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**Conference Paper**

## An integrated approach for top-corrected Ginis

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# Top-corrected Ginis

March 1, 2016

## Abstract

Household survey data provide a rich information set on income, household context and demographic variables, but tend to under-report incomes at the very top of the distribution. Tax record data offer more precise information on top incomes at the expense of household context details and incomes of non-filers at the bottom of the distribution. We combine the benefits of the two data sources to improve survey-based Gini coefficients in two ways. First, we incorporate top income share estimates based on tax records with survey-based Ginis for the rest of the population following Atkinson (2007) and Alvaredo (2011). Second, we impute top fractile's income in EU-SILC survey data with the Pareto distribution coefficients obtained from tax records and then calculate the Gini coefficient. We find that both approaches produce rather similar results. The gap between unadjusted and top-corrected Ginis is highest in countries that rely exclusively on survey data as compared to purely register or partly register countries.

**JEL Classification:** D31, H2

**Keywords:** Gini coefficient, Top income shares, Survey data, Tax record data, Pareto distribution

# 1 Introduction

Has income inequality in European countries increased in recent years? The answer is far from conclusive, if we look at different data sources and different inequality measures. For the United States, a growing number of studies investigates these differences by reconciling estimates from administrative and survey data (Burkhauser et al.; 2012; Armour et al.; 2013; Bricker et al.; 2015) or adjusting survey-based Gini coefficients with tax data-based top income shares (Atkinson et al.; 2011; Alvaredo; 2011).

A well-known and intensively discussed reason for diverging trends is the inequality measure's sensitivity to changes in the top, middle or bottom of the income distribution. Whereas the top income share literature has produced evidence for rising income inequality in many industrialized countries,<sup>1</sup> documented trends for Gini coefficients are more ambiguous. Even though survey-based Gini coefficients seem to correlate with tax record-based top income shares in the long-run (Leigh; 2007; Roine and Waldenström; 2014), the revealed trends diverge when looking at particular year-to-year changes. If most of the changes occurred in the top of the distribution, than the more top-sensitive index – in this case top income shares – shows the bigger inequality increase. In contrast, Gini coefficients are more sensitive to changes in the middle of the distribution.

Another reason for diverging trends is much less investigated: the different nature of the data. Whereas household surveys apply a comprehensive income concept, tax data contain taxable incomes. Whereas incomes are aggregated at the household level in survey data, the income-receiving unit is the tax unit in tax data. If households pool their income, the narrower sharing unit of a tax unit mechanically produces higher inequality. Furthermore, survey and tax data are affected differently by factors which may change over time such as survey response and reporting behavior, tax filing behavior as well as economic, demographic and legislative changes over

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<sup>1</sup>The top incomes literature has produced internationally comparable measures for income concentration at the top of the income distribution based on taxable incomes received by tax units which are available for long periods for many countries of the world. Piketty (2001, 2003) revived the method of Kuznets to derive top income shares from income tax data. Since then, an international effort put together long-run top income share series for more than 25 countries in the World Wealth and Income Database (WID) online available at <http://www.wid.world/>.

time. Undercoverage and underreporting of top incomes may produce a downward-bias for survey-based inequality measures. Tax filing behavior is sensitive to changes in the income tax law creating downward- or upward-bias before or during reform years. Top income earners tend to benefit disproportionately from economic growth (Roine et al.; 2009), which in turn is reflected more by tax data than by survey data. An increasing number of unmarried couples in countries with joint taxation may increase a downward- or upward-bias in tax-based inequality measures depending on the degree of assortative mating.

To get a more complete picture of recent inequality trends, new methods are needed to combine different data sources in order to obtain composite inequality measures. Bach et al. (2009) integrate both survey and tax record micro data to obtain Gini coefficients over the whole spectrum of the population in Germany. However, data access to tax record microdata is limited and difficult to obtain in many countries. Moreover, record linkage is often not possible. Our contribution is three-fold: First, we reconcile German survey and tax data and examine the extent to which differences in top income share estimates from household surveys and tax returns arise from differences in income concepts and observation units or from the ability to capture top incomes. We find that the income share accruing to the bottom 9% of the top decile is very similar for reconciled survey and tax data, but survey data exhibit substantially lower income shares of the top 1%. Second, we show that a decomposition approach for top-corrected Gini coefficients (Atkinson; 2007; Alvaredo; 2011) and a new top income imputation approach produce rather similar Gini coefficients for Germany regarding both level and trend. For the imputation approach, we estimate parameters of the Pareto distribution from top income shares and then replace the top of the survey income distribution by Pareto-imputed incomes.<sup>2</sup> Third, we apply the top income imputation approach to EU-SILC data and estimate top-corrected Gini coefficients for European countries where information on the shape of the top of the income distribution is available in the World Wealth and Income Database (WID). Our approach relies on information on top

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<sup>2</sup>Another example of an imputation approach can be found in Lakner and Milanovic (2013). To obtain a global Gini coefficient, they distribute the gap between national accounts and survey means over the top decile according to a fitted Pareto distribution.

income shares and income thresholds for certain top fractiles such that tax record microdata are not needed.

## 2 Reconciling household survey and income tax return data

Two major differences between household survey data and income tax return data call for reconciling the data before comparing inequality measures across data sources. First, survey data and administrative data differ in what is counted as income. Second, data discord in the definition of the income receiving unit. Household survey based inequality measures include incomes collected on the questionnaires before and after taxes and transfers. Incomes aggregated at the household level are then usually adjusted to differences in households' needs using an equivalence scale. Income tax return data document taxable incomes before taxes and transfers received by the tax unit which may be the individual or a married couple depending on the country's income tax legislation.

For the decomposition approach, we reconcile German SOEP data<sup>3</sup> and income tax records. Using microsimulation we construct tax units and total amount of income according to the governing income tax law in each year from 2001 to 2012. The opposite direction is not possible since tax records offer no information on household context such that tax units cannot be summed up to households. One household with a married couple in SOEP data is treated as one unit and one household with an unmarried couple as two units. The income concept used in the income tax statistics is total income (*Gesamtbetrag der Einkünfte*, Section 2 of the German Income Tax Act (*Einkommensteuergesetz*)), which is the sum of the seven income categories (agriculture and forestry, business, self-employment, employment, capital income, renting and leasing, other), plus tax-relevant capital gains less income type-specific income-related expenses, savings allowances, and losses. Old-age lump-sum allowance and exemptions for single parents are deducted. Since some

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<sup>3</sup>For further details on German SOEP data see Wagner et al. (2007) and Gerstorff and Schupp (2015).

large tax-deductible amounts, such as special expenses for social security contributions, are not deducted at that stage, the total amount of income is considerably higher for most tax households than the eventual taxable income to which the tax rate is applied. The total amount of income tax is modeled in the SOEP data by deducting the allowances from the gross income of the tax unit and only adding the taxable share of the pension income. It should be noted, however, that, e.g., income from self-employment is recorded differently in both sets of data and therefore the total amount of income can only be simulated approximately in the SOEP data.

Parameters of the Pareto distribution which we need for both the decomposition and the imputation approach are taken from the WID. The WID offers long-run series of top income shares for a large number of countries, including many EU countries such as France, Germany, Italy, Ireland, Spain, Sweden and United Kingdom. The top income share estimates are used to derive the Pareto coefficient  $\alpha$  describing the shape of the very top of the income distribution by country and year.

### **3 Inequality measures in income tax return and survey data in Germany**

We first compare the share of total income accruing to the top of the income distribution according to household survey data and income tax records. The observation unit is the tax unit and the income concept is total taxable income in both data sources. Figure 1 shows how income accruing to the top decile in Germany is split among to bottom half (10-5%), the upper 4% (5-1%) and the top 1%. Four findings stand out: First, the estimates of the income share of the top 10-5% and top 5-1% are of similar magnitude in both data sources. In contrast, there are large quantitative differences between SOEP and tax data for the top 1%. Tax data measure 4 to 6 %-points higher income shares for the top 1%. This does not come as a surprise as average incomes of the top 1% in the two data sources differ by more than 100.000 Euros. The first two findings are in line with Burkhauser et al. (2012) for the US who compare top income shares based on CPS data and on tax data. Third, both data sources document a trend of rising income concentration over the period. But

whereas the tax data show a steep increase until 2008, particularly for the top 1%, and then a stable path after the crisis in 2009, SOEP data indicate a stable development since 2005. Fourth, the income share of the bottom half of the top decile is higher in the SOEP data than in the tax records. This indicates a potential middle class bias in the SOEP data.

[Figure 1 about here]

Cross-walking from income tax data definitions to survey data definitions results in a decline in inequality measured by the Gini coefficient as shown by Figure 2. The Gini based on tax income per tax unit exhibits the highest level of inequality. If we aggregate tax income on the household level (unadjusted tax income (by hh unit)), we obtain Gini coefficient that is about 5%-points lower. Considering gross household income instead of tax income yields another Gini reduction of about 4%-points. Finally, equalizing gross household income to account for differences in needs depending on the household size the Gini declines by another 2%-points. All in all, the definitional differences do not seem to affect the inequality trends observed over time. One should note, however, that data are not adjusted for missing top incomes, yet.

[Figure 2 about here]

## 4 Two Approaches for Top-corrected Gini coefficients

We employ two approaches to derive top-corrected Gini coefficients. First, we incorporate top income share estimates based on tax records with survey-based Ginis for the rest of the population. Second, we impute top fractile's income in survey data with the Pareto distribution coefficients obtained from tax records and then calculate the Gini coefficient.

The approach derived by Atkinson (2007) and extended by Alvaredo (2011) is based on the Gini decomposition for two non-overlapping subgroups by Dagum (1997)

$$G = \sum_{j=1}^k G_{jj} S_j + \sum_{j=1}^k \sum_{h=1}^{j-1} G_{jh} (P_j S_h + P_h S_j), \quad (1)$$

where  $P_j$  is the population share of group  $j$  and  $S_j$  is the income share of group  $j$ . Assuming that the population can be divided into two groups – the top covered by tax records (e.g., the top 1%) and the rest of the population covered by survey data – we can rearrange Eq. 1 using the notation from Alvaredo (2011) to

$$G = G^{**} P S + G^* (1 - P)(1 - S) + S - P, \quad (2)$$

where  $P$  and  $S$  are population and income share of the top, respectively, and  $1 - P$  and  $1 - S$  are population and income share of the rest of the population. Under the assumption that incomes at the top are Pareto distribution, we can compute the Gini of the top as  $G^{**} = \frac{1}{2\alpha - 1}$ , where  $\alpha$  is the Pareto coefficient obtained from the tax data.

With survey data we can ”cross-walk” from survey to tax data income definitions and income-receiving units. Since the data requirement is large and a microsimulation model incorporating frequent changes of the tax law needs to be at hand, we restrict the first approach to German SOEP data.

Our second approach replaces incomes at the top of the survey income distribution with imputed incomes building on the assumption that top incomes are Pareto distributed. A nice feature of the Pareto distribution is its small number of parameters that need to be estimated. The Pareto distribution function can be written as follows

$$1 - F(y) = \left( \frac{k}{y} \right)^\alpha, \quad (3)$$

where  $\alpha$  is the Pareto coefficient and  $k$  is the income threshold above which incomes are Pareto distributed. We estimate the Pareto coefficient  $\alpha$  from the share of a top group  $S_i$  in total income of the top group  $S_j$  using top income shares of the WID as



$$\alpha = \frac{1}{\left(1 - \frac{\log(S_j/S_i)}{\log(P_j/P_i)}\right)}. \quad (4)$$

Empirically,  $\alpha$  increases from the middle of the distribution to the top. So we estimate  $\alpha$  for different share ratios. Threshold  $k$  for the respective fractiles is then obtained from rearranging Eq. 3. Our results for  $\alpha$  and  $k$  are presented in Appendix A.9.<sup>4</sup> We then replace the top 1% incomes observed in the survey data with incomes following the Pareto distribution characterized by our estimated parameters. We use the estimated  $\alpha$  for  $P_i = 0.1\%$  and  $P_j = 1\%$ . Our estimates for  $\alpha$  range between 1.53 and 1.7 in Germany. First, it seems reasonable to calculate the  $\alpha$  over the upper part of the distribution which is less well represented in survey data as shown in Figure 1. Additionally, we have tested alternative combinations.<sup>5</sup> The larger the population group, the higher is  $\alpha$  and the lower are shares and thresholds in comparison to the tax data.

If one plots  $\log(1 - F(y))$  against  $\log(y)$ , one obtains a straight line with the slope  $-\alpha$  if incomes are Pareto distributed. The smaller  $\alpha$  (the flatter the line), the more unequal the income distribution. Figure 3 shows  $\log(1 - F(y))$  plotted against  $\log(y)$  for both original SOEP data and SOEP data with Pareto imputed incomes for the top 1%. Figure 3 shows replacing top incomes with Pareto imputed incomes generates a more unequal income distribution reflected by the flatter curve than original SOEP incomes. If we would estimate Pareto parameters from SOEP data, we would therefore underestimate the tail of the income distribution under the assumption that tax data provide a more accurate picture of the very top. In most of the years, original SOEP top incomes do not seem to follow a Pareto distribution. However, in 2002 and 2006 we obtain rather straight lines from original SOEP incomes.

[Figure 3 about here]

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<sup>4</sup>See Atkinson (2007) for the derivation of Eq. 4.

<sup>5</sup>Appendix Figure A.4 shows that the  $\alpha$  estimated for  $P_i = 0.1\%$  and  $P_j = 1\%$  produces the best fit of the top 1% income share. Using  $\alpha$  estimated for  $P_i = 1\%$  and  $P_j = 5\%$  or  $\alpha$  estimated for  $P_i = 1\%$  and  $P_j = 10\%$  we obtain substantially lower share of income accruing to the top 1% in comparison to income tax data. Additionally,  $\alpha$  estimated for  $P_i = 0.1\%$  and  $P_j = 1\%$  yields the best fit for the income share of the lower half of the upper decile (see Appendix Figure A.2).

Figure 4 shows the Kernel density for the original and the imputed income distribution. The densities cross for values of log income between 12 and 13 which roughly equals income levels between 160.000 and 440.000 Euro. This means that our imputation approach creates a higher density above the intersection.

[Figure 4 about here]

## 5 Inequality Trends According to Gini Coefficients

Top-corrected Gini coefficients in Germany are about 2%-points higher than Ginis based on unadjusted tax income. Furthermore, top-corrected Ginis show a continuous increase in inequality between 2005 and 2008. During this time incomes of the top 1% grew particularly rapidly which is not captured by survey data where this group is underrepresented. All in all, we find that both correction approaches produce rather similar levels and trends of income inequality measured by the Gini coefficient as shown in Figure 5. The discrepancy in 2007 and 2008 can be explained by comparably lower average incomes in the SOEP beneath the top percentile where we impute incomes. In 2007 and 2008, SOEP data show a significantly lower income share of the lower 4% of the top 5% than tax data as presented in the middle graph of Figure 1. In the preceding years, shares in both data sources did not significantly differ from each other. After 2009, we are lacking income thresholds from tax data and, therefore, use income thresholds from SOEP data to impute top incomes. This explains the large gap between the two approaches after 2009.

[Figure 5 about here]

Having tested the performance of both approaches for Germany, we then apply the second approach to other European countries where both EU-SILC survey data and top income shares are available. Using the top income shares and income thresholds documented in the WID<sup>6</sup> we can estimate the Pareto parameters  $\alpha$  and

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<sup>6</sup>See Appendix Figure A.5 for income shares of the top 1% in European countries as provided by the WID.

$k$  and then replace the top 1% of the country-specific income distribution with Pareto imputed incomes.

Figure 6 shows trends of Gini coefficients for gross household income in nine countries: Germany, Spain, Italy, Denmark, Norway, Sweden, Switzerland, France and United Kingdom. Income inequality increases in all countries when imputing top incomes except Italy. Indeed, Italian EU-SILC data strongly oversample rich households in comparison to other European countries (Törmälehto; 2014). Interestingly, the gap between original EU-SILC incomes and imputed top incomes is largest in Germany, where EU-SILC is based on survey data only. All other countries (except UK) use register data information either exclusively or at least partly providing a better picture of the top of the distribution.<sup>7</sup> The difference between original and imputed income Ginis is almost negligible in register countries like Norway and Sweden. The rapid increase in Norway's top-corrected Gini in 2005 is explained by an increase in dividends for top income earners in this year before the implementation of a permanent dividend tax in 2006 (Aaberge and Atkinson; 2010).

[Figure 6 about here]

## 6 Conclusion

This paper provides a picture of recent inequality trends in EU countries using a novel top income imputation approach for survey data. First, we reconciled German survey and tax data and examined the extent to which differences in top income share estimates from household surveys and tax returns arise from differences in income concepts and observation units or from the ability to capture top incomes. We found that the income share accruing to the bottom 9% of the top decile is very similar for reconciled survey and tax data, but survey data exhibit substantially lower income shares of the top 1%. Second, we showed that a decomposition approach for top-corrected Gini coefficients suggested by Atkinson (2007) and Alvaredo (2011) and a new top income imputation approach produce rather similar Gini coefficients for

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<sup>7</sup>Denmark, Norway and Sweden make extensive use of register data. Switzerland and France use incomes mostly from registers. Spain and Italy partly link incomes from register and/or apply mixed methods (?).

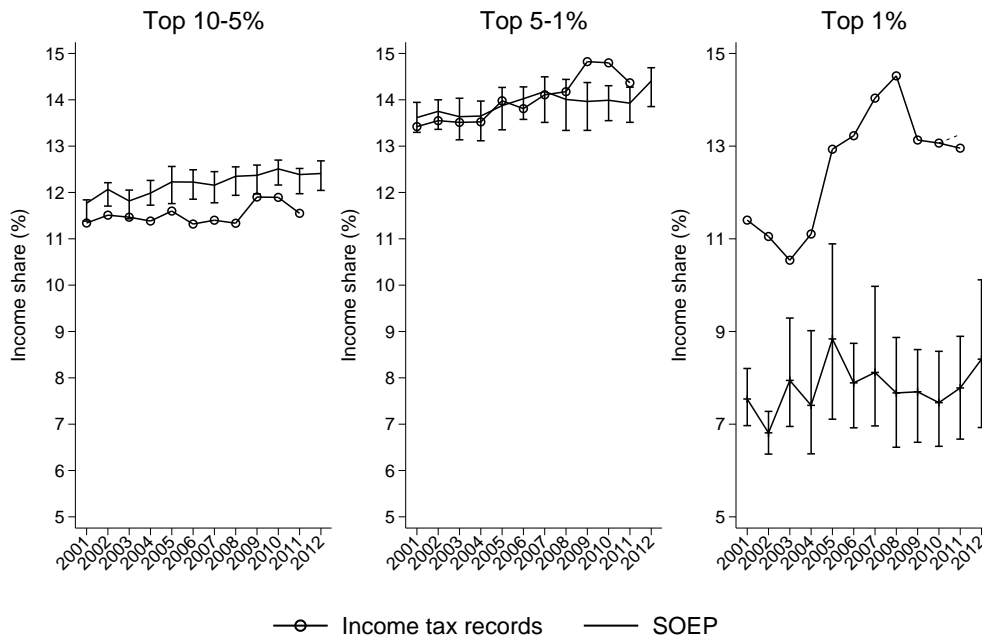
Germany regarding both level and trend. For the imputation approach, we estimated parameters of the Pareto distribution from top income shares and then replace the top of the survey income distribution by Pareto-imputed incomes. Third, we applied the top income imputation approach to EU-SILC data and estimate top-corrected Gini coefficients for European countries where information on the shape of the top of the income distribution is available in the World Wealth and Income Database (WID). The gap between unadjusted and top-corrected Ginis is highest in countries that rely exclusively on survey data as compared to purely register or partly register countries.

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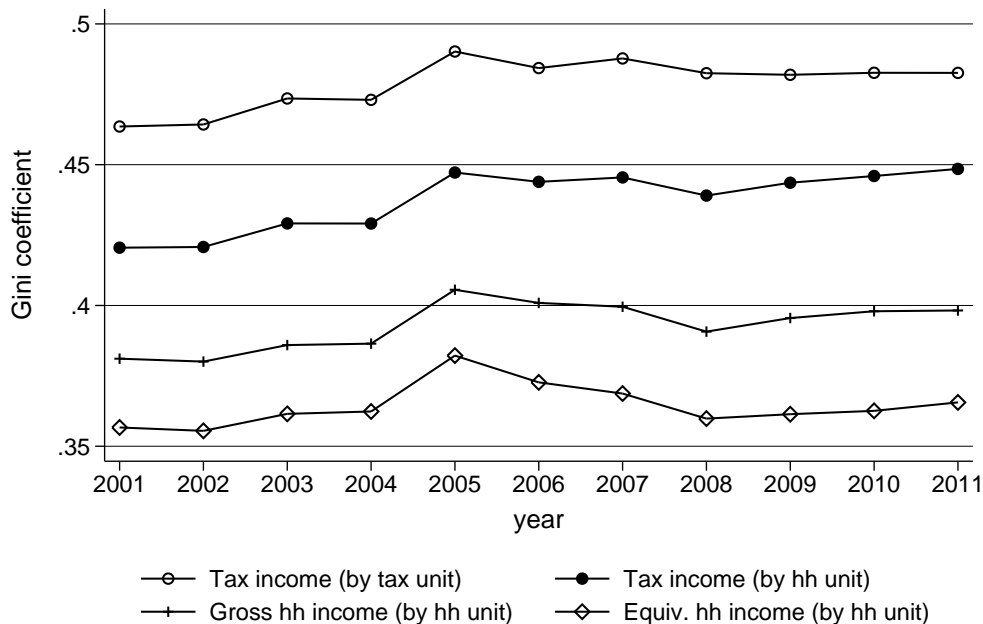
Figure 1: Top income shares in income tax return and survey data, Germany



Source: Income tax records (Bartels and Jenderny; 2015) and SOEP (own calculations).

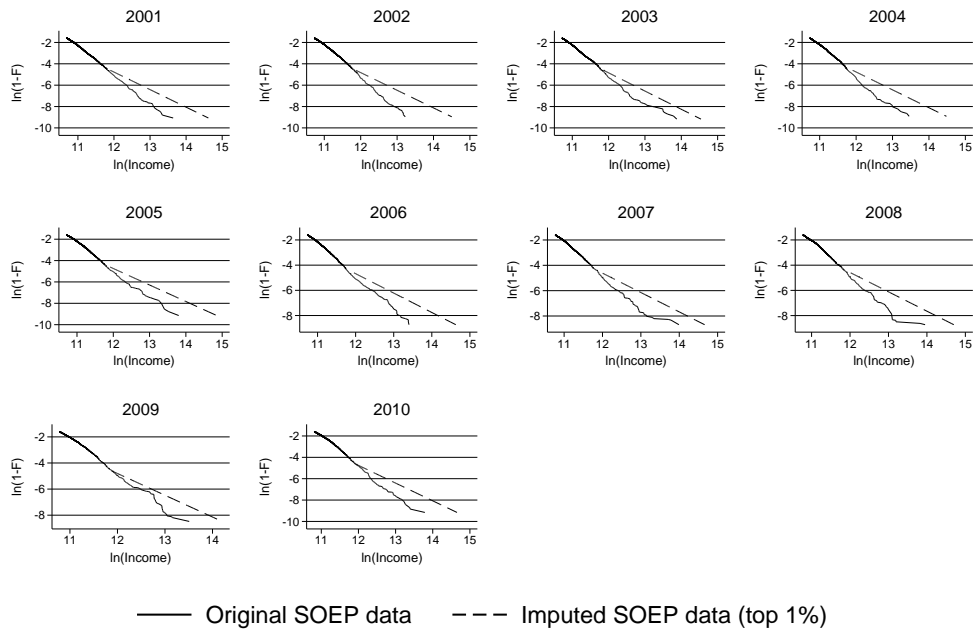
Note: The observation unit is the tax unit and the income concept is total taxable income in both data sources. Vertical lines show bootstrap confidence intervals at the 95%-level based on 200 drawings.

Figure 2: Gini coefficients cross-walking from tax to survey data, Germany



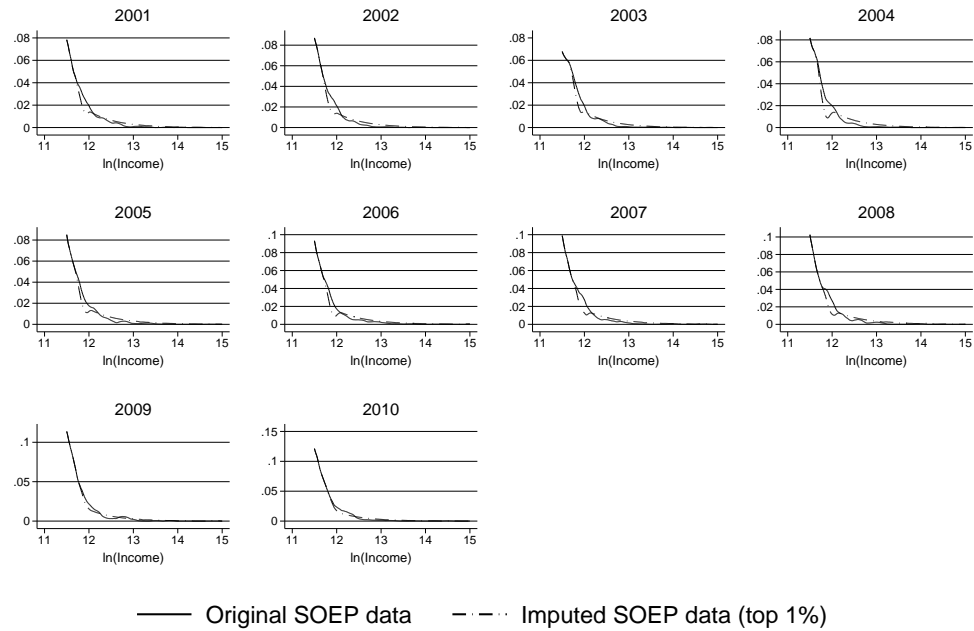
Source: SOEP (own calculations).

Figure 3: Fit of the Pareto distribution



Source: SOEP (own calculations).

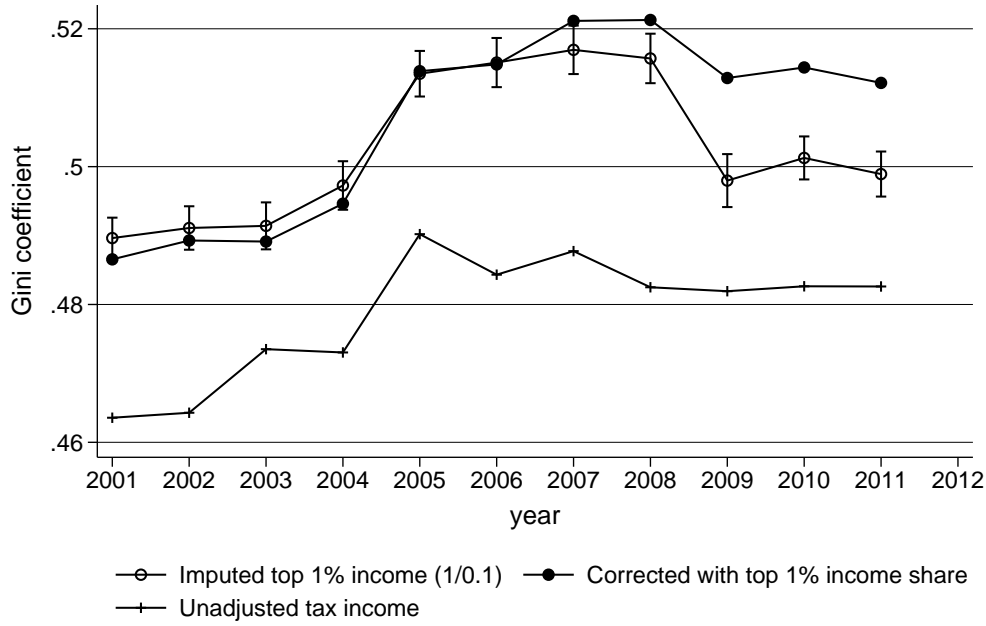
Figure 4: Kernel density



Source: SOEP (own calculations).



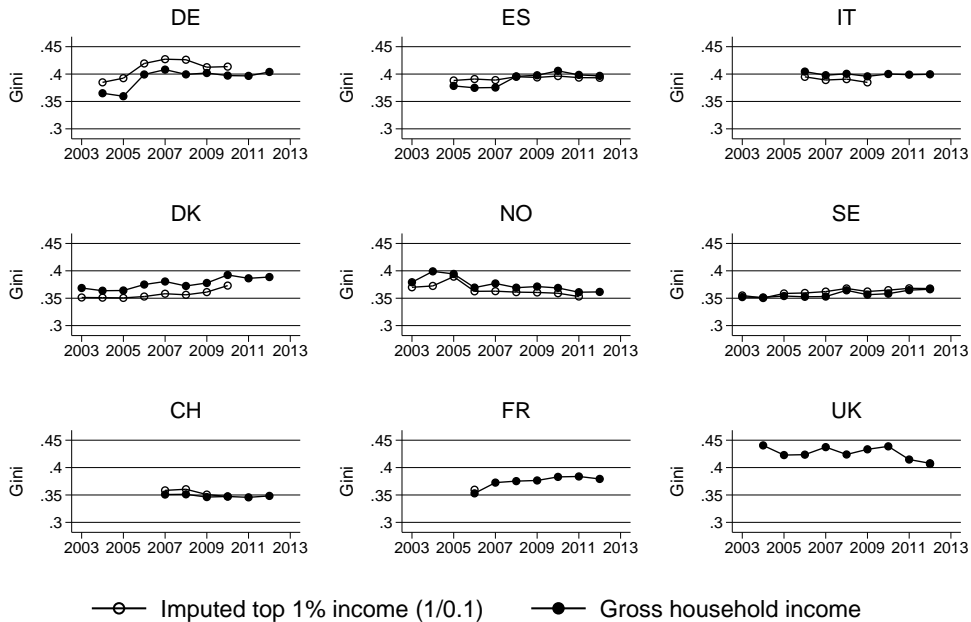
Figure 5: Top-corrected Gini coefficients, Germany



Source: Income tax returns (Bartels and Jenderny; 2015) and SOEP (own calculations).

Note: Top-corrected Ginis based on alternative  $\alpha$  specifications are presented in Appendix Figure A.3.

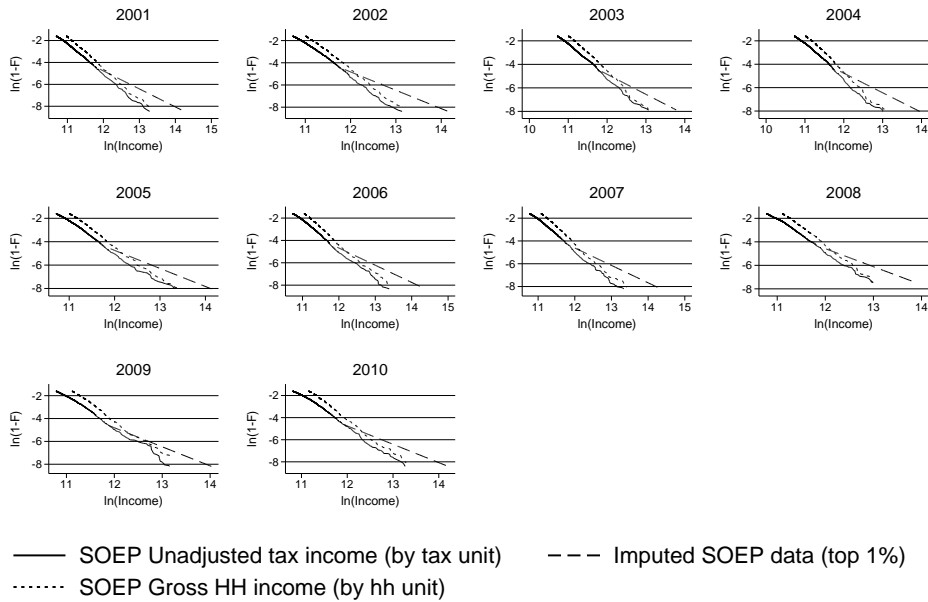
Figure 6: Top-corrected Gini coefficients, European countries



Source: EU-SILC (own calculations) and World Wealth and Income Database (WID).

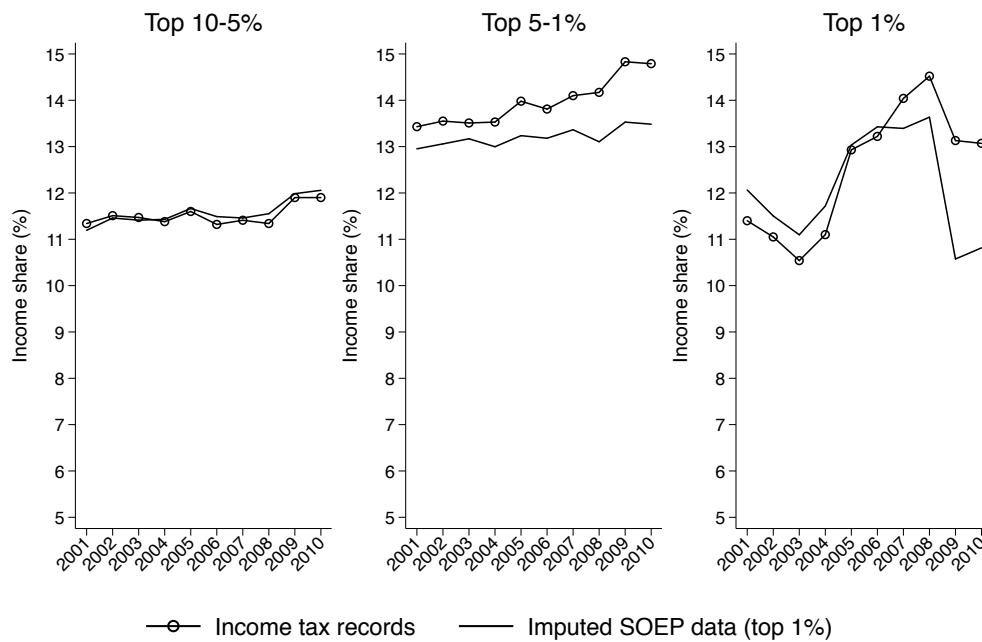
# A Appendix

Figure A.1: Fit of the Pareto distribution



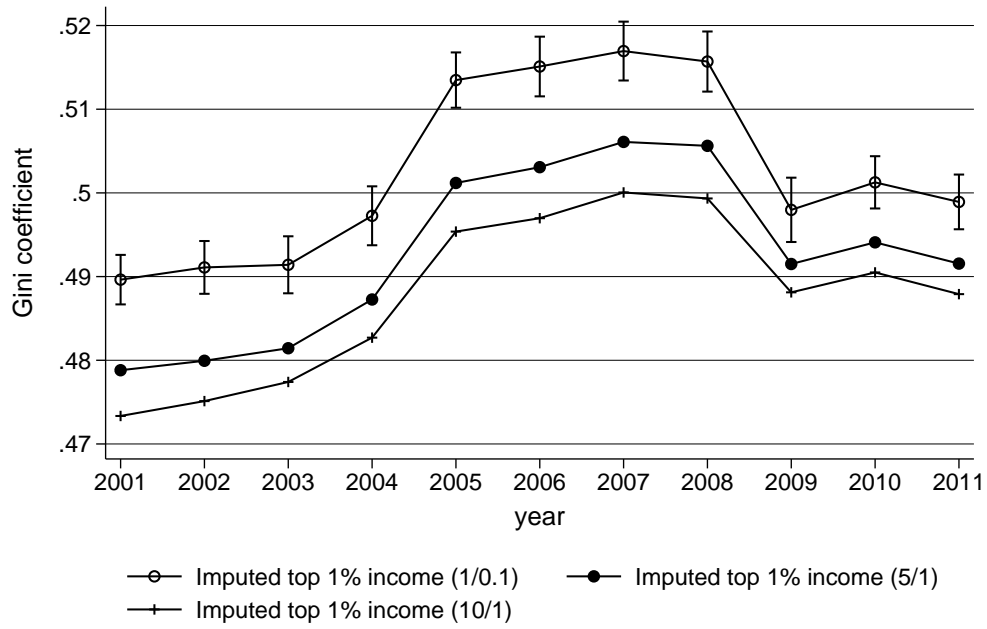
Source: SOEP (own calculations).

Figure A.2: Top income shares ( $\alpha 1/0.1$ )



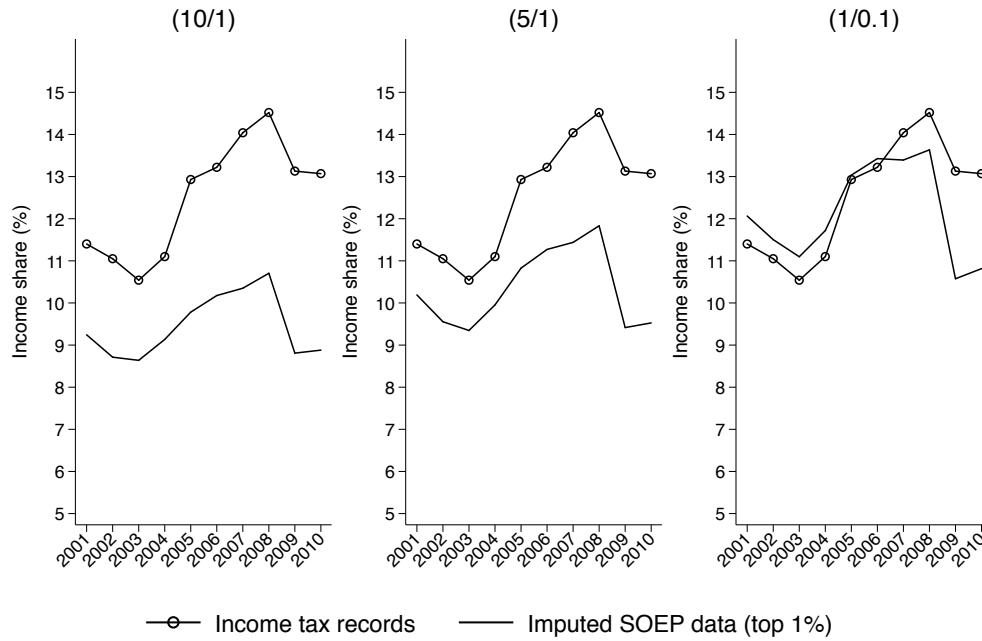
Source: SOEP (own calculations).

Figure A.3: Top-corrected Gini coefficients, Germany



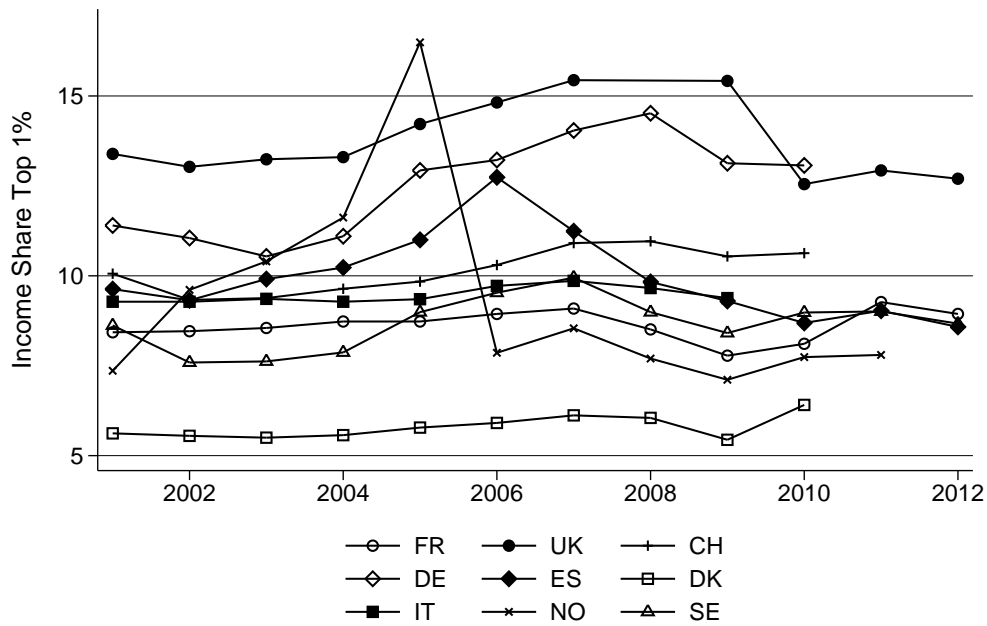
Source: Income tax returns (Bartels and Jenderny; 2015) and SOEP (own calculations).

Figure A.4: Top 1 % income share (all  $\alpha$  variations)



Source: SOEP (own calculations).

Figure A.5: Income share of top 1%, European countries



Source: World Wealth and Income Database (WID).

Table A.1: Pareto distribution parameter, Germany (DE)

10/5	$k$				
	$\alpha$	10%	5%	1%	0.1%
2001	2.19	20660.51	19954.32	17922.08	21299.42
2002	2.24	20883.14	20355.76	18287.34	20838.80
2003	2.29	21080.26	20758.10	18873.96	21069.62
2004	2.21	20830.89	20361.28	18454.30	20940.04
2005	2.07	18891.21	18253.78	16137.41	18154.16
2006	2.02	18512.76	17833.50	15868.17	17954.07
2007	1.96	18072.96	17365.07	15513.15	17473.27
2008	1.93	17601.66	16886.37	15146.64	17426.06
2009	2.05	21668.73	20155.15	15242.26	12482.07
2010	2.05	22756.34	20995.45	15844.12	11017.91
5/1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	1.94	18034.46	16719.64	13655.66	14166.23
2002	1.99	18336.65	17187.42	14099.35	14107.34
2003	2.05	18786.94	17869.42	14990.75	14914.11
2004	1.98	18447.75	17384.28	14473.33	14544.00
2005	1.84	16389.86	15173.97	12146.87	11855.56
2006	1.80	16113.69	14887.29	12021.94	11839.54
2007	1.76	15775.26	14549.47	11819.38	11620.28
2008	1.73	15422.77	14218.99	11628.78	11722.65
2009	1.89	19674.68	17776.23	12566.03	9343.50
2010	1.89	20618.22	18466.07	13006.66	8194.93
1/0.1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	1.64	14579.94	12678.85	8925.19	7485.34
2002	1.65	14489.65	12652.16	8803.90	6960.80
2003	1.70	14946.08	13270.30	9487.81	7509.50
2004	1.67	14879.80	13143.49	9416.21	7632.12
2005	1.54	12937.66	11154.71	7568.78	5831.28
2006	1.54	12977.33	11233.27	7797.50	6184.52
2007	1.53	12940.09	11243.65	7952.72	6413.55
2008	1.53	12983.91	11366.00	8241.77	6994.48
2009	1.67	16782.25	14454.19	9142.88	5798.79
2010	1.66	17448.33	14861.18	9314.75	4966.53

Source: Income tax returns (Bartels and Jenderny; 2015) also available in WID.

Note:  $\alpha$  and  $k$  are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Threshold  $k$  is presented in real terms (2010).

Table A.2: Pareto distribution parameter, Switzerland (CH)

10/5	$k$				
	$\alpha$	10%	5%	1%	0.1%
2001	2.17	29236.56	26930.38	25954.44	28558.24
2002	2.28	30917.23	28951.41	27723.70	31894.85
2003	2.26	30250.09	28679.21	26945.40	30356.09
2004	2.24	29988.30	28467.41	26866.62	30020.32
2005	2.20	29356.14	27908.77	26548.94	29404.37
2006	2.15	28938.58	27532.77	26283.51	29142.17
2007	2.08	28745.29	27290.81	25883.91	29000.76
2008	2.09	28912.86	27582.85	26300.23	28758.01
2009	2.14	30160.70	28899.98	27310.93	30251.91
2010	2.14	30293.18	29084.34	27617.27	30503.00
2011	-	-	-	-	-
2012	-	-	-	-	-
5/1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	1.94	25697.49	22768.72	20051.21	19392.10
2002	2.04	27468.95	24822.81	21884.38	22368.93
2003	2.02	26738.52	24425.65	21052.63	20964.19
2004	2.00	26518.43	24258.72	21008.99	20758.86
2005	1.98	26145.85	24005.11	21059.83	20774.15
2006	1.95	25801.59	23714.76	20894.01	20655.21
2007	1.88	25540.38	23400.35	20433.90	20341.90
2008	1.90	25861.19	23856.89	21041.39	20579.33
2009	1.93	26786.18	24765.93	21541.47	21191.46
2010	1.94	27080.18	25136.68	22069.58	21790.27
2011	-	-	-	-	-
2012	-	-	-	-	-
1/0.1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	1.70	21808.38	18391.52	14441.29	11852.85
2002	1.81	23762.19	20556.24	16376.57	14480.32
2003	1.75	22452.55	19459.64	14844.41	12412.61
2004	1.73	22246.65	19302.83	14785.59	12256.14
2005	1.75	22466.44	19706.38	15549.55	13180.07
2006	1.73	22309.44	19626.75	15620.91	13352.31
2007	1.69	22187.69	19485.41	15421.29	13336.61
2008	1.70	22476.90	19877.67	15894.63	13511.24
2009	1.71	22913.67	20212.68	15763.16	13265.17
2010	1.73	23457.72	20852.98	16560.08	14163.32
2011	-	-	-	-	-
2012	-	-	-	-	-

Source: WID.

Note:  $\alpha$  and  $k$  are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Threshold  $k$  is presented in real terms (2010) and Euro.

Table A.3: Pareto distribution parameter, Denmark (DK)

10/5	$k$				
	$\alpha$	10%	5%	1%	0.1%
2001	3.03	21215.51	21029.02	20532.46	21678.91
2002	3.07	21559.04	21379.08	20898.85	21773.82
2003	3.09	21713.18	21511.23	21072.70	21857.03
2004	3.06	21745.07	21507.38	21002.94	21868.81
2005	3.00	21587.80	21226.85	20591.56	22006.59
2006	2.95	21580.66	21118.17	20388.02	22542.33
2007	2.88	21474.80	20881.57	20120.26	21934.68
2008	2.91	21439.42	20948.14	20346.38	21910.18
2009	3.16	22590.43	22245.85	21841.85	22440.78
2010	2.82	21637.93	21014.15	20349.73	22531.31
2011	-	-	-	-	-
2012	-	-	-	-	-
5/1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	2.89	20462.29	20062.90	19100.40	19450.90
2002	2.92	20739.90	20328.34	19340.89	19385.00
2003	2.94	20898.14	20466.69	19520.39	19486.94
2004	2.89	20773.16	20265.22	19167.42	19065.59
2005	2.77	20286.53	19577.48	18183.93	18262.10
2006	2.70	20046.52	19186.25	17592.35	18068.50
2007	2.62	19795.44	18782.52	17096.45	17180.66
2008	2.68	20027.34	19171.16	17754.47	17859.81
2009	2.98	21600.10	20985.50	19968.79	19616.95
2010	2.58	20043.73	19022.57	17461.60	17909.13
2011	-	-	-	-	-
2012	-	-	-	-	-
1/0.1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	2.50	18093.57	17095.41	14934.21	13447.74
2002	2.51	18206.27	17158.63	14904.09	13113.22
2003	2.52	18355.57	17288.13	15059.45	13204.58
2004	2.44	17961.30	16771.51	14329.60	12324.12
2005	2.29	17032.47	15594.43	12818.22	10808.38
2006	2.22	16660.90	15082.19	12151.86	10372.90
2007	2.13	16229.34	14505.11	11491.51	9467.74
2008	2.22	16720.20	15159.03	12374.98	10392.78
2009	2.51	18726.57	17428.45	15009.17	12783.18
2010	2.16	16856.12	15184.65	12349.31	10651.54
2011	-	-	-	-	-
2012	-	-	-	-	-

Source: WID.

Note:  $\alpha$  and  $k$  are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Threshold  $k$  is presented in real terms (2010) and Euro.

Table A.4: Pareto distribution parameter, Spain (ES)

10/5	$k$				
	$\alpha$	10%	5%	1%	0.1%
2001	2.29	11252.68	11214.16	10880.19	11023.09
2002	2.32	11403.15	11392.50	11116.35	11378.98
2003	2.25	11390.47	11165.06	10657.04	11319.60
2004	2.21	11236.60	10962.40	10425.23	11256.34
2005	2.11	10886.76	10535.08	9892.79	10829.75
2006	1.95	10289.70	9818.93	9018.97	10262.98
2007	2.08	11131.37	10837.13	10234.17	11209.94
2008	2.24	12052.63	11867.17	11392.24	12206.71
2009	2.32	12519.56	12350.61	11941.85	12645.50
2010	2.41	12601.47	12472.70	12209.77	12316.16
2011	2.35	11809.94	11696.79	11320.08	11745.12
2012	2.40	11336.96	11301.75	10970.10	11257.91
5/1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	2.20	10820.28	10656.80	10060.08	9800.56
2002	2.25	11050.75	10936.60	10439.89	10356.29
2003	2.14	10802.34	10420.94	9584.94	9655.18
2004	2.09	10581.07	10137.76	9244.32	9398.99
2005	1.98	10153.02	9620.82	8604.23	8784.32
2006	1.82	9406.01	8736.30	7536.38	7839.38
2007	1.95	10333.69	9837.83	8819.94	8968.56
2008	2.12	11365.01	10993.99	10129.44	10234.41
2009	2.19	11808.17	11445.48	10623.29	10610.04
2010	2.32	12125.19	11862.90	11304.27	10971.79
2011	2.25	11292.03	11033.88	10349.00	10266.68
2012	2.31	10913.97	10756.25	10166.77	10044.22
1/0.1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	1.92	9266.80	8710.77	7378.78	6156.38
2002	1.99	9699.78	9230.08	8043.34	7003.50
2003	1.87	9227.07	8488.80	6993.29	6017.25
2004	1.83	9035.10	8254.59	6740.33	5851.82
2005	1.73	8588.39	7738.37	6156.67	5316.90
2006	1.61	7977.35	7050.87	5420.87	4782.35
2007	1.70	8686.88	7848.97	6232.79	5327.80
2008	1.83	9541.68	8756.86	7139.95	6056.58
2009	1.87	9869.14	9063.15	7420.82	6194.50
2010	1.99	10301.61	9596.20	8159.72	6728.63
2011	1.89	9284.39	8552.96	6996.18	5706.56
2012	1.96	9174.25	8581.18	7183.86	5965.94

Source: WID.

Note:  $\alpha$  and  $k$  are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Threshold  $k$  is presented in real terms (2010).



Table A.5: Pareto distribution parameter, France (FR)

10/5	$k$				
	$\alpha$	10%	5%	1%	0.1%
2001	2.52	19847.20	19748.62	19374.92	19831.13
2002	2.51	19814.83	19744.48	19320.02	19869.37
2003	2.49	19525.10	19455.90	19047.68	19522.41
2004	2.46	19434.30	19364.24	18927.25	19406.53
2005	2.43	19355.57	19195.06	18858.57	19951.60
2006	2.37	19186.46	19000.19	18605.98	19732.03
2007	2.32	-	-	-	-
2008	2.40	-	-	-	-
2009	2.55	-	-	-	-
2010	2.48	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-
5/1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	2.44	19234.29	18958.88	18196.75	18050.03
2002	2.42	19179.20	18924.45	18100.38	18017.91
2003	2.40	18913.47	18666.74	17873.02	17744.64
2004	2.37	18763.28	18498.93	17642.79	17464.94
2005	2.33	18606.17	18233.84	17426.52	17722.74
2006	2.27	18365.46	17949.30	17047.74	17305.85
2007	2.26	-	-	-	-
2008	2.40	-	-	-	-
2009	2.59	-	-	-	-
2010	2.51	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-
1/0.1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	2.26	17896.98	17262.15	15754.35	14540.80
2002	2.25	17859.01	17247.50	15694.28	14547.39
2003	2.26	17789.21	17236.23	15811.35	14764.68
2004	2.23	17634.73	17064.63	15584.30	14499.31
2005	2.21	17592.69	16952.39	15579.78	14981.55
2006	2.12	17105.75	16364.33	14789.30	13983.44
2007	-	-	-	-	-
2008	-	-	-	-	-
2009	-	-	-	-	-
2010	-	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-

Source: WID.

Note:  $\alpha$  and  $k$  are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Threshold  $k$  is presented in real terms (2010).

Table A.6: Pareto distribution parameter, Italy (IT)

10/5	$k$				
	$\alpha$	10%	5%	1%	0.1%
2001	2.18	10987.04	10693.18	11006.54	10156.55
2002	2.19	11103.10	10857.58	11042.66	10347.49
2003	2.17	11139.64	10872.30	11020.41	10456.19
2004	2.19	11302.12	11044.04	11154.00	10381.99
2005	2.19	11393.43	11140.16	11240.97	10450.42
2006	2.14	11402.90	11126.81	11175.84	10439.31
2007	2.14	11469.01	11216.82	11199.82	10607.02
2008	2.17	11468.02	11291.41	11287.74	10678.39
2009	2.21	11680.99	11514.73	11619.49	10795.70
2010	-	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-
5/1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	2.25	11352.04	11157.65	11749.98	11202.78
2002	2.25	11437.38	11284.78	11717.59	11310.50
2003	2.23	11417.87	11226.92	11577.80	11259.41
2004	2.25	11608.33	11434.91	11766.58	11248.90
2005	2.24	11667.47	11490.01	11788.20	11222.77
2006	2.19	11642.26	11431.64	11649.95	11110.61
2007	2.18	11748.21	11573.38	11751.76	11400.69
2008	2.22	11777.84	11689.88	11905.87	11567.43
2009	2.28	12066.73	12011.89	12399.58	11900.93
2010	-	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-
1/0.1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	2.19	11069.74	10798.02	11172.86	10387.63
2002	2.17	11028.11	10762.27	10894.00	10139.24
2003	2.14	10934.57	10612.63	10618.41	9889.30
2004	2.16	11103.03	10791.61	10764.50	9842.95
2005	2.12	11015.54	10661.85	10507.65	9444.67
2006	2.03	10740.32	10293.10	9914.79	8723.23
2007	2.04	10896.12	10493.42	10108.90	9095.62
2008	2.11	11134.31	10865.81	10640.37	9773.06
2009	2.18	11496.58	11278.79	11255.52	10292.44
2010	-	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-

Source: WID.

Note:  $\alpha$  and  $k$  are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Threshold  $k$  is presented in real terms (2010).

Table A.7: Pareto distribution parameter, Norway (NO)

10/5	$k$				
	$\alpha$	10%	5%	1%	0.1%
2001	2.40	19241.26	18885.30	17846.46	20151.15
2002	2.08	17229.89	16248.60	14468.26	17562.55
2003	2.00	16636.00	15578.94	13889.92	17306.15
2004	1.93	16767.61	15576.39	13569.33	16825.76
2005	1.66	14173.54	12793.70	11111.22	14998.98
2006	2.34	21293.35	21064.81	19811.04	22481.73
2007	2.22	21610.14	21270.70	20016.31	23297.80
2008	2.29	22329.42	22092.29	20980.31	24079.30
2009	2.42	23926.83	23990.24	23036.02	25012.03
2010	2.34	23668.09	23556.13	22360.54	24476.31
2011	2.35	24781.15	24704.59	23512.80	26057.45
2012	-	-	-	-	-
5/1	$k$				
	$\alpha$	10%	5%	1%	0.1%
2001	2.24	17941.50	17242.71	15516.82	16337.13
2002	1.85	14997.86	13565.15	10962.51	11583.18
2003	1.78	14474.62	12998.75	10515.18	11399.24
2004	1.71	14412.84	12792.67	10025.71	10685.88
2005	1.50	12177.81	10501.38	8202.44	9513.36
2006	2.21	20076.44	19512.21	17611.35	18843.32
2007	2.09	20230.47	19521.13	17542.07	19114.37
2008	2.17	21099.89	20522.92	18733.44	20316.66
2009	2.36	23334.28	23220.18	21909.17	23199.41
2010	2.23	22515.87	22075.22	20236.42	21072.83
2011	2.24	23612.71	23199.98	21347.79	22542.64
2012	-	-	-	-	-
1/0.1	$k$				
	$\alpha$	10%	5%	1%	0.1%
2001	1.90	14955.25	13606.28	10781.33	9461.93
2002	1.57	12012.21	10162.42	7032.29	5951.26
2003	1.55	11953.51	10133.77	7171.22	6420.08
2004	1.48	11703.46	9756.68	6610.66	5721.43
2005	1.43	11336.84	9567.83	7108.67	7675.41
2006	1.91	17075.25	15805.88	12739.52	11593.07
2007	1.87	17791.61	16516.57	13567.49	13001.34
2008	1.96	18851.13	17724.05	14953.12	14488.51
2009	2.14	21101.19	20371.68	17916.42	17155.94
2010	1.96	19568.27	18391.83	15284.84	13832.92
2011	2.02	21086.91	20024.62	17025.00	16054.85
2012	-	-	-	-	-

Source: WID.

Note:  $\alpha$  and  $k$  are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Threshold  $k$  is presented in real terms (2010) and Euro.

Table A.8: Pareto distribution parameter, Sweden (SE)

10/5	$k$				
	$\alpha$	10%	5%	1%	0.1%
2001	2.38	15407.02	14407.67	13959.51	15642.90
2002	2.56	16650.67	15873.54	15547.03	16285.89
2003	2.53	16676.10	15813.94	15448.88	15643.14
2004	2.64	17958.45	15238.78	17773.94	19236.05
2005	2.34	16468.09	14241.20	16068.44	18589.45
2006	2.19	16306.33	14214.50	15426.01	16048.82
2007	2.09	16246.36	14500.63	15103.34	14834.57
2008	2.23	17204.24	15169.15	16031.57	15570.56
2009	2.31	17938.29	16345.24	16893.70	16068.23
2010	2.23	17366.79	16111.92	16617.14	16316.13
2011	2.21	17168.75	15820.07	16311.74	16192.97
2012	2.25	17874.01	16512.59	16858.92	16339.34
5/1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	2.01	12909.20	11445.90	9800.14	9201.53
2002	2.21	14454.92	13205.96	11716.98	10655.25
2003	2.18	14419.40	13088.31	11550.54	10113.04
2004	2.11	14411.91	11445.65	11446.93	9942.01
2005	1.99	13857.30	11376.67	11377.43	11075.73
2006	1.97	14499.03	12199.91	12196.04	11282.13
2007	1.98	15318.42	13432.47	13427.30	12435.08
2008	2.07	15889.67	13678.84	13675.25	12267.12
2009	2.21	17112.91	15373.60	15374.82	13950.71
2010	2.14	16627.80	15225.71	15233.05	14320.66
2011	2.12	16425.36	14934.74	14929.75	14179.30
2012	2.18	17343.06	15877.30	15872.20	14926.08
1/0.1	$k$				
$\alpha$	10%	5%	1%	0.1%	
2001	1.69	10414.81	8656.28	6378.76	4831.88
2002	1.86	11870.24	10220.19	7901.39	5900.59
2003	1.81	11639.84	9905.76	7526.66	5319.63
2004	1.81	12074.60	9091.96	8035.10	5846.92
2005	1.76	11899.85	9331.88	8390.16	7013.93
2006	1.67	11779.31	9310.63	8049.72	6049.70
2007	1.68	12422.35	10227.01	8830.15	6631.59
2008	1.73	12738.42	10260.10	8788.95	6320.41
2009	1.86	14096.80	11946.07	10432.87	7798.07
2010	1.80	13614.28	11738.06	10211.91	7860.38
2011	1.77	13256.21	11299.98	9724.38	7453.65
2012	1.78	13715.40	11699.82	9926.65	7382.34

Source: WID.

Note:  $\alpha$  and  $k$  are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Threshold  $k$  is presented in real terms (2010) and Euro.

Table A.9: Pareto distribution parameter, United Kingdom (UK)

10/5	$\alpha$	$k$			
		10%	5%	1%	0.1%
2001	2.05	-	-	-	-
2002	2.07	-	-	-	-
2003	2.06	-	-	-	-
2004	2.05	-	-	-	-
2005	1.97	-	-	-	-
2006	1.92	-	-	-	-
2007	1.89	-	-	-	-
2008	-	-	-	-	-
2009	1.89	-	-	-	-
2010	2.05	-	-	-	-
2011	2.02	-	-	-	-
2012	2.04	12145.35	11868.16	11713.70	-
5/1	$\alpha$	$k$			
		10%	5%	1%	0.1%
2001	1.93	-	-	-	-
2002	1.96	-	-	-	-
2003	1.95	-	-	-	-
2004	1.91	-	-	-	-
2005	1.83	-	-	-	-
2006	1.79	-	-	-	-
2007	1.75	-	-	-	-
2008	-	-	-	-	-
2009	1.70	-	-	-	-
2010	1.88	-	-	-	-
2011	1.89	-	-	-	-
2012	1.92	11346.17	10862.36	10222.87	-
1/0.1	$\alpha$	$k$			
		10%	5%	1%	0.1%
2001	1.82	-	-	-	-
2002	1.86	-	-	-	-
2003	1.86	-	-	-	-
2004	1.82	-	-	-	-
2005	1.78	-	-	-	-
2006	1.74	-	-	-	-
2007	1.69	-	-	-	-
2008	-	-	-	-	-
2009	1.61	-	-	-	-
2010	1.76	-	-	-	-
2011	1.76	-	-	-	-
2012	1.79	10377.38	9671.51	8551.64	-

Source: WID.

Note:  $\alpha$  and  $k$  are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Threshold  $k$  is presented in real terms (2010) and Euro.