

# Online Appendix Part 8: Technical Notes on the Construction of Top Income Data Series

## The Swiss Income Tax Reform of 1995

Before 1995, taxes were assessed upon a two-years basis and the praenumerando method was applied for levying the federal income tax. Within this system, fiscal 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 taxation period (*Veranlagungsperiode* or *période de taxation*). So according to the praenumerando system, all incomes from the preceding two years constituted the basis for the tax liability arising in the next two-years fiscal period.<sup>27</sup> The notion praenumerando method refers to this fact that the assessment period and the fiscal period do not coincide under such a tax system, the assessment period precedes the fiscal period (Eidgenössische Steuerverwaltung ESTV, 2003). This implies that the incomes on which the taxes payable in fiscal period 1995/96 are based were realized in the assessment period 1993/94. The tax duty for a fiscal period was thus calculated from an estimated income stream based upon past income and unless income or living conditions changed substantially, taxes were only adapted to the new income situation in the next fiscal period.

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

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

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

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<sup>27</sup>Note that the use of the praenumerando method does not include the necessity to assess incomes on a two-years basis, a yearly basis would be possible as well under such a tax system.

taxation systems,<sup>28</sup> began in the 1980s. In 1990 the change to the postnumerando taxation with the one-year assessment basis was enacted with a transitional period of several years, during which each canton could choose when to adopt the new system.<sup>29</sup>

This cantonal freedom to choose the timing to switch to the new system is the reason why during the transitional period from 1995 to 2002, there is no uniform tax data published on the Swiss level but only data on the cantonal level is available. Table 8.1 shows the time schedule of the adoption of the new taxation method by canton. Basel Stadt 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.<sup>30</sup>

Table 8.1: Transition from praenumerando to postnumerando taxation by canton

1995	BS
1999	ZH, TG
2001	BE, LU, UR, SZ, OW, NW, GL, ZG, FR, SO, BL, SH, AR, AI, SG, GR, AG, NE, GE, JU
2003	TI, VD, VS

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

The tabulated tax statistics have remained stable over time so that the total number of tax units and total income are comparable over time. Nevertheless, attention has to be paid on the correct selection of these data. For the correct selection of the total of tax units, it has to be made sure that not only the normal cases but also the special cases (so-called *Sonderfälle* or *cas spéciaux*) are included. The latter include the high net wealth individuals taxed according to their expenditures (*Besteuerung nach dem Aufwand* or *imposition d'après la dépense*) and are highly relevant in the top income group.<sup>31</sup> 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

<sup>28</sup>Botschaft zum StHG sowie zum Bundesgesetz über die direkte Bundessteuer, DBG, BBl 1983 III 1ff.

<sup>29</sup>Bundesgesetz vom 14. Dezember 1990 über die direkte Bundessteuer (DBG; SR 642.11).

<sup>30</sup>For further information on these transitory provisions see Eidgenössische Steuerverwaltung ESTV (2003).

<sup>31</sup>Note that to be eligible for the expenditure-based taxation no labor income can be earned in Switzerland. As tax statistics do not differentiate between labor and capital income, the inclusion of these special cases makes sense.

included, as these are only listed for illustrative purposes.<sup>32</sup> They are not in fact separate tax units and including them in the total amount of tax units leads to double counting. Including them in years prior to the tax period 1989/90 does not make a big difference, as numbers are small. But as since 1990 occupational pension funds can be used to acquire real estate, the number of these cases increases remarkably. This is why the inclusion of capital payments as separate cases after 1990 leads to an over-estimate of the number of filing tax units by 2 to 3 percentage points.

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

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

## **Tax Units**

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

## **Tax Units and Incomes not Covered**

Individuals and incomes missing in the tax statistics are the reason why we need to estimate a total income denominator as well as the total number of tax units in order to construct the relative income shares. The statistics do only report cases that were actually taxed, i.e., when taxable income was high enough to excess the amount of exemption of the federal income tax. The schedule of the federal income tax is very progressive but with a low exemption level, therefore not many low-income tax units are missing.

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

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<sup>32</sup>In the publication by Dell *et al.* (2007) these cases are included in the total number of tax units.

### *Individuals Taxed at the Source*

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

Foreign residents with a temporary permit are required to fill a tax return ex post only if their total yearly income exceeds a certain threshold (around CHF 120 000 in 2012), in which case they will then be included in the tax statistics. As this threshold lies below the top 10% income threshold, this implies that these individuals and their incomes nevertheless do appear in the statistics. As for those taxed at the source but falling below this threshold, we can only make an educated guess about their incomes. We start assuming that the distribution of incomes for legal foreign residents should be somewhat similar to the one of permanent residents (although one could expect some sort of wage discrimination against immigrants in some industries). Then there are the mentioned income earners at the top, which are not taxed at the source while special groups such as foreign students are subject to taxation at the source. The latter typically earning below-average incomes and the former having high incomes by definition, leaves us with a pool of below-average income earners not covered in the tax statistics. With regard to the extent to which taxation at the source is present, data from several cantons show a mixed picture, depending mainly on the geographical location of the canton. In all the cantons, however the number of individuals taxed at the source has been increasing over time, especially since the mid 1990s. By 2010 it reached over 20% of the population in some of the cantons exposed most to cross-border commuters, such as the cantons Schaffhausen (SH) and Basel-Country (BL). In Zurich (ZH) and Basel-Stadt (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*

International organizations' staff based in Switzerland is exempted totally or partially from personal income taxation.<sup>33</sup> No less than 24 organizations residing in Switzerland benefit from tax exemptions for their whole or part of their staff, all of them except for two located in Geneva (GE). Geneva does indeed have the lowest rate of filers, reaching an average of only 76% compared to the Swiss average of 86% for the period covered, reflecting the high percentage of residents who are not subject to personal income tax.

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<sup>33</sup>At some of the organizations benefiting from a special treatment, Swiss citizens are not subject to the tax exemption.

### *True Non-Filers*

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

### *Individuals Evading Taxes*

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

## **Estimation of Total Income**

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

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

In addition to estimate total personal income taxed one would like to relate these values to another, exogenous measure of total income in the economy, such as net national income reported in the national accounts. The ratio of reported tax income to the net national income starts at around 72% 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 can at least partly be explained by tax evasion.

## **Estimation of Total Tax Units in the Country or Canton**

To calculate the top income groups as percentage shares accurately, the same argument as for the total income applies: as not all tax units are contained in the tax statistics

we need to calculate the total of tax units in the country. These have to be constructed either from census data or register data.

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

For the present study, a slightly different approach is adopted. As for the time span of our study register data on the federal as well as on the cantonal level are available on a yearly basis, we make use of this detailed information. This has the advantage, that migration shocks and population trends are better represented in the data. Especially migration shocks remain probably disregarded when interpolating linearly over a time span of 10 years. Another reason why we do not follow the linear interpolation approach between census years is of a practical nature: the decennial census has been abolished after 2000 and is now replaced by a representative population sample combined with register data. Furthermore, the use of register data makes it easy to account for the reduction of the legal age from 20 to 18 years by January 1 of 1996. This reduction of the legal age led to an increase of the total amount of tax units in the country and by not accounting for this change one would overestimate the fraction of tax filers. So up to 1995 our total tax units refer to the total adult population minus half the married individuals aged 20 and above, while from 1996 onwards the same population groups but aged 18 and above are used.

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

the estimation of top income shares.

### Special Notes on the Calculations at Cantonal Level

In principle, wherever possible the same procedures were carried out on cantonal level as on the Swiss level. Yet the lack of data availability makes it sometimes necessary to adopt a slightly different method. For the total number of tax units on cantonal level, the number of married individuals is linearly interpolated, as no register data on the married individuals by age are available on cantonal level. A comparison of interpolated vs. actual yearly register data on the federal level shows that the interpolated series for the married individuals lead to estimates below the values reported from the registers (see above). Therefore we slightly overestimate the total of tax units and the fraction of non-filers on cantonal level, which in turn has a somewhat dampening effect on the total income denominators on cantonal level.

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

### Estimation of the top income shares using Pareto interpolation

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

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

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

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

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

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

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

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

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

### Estimation of Swiss Top Shares for the Missing Years

In order to estimate the values for the missing years we extrapolate them from the existing cantonal series using linear fixed effects OLS estimation. In order to make use of the maximum number of data points available, several linear regressions are carried out, always regressing the series for Switzerland on those of one or several regions as defined above. Table 8.2 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 8.2 indicates the years for which each model was used to obtain the extrapolated values.

Table 8.2: Regression models used for estimation of Swiss top income shares

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

Dependent variable: top p percent group's income share at federal level