderfälle*) must be considered.⁷ The latter do 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.⁸ Married and officially registered couples are subject to joint tax liability and show up as one single case in the tax statistics. This means that a tax unit is not always an individual nor does it necessarily correspond to the concept of a household. This becomes more accentuated with the change from traditional household and family structures to more mixed forms of cohabiting.

Even though according to the definition above every permanent resident is subject to income taxation, the rate of filers covered is below 100%. Different reasons lead to this result. First, the statistics do only report cases and their incomes if they were actually taxed, i.e. when taxable income was high enough to exceed the amount of exemption. Thus even though tax units with none or very low incomes have to hand in a tax return, they and their income 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 normally foreign nationals living in Switzerland but with a yearly or any other temporary resident permit only. Only when their income exceeds a certain threshold (around CHF 120'000.- in 2012), they are required to fill 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. Geneva does indeed have the

⁷ The study of Schaltegger and Gorgas (2011) includes normal cases only, so our results will not be directly comparable to theirs.

⁸ 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 labour and capital income, the inclusion of these special cases makes sense. See Appendix B for further details on the data selection.

lowest rate of filers, reaching an average of only 76% compared to the Swiss average of 86% for the period covered, therefore reflecting the high percentage of residents who are not subject to personal income tax. These individuals as well as their incomes are therefore not covered in the statistics. Apart from these three groups not showing up in the statistics due to their special legal status or low incomes, people who simply do not hand in their tax return, even though they are required to do so, these “true non-filers” do in fact show up in the statistics.⁹ In these cases the cantonal tax administrations will simply attribute these individuals an income based on older tax returns and on employer’s information about the income. These non-filers are then taxed according to that imputed income (and they will have to pay some fine in addition and tax administrations will disregard any possible tax exemptions). It is important to note that only for the true non-filers incomes are imputed, but not for international staff or for individuals taxed at the source.

Finally, individuals who did not file their tax declaration for other reasons, do in fact show up in the statistics, as in these cases the cantonal tax administrations will simply attribute these individuals an income based on older tax returns and on employer’s information about the income.

2.3.3 *Income definition*

A tax return, where all incomes from employment and self-employment as well as capital income and taxable transfer payments such as old age pensions are reported, has to be filled on a yearly basis (biennial before the change in the tax system, see above). House owners living in their own house have to report in addition the value of an estimated rent, the so-called *Eigenmietwert*.¹⁰ Realized capital gains on private assets on the other hand are excluded from the income definition. Over all, no distinction between labor and capital income is made. This implies some limitations for analyses carried out with the present data basis for, as Piketty and Saez (2006: 200) state it, economic mechanisms can be very different for the distribution of labor and capital income.

⁹ 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.

¹⁰ The aim of this clause is to achieve equal treatment between individuals who live in a self-owned apartment and tax subjects who rent one and invest their wealth into other assets.

Expenditures related to the realization of the income as well as the health insurance premium payments 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 up again to the taxable income so the reported income corresponds more or less to a 'gross income' notion.¹¹ Most importantly this income definition has remained stable over time.

2.4 Total Income Denominator and the Total Number of 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 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% in 1981 but then falls over time to a low of 60% in 2006, rising again afterwards.

It is thus necessary to accurately estimate the total personal income, which is then used as denominator to calculate the top group's income shares. Following the approach adopted by Dell et al. (2007) we assign the tax units not covered in the statistics 20% of average personal income reported in the tax statistics, i.e. 20 percent of *Reineinkommen* per tax unit. 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 the non-filers fluctuates somewhere between 65% and 74%. These results are in line with those reported by Dell et al. (2007). This remaining gap can at least partly be explained by tax evasion, which according to a study by Feld and Frey (2002) lies somewhat above 20 percent on average. Unfortunately, we are unable to correct neither the total income denominator nor the incomes declared by the top groups for tax evasion in a systematic manner. For measurement errors caused by tax eva-

¹¹ Due to lack of detailed information on all deductions made and because some income sources are tax-free, the income definition does not correspond exactly to the gross income. The statistical nomenclature used by the Swiss statistical publications is *revenu net* or *Reineinkommen* (i.e. "net or pure income"). For detailed information see the tax statistics' appendix with explanations: <http://www.estv.admin.ch/dokumentation/00075/00076/00701/>

sion, we have to assume that the behavioral patterns of intended and unintended tax evasion remained relatively stable among the top groups over time.

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 it is necessary to calculate the total of tax units in the country. Formally, the total number of tax units covers the adult population minus half of the married adult population. We construct this number using register data, which is available on a yearly basis on the federal as well as on the cantonal level for the time span considered in the present study.¹²

We follow the same approaches to construct the number of total tax units and the total income denominators on cantonal level. However, as data on married adults in each canton is available on a decennial basis only, the number of married adults on cantonal level had to be interpolated linearly.

As it turns out, the correction for total income has only little effect on the estimated values of the top shares. The differences in top shares are around 1 percentage point for the top 10% and top 5% groups and fall below 0.1 percentage points for the top 0.01% group. This is small considering the different sources of potential errors in measurement.

¹² This approach differs slightly from the one adopted by Dell et. al (2007) who use decennial census data and linearly interpolate the values for the years in between. See Appendix B for further details.

3 Estimating top income shares in Switzerland from 1981/82 to 2008

3.1 Pareto Interpolation

Since tax data are given in absolute income brackets, the income of a given quantile must be estimated. If the share in the top bracket is larger than the quantile of interest, we even need to make an extrapolation. In both cases we need a parametric assumption on the distribution. There is ample empirical evidence that incomes at the top of distribution are approximately Pareto distributed.¹³

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

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

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

$$\bar{y}(s) = \int_s^\infty z f((z|z \geq s)) dz = \int_s^\infty z f(z) dz / (1 - F(s)) = \frac{a}{a-1} s.$$

This is a central characteristic of the Pareto distribution: expected income above a given threshold s is a factor $b \equiv a/(a-1)$ times the threshold s ; the factor is constant and independent of the threshold s itself. If we know the number of tax units above a given threshold s and their average income $\bar{y}(s)$, it is possible to estimate the parameters a .

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 onwards, 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.

¹³ Gabaix (2009) 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 CEO's can explain the emergence of a power law. For an overview over popular variants of Pareto's models the reader is referred to Arnold (2008).

3.2 *First results (raw series)*

In years where data on the federal level are available, we can directly calculate 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 above. Our approach is to estimate the national income shares using data on cantonal level, as the latter are available throughout that period with the exception of the years before the cantonal change from post- to praenumerando method.

Figure 1 below shows the income shares for the top 10%, 5% and 1% groups in Switzerland and several cantons from 1981/82 to 2008. Cantons which changed their tax system at the same date are pooled together in Figure 1, these are, Zurich and Thurgau (ZH, TG), Vaud, Valais and Ticino (VD, VS, TI), the group of the other 20 cantons and Basel-City (BS) alone. So instead of speaking of cantonal series, what follows is based upon series on geographical areas that do not need to correspond to one canton only. An advantage of these aggregated series is that they are less sensitive both to changes in the composition of the underlying population and to idiosyncratic changes of individual top incomes. E.g., Basel City, a small canton in terms of population, exhibits higher volatility in top income shares.

In the years where national data are available, the cantons reveal similar trends as the national level. Note however, 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, obviously. The next step is to estimate the values for these missing years accurately.

Figure 1: Top income shares in Switzerland and different cantons, 1981/82-2008

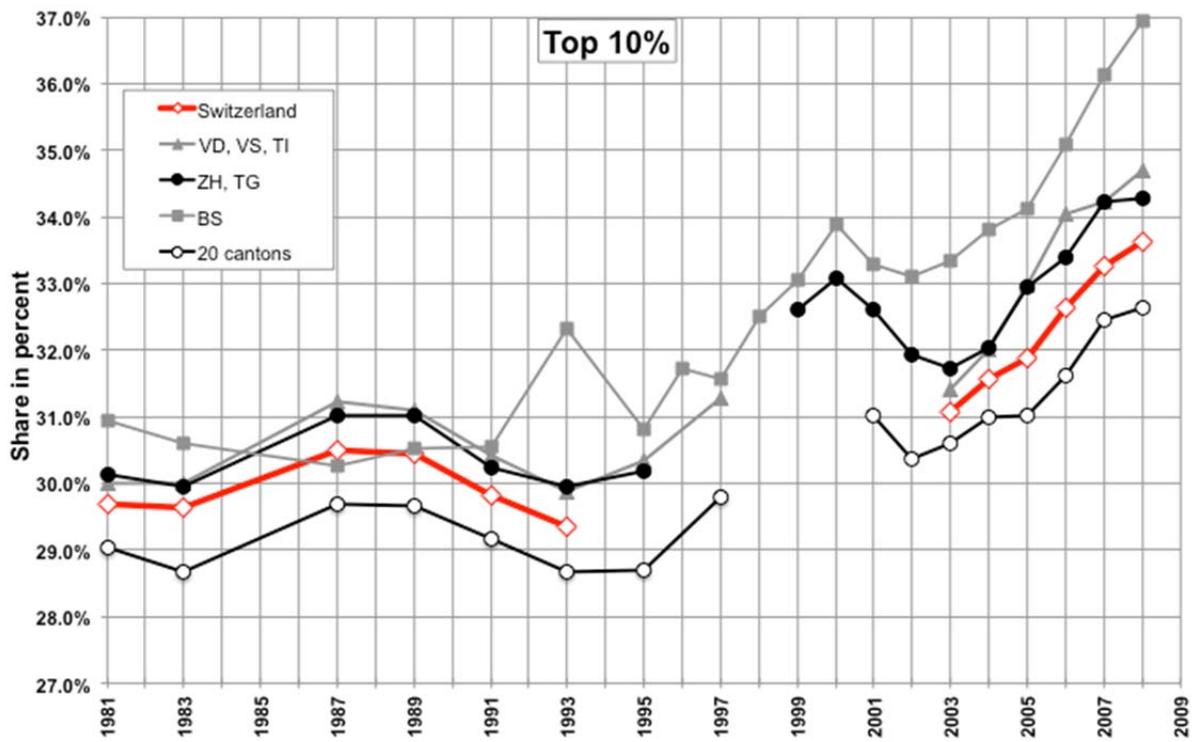


Fig. 1.a) Top 10% shares

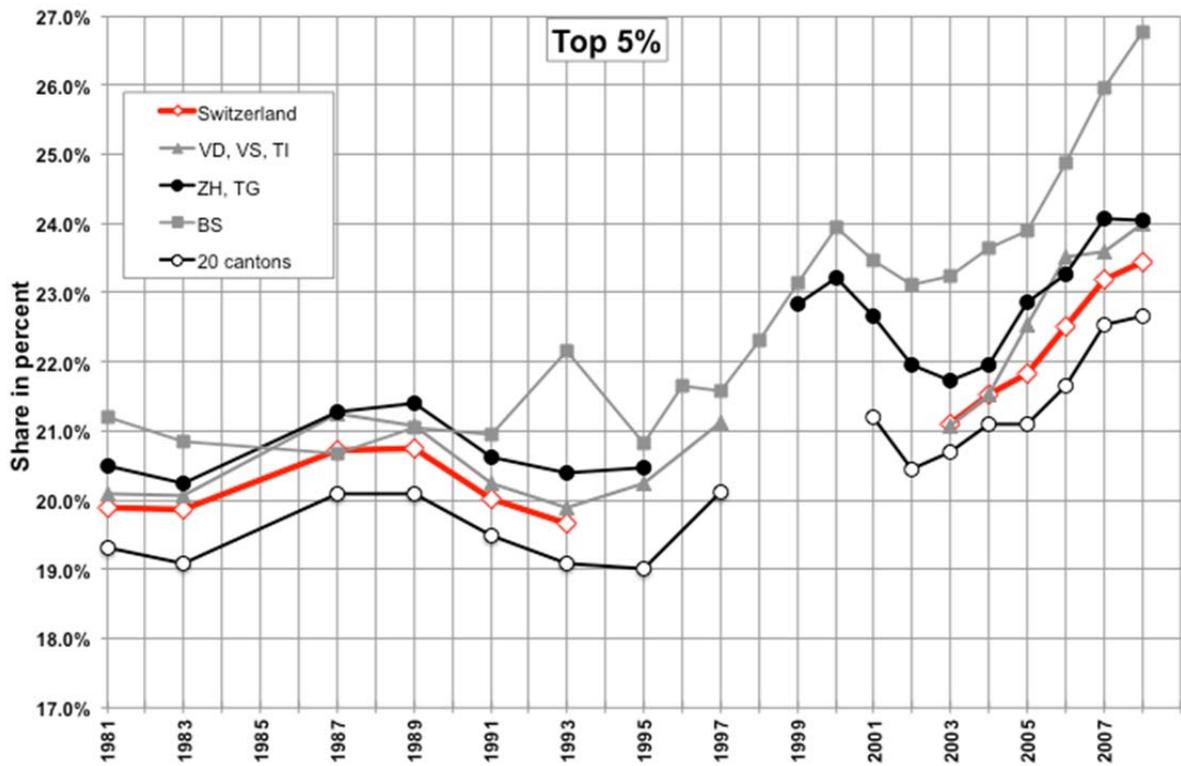


Fig. 1.b) Top 5% shares

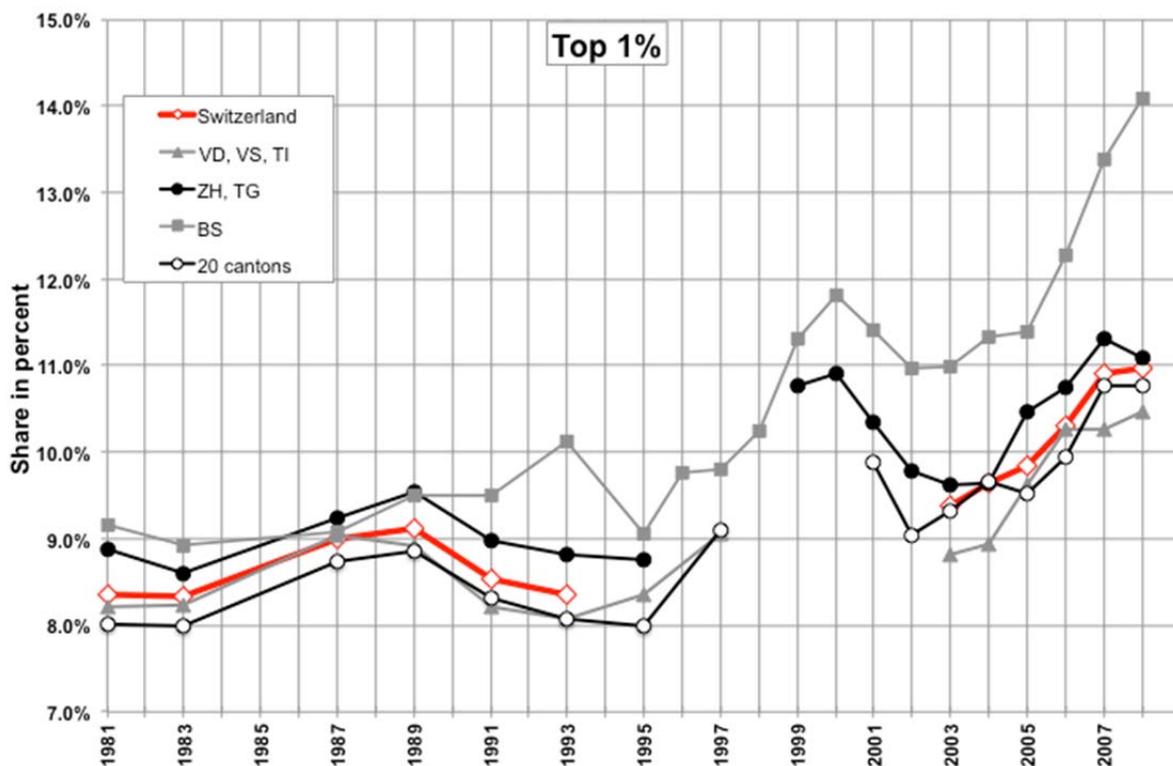


Fig. 1.c) Top 1% shares

3.3 Estimating top income shares for the transition period 1993/94 – 2003

Figure 1 revealed the structure of the data that is now used for the estimation of the missing years on national level. By OLS, we estimate the relationship between the national and cantonal top income shares for the 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. We always regressed the series for Switzerland on the maximum number of available cantons. Table B2 in the Technical Appendix shows the different models estimated for each year. The last row indicates the years for which each model was used to obtain the extrapolated values. The detailed regression results of all models for all the top shares estimated are reported in Table C1 in the Appendix C.

In their study of cantonal top shares, Schaltegger and Gorgas (2011) try to account for 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 account for any individual income mobility across brackets.

Such averaging will therefore potentially decrease estimated inequality at the top even more than the biennial assessment of incomes did.

An alternative to the estimation via OLS is the *synthetic control method* by Abadie and Gardeazabal (2003). Their motivation for the use of synthetic controls originally 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 would not have 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 (see Abadie and Gardeazabal, 2003, and Abadie et al., 2010, for more details). Similar to the analysis of the evolution of an outcome variable after a policy change, 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 the top groups' income shares and the corresponding income level thresholds. In some specifications also measures such as GDP and population growth rates were included.

A third alternative finally 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 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 10 years and different cantons are available in different years, the imputation is done in a consecutive way and based on different cantonal series.

4 Top income shares in Switzerland

4.1 Top income shares in Switzerland between 1981/82 and 2008

Figure 2 below shows the estimated top income shares since 1981/82 on the national level. The estimates from the OLS regressions are reported along estimates from the synthetic control method as well as values gained by imputation. We see that the estimates of the alternative methods (synthetic control and imputation) follow the same trend as our OLS estimates. The imputation method, in particular, exhibits much more variation as it uses less information. We discuss the differences between the methods in subsection 4.1.1 “Robustness” below.

Figure 2: The Evolution of top income shares in Switzerland, 1981/82– 2008

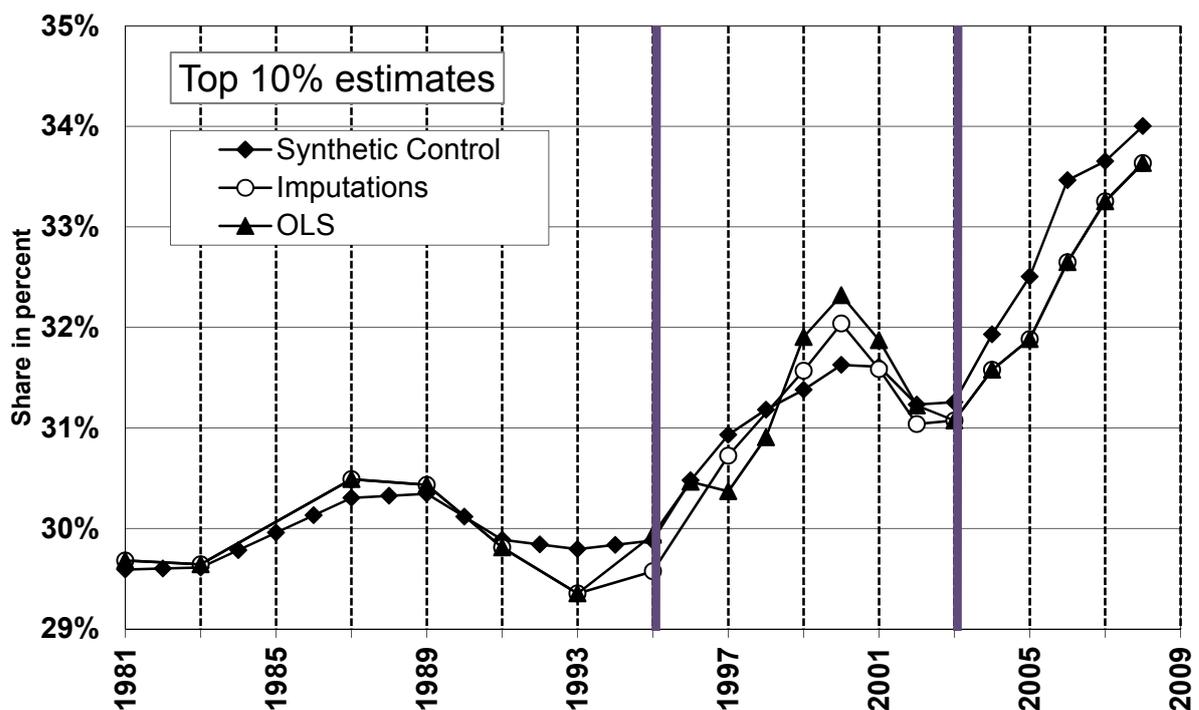


Fig. 2.a) Top 10%

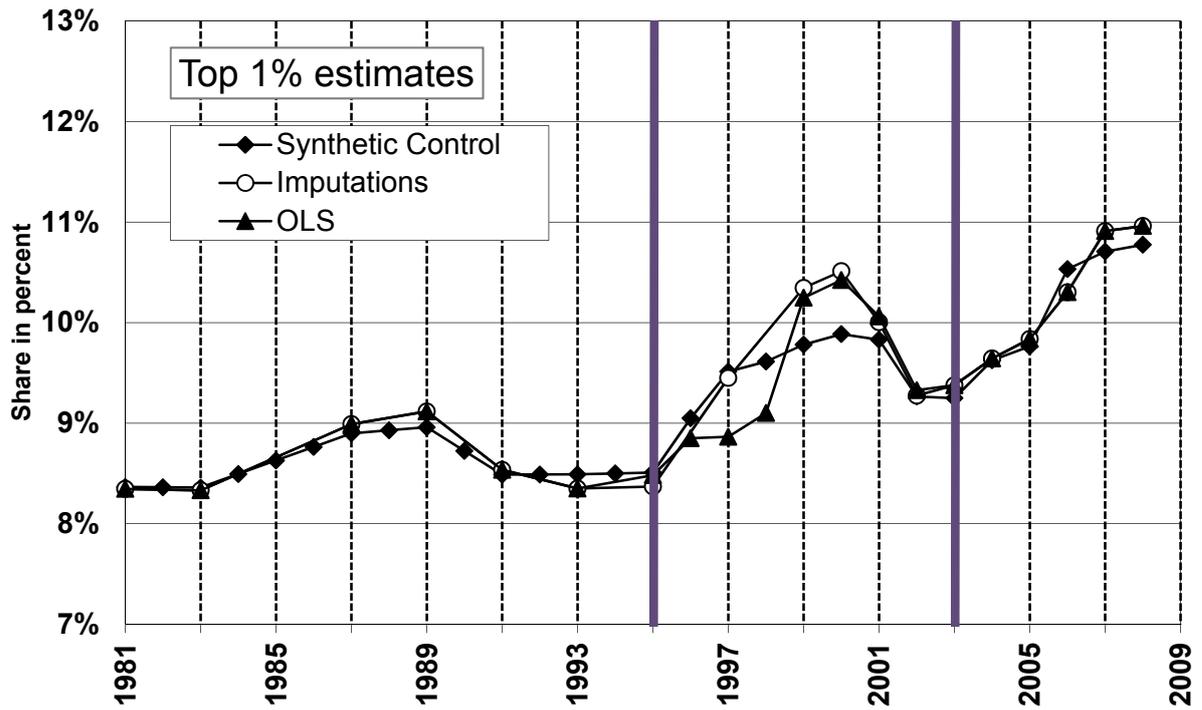


Fig. 2.b) Top 1%

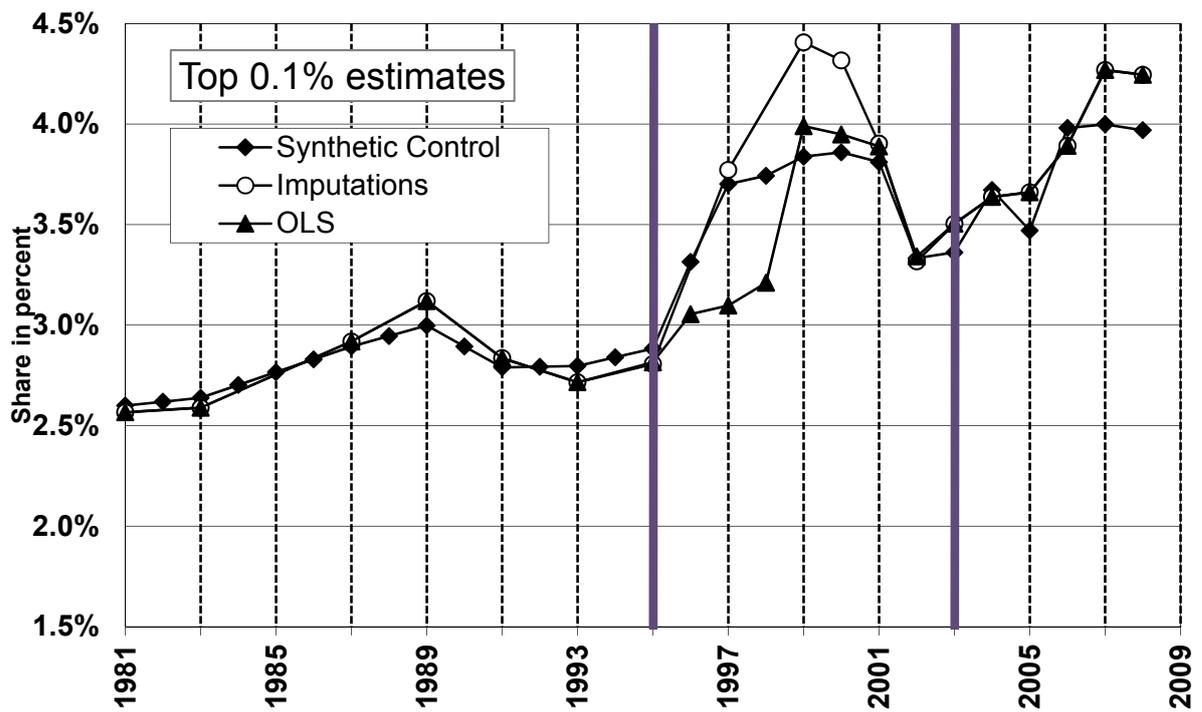


Fig. 2.c) Top 0.1%

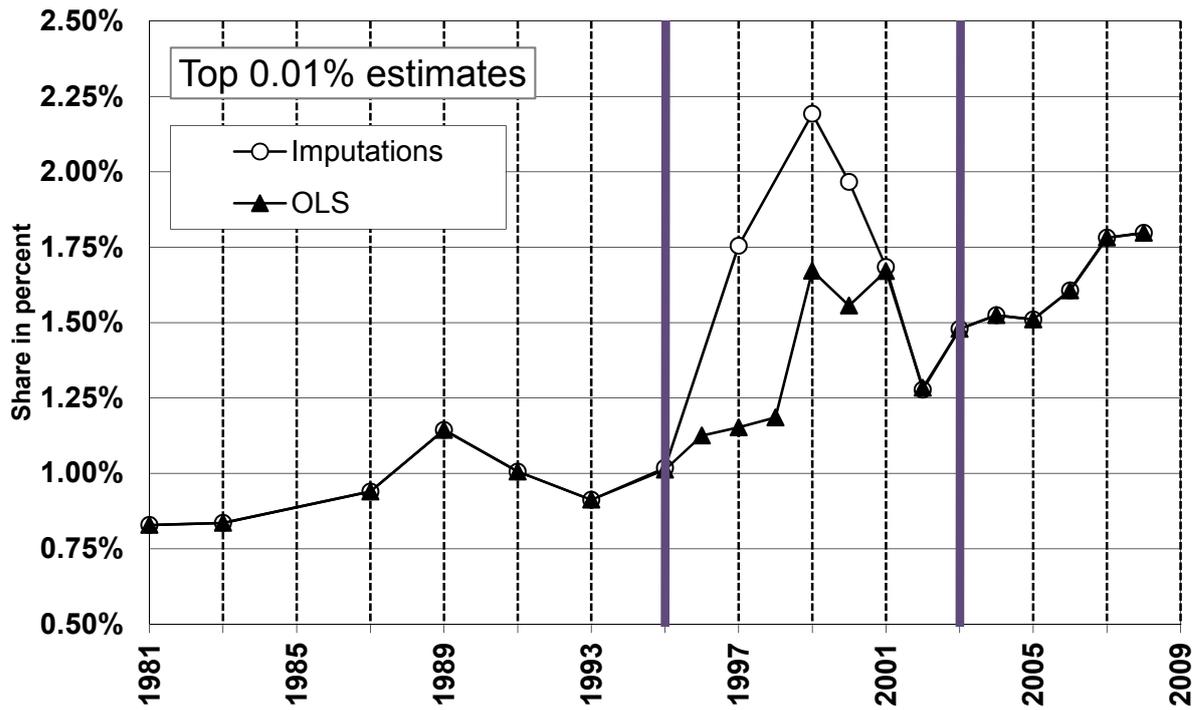


Fig. 2.d) Top 0.01%

Note: For the years 1987/88 onwards, the top bracket contains more than 0.01% of tax units, so that the estimates are based on extrapolation rather than interpolation and might therefore be imprecise. For the top 0.01% of tax units no synthetic control estimates could be obtained due to missing values of top shares in 2 cantons.

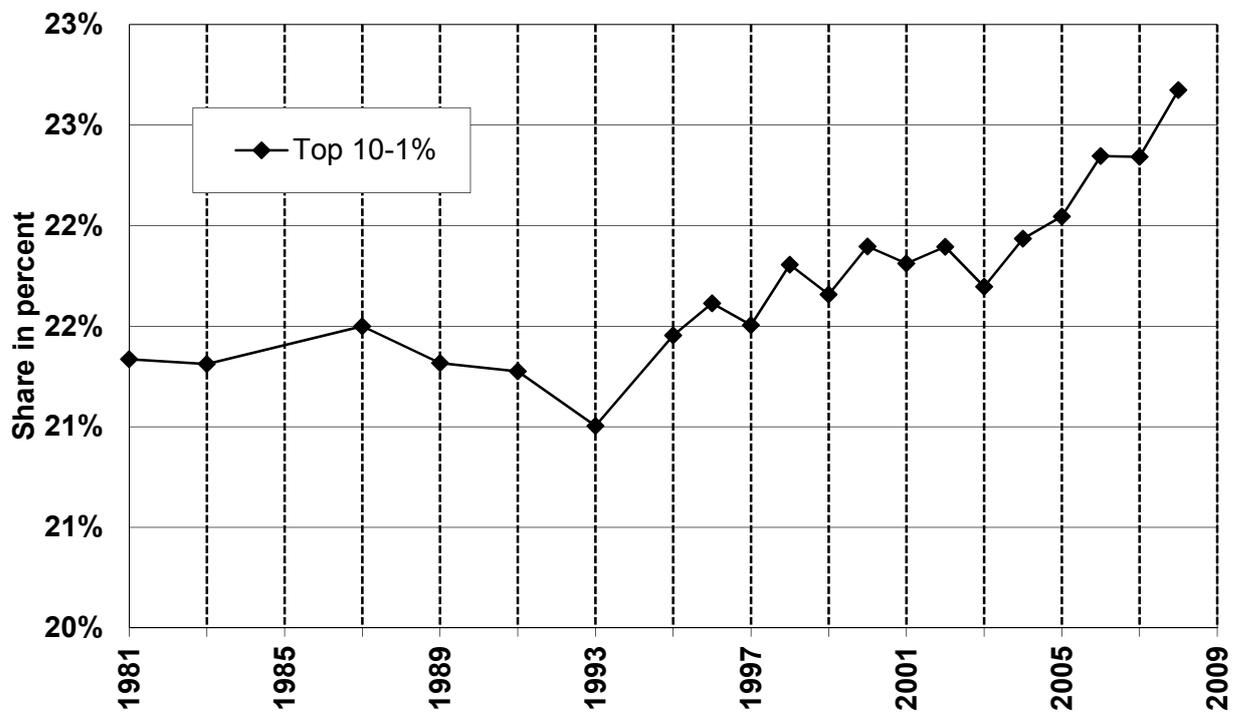


Fig 2.e) Top 10% minus Top 1% share

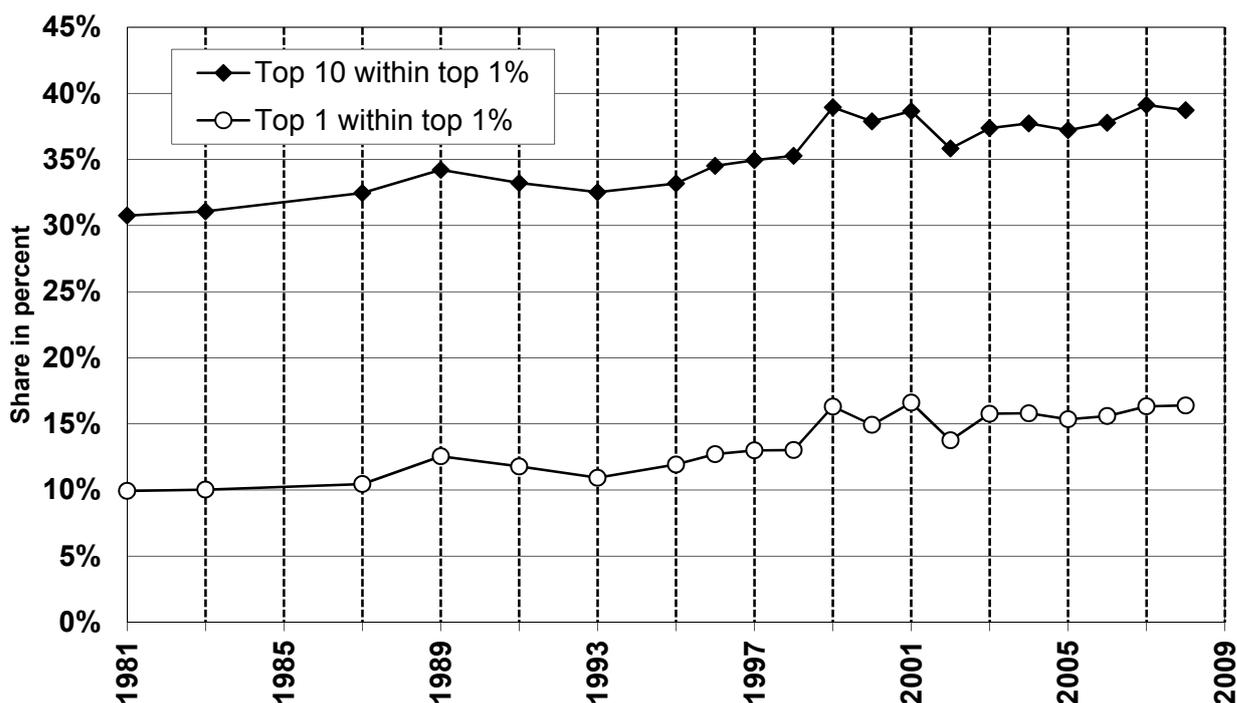


Fig 2.f) Top 10% and top 1% within top 1% group

Main Findings

An Upward Trend

The panels a) to i) altogether show that the share of income going to the top income earners has overall been increasing from the 1980s to 2008 and the previously missing years 1993 to 2005 are no exception in that regard. Yet there are differences between the top groups, with larger increases further up in the income distribution. So while the top 10% group experienced an increase of 13% over the whole period, the increase for the top 1% was of 31% and added up to 117% for the richest 450 tax units belonging to the top 0.01% (see Figure 3 below). The patterns above also suggest that higher percentiles in the income distribution tend to have more volatile earnings, which is confirmed when looking at the variance of periodical growth rates (Table 2 below).

We see a strong correlation of top income shares react and the business cycle. The last recession covered in the data was 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 only slightly different at

the very top compared to the top decile. 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 10% group. But despite these small differences, by the end of the time span covered all groups reached top shares in total income above any level reached before in the time span covered. Only the availability of more recent data will show how top income shares in Switzerland reacted to the outbreak of the financial crisis in 2008/09.

This picture is in line with earnings distribution theories, which attribute a higher volatility to more disperse distributions, especially at the top (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 incomes combined with a different wealth composition at the very top compared to top groups in 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 evidence for the U.S. shows (Kopczuk and Saez, 2004; Saez, 2006).

Figure 3: Growth in Income Shares for Different Top Groups since 1981

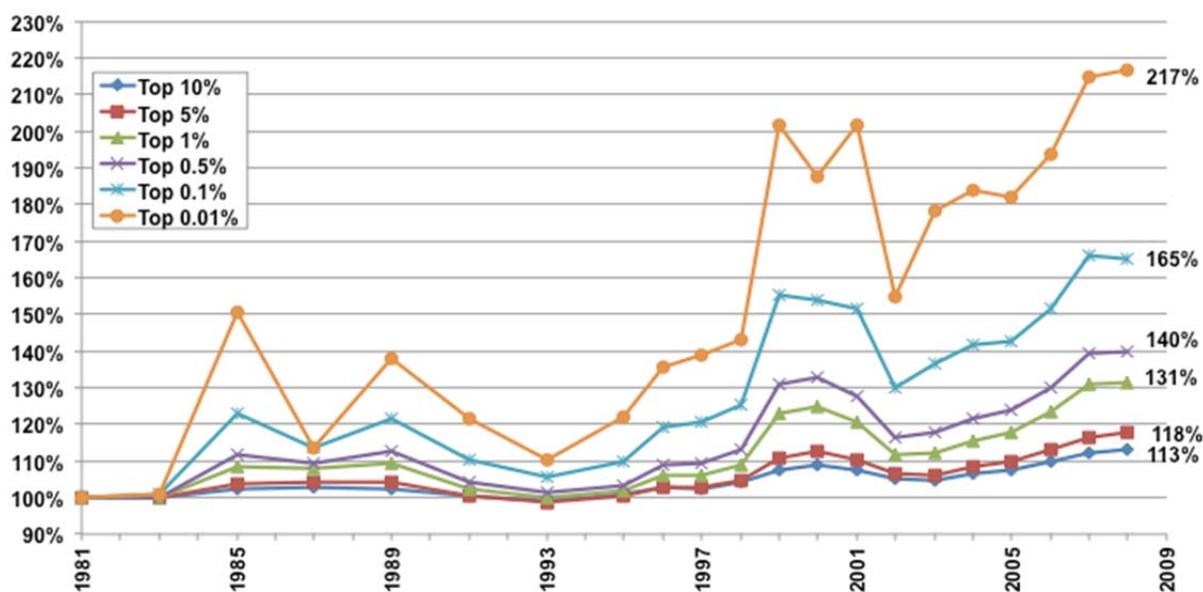


Table 2: Variance in Top Share Growth Rates

<u>Variance in Growth Rates</u>	
Top 10%	2.478
Top 5%	5.813
Top 1%	21.277
Top 0.5%	33.259
Top 0.1%	83.511
Top 0.01%	325.745

Long Term Development

As the series presented in this study are constructed following the approach by Dell et al. (2007) we can now combine our results with the latter to obtain series in top income shares from 1933 up to 2008. We use only the OLS estimates in what follows. As Figures 4.a) to 4.d) below show, top income shares have remained remarkably stable over the considered period. This is especially true for the two decades from the mid-1970s to the mid-1990s. Thereafter however, we observe a steady increase which made some top groups, such as the top 10%, reach by the end of the last decade the highest share in total incomes they had ever experienced. The long-term picture also provides further evidence for the steeper increase the further we move to the top of the distribution. Figure 4.c) shows how the top 0.1% group outperformed neighboring groups, especially so in the last decade for which data is available. Figure 4.d) makes this point even more clearly by comparing the top 10% of the top 10% and top 1% group respectively. While these within group shares were more or less equal from 1933 to the beginning of the 1970s, the top 0.1% within the top 1% started to rise and drift away thereafter. Similarly, the ratio of the average income of tax units of each top group relative to 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% 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 – a so far unprecedented level.

Figure 4: Long Term Evolution of Top Income Shares in Switzerland, 1933-2008

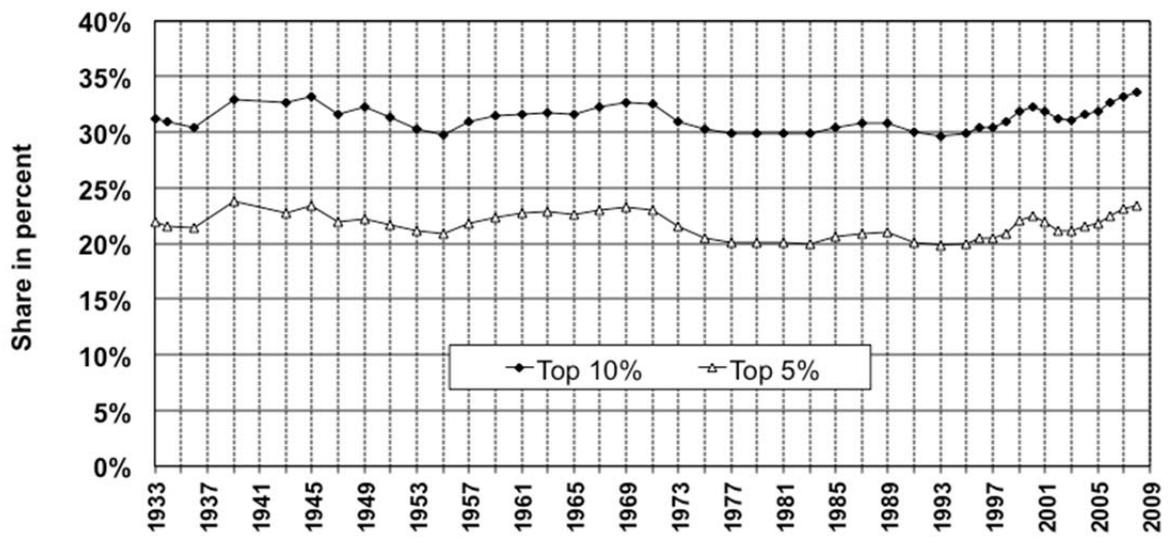


Fig. 4.a) Top 10% and Top 5%

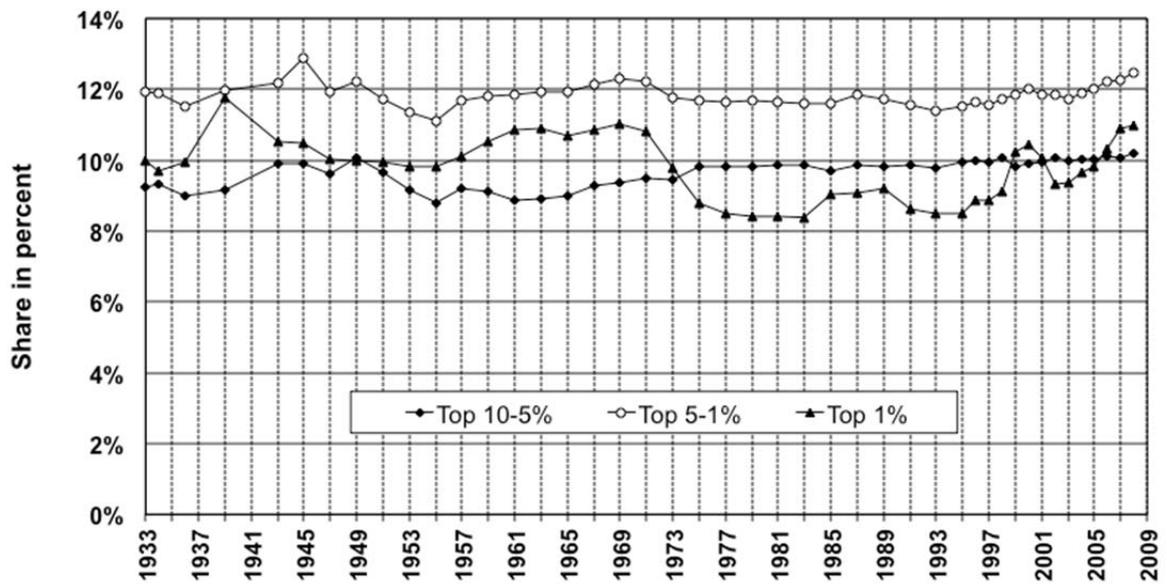


Fig. 4.b) Top 1%, Top 5-1%, and Top 10-5%

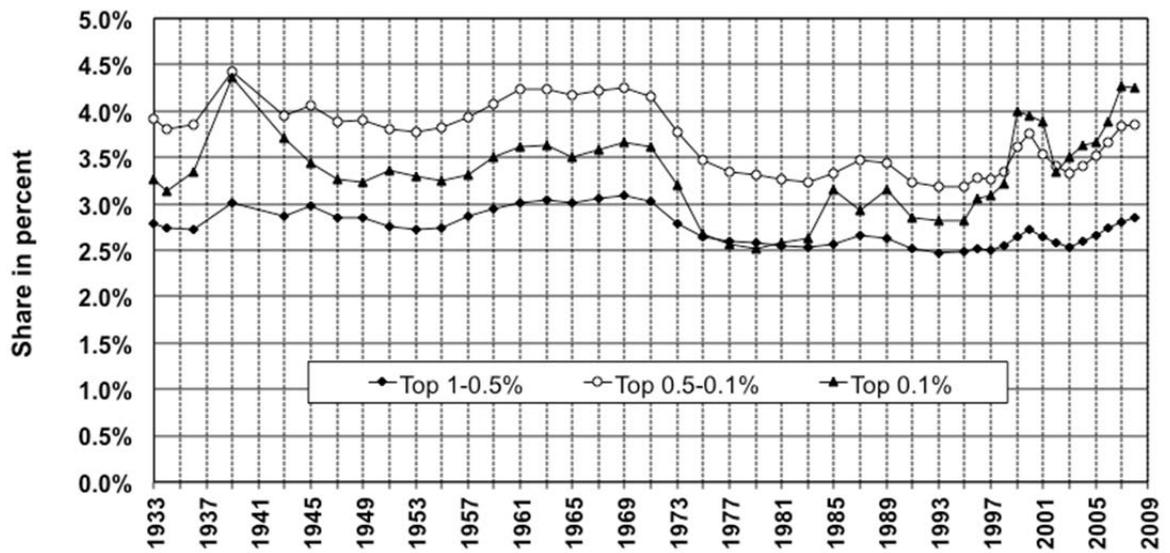


Fig. 4.c) Top 0.1%, Top 0.5-0.1%, and Top 1-0.5%

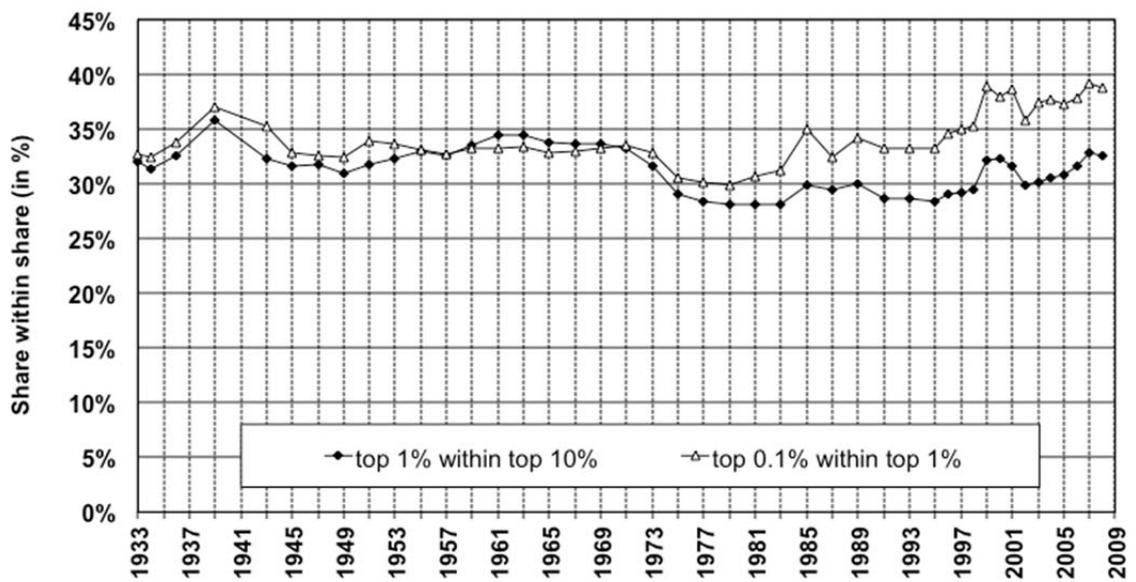


Fig. 4.d) Shares within shares

4.1.1 Robustness

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

When comparing the results of the years 1981/82 to 1992/94 to those of Dell et al. (2007), the estimates are very similar although not exactly identical. This is due to different reasons. First, our estimates of total tax units in the country are based on yearly register data and not on linear interpolation between decennial censuses. Second, we also used a total in tax units that is slightly lower than the one the authors used (see Appendix B for details). Note however, that differences in the denominator do not matter very much as the top shares calculated upon total reported tax income instead of the denominator which corrects for non-filers do not change a lot. Without this correction for total income top 10% income shares are overestimated by less than 2 percentage points and top 0.01% income shares by 0.07 percentage points, respectively, compared to the estimates where the correction for total incomes has been made. The differences between the estimates presented in our study are very small compared to those reported by Dell et al. (2007), ranging between 0.006 and 0.347 percentage points or 0.6% and 7.4%. This is still in an acceptable range, for as Atkinson et al. (2010: 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 $\pm 20\%$.

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 the Appendix shows the detailed regression results of the fixed effects OLS regressions used for prediction of the missing years. The overall fit of the different models for all the different series of top income shares is good and normally very high. Model I with Basel City (BS) as only regressor achieves the lowest R^2 , but even there the values range between 0.84 for the top 10% estimates and 0.90 for the top 0.01%. In models II and III the coefficient for BS turns out to be insignificant for estimates on the top 10% to top 1% shares but not the ones above (the coefficients in models II and III are robust to the exclusion of BS). This makes sense considering its small size and relative importance for the distribution of incomes. At the same time some of the richest entrepreneur families in Switzerland come from Basel City, 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 (Jeitziener 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. Looking at the evolution of top income shares of labor income (see below) they follow 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% and 5% groups and a somewhat lower increase for the top 0.1% 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 the years that are based only on the data from Basel City (i.e. 1995 to 1998) do not seem to be biased.

Predicting Missing Years by Imputation

While the imputed values in Figure 2 above follow a pattern very similar to the OLS estimates for the top 10% to top 1% groups, estimates further at the top become very large and volatile. Especially for the top 0.1% and top 0.01% 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 top shares, this technique is not precise enough to impute values at the very top, as these series are themselves more volatile than the ones for lower top groups.

Change from Biennial to Annual System

With respect 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 available. There is no jump to be observed 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 onwards.

4.2 *Driving forces behind the evolution of top income shares*

The picture of top income shares we got 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. Even though Swiss tax data does not allow for such a distinction, other sources allow for 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 only be taken as indicative to judge how the income composition of the top groups changed.

4.2.1 *Labor income*

The old age insurance 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 due upon the whole income (including all wage components, like stock market shares for example), all incomes legally earned in Switzerland are covered. Being a comprehensive micro data set, it is possible to obtain the percentile values of interest directly from the data, without estimating them.¹⁴ The obtained top income shares are thus not estimates but correspond to the true shares within the labor income distribution. An important difference between social security and tax statistics is that the former relies on individuals whereas the latter samples tax units. As far as the correlation between top incomes and household structure did not change, however, the evolution of top labor incomes may be directly compared to the evolution of total incomes. Hence, if top labor incomes grew faster than total incomes, labor incomes grew relatively more important among the very top income owners.

Figure 5 below shows the top labor income shares together with the top income shares from income tax data. They clearly follow the same patterns, with the latter being higher for every top group at every point in time.

¹⁴ We owe thanks to the data team of the *Zentrale Ausgleichsstelle der AHV (ZAS)*, and especially Mr. Hans-Peter Naef who extracted the data we needed.

Figure 5: Top income shares of total income and labor income only

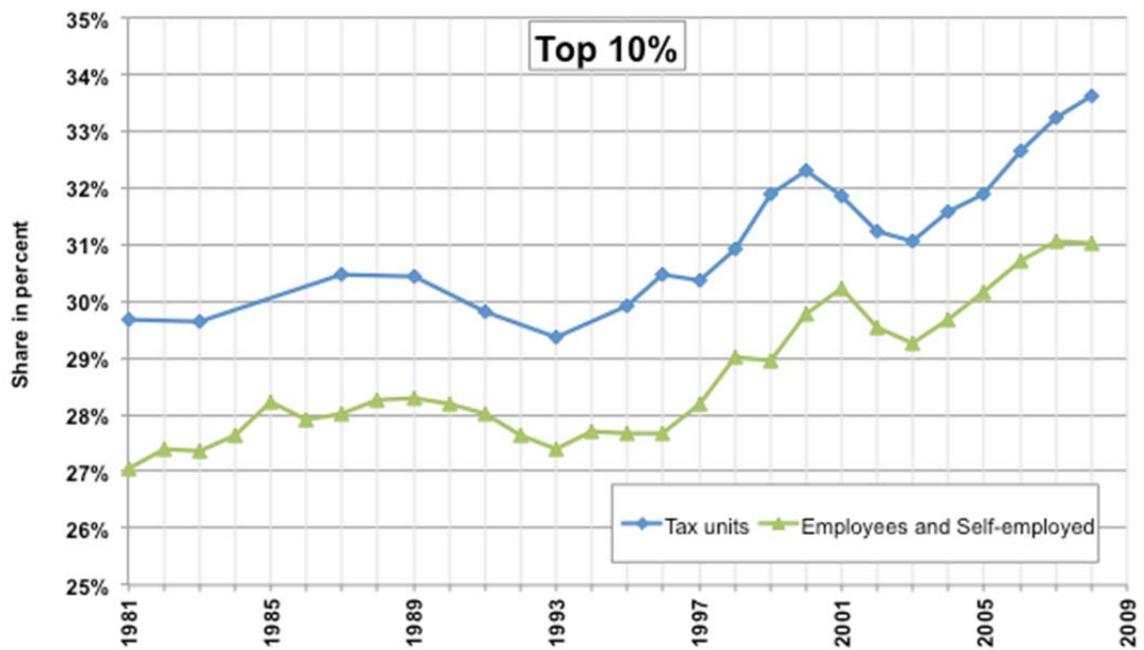


Fig.5.a) Top 10% income shares of total income and labor income only

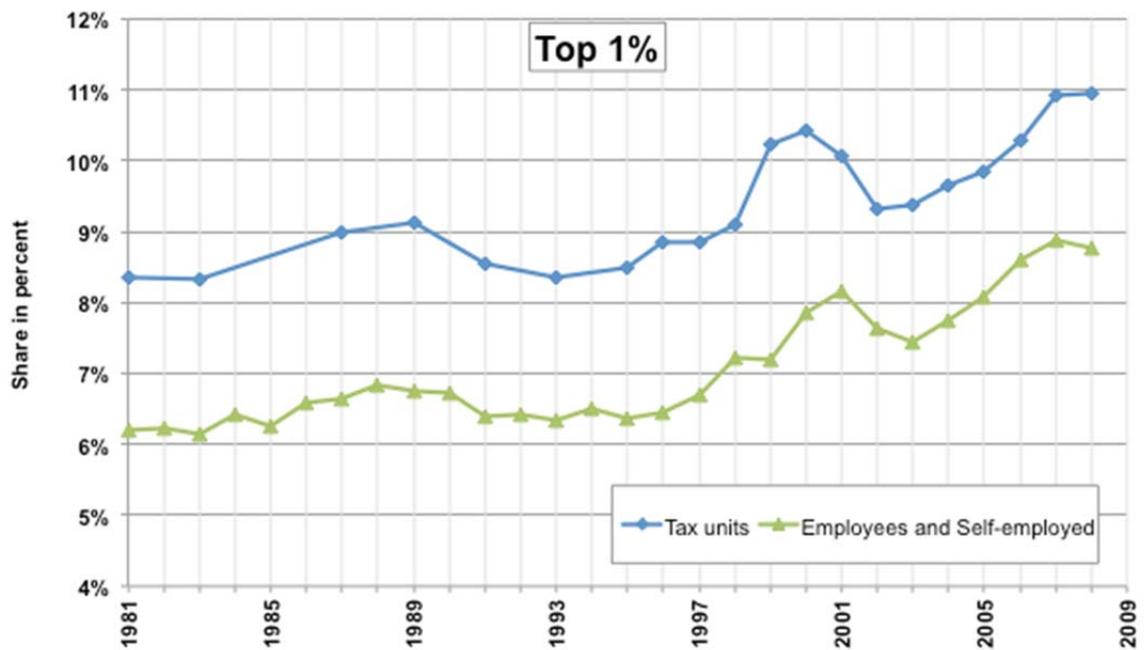


Fig.5.b) Top 1% income shares of total income and labor income only

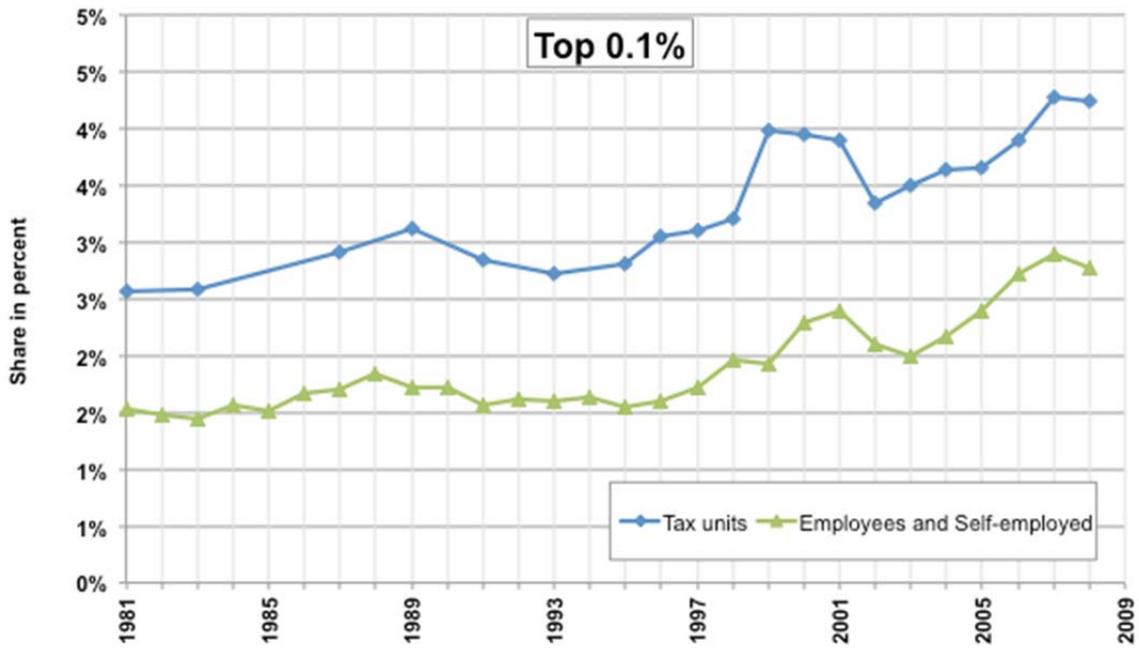


Fig.5.e) Top 0.1% income shares of total income and labor income only

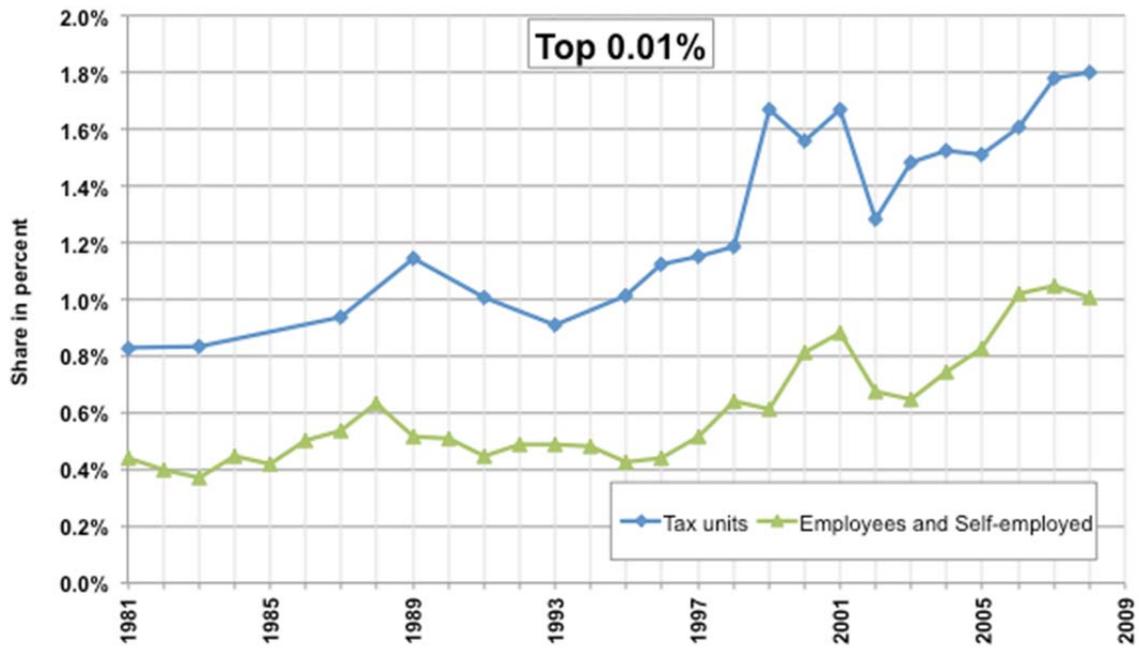


Fig.5.d) Top 0.01% income shares of total income and labor income only

The old age insurance statistics further allow us to decompose labor income into wages paid to employees and business income of the self-employed. Not surprisingly, self-employed at the very top have very high shares of total income generated by all self-employed, also be-

cause some businesses will generate only very low profits.¹⁵ 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. Similar to the tax data covering all incomes, these patterns become more pronounced the further up we go 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 the employees’ incomes.

Figure 6: Top Income Shares for Employees and Self-employed

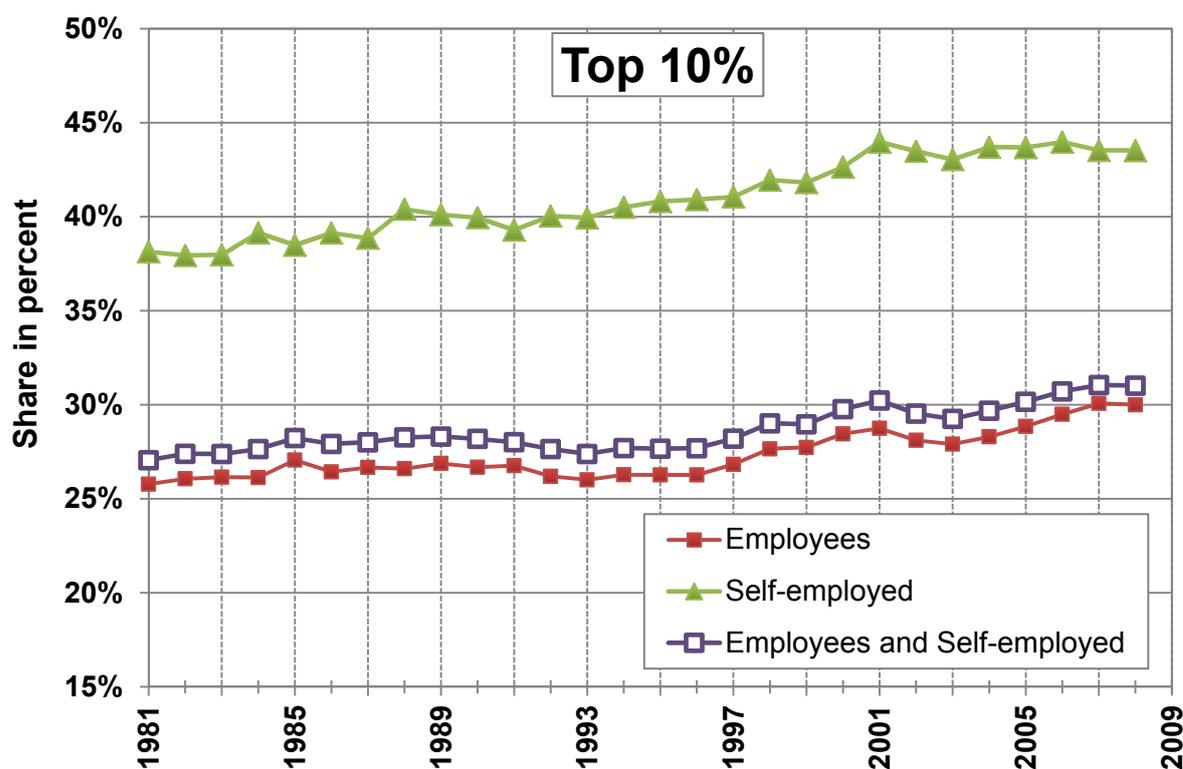


Fig. 6.a) Top 10% income shares of employees and self-employed

¹⁵ Note that in the old age insurance statistics the main income source determines whether someone is classified as employee or self-employed, therefore making sure that the self-employed’s incomes are actually their main income – except from incomes possibly earned by other persons such as a spouse.

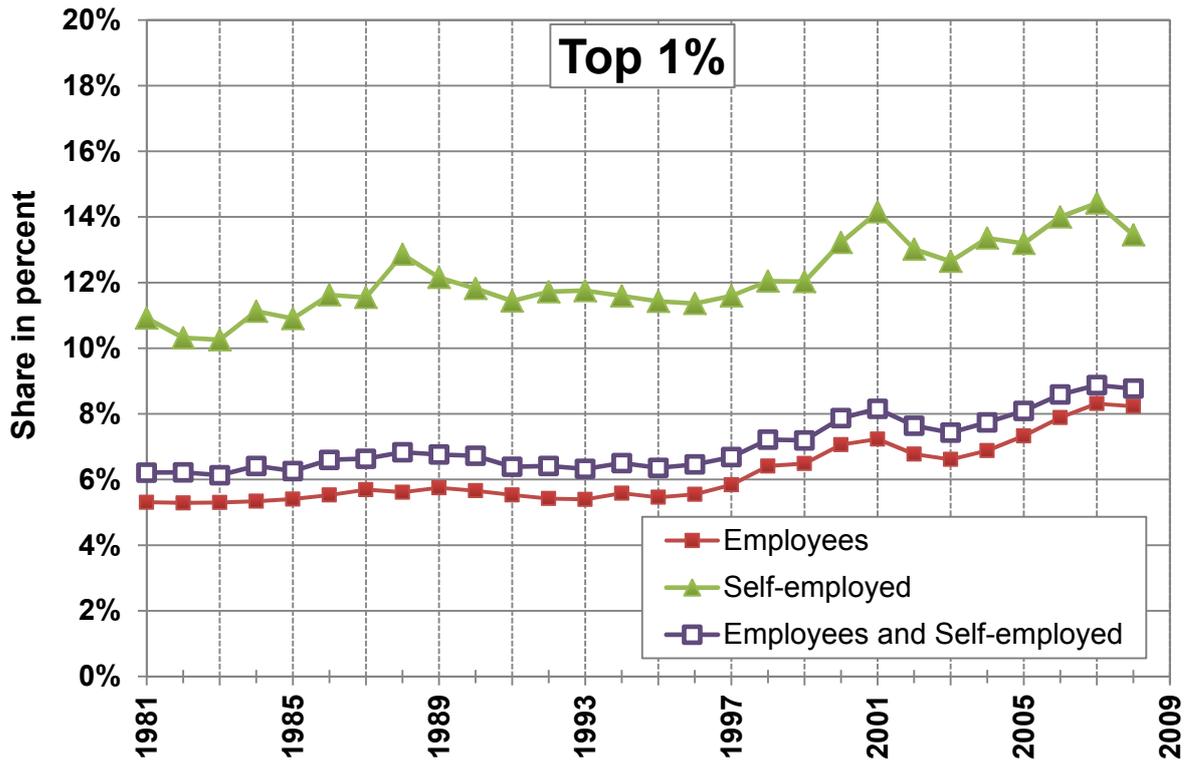


Fig. 6.b) Top 1% income shares of employees and self-employed

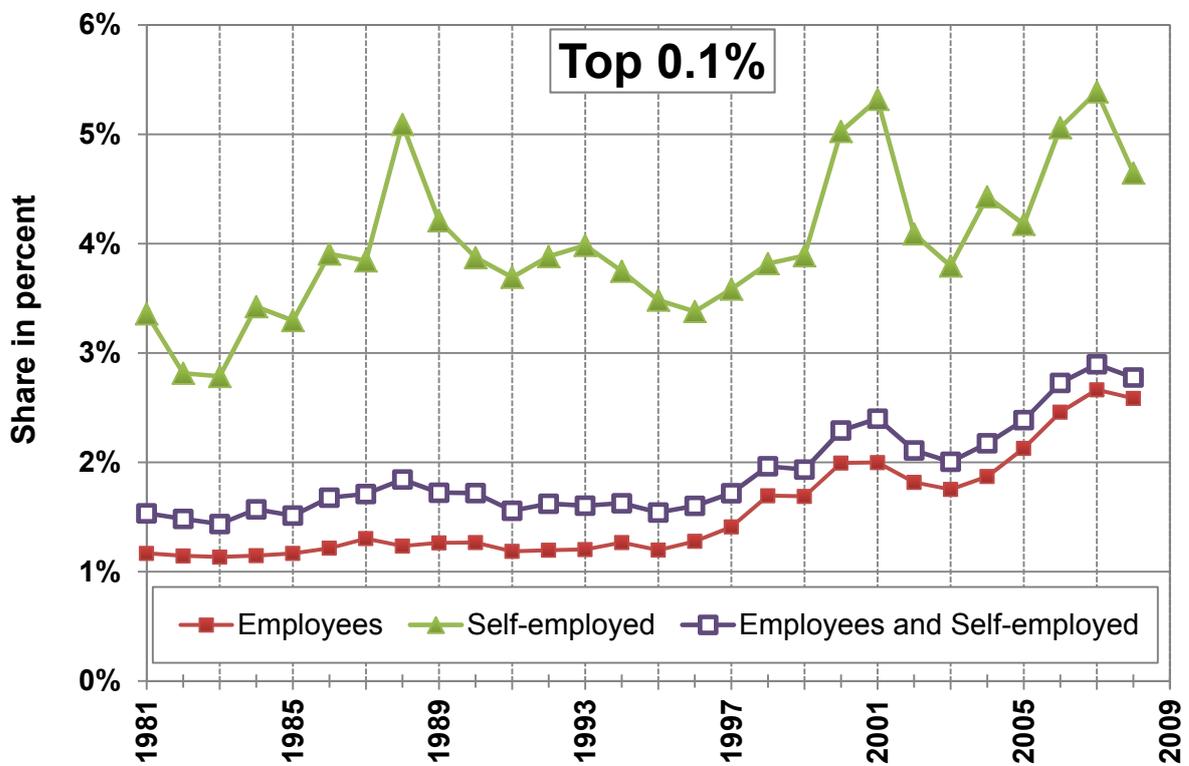


Fig. 6.e) Top 0.1% income shares of employees and self-employed

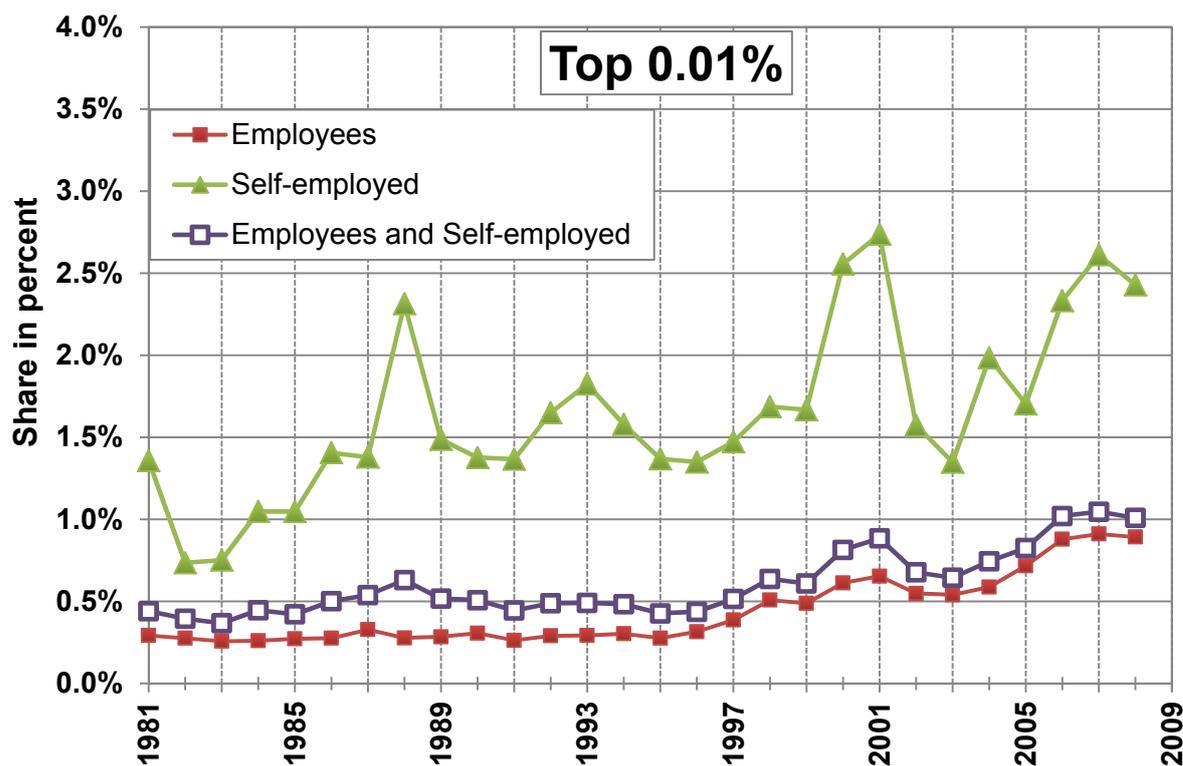


Fig. 6.d) Top 0.01% income shares of employees and self-employed

So summing up, we can say that top business income shares are considerably higher than top employee's income shares and that they are also more volatile. For both groups of top earners we observe an upward trend from the mid-1990s onwards. All these findings become more accentuated the further up we go in the corresponding income distributions.

Did top self-employed and employee's incomes grow differently since 1981? This is depicted in Figure 7 below. While for the top 10% and (even though to a lesser extent) for the top 5% 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% it more than tripled over the observed period, compared to the top self-employed's shares which less than doubled. These changes over time are of course limited, as the shares themselves are bounded above. Nevertheless Figure 7 clearly shows how the distribution of labor earnings in Switzerland is undergoing some remarkable changes since the beginning of the millennium. While up to the mid-1990s the evolution of top incomes was very similar for entrepreneurs and employees at the very top, the latter benefitted from a steady increase in their income shares. Taken together these evolutions imply 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 employee's incomes than for self-employed's incomes and for general incomes as measured by tax data.

Figure 7: Growth of Top Labor Income Shares

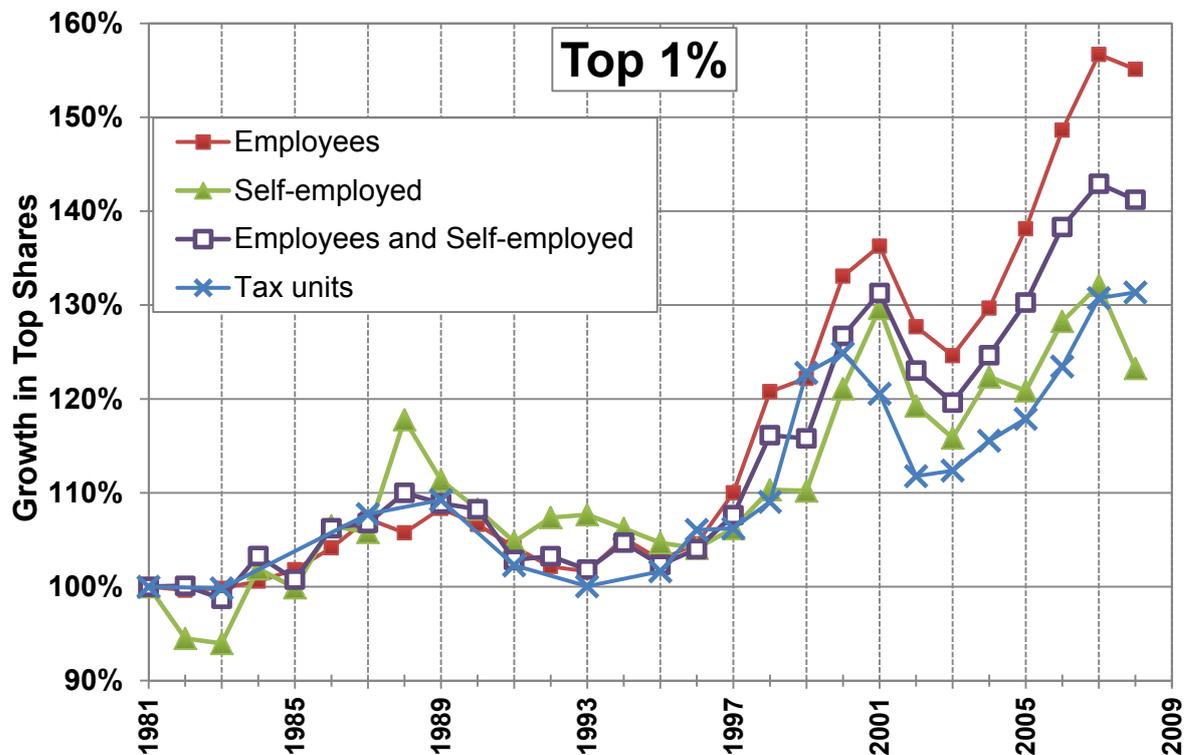


Fig. 7.a) Top 1% income share growth

Labor incomes: Precision of Pareto distribution assumption

Apart from making it possible to obtain the true income shares of top percentile groups, the old age insurance data offer a further feature: using them in grouped form, they allow thus to check for the accuracy of the Pareto interpolation method. We obtained a dataset in grouped form with the same brackets as those reported in the tax statistics and applied the same estimation method as with the latter data. Estimates of the top shares with this method are highly 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 francs up to a couple

of thousands.¹⁶ 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% group. Even more, the top 0.1% and 0.01% shares, which have been extrapolated whenever not contained in the top bracket, are just as precise as the interpolated values.¹⁷

4.2.2 *The evolution of top wealth shares and the role of capital income*

Our estimates of the evolution of capital incomes are much more crude than the labor income estimates. To gain at least a simple idea how the distribution of capital income evolved, we simply look at the evolution of wealth inequality. Assuming the capital returns do not systematically vary among the top groups, the evolution of wealth inequality is a good proxy for the evolution of capital income inequality. Figure 9 below 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). The panels of Figure 9 show that similar to top income shares, top wealth shares have 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 from 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), wealth shares of the top 1% groups and above have by 2007 reached levels comparable to the maximal levels for the whole period after World War I. For the top 0.1% and the top 0.01% we even observe an unprecedented concentration in wealth.

¹⁶ For the group of self-employed for some single years the deviations jump to 100'000 francs. We attribute these changes to measurement error and higher volatility of reported business incomes.

¹⁷ This is the case for employees in years after 2000 and for self-employed over the whole period.

Figure 8: Top Wealth Shares in Switzerland, 1913-2008

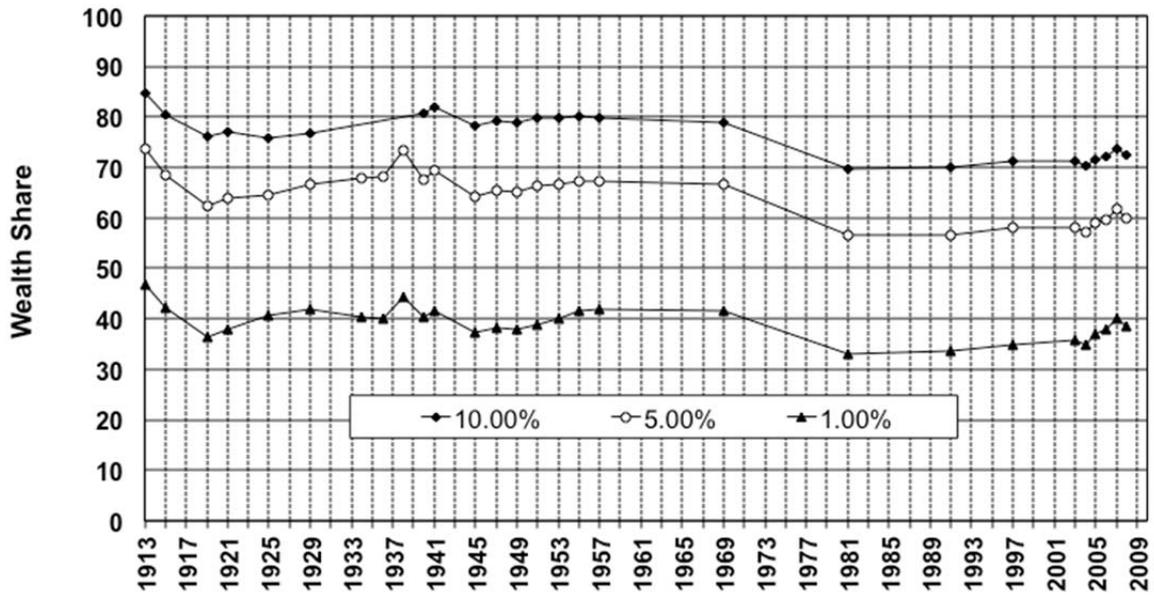


Fig. 8.a) Top 10%, Top 5%, and Top 1% wealth shares

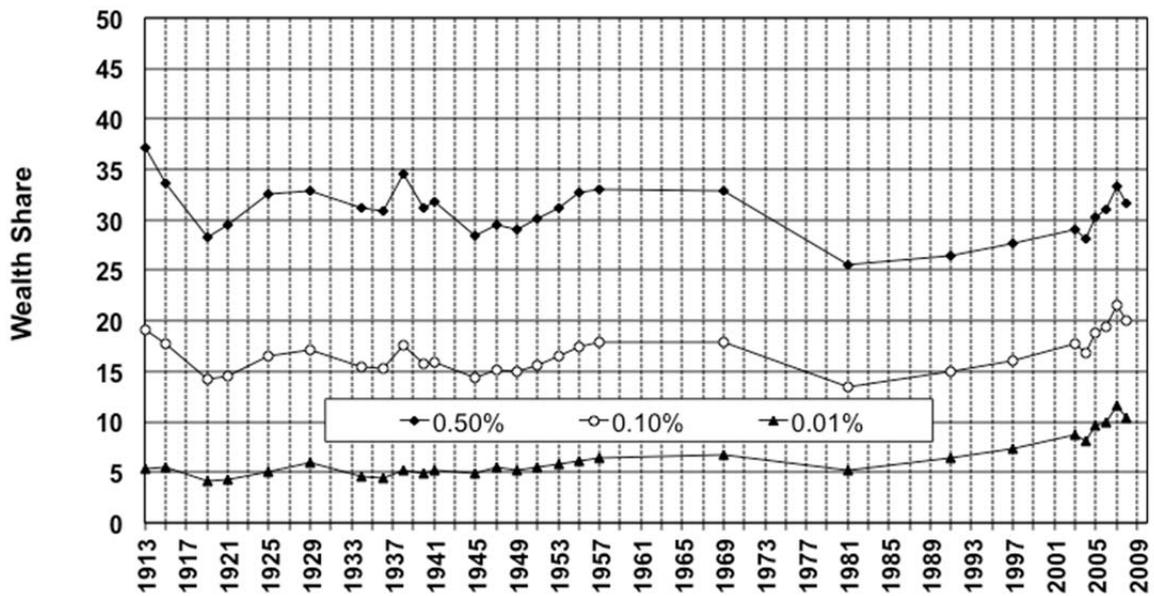


Fig. 8.b) Top 0.5%, Top 0.1%, and Top 0.01% wealth shares

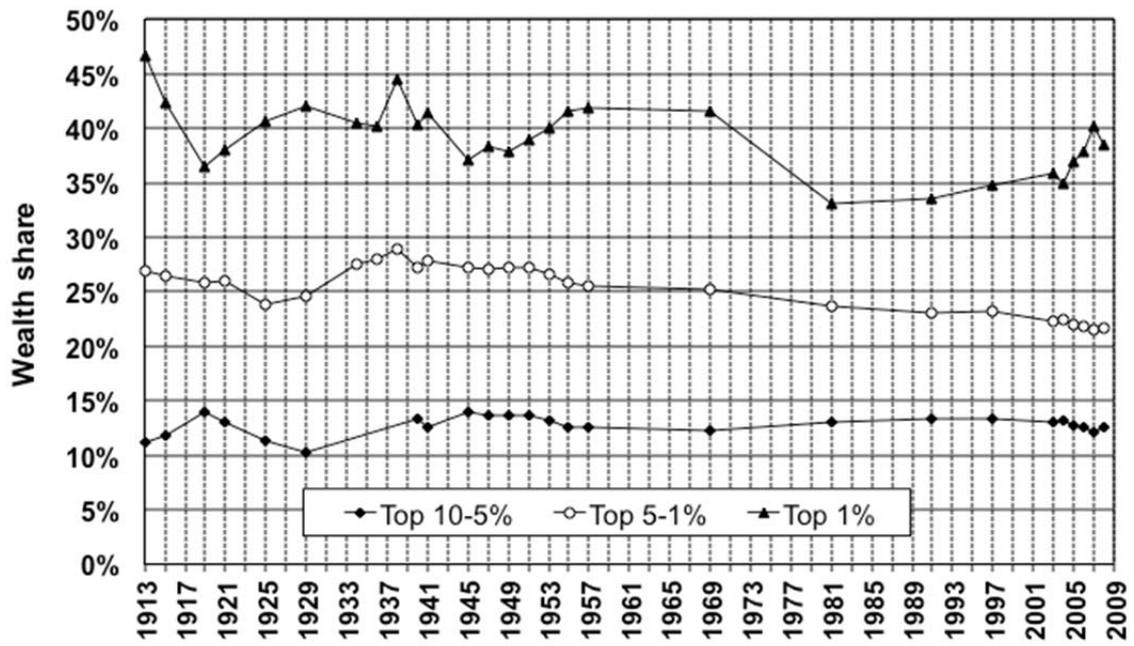


Fig. 8.c) Top 10-5%, Top 5-1%, and Top 1% wealth shares

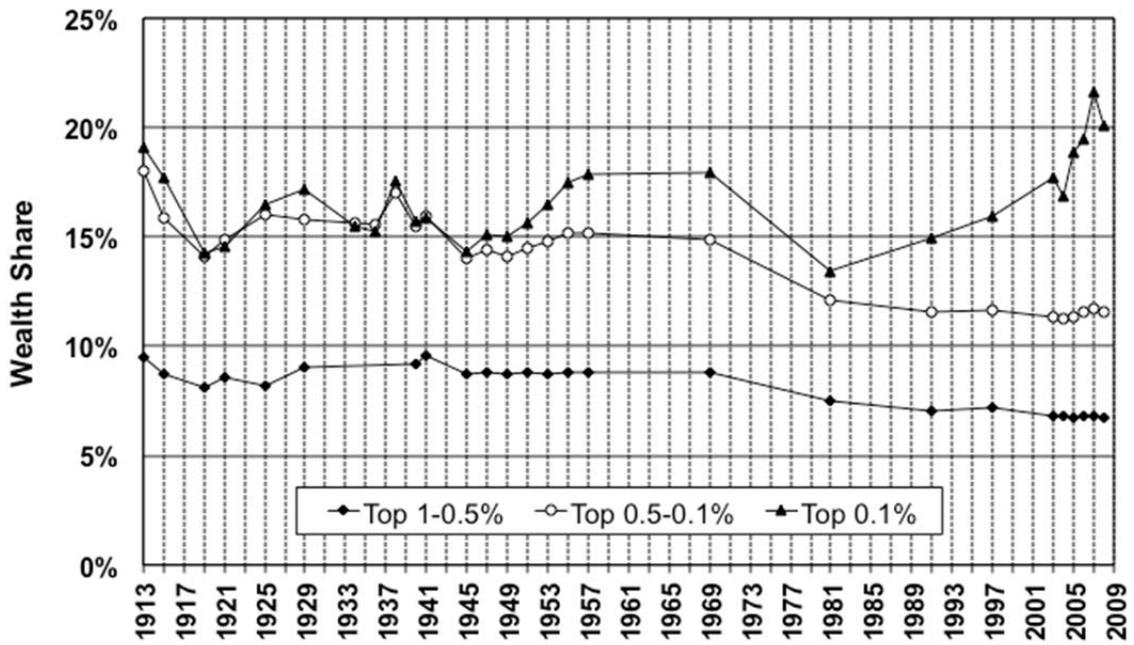


Fig. 8.d) Top 1-0.5%, Top 0.5-0.1%, and Top 0.1% wealth shares

5 Conclusion and Discussion

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

Our results show that top incomes shares in Switzerland have increased, with stronger increases at the very top: The top 1% income share rose from 8.5% in the late 80's to 11% in the late 00's, whereas the top 0.1% share increased from 2.9% to 4.2% in the same period. Together with the large increase, the very highest incomes also exhibited the largest volatility in the business cycle.

We compared the income data from tax statistics with labor income data from the social security statistics. The latter data have the great advantage that they are directly available as register data and allow us to directly observe the top shares without need to estimate them. Assuming the household income correlation did not change, we find that inequality among top labor incomes earners (employees and self-employed) rose sharply as well, with the same time trend as the estimated values for the top total incomes. Thus, the latter finding confirms our estimates for the income inequality data series 1993 – 2003. Further, labor incomes grew faster than total incomes at the top. Switzerland follows herein the trend of other industrialized countries that labor income becomes more important among top income earners.

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 (Dell et al., 2007, Kopczuk and Saez, 2004). Our time series for recent years now document that Switzerland saw an increase in top incomes shares as well, suggesting that there might be other mechanisms at work too. It would be interesting to see whether the upward trend (and the volatility) outlived the recent financial and economic crisis and the accompanied changes in the tax schedule.

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APPENDIX

A) *Data Sources*

Tax Statistics

Data set with grouped tax data provided by Raphaël Parchet, Université de Lausanne. 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 2008, 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, 1'000'000 and 2'000'0000 Swiss Francs (SFr.), 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 total insured persons for each year for the groups of employees, self-employed and all insured working persons taken together. Additionally, we obtained grouped tabulations in accordance to the tax statistics with the same income brackets.

Wealth Statistics

Grouped tax data of net wealth with income brackets from 0 SFr. up to 10 million SFr. 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>

*B) Technical Derivations**Choice of Tax Units: Normal and special cases, capital gains*

The tabulated tax statistics have remained relatively 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”) and are highly relevant in the top income group.¹⁸ 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 for illustrative purposes.¹⁹ They are not in fact separate tax units and including them in the total amount of tax units would lead 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 per cent 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. For Zurich and Thurgau for example, the incomes realized in 1995/96 are recorded and published in the 1997/98 fiscal period. For the fiscal periods 1999 and 2000 under the new system, the incomes of 1999 and 2000 are reported, with the consequence that incomes realized in 1997/98 do not show up in any statistics. In what follows, 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 (so-called “Normalfälle”) 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 Administra-

¹⁸ 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 labour and capital income, the inclusion of these special cases makes sense.

¹⁹ In the publication by Dell et. al (2007) these cases are included in the total number of tax units.

tion. This means, that also for further updates of the dataset one may have to request the data, unless tax statistics are again published in the former format.

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. In order to include all tax units filling a tax return, not only the normal cases (*Normalfälle*) but also the special cases (*Sonderfälle*) must be considered. The latter include the high net wealth individuals taxed according to their expenditures (*Besteuerung nach dem Aufwand*) and are thus highly relevant in the top income groups.²⁰ Married and officially registered couples (in act since January 1 of 2007) are subject to joint tax liability and show up as one single case in the tax statistics. This means that a tax unit is not always an individual nor does it necessarily correspond to the concept of a household. This becomes more accentuated with the change from traditional household and family structures to more mixed forms of cohabiting.

Tax units not covered in the statistics

The statistics do only report cases and their incomes if they were actually taxed, i.e. when taxable income was high enough to exceed the amount of exemption. As the purpose of the present paper is to study incomes at the top, this is only a minor problem. However, the exclusion of very low income earners means that the actual total of incomes earned in a year as well as the total number of tax units are underestimated in the totals reported in the tax statistics. 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.

Incomes not reported in the tax statistics

In order to make reasonable assumptions when estimating a total income control, one should ask which ones are the individuals not covered in the statistics. The first group are the very low income earners which by definition are not included in the tax statistics. 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

²⁰ 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 labour and capital income, the inclusion of these special cases makes sense.

show up in the statistics but corresponding incomes reported are too low due to tax evasion.

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 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 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 that case, they will then be included in the tax statistics. This implies, again, that incomes at the top do appear even for these individuals.

As for the level of incomes taxed at the source, we can only make an educated guess. We start assuming that the distribution of incomes for legal foreign residents should be somewhat similar to the one of permanent residents but one could expect some sort of wage discrimination against immigrants. 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 1990ies. By 2010 it reached over 20% 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% of the population and it is substantially lower in cantons with no boundaries with surrounding countries, such as in Bern (BE; 4%), or Aargau (AG; 7%).

International organizations' Staff

Another special category of residents is the international organizations' staff based in Switzerland, which is exempted totally or partially from personal income taxation.²¹ No less than 24 organisations residing in Switzerland benefit from tax exemptions for their whole or part of their staff. As all of them except for two are located in Geneva (GE), one would expect a high fraction of non-filers in this canton. Indeed, Geneva has the lowest average rate of filers for the considered time span. While the Swiss average lies around 86%, it is only 76% for Geneva, and 82% for Basel-City (BS), the canton having the second lowest rate of filers.

Non-filers

Even though it is the law to fill and hand in a tax return every year, there are people who would not hand-in their tax return. In cases where individuals do not accomplish with their duty to fill out a tax return within due time, the tax administration will simply attribute these individuals an income based on older tax returns and on employer's information about the income, so that these individuals will show up in the statistics – even though their income will be measured with some error. According to information from cantonal tax administrations, they are not confronted with many of these cases (around 4% 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 should be much less on the number of total tax returns handed in. 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. We therefore assume that only a small fraction of the non-filers are actually evading taxes.

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 estimate the total income, which is then used as denominator to calculate the top group's income shares.

²¹ At some of the organisations benefitting from a special treatment, Swiss citizens are not subject to tax exemption.

With respect to incomes simply not disclosed by the statistics as described above we have to assume that their incomes are below average income. Following the approach adopted by Dell et al. (2007) we assign the tax units not covered in the statistics 20% of average personal income reported in the tax statistics, i.e. 20% of *Reineinkommen* per capita. This seems to be 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% in 1981 but then falls over time to a low of 60% in 2006, rising again afterwards. Similarly, our income denominator containing the imputed incomes for the non-filers fluctuates somewhere between 65% and 74%. 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 finally, can at least partly be explained by tax evasion. In their case study Feld and Frey (2002) estimate, that tax evasion varies between 12.6% in 1978 and 35.1% in 1990, and that on average it lies somewhat above 20% of gross household income. Furthermore, there are large cantonal differences and also these differences change considerably over time (between 1970 and 1995). The average over all cantons in 1995 is 22.3%. Unfortunately, we are unable to correct for tax evasion in a systematic manner, which means that this source of measurement error remains in the data.

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 however, 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 will 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 from 1981/82 up to 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 per cent points. Note however, that differences in the number of total tax units and the fraction of non-filers will 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 made it sometimes necessary to adopt a slightly different method.

For the total number of tax units on cantonal level, the number of married individuals was 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 but 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 \bar{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

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

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 .²² The income threshold T_ρ to belong to the top quantile 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 threshold, \bar{y}_ρ , reads

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

²² As an alternative, we could, as in Martínez (2011), linearly interpolate the logarithms of the corresponding population and income shares as these follow a linear path with a Pareto distribution. The results are very close to Piketty's (2001) method. We follow the latter method to have comparable time series data to Dell et al. (2007).

Total income for each top group follows

$$y_p = \bar{y}_p(100 - \rho)N$$

The total income of a top group is then divided by the total income denominator, which results in the income share of that 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 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, Neuchâtel, Geneva, Jura
2003	Ticino (TI), Vaud (VD), Valais (VS)

Table B2: Regression models used for extrapolation of top income shares in Switzerland

Model	I	II	III
	<i>Dependent variable: Top p percent's income share on Swiss level</i>		
	constant	constant	constant
	Basel City (BS)	Basel City (BS)	Basel City (BS)
	-	Zurich, Thurgau (ZH, TG)	Zurich, Thurgau (ZH, TG)
	-	-	20 cantons
Model used for extrapolation in...	for 1995, 1996, 1997, 1998	1999, 2000	2001, 2002

C) *Detailed Results*

Table C1: Models used for extrapolation of top income shares

<i>Top 0.01% shares</i>			
	Model I	Model II	Model III
Basel City (BS)	0.346 ^{***} (0.0396)	0.163 [*] (0.0697)	0.0337 ^{**} (0.00877)
Zurich and Thurgau (ZH, TG)		0.589 [*] (0.204)	0.286 ^{***} (0.0243)
Twenty Cantons			0.608 ^{***} (0.0218)
Constant	0.00676 ^{***} (0.000792)	0.00343 [*] (0.00130)	0.000565 [*] (0.000172)
Observations	12	12	12
R^2	0.884	0.940	0.999

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

<i>Top 0.1% shares</i>			
	Model I	Model II	Model III
Basel City (BS)	0.406 ^{***} (0.0426)	0.199 [*] (0.0650)	0.0255 (0.0163)
Zurich and Thurgau (ZH, TG)		0.608 ^{**} (0.171)	0.302 ^{***} (0.0372)
Twenty Cantons			0.603 ^{***} (0.0380)
Constant	0.0158 ^{***} (0.00193)	0.00493 (0.00333)	0.00189 [*] (0.000648)
Observations	12	12	12
R^2	0.900	0.959	0.999

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

<i>Top 0.5% shares</i>			
	Model I	Model II	Model III
Basel City (BS)	0.486 ^{***} (0.0512)	0.165 (0.0766)	0.00959 (0.0272)
Zurich and Thurgau (ZH, TG)		0.723 ^{**} (0.159)	0.344 ^{***} (0.0601)
Twenty Cantons			0.617 ^{***} (0.0622)
Constant	0.0284 ^{***} (0.00422)	0.00392 (0.00592)	0.00181 (0.00174)
Observations	12	12	12
R^2	0.900	0.970	0.998

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

<i>Top 1% shares</i>			
	Model I	Model II	Model III
Basel City (BS)	0.522 ^{***} (0.0565)	0.135 (0.0801)	0.00117 (0.0335)
Zurich and Thurgau (ZH, TG)		0.774 ^{***} (0.149)	0.363 ^{**} (0.0751)
Twenty Cantons			0.623 ^{***} (0.0795)
Constant	0.0375 ^{***} (0.00618)	0.00392 (0.00724)	0.00135 (0.00263)
Observations	12	12	12
R^2	0.895	0.974	0.997

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

Top 5% shares

	Model I	Model II	Model III
Basel City (BS)	0.574 ^{***} (0.0724)	0.0319 (0.0654)	-0.00846 (0.0423)
Zurich and Thurgau (ZH, TG)		0.891 ^{***} (0.0999)	0.413 [*] (0.139)
Twenty Cantons			0.597 ^{**} (0.154)
Constant	0.0804 ^{***} (0.0167)	0.00986 (0.00968)	0.000815 (0.00650)
Observations	12	12	12
R^2	0.863	0.986	0.995

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

Top 10% shares

	Model I	Model II	Model III
Basel City (BS)	0.573 ^{***} (0.0779)	0.00559 (0.0544)	-0.0121 (0.0456)
Zurich and Thurgau (ZH, TG)		0.893 ^{***} (0.0790)	0.509 [*] (0.180)
Twenty Cantons			0.476 (0.208)
Constant	0.123 ^{***} (0.0257)	0.0258 [*] (0.0110)	0.00922 (0.0116)
Observations	12	12	12
R^2	0.844	0.990	0.994

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

D) Additional graphs

Figure 1: Top income shares in Switzerland and different cantons, 1981/82-2008

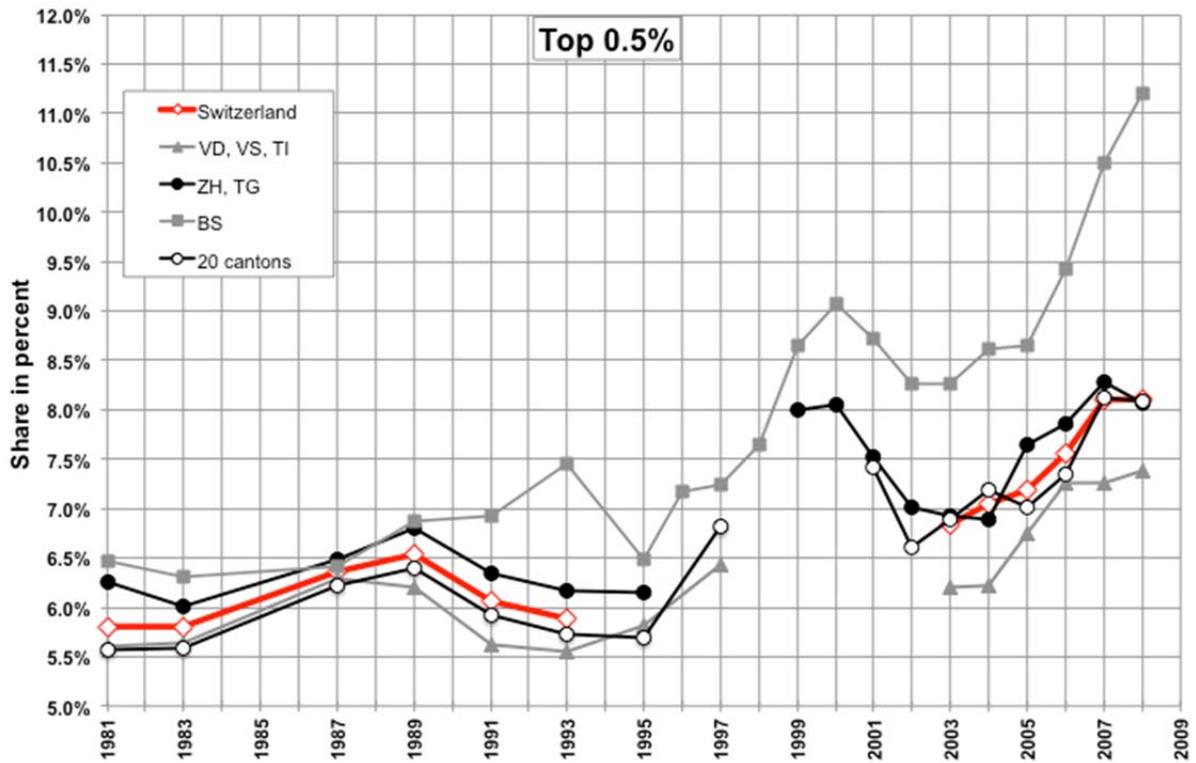


Fig. 1.i) Top 0.5% income shares

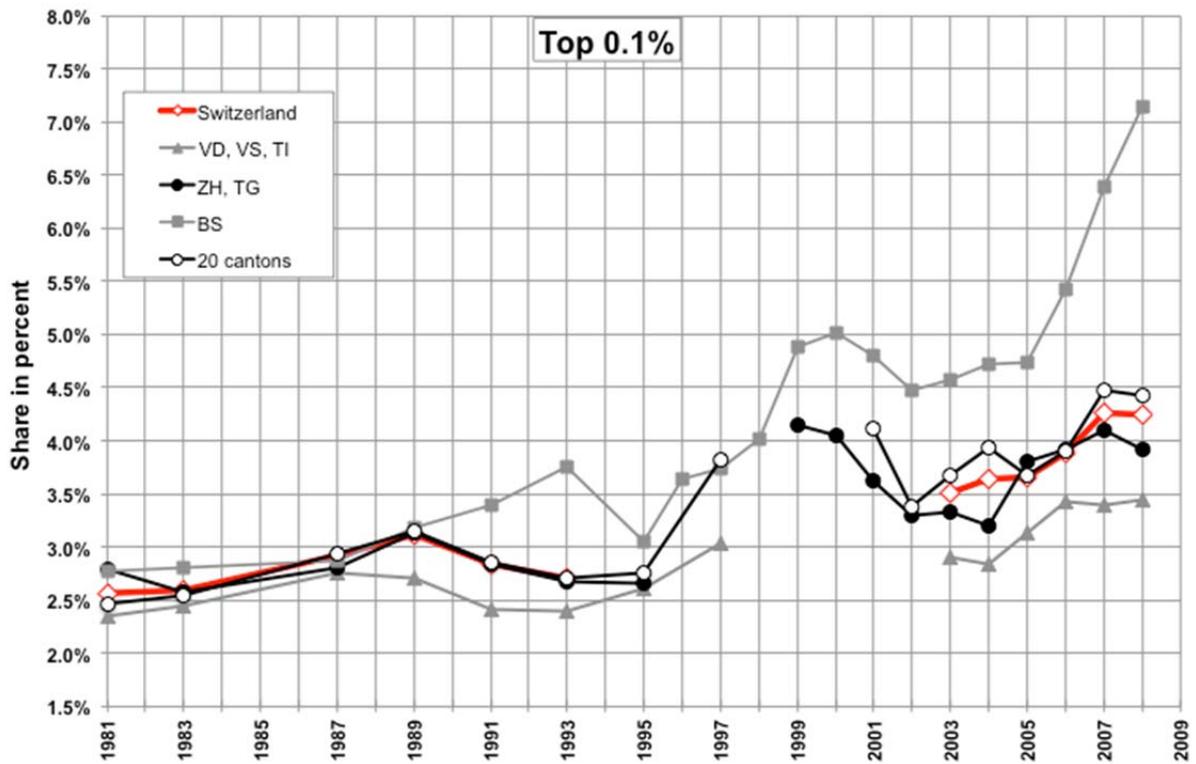


Fig. 1.ii) Top 0.1% income shares

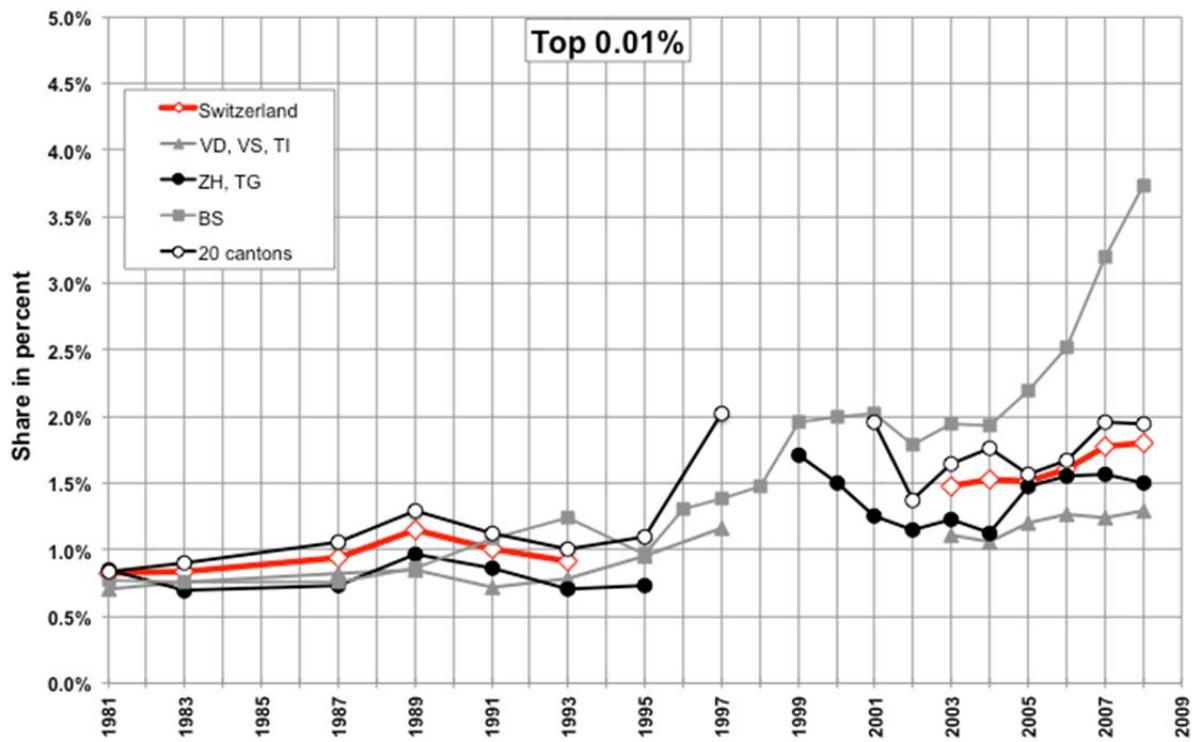


Fig. 1.iii) Top 0.01% income shares

Figure 2: The Evolution of top income shares in Switzerland, 1981/82– 2008

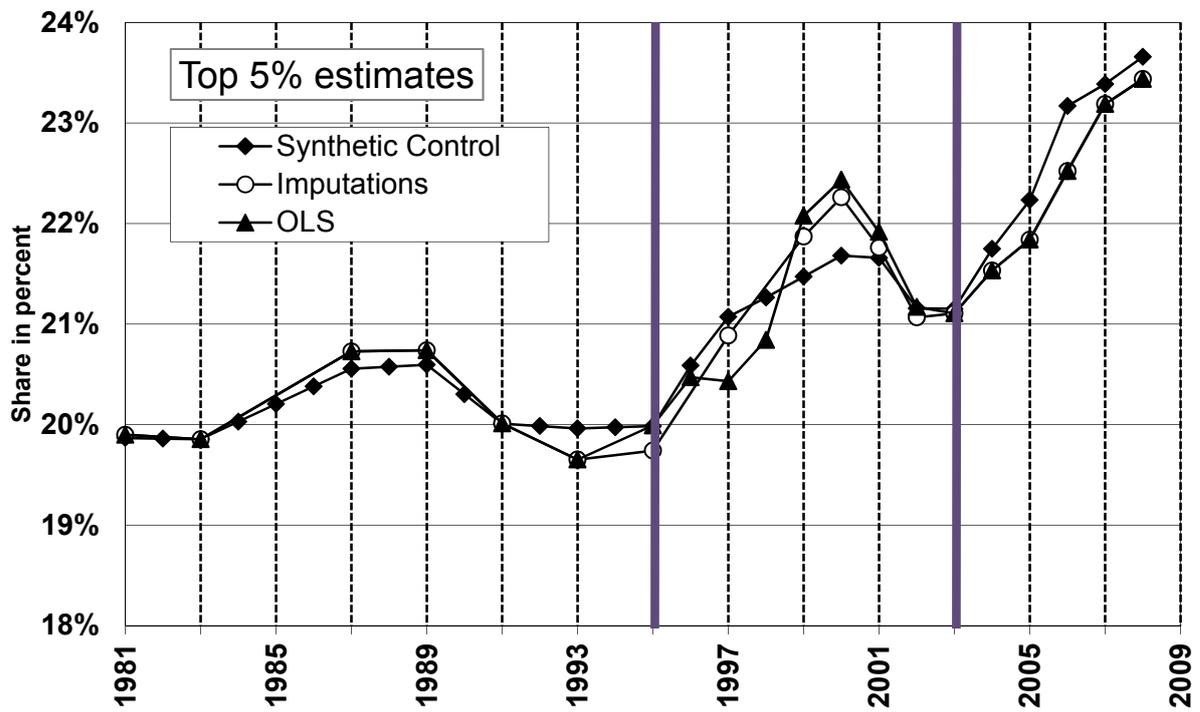


Fig 2.i) Top 5% share

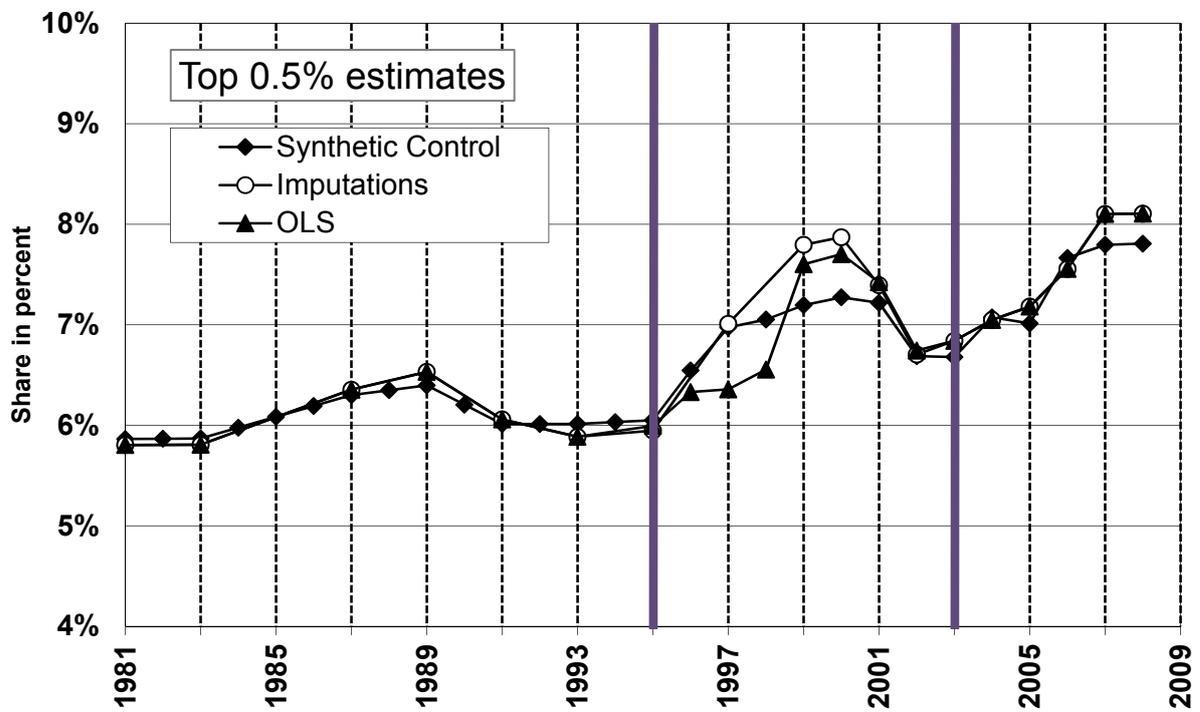


Fig 2.ii) Top 0.5% share

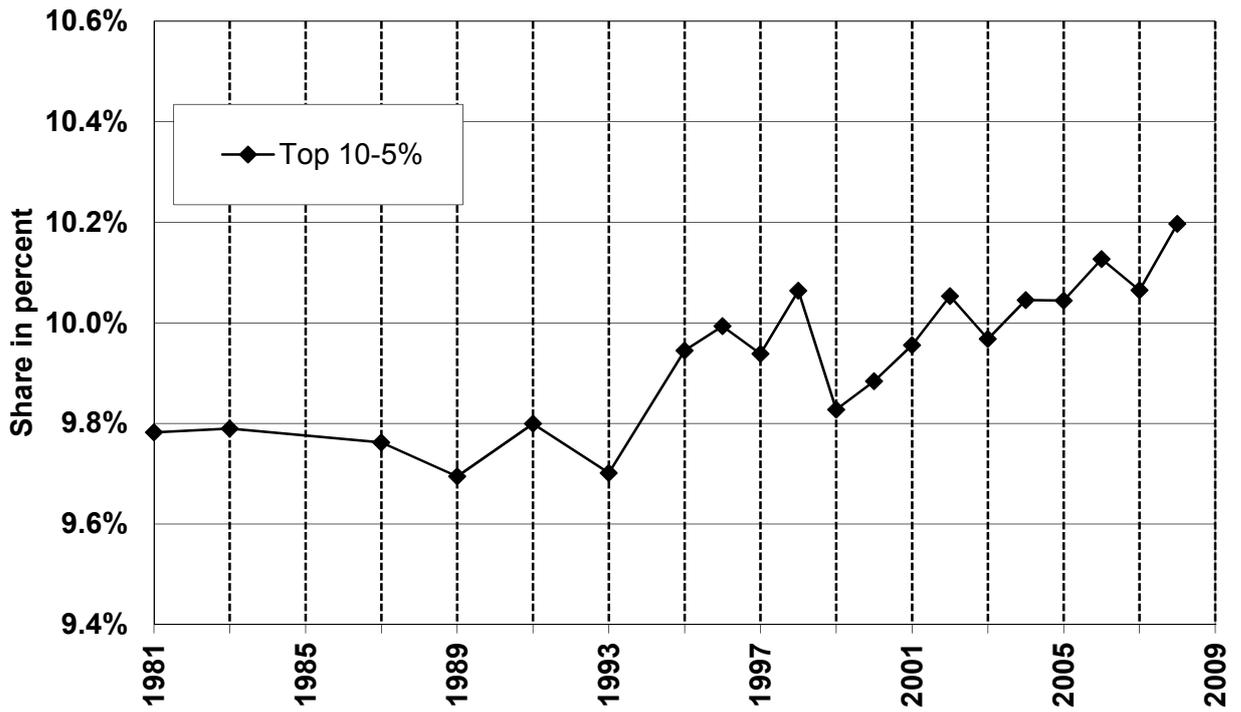


Fig 2. iii) Top 10% minus Top 5% share

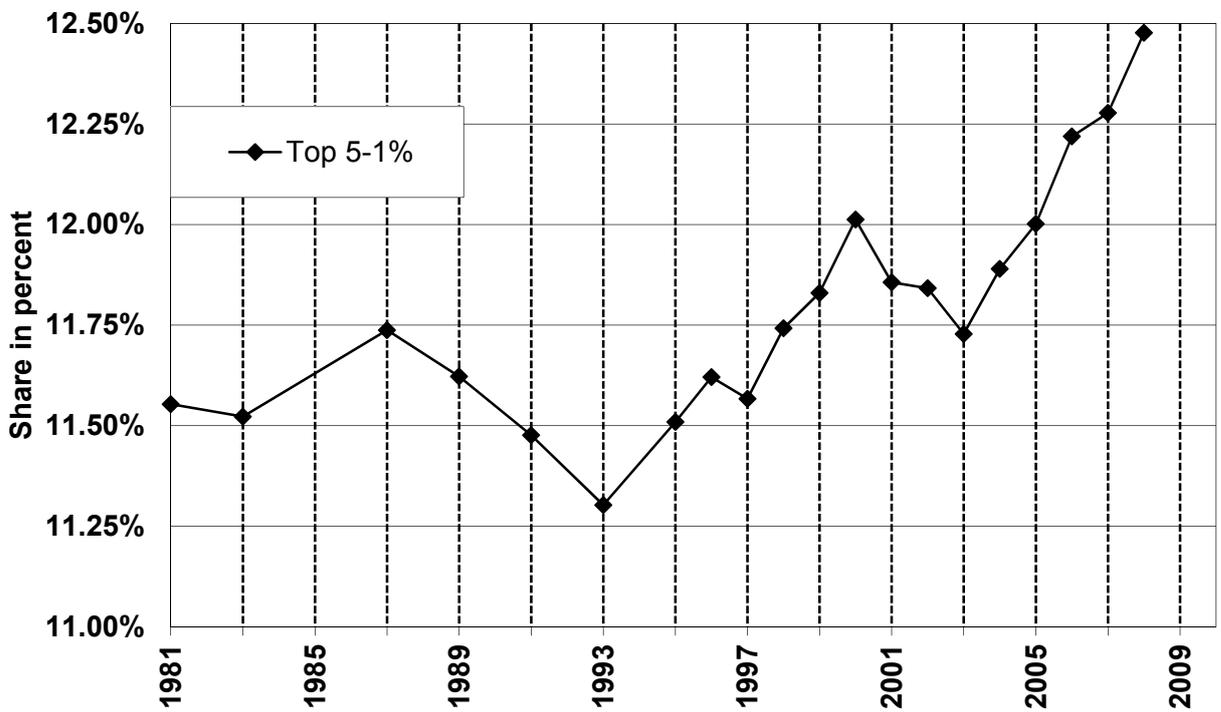


Fig 2. iv) Top 5% minus Top 1% share

Figure 5: Top income shares of total income and labor income only

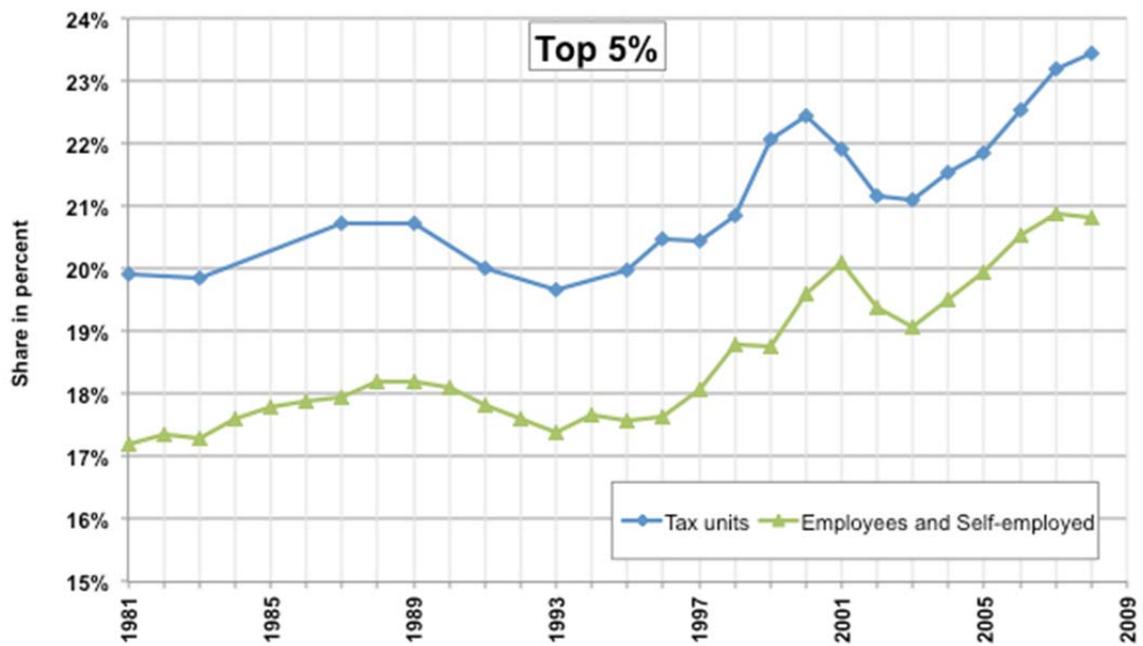


Fig. 5.i) Top 5% income shares of total income and labor income only

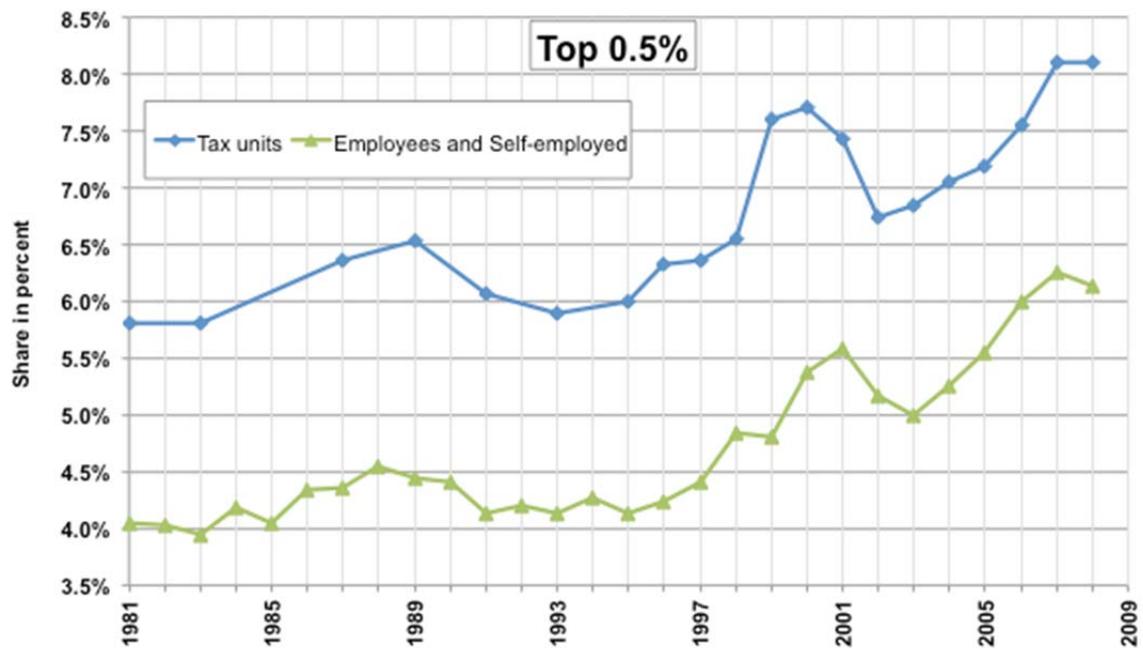


Fig. 5.ii) Top 0.5% income shares of total income and labor income only

Figure 6: Top Income Shares for Employees and Self-employed

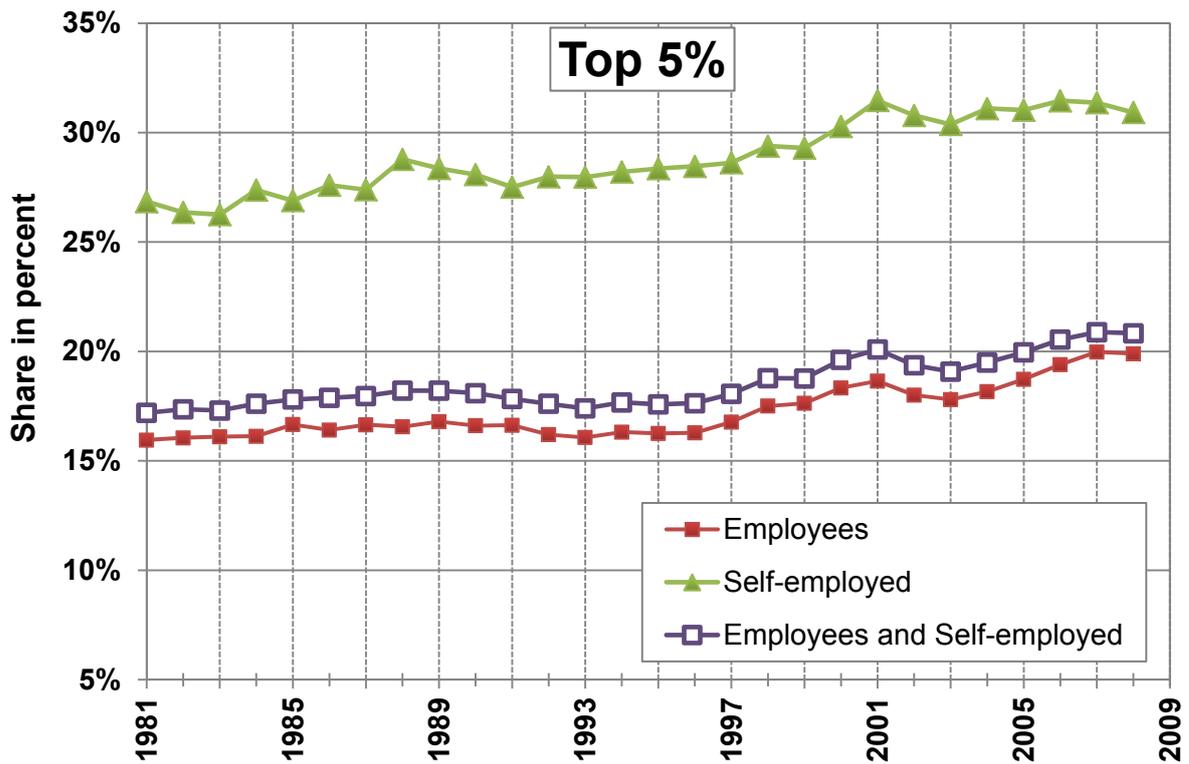


Fig. 6.i) Top 5% income shares of employees and self-employed

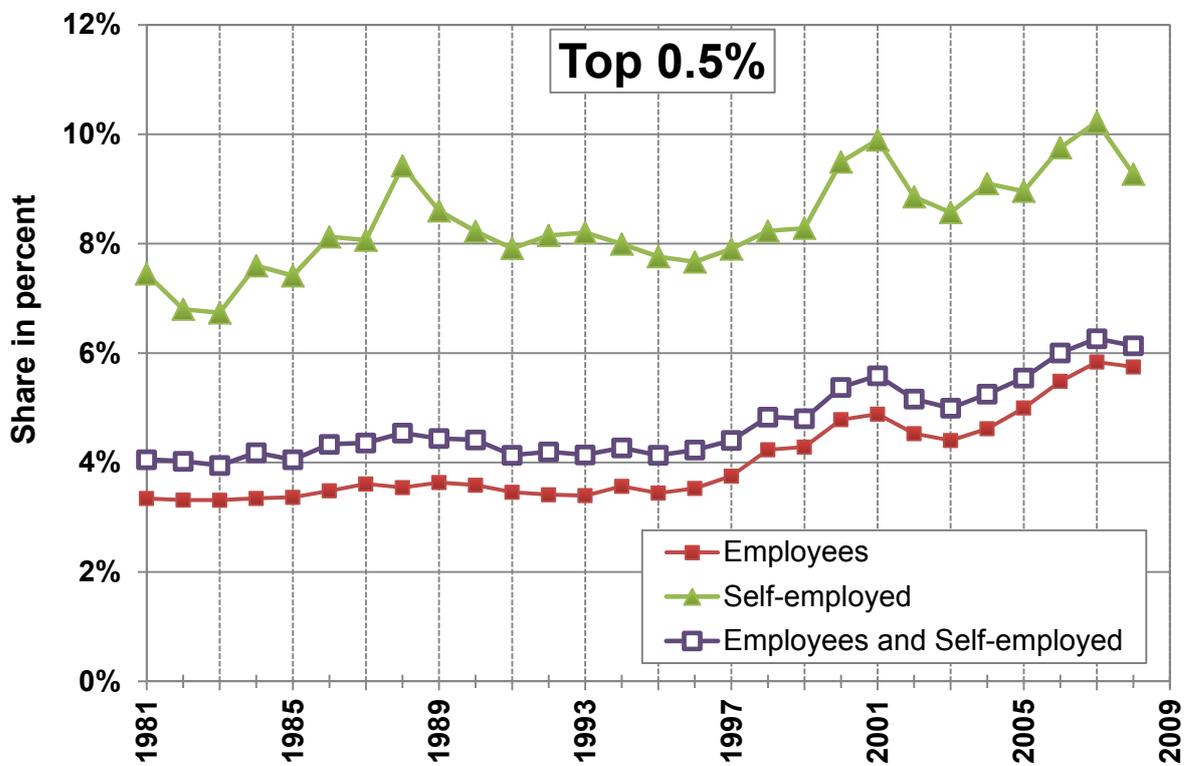


Fig. 6.ii) Top 0.5% income shares of employees and self-employed

Figure 7: Growth of Top Labor Income Shares

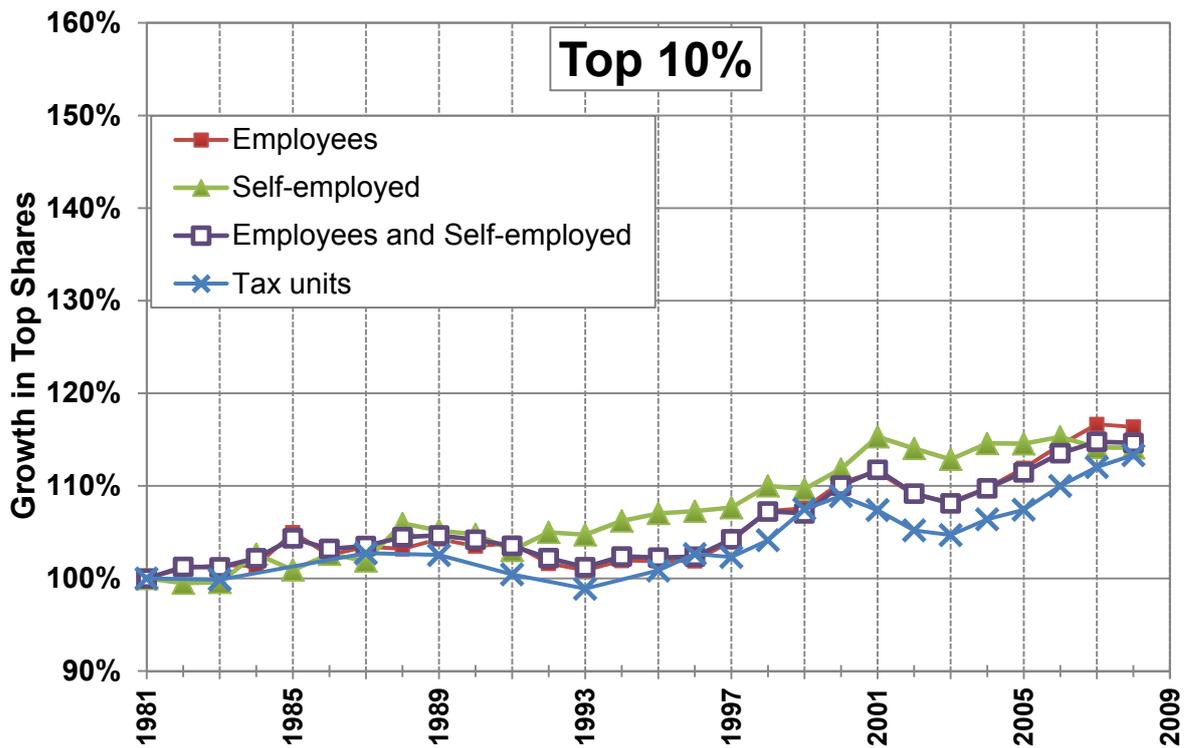


Fig. 7.i) Top 10% income share growth

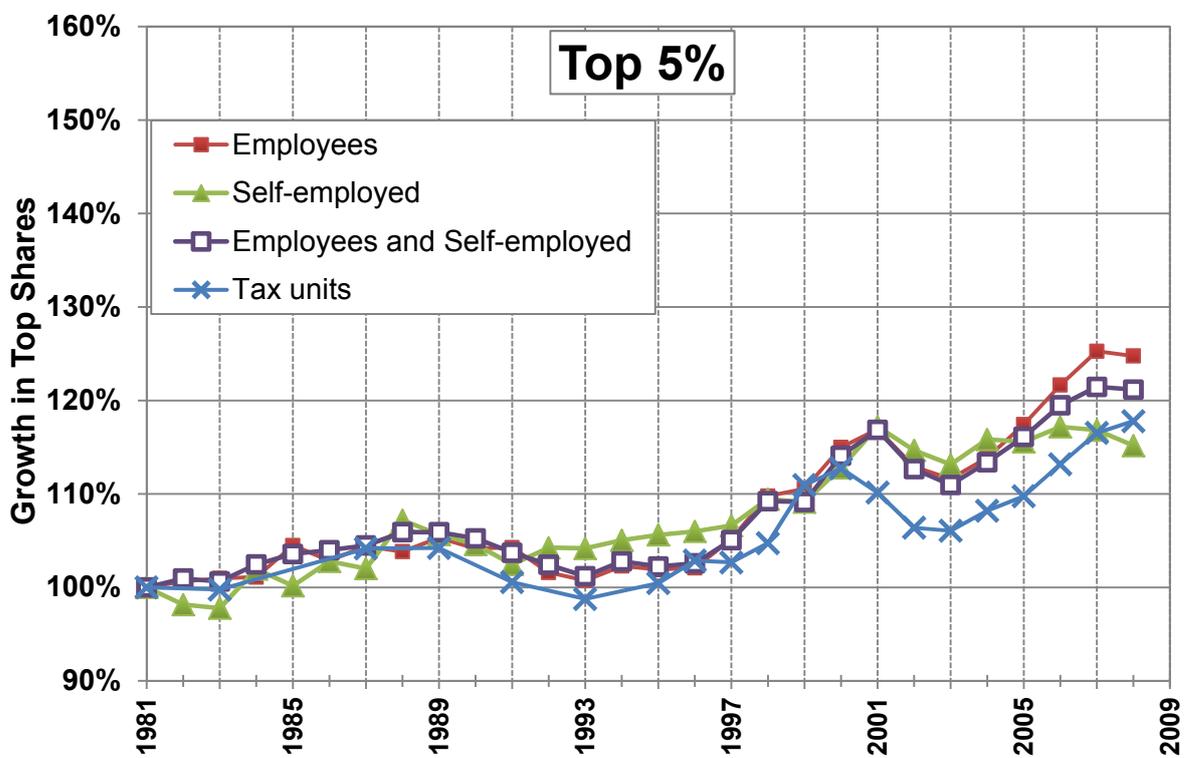


Fig. 7.ii) Top 5% income share growth

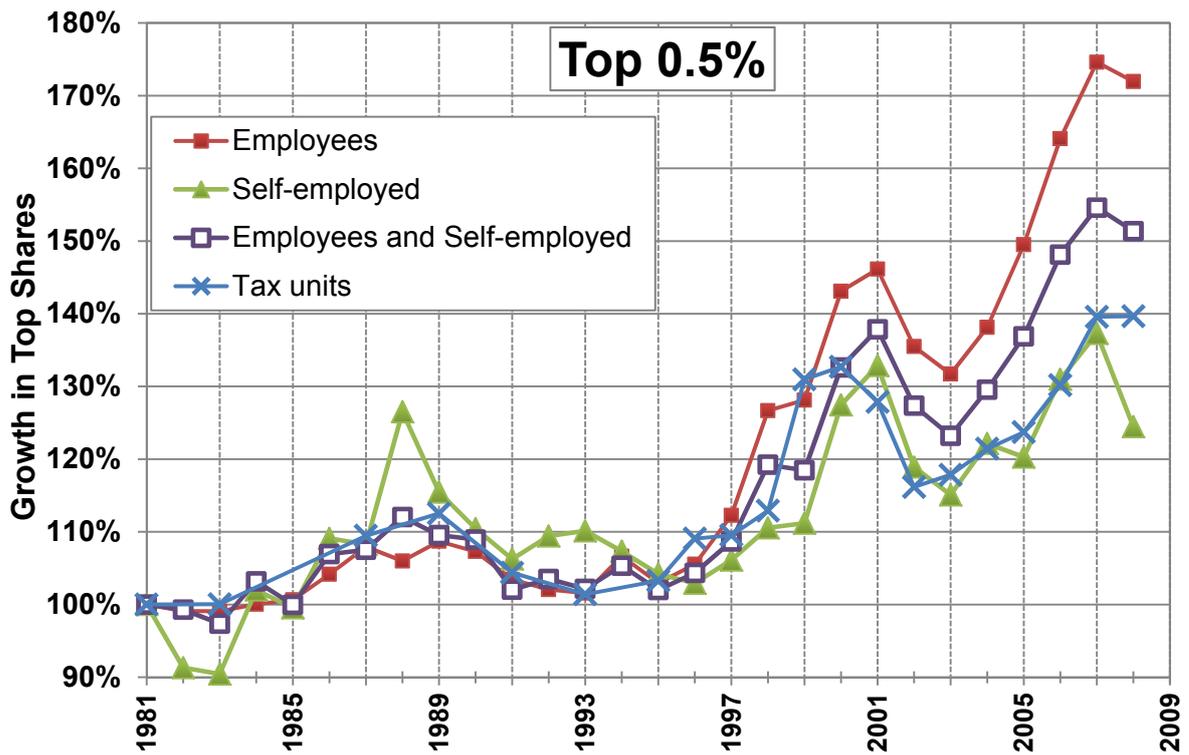


Fig. 7.iii) Top 0.5% income share growth

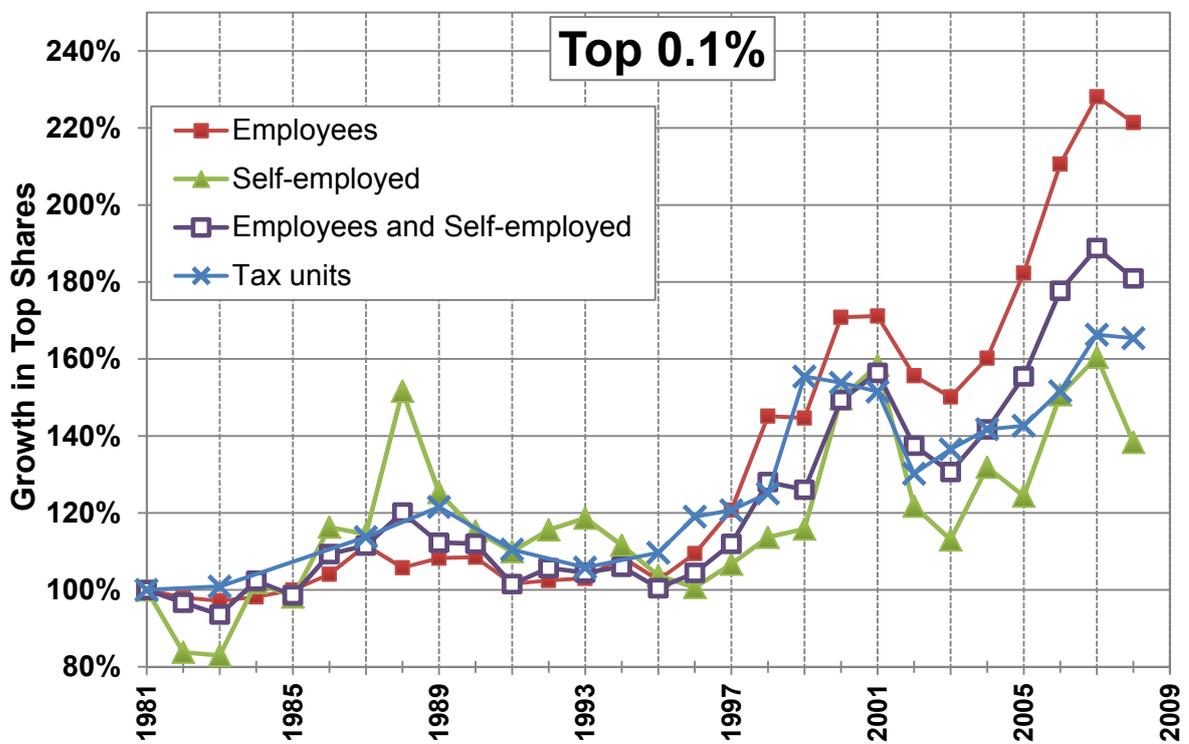


Fig. 7.iv) Top 0.1% income share growth

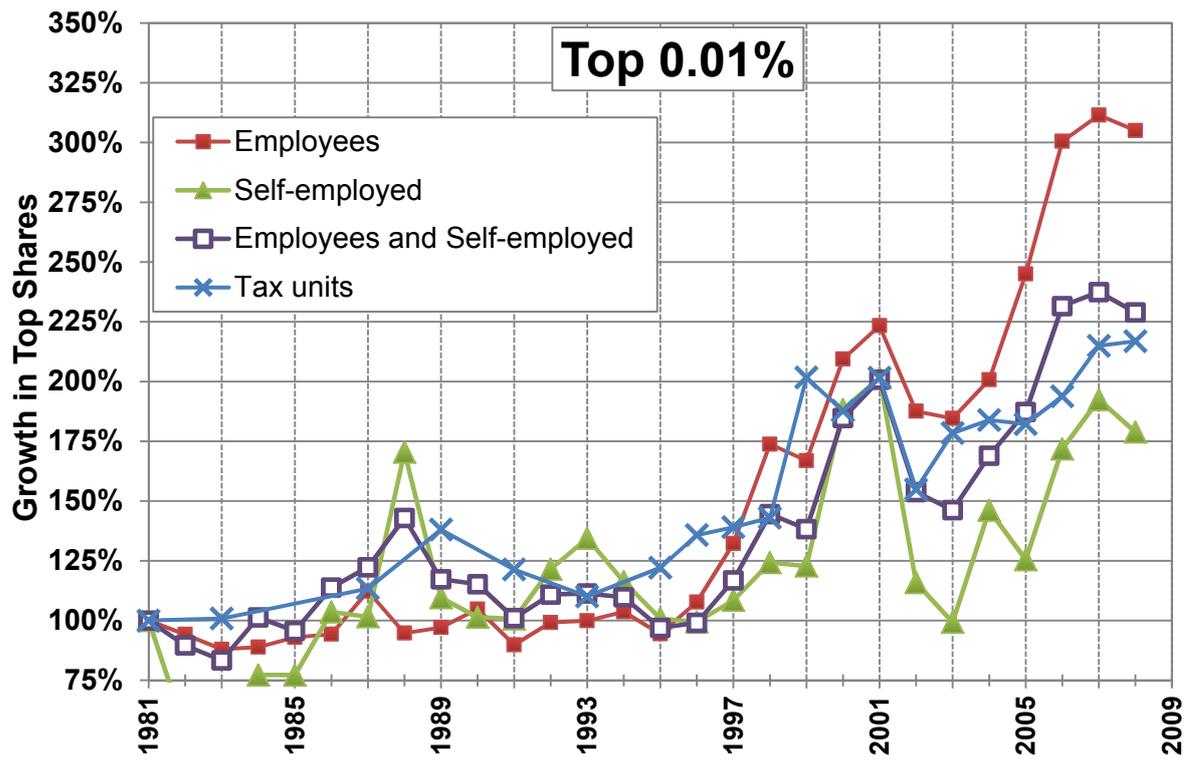


Fig. 7.v) Top 0.01% income share growth

E) Labor Incomes of Self-employed vs. Employed

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

$$P_{\alpha}(P_{\rho g}) = \frac{Y_{\rho g}}{Y} \frac{N}{N_g} \quad (7)$$

where $P_{\rho g}$ denotes the top percentile ρ of to 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 the total labor income. Figure 9 below shows the corresponding shares in total labor income for the top groups of self-employed corrected for their number 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 when compared to the self-employed.

Figure 9: Self-employed Top Income Shares with Respect to Total Labor Income

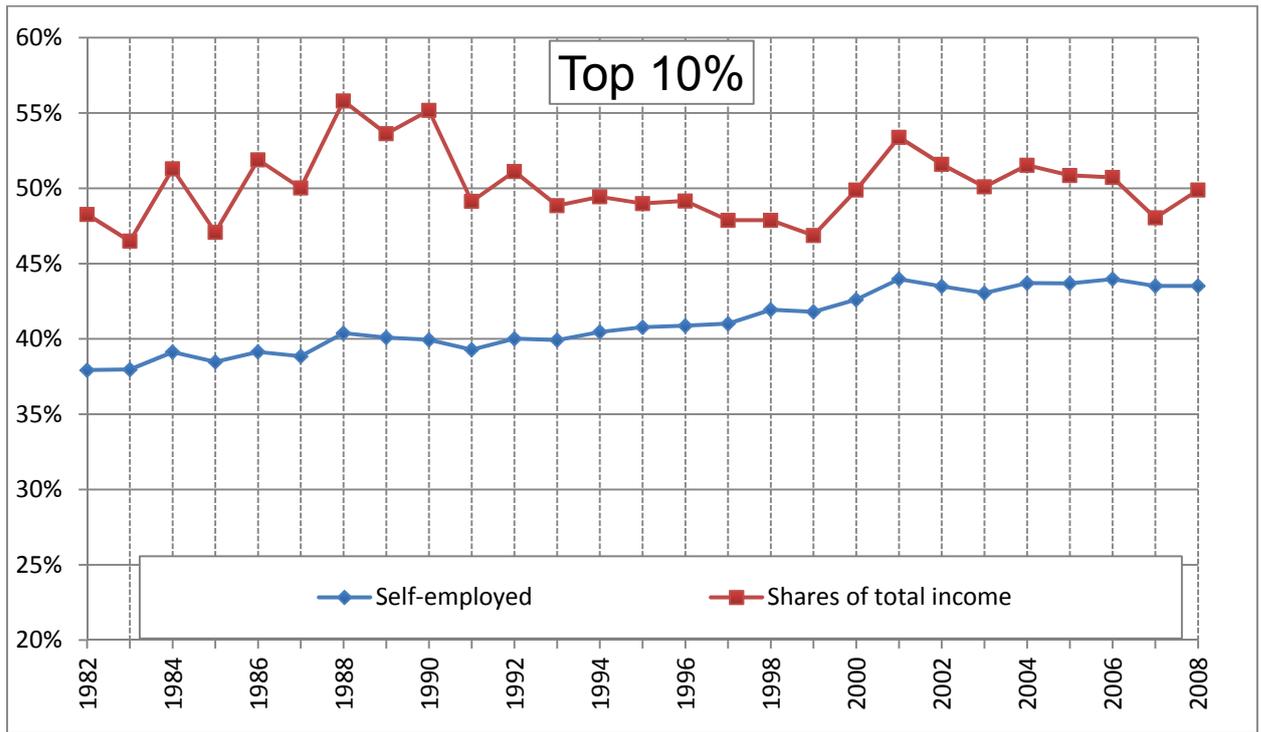


Figure 10.a) Top 10% share

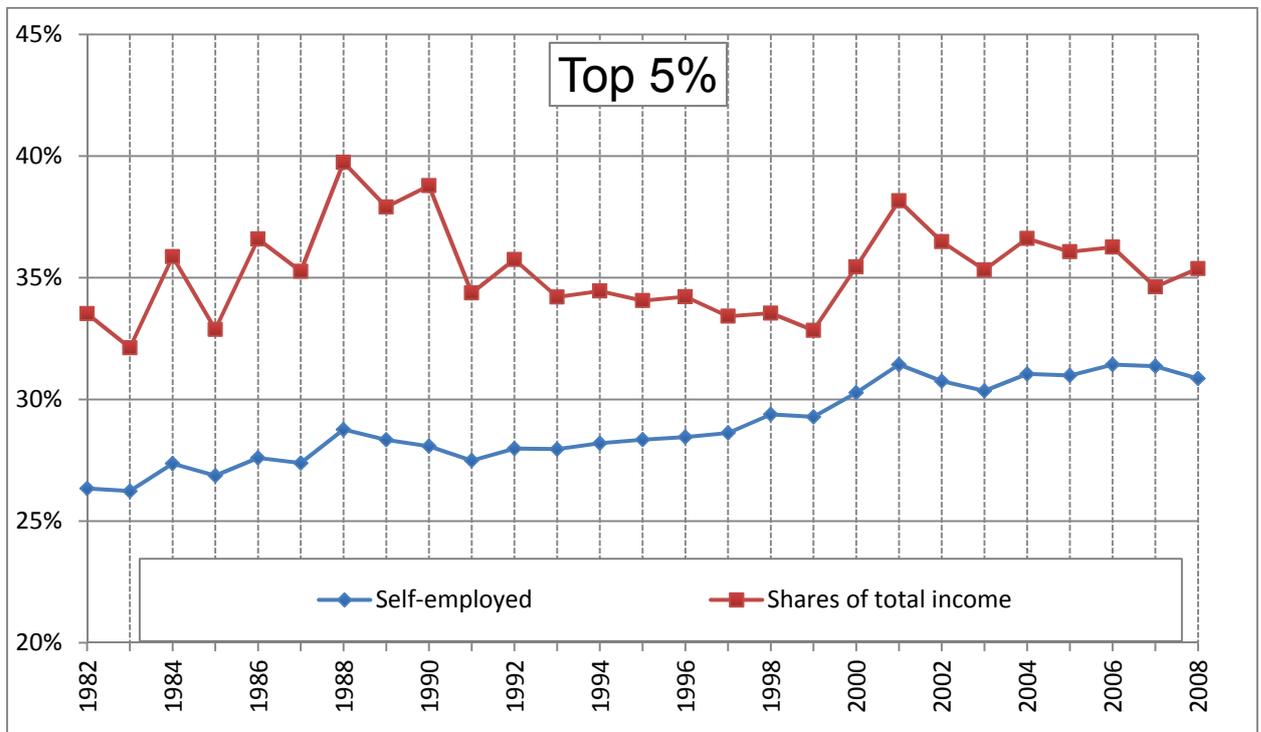


Figure 9.b) Top 5% share

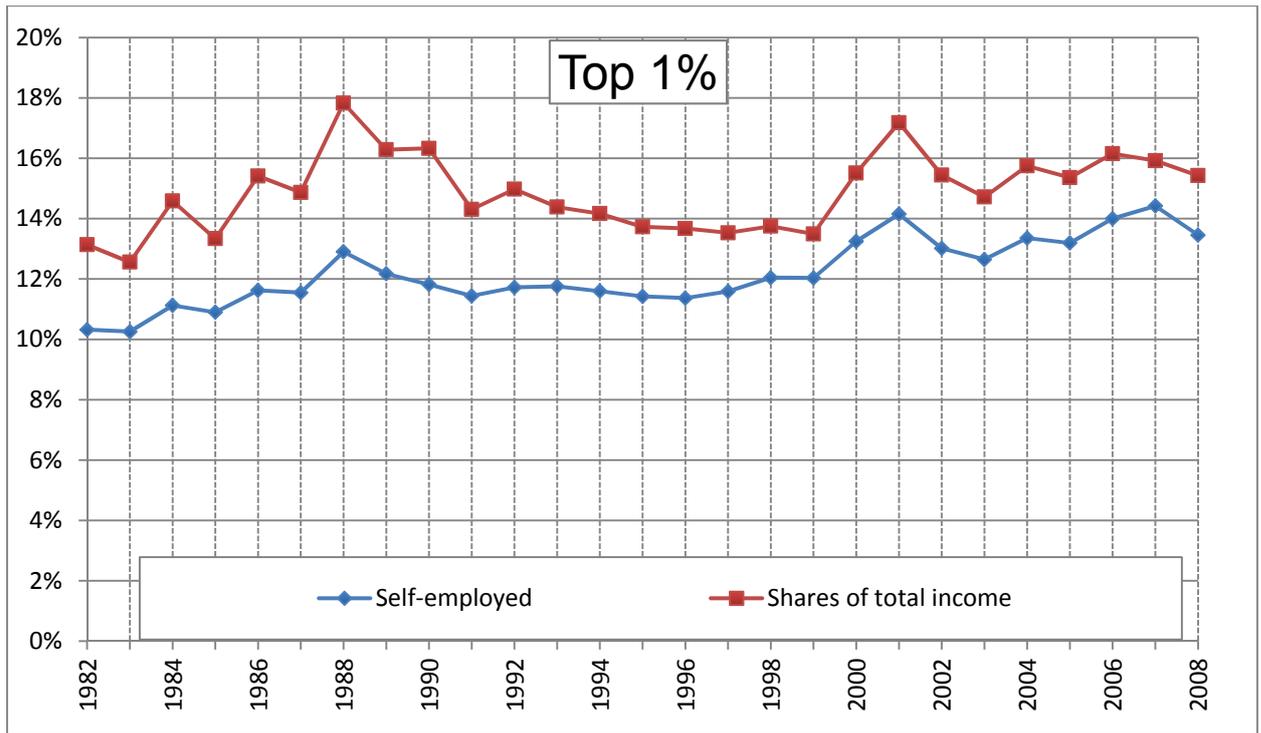


Figure 9.c) Top 1% share

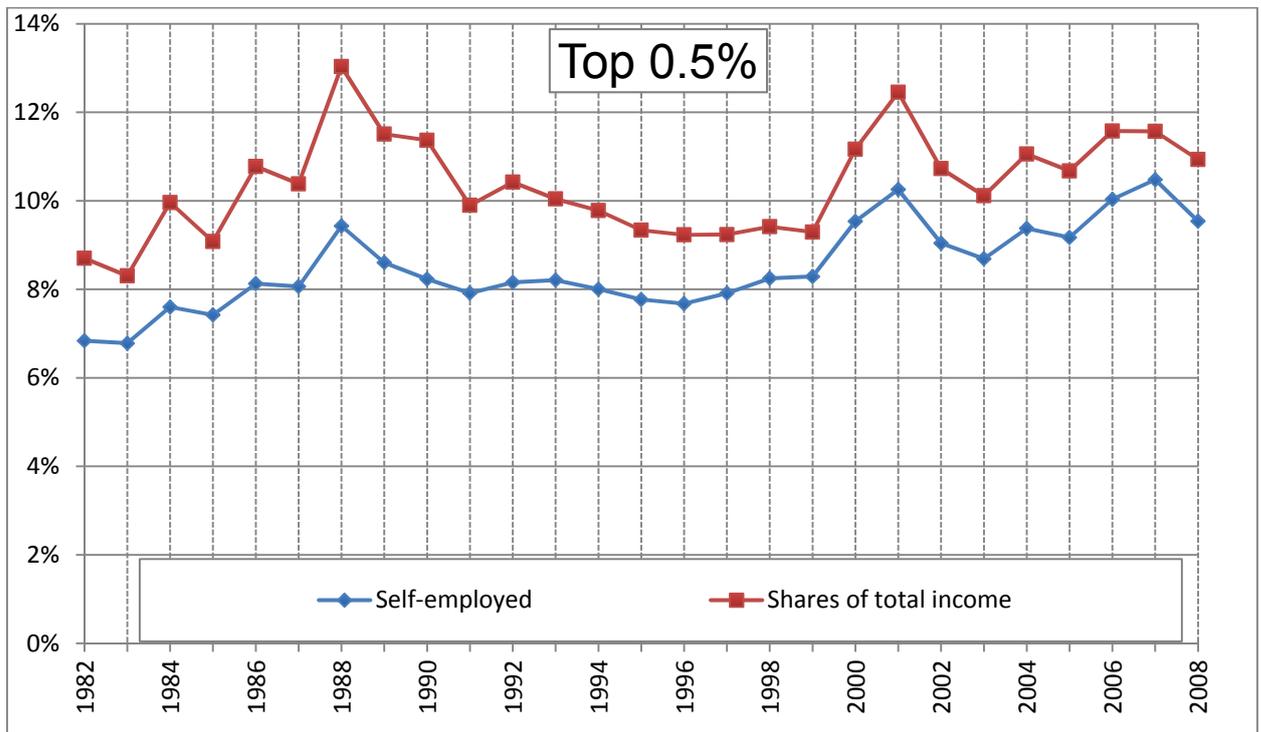


Figure 9.d) Top 0.5% share

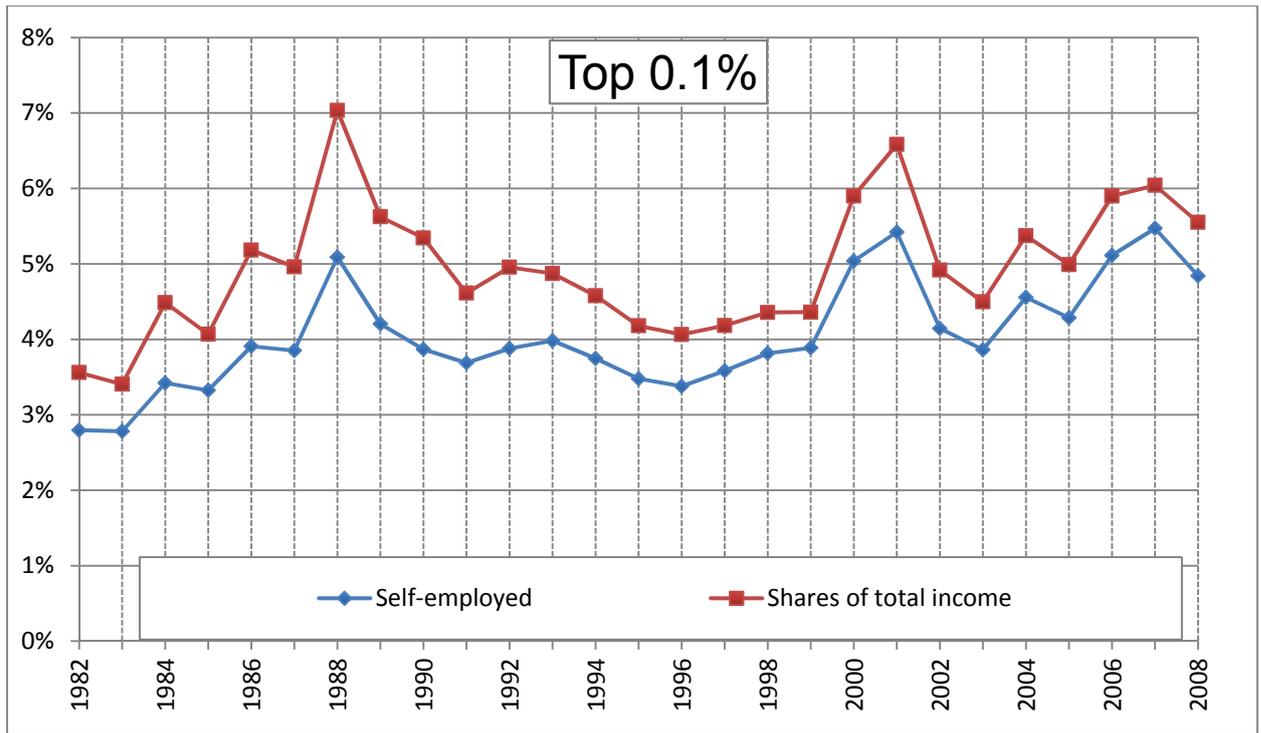


Figure 9.e) Top 0.1% share

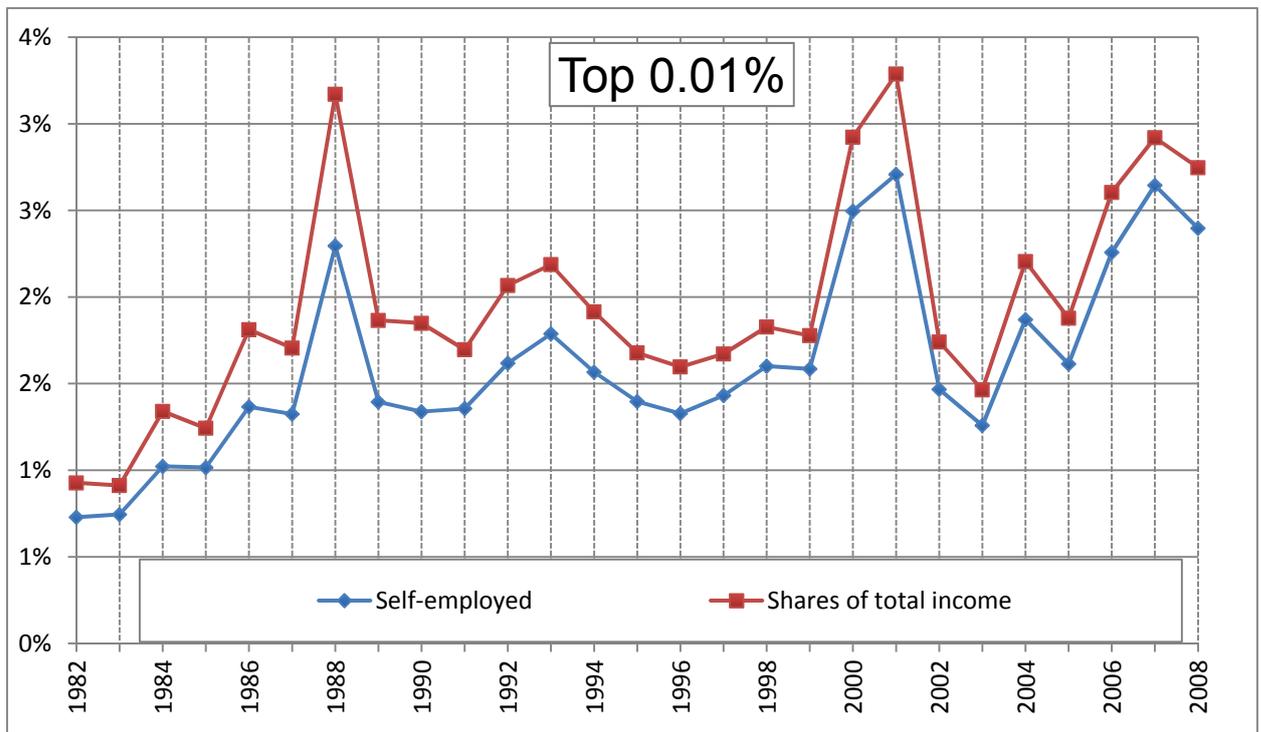


Figure 9.f) Top 0.01% share

Even though Figure 9 above made the shares comparable by normalizing them by the relative size of the group, the distributions itself are still not directly comparable. The threshold to

belong to the top 10% of employees was roughly 120'000 SFr. in 2008, while it was 158'000 SFr. to belong to the top 10% of self-employed. In order to make comparisons across the different income distributions, the population shares above any threshold amount (expressed in SFr.) 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% 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:

$$\alpha_g(T_\rho) = \left(\frac{k_{T,g}}{T_\rho}\right)^{\frac{b_{T,g}}{b_{T,g}-1}} \tag{8}$$

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

Figure 10: Percent of Employees above Top Self-employed Earnings Thresholds

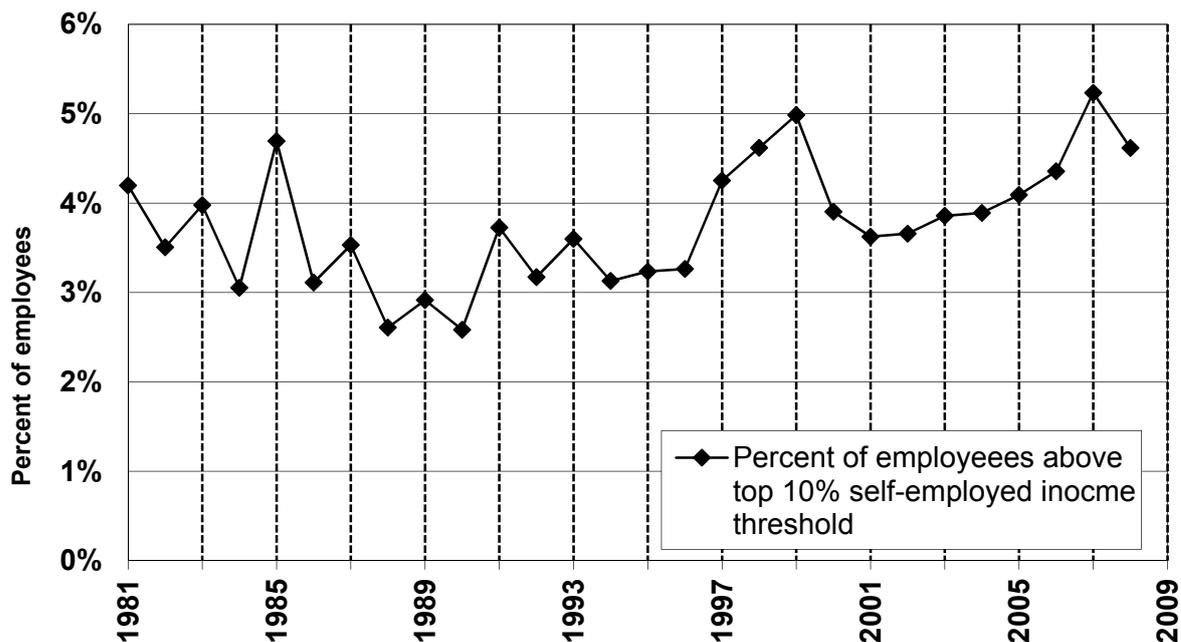


Fig. 10.a) Employees above top 10% self-employed income threshold

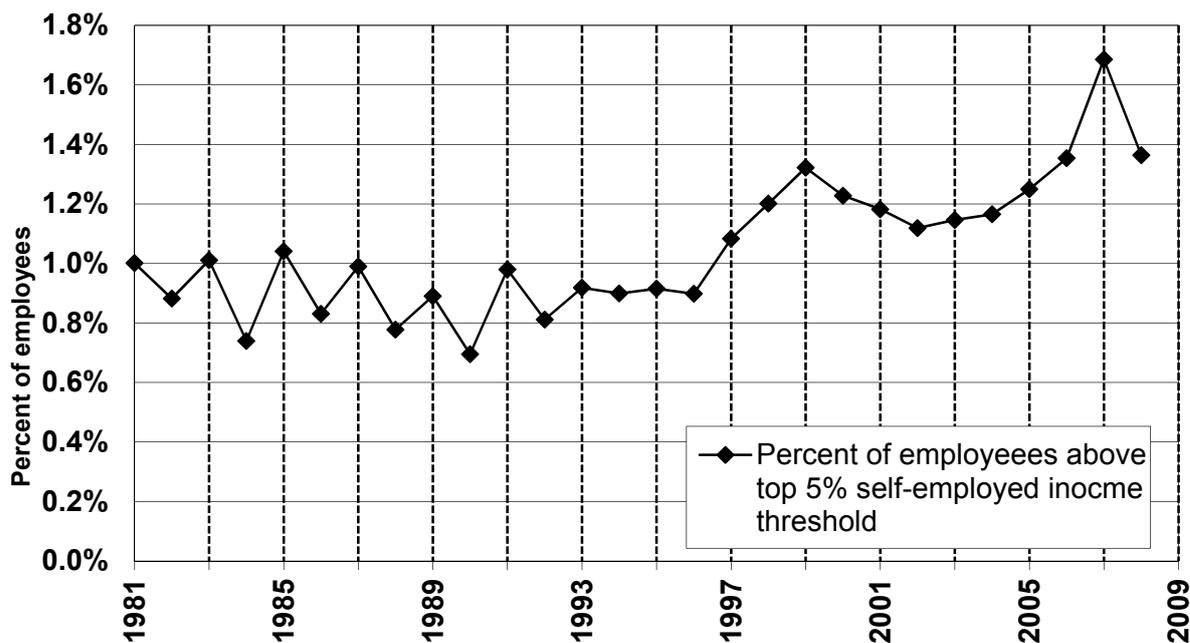


Fig. 10.b) Employees above top 5% self-employed income threshold

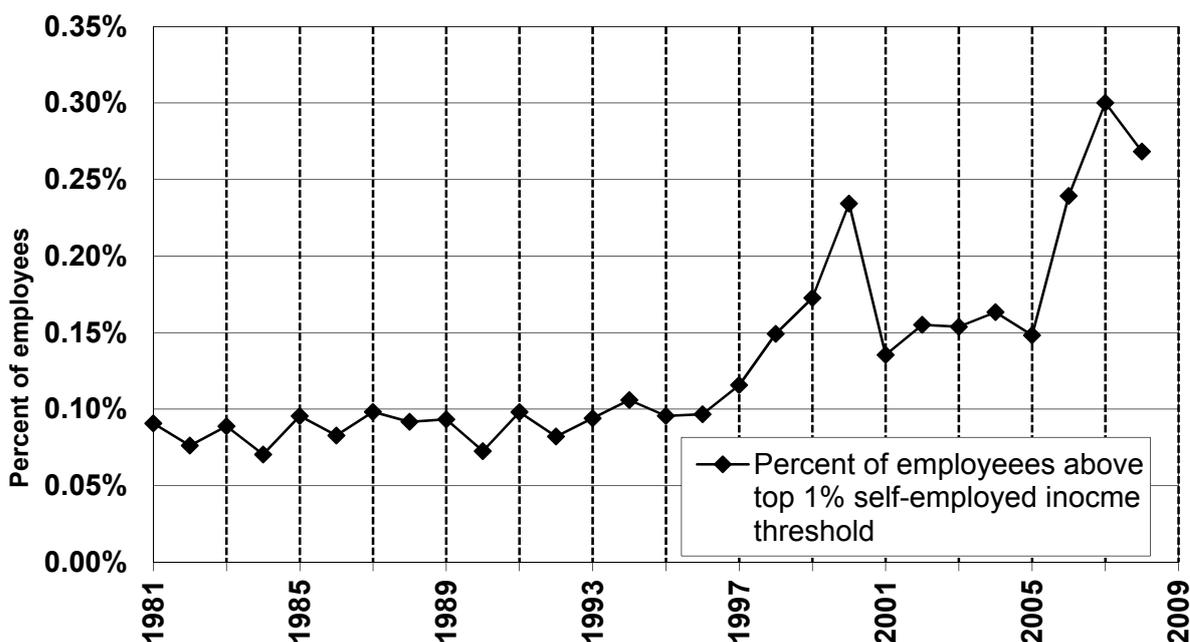


Fig. 10.c) Employees above top 1% self-employed income threshold

Figure 10 shows two things. First, the percentage of employees above the top 10%, 5% and 1% threshold of self-employed remained stable until the second half of the 1990s. After that, wages of employees at the top started to catch up with self-employed top earnings – even though it is far from being a full catch up, self-employed at the top still have higher earnings than employees. Second, we again see that these earnings at the top have become more vola-

tile. 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, top paid employees like CEO's will also bare 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 empirical literature showing that CEO's 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 era which was followed by a wave of liberalizations in many spheres (Pontusson, 2005). Related to this institutional view is a wide literature considering the effects of tax rates on top incomes. Piketty, Saez and Stantcheva (2011), present an overview of different effects from taxation on top incomes along with a very innovative model which includes bargaining responses along with standard supply-side and tax avoidance responses to taxation. Clearly, there is scope for further research in this area.