An integrated approach for top-corrected Ginis*

Charlotte Bartels Maria Metzing

June 14, 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 and develop an integrated approach for top-corrected Gini coefficients where we impute top incomes in survey data based on information from tax data on the upper end of the income distribution. Thereby, we can produce top-corrected Ginis reflecting the inequality of living standards of a population, in contrast to the established top-corrected Gini approach which is restricted to inequality of tax income over tax units.

JEL Classification: C46, C81, D31, H2
Keywords: Gini coefficient, Top income shares, Survey data, Tax record data, Pareto distribution

* Charlotte Bartels (cbartels@diw.de) and Maria Metzing (mmetzing@diw.de) are affiliated to DIW. This paper has greatly benefited from the comments of Carsten Schröder.

1 Introduction

Has inequality of living standards in European countries increased in recent years? The answer is far from conclusive, if we look at different inequality measures and different data sources. 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. Another reason for diverging trends is much less investigated: the different nature of the data employed to estimate inequality measures. Whereas the top income share literature based on tax data produced wide evidence for rising inequality, survey data based inequality studies found less clear trends.[1]

Survey and tax data are substantially different in the definition of income and unit of observation. Whereas household surveys usually apply a comprehensive income concept, tax data only contain the share of income subject to taxation.[2] Whereas incomes in survey data are aggregated at the household level, the income-receiving unit in tax data is the tax unit. 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 time-variant factors such as survey response and reporting behavior, tax filing behavior as well as economic, demographic and legislative changes. 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 produces higher inequality estimates in tax data than in survey data where top income earners are underrepresented. The rising number of unmarried couples affects tax-based inequality measures in countries with joint taxation with the direction of the effect

[1] 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. Since Piketty (2001, 2003) revived the method of Kuznets to derive top income shares from income tax data, an international effort put together long-run series for more than 25 countries in the World Wealth and Income Database (WID) available online at `http://www.wid.world/`. Studies inequality in Europe??

[2] E.g., surveys not only document different market income sources, but also private transfers. In contrast, capital income often vanished from income tax records following the international trend towards dual income taxation where capital income is taxed separately.

depending on the degree of assortative mating.

For the United States and the United Kingdom, 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; Burkhauser et al.; 2016) or adjusting survey-based Gini coefficients with tax data-based top income shares (Atkinson et al.; 2011; Alvaredo; 2011). These contributions draw on access to tax record microdata, which is limited and difficult to obtain in many countries. Furthermore, these studies document inequality trends of tax income over tax units which do not necessarily reflect how inequality of living standards evolved.

We develop a new method to obtain top-corrected Gini coefficients combining easily available information from tax and survey data. 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, observation units or from the ability to capture top incomes. We find that the top 1% is underrepresented in German SOEP data compared to tax data, but the lower percentiles of the top decile match very well. Second, we replace the top 1% of the survey income distribution by Pareto-imputed incomes using Pareto parameter estimates from the top income distribution documented in tax data and compute top-corrected Gini coefficients.[3] We find that our integrated approach produces rather similar Gini coefficients for Germany regarding both level and trend as the decomposition approach for top-corrected Gini coefficients (Atkinson; 2007; Alvaredo; 2011). Third, we apply our integrated approach to EU-SILC data and estimate top-corrected Gini coefficients for those European countries where information on the top incomes' distribution is available at the World Wealth and Income Database (WID). Our approach is easily applicable by relying on information publicly available at WID and easily accessible EU-SILC survey data. Neither access to tax record microdata, which is limited and difficult to obtain in many countries, nor record linkage, which is often not allowed, is needed.[4] In contrast to the decomposi-

[3]Another example of a top income imputation approach can be found in Lakner and Milanovic (2013). They distribute the gap between national accounts and survey means over the top decile according to a fitted Pareto distribution to obtain a global Gini coefficient.

[4]Bach et al. (2009) is an example where the authors integrate both survey and tax record micro data to obtain Gini coefficients over the whole spectrum of the population in Germany.

tion approach for top-corrected Gini coefficients (Atkinson; 2007; Alvaredo; 2011), our integrated approach allows to produce a variety of measures for the inequality of living standards in the entire population of a country also considering differences in households' needs.

The paper is structured as follows. In Section 2, we reconcile German household survey and income tax return data and compute top income shares and Gini coefficients for the reconciled data. Our new integrated approach for top-corrected Gini coefficients is explained in Section 3. In Section 4, inequality trends according to top-corrected Gini coefficients in European countries are presented. Section 5 concludes.

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 consist of an individual or a married couple depending on the country's income tax legislation.

We reconcile German SOEP survey data[5] and income tax records. Using microsimulation we construct tax units and total amount of income in the SOEP data according to the governing income tax law in each year from 2001 to 2012. The opposite direction is not possible since tax records offer very limited information on household context such that tax units cannot be summed up to households. In the

[5]For further details on German SOEP data see Wagner et al. (2007) or Gerstorf and Schupp (2015).

reconciled SOEP data, one household with a married couple 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 amount of income (*Gesamtbetrag der Einkünfte*) defined by the German Income Tax Act (*Einkommensteuergesetz*), which is the sum of the seven income categories (agriculture and forestry, business, self-employment, employment, capital income,[6] 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.[7] Since a number of 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 units than the eventual taxable income to which the tax rate is applied. For reasons of simplicity, we refer to tax income instead of total amount of income in the following.

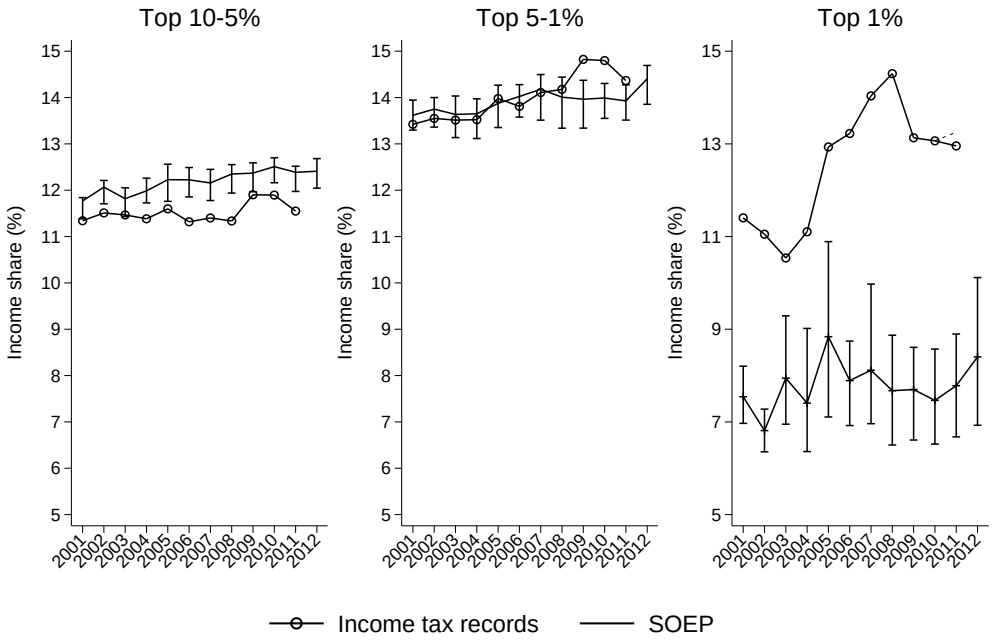
We first compare the share of total income accruing to the top of the income distribution according to household survey data and income tax records. The observation unit is the tax unit and the income concept is tax income in both data sources. Figure 1 shows how income accruing to the top decile in 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. The income share of the bottom half (10-5%) is around 12 % in the SOEP data and between 11.2 to 11.8 % in the income tax data. The upper 4 % do not differ statistically (except in 2009 and 2010) in both datasets and are between 13.4 and 15 %. 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%. The income share in the tax data is between 10.6 % to 15 % whereas the income share in the SOEP data is between 7

[6]Since the introduction of dual income taxation in 2009, capital income is taxed separately at a flat rate in Germany. But for some tax units it is beneficial to declare capital income in their income tax declaration, e.g., if the flat rate exceeds their personal income tax rate.

[7]The total amount of income 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 be simulated only approximately in the SOEP data.

% and 8.8 %. Based on this finding, we decide to replace the top 1% of the survey income distribution by Pareto imputed incomes in our integrated approach which will be described in Section 3. The mismatch between the data sources for the top 1% 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. It is also 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 significantly higher in the SOEP data than in the tax records. This indicates a potential middle class bias in the SOEP data.

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

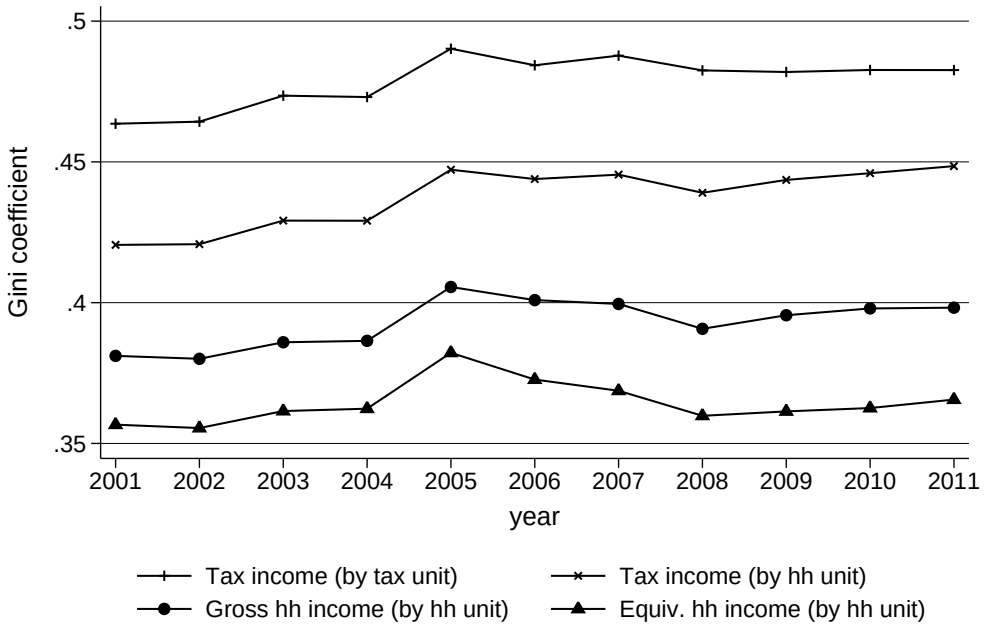


Source: Income tax records (Bartels and Jenderny; 2015) and SOEP (own calculations).
Note: The observation unit is the tax unit and the income concept is tax income in both data sources. Vertical lines show bootstrap confidence intervals at the 95%-level based on 200 drawings.

Cross-walking from income tax data definitions to survey data definitions reveals a gradual decline in inequality measured by the Gini coefficient as shown by

Figure 2. The Gini based on tax income per tax unit (*Tax income (by tax unit)*) exhibits the highest level of inequality. If we then aggregate tax income at the household level (*Tax income (by hh unit)*), we obtain a Gini coefficient that is about 5%-points lower. Considering gross household income (*Gross hh income (by hh unit)*)[8] instead of tax income yields another Gini reduction of about 4%-points. Finally, when we equivalize gross household income to account for differences in households' needs (*Equiv. hh income (by hh unit)*), the Gini declines by another 2%-points. All in all, the definitional differences affect the inequality trends observed between 2005 and 2008, but are of minor importance for the preceding and the following years. One should note, however, that data are not yet adjusted for missing top incomes.

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



Source: SOEP (own calculations).

[8]Gross household income includes household social security pensions in order to increase comparability with tax income. In Germany, an increasing share of social security pensions is subject to income taxation and thus included in tax income.

3 An integrated approach for top-corrected Gini coefficients

In our integrated approach, we impute the top percentile's income in survey data with Pareto distribution coefficients obtained from tax records and then calculate the Gini coefficient. We compare our results to the decomposition approach established by Atkinson (2007) where top income share estimates based on tax records are incorporated with survey-based Ginis for the rest of the population and data reconciling is needed. Hence, we provide a brief description of the decomposition approach in the second part of this section. Finally, we contrast the resulting levels and trends of both approaches.

We replace the incomes of the top 1% of the survey income distribution with imputed incomes building on the assumption that top incomes are Pareto distributed. We opt to replace the top 1% since the comparison of the top income shares in Section 2 revealed this group to be underrepresented in the survey data. 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

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

where α is the Pareto coefficient and k is the income threshold above which incomes are Pareto distributed.[9] We estimate the Pareto coefficient α from the share of a top group S_i in total income of the top group S_j using top income shares of the World Wealth and Income Database (WID) as

$$\alpha = \frac{1}{\left(1 - \frac{log(S_j/S_i)}{log(P_j/P_i)}\right)} \tag{2}$$

Empirically, α increases from the middle of the distribution to the top. So we estimate α for different share ratios. Threshold k for the respective fractiles is then

[9] A large literature shows that incomes follow a Pareto distribution, e.g., Clementi and Gallegati (2005a) for Germany, Piketty (2003) for France, Clementi and Gallegati (2005b) for Italy, Atkinson (2007) for United Kingdom and Piketty and Saez (2003) for United States.

obtained from rearranging Eq. 1 to

$$k = (1 - F(y))^{1/\alpha} \cdot y, \tag{3}$$

Our results for α and k for Germany are presented in Appendix A.1.[10] We then replace the top 1% of incomes observed in the survey data with incomes following the Pareto distribution characterized by our estimated parameters. We use the estimated α for $P_i = 0.1\%$ and $P_j = 1\%$. First, it seems reasonable to calculate the α for 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 to estimate α.[11] The larger the population group, the higher is α and the lower are fractile income shares in comparison to the tax data.

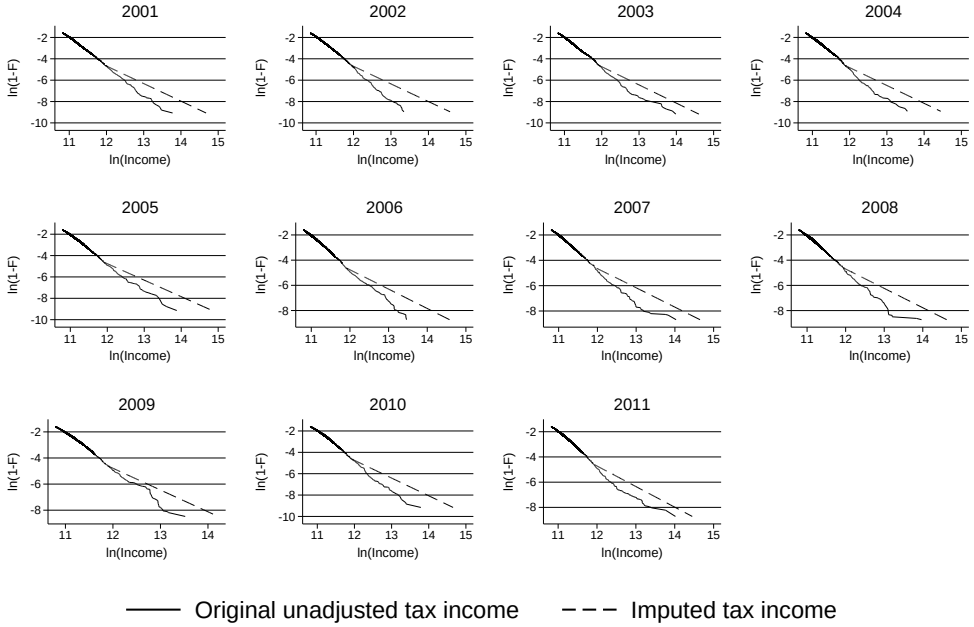
A nice feature of the Pareto distribution is that one obtains a straight line with the slope $-\alpha$ if one plots $log(1 - F(y))$ against $log(y)$. The smaller α (the flatter the line), the more unequal the income distribution. Figure 3 shows this plot for both original SOEP data and SOEP data with Pareto imputed incomes for the top 1%. Replacing top incomes with Pareto imputed incomes generates a more unequal income distribution reflected by the flatter curve than original SOEP incomes. Assuming that tax data provide a more accurate picture of the very top, we would underestimate the tail of the income distribution using survey data. Any Pareto parameter estimated from SOEP data would generate a steeper curve. 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 4 shows the Kernel density for the original and the imputed income

[10] See Atkinson (2007) for the derivation of Eq. 2.

[11] Appendix Figure A.4 shows that the α estimated for $P_i = 0.1\%$ and $P_j = 1\%$ produces the best fit of the top 1% income share in Germany. Using α estimated for $P_i = 1\%$ and $P_j = 5\%$ or $P_i = 1\%$ and $P_j = 10\%$ we obtain a substantially lower top 1% income share in comparison to income tax data. Moreover, α 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). Our α estimates for Germany are between 1.53 and 1.7.

Figure 3: Fit of the Pareto distribution



Source: SOEP (own calculations).

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 these income levels.

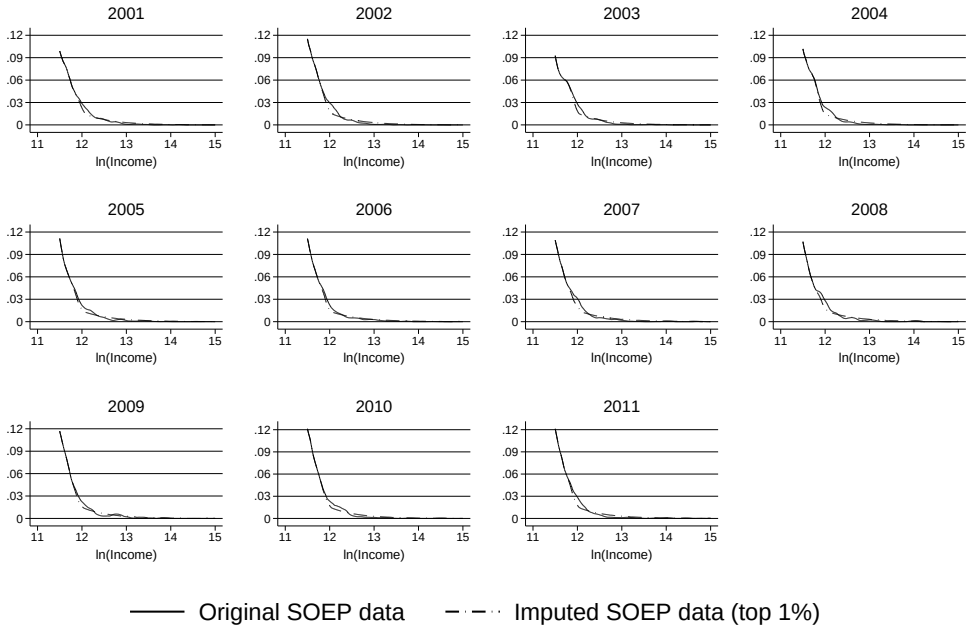
The approach derived by Atkinson (2007) and extended by Alvaredo (2011) is based on the Gini decomposition for two non-overlapping subgroups by Dagum (1997)

$$G = \sum_{j=1}^{k} G_{jj} S_j + \sum_{j=1}^{k} \sum_{h=1}^{j-1} G_{jh}(P_j S_h + P_h S_j), \tag{4}$$

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. 4 using the notation from Alvaredo (2011) to

$$G = G^{**} PS + G^{*}(1 - P)(1 - S) + S - P, \tag{5}$$

Figure 4: Kernel density



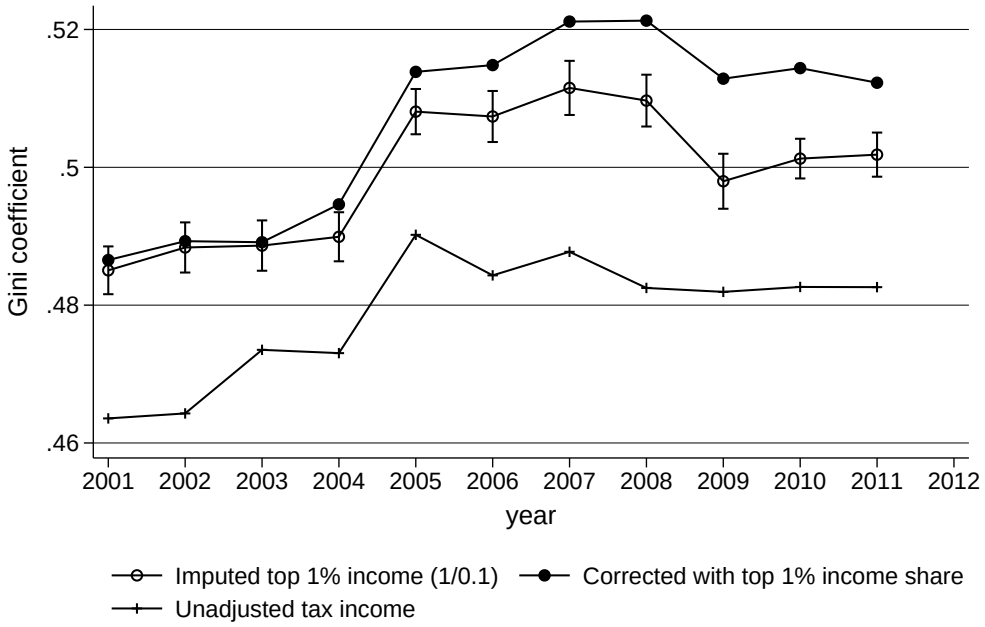
Source: SOEP (own calculations).

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. G^* is the Gini for the population without the top group. Assuming that top incomes are Pareto distributed, the Gini of the top is computed as $G^{**} = \frac{1}{2\alpha-1}$, where α is the Pareto coefficient obtained from the tax income distribution documented by tax data by applying Eq. 2.

We first present a comparison of the two approaches for top-corrected Gini coefficients for Germany. Since the data requirement for reconciling data is large and a microsimulation model incorporating frequent changes of the tax law needs to be at hand, we undertake this comparison to Germany. Top-corrected Gini coefficients in Germany are about 2%-points higher than Ginis based on unadjusted tax income as shown in Figure 5. Furthermore, both 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. The discrepancy in 2007 and 2008 can be explained by comparably lower average incomes in the SOEP beneath the top percentile cut-off

above which we impute incomes.[12] 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. All in all, we find that both correction approaches produce rather similar levels and trends of income inequality measured by the Gini coefficient. Highlight strength of our approach (data availability, living standard...)

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 α specifications are presented in Appendix Figure A.3.

4 An application to European survey data

We apply our integrated approach to other European countries where both EU-SILC survey data and top income shares are available. Appendix Figure A.1 suggests that the steepness of the log-log-curve for unadjusted tax incomes by tax unit is quite

[12] 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.

similar to household incomes by household unit in the German SOEP data. Hence, we argue that the α parameter estimated from tax records can be used to impute both the top of the tax and the household income distribution regardless of the unit of observation. We estimate the Pareto parameter α using the country-specific top income shares based on tax data documented in the WID.[13] The WID offers long-run series of top income shares for a large number of countries, including many European countries such as Denmark, France, Germany, Ireland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland and United Kingdom.[14] We then replace the top 1% of the country's gross household income distribution with Pareto imputed incomes.

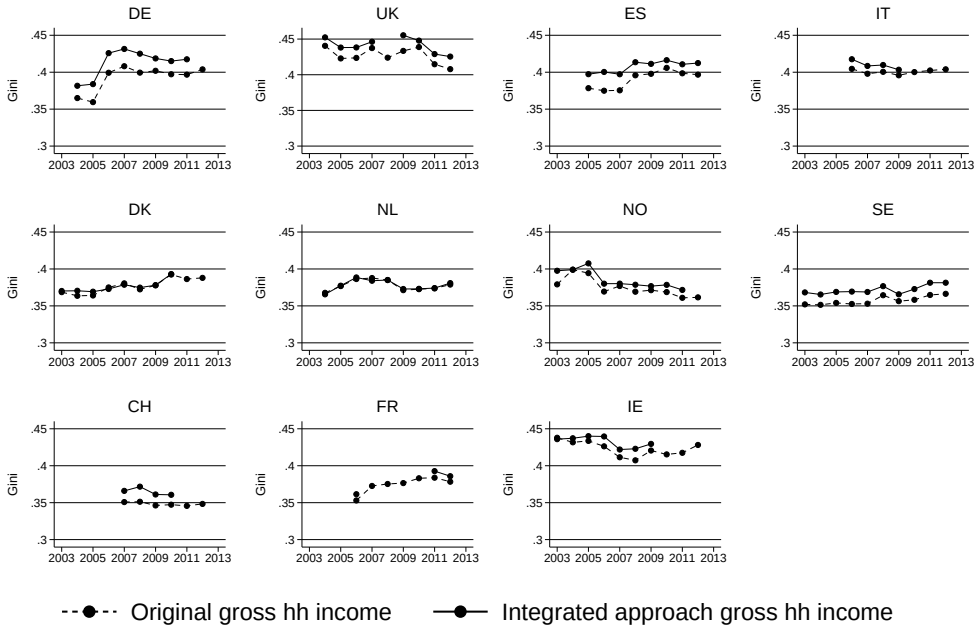
Figure 6 shows trends of Gini coefficients for gross household income in nine countries: Denmark, France, Germany, Ireland, Italy, Netherlands, Norway, Spain, Sweden, Switzerland and United Kingdom. Income inequality increases in all countries when imputing top incomes. The difference between original and imputed income Ginis is almost negligible in register countries like Netherlands, Denmark and Norway. However, the gap between the observed and the imputed Gini in Sweden, a register country as well, is puzzling. 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.[15] 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).

[13]See Appendix Figure A.5 for income shares of the top 1% in European countries as provided by the WID.

[14]The series for Portugal is only available until 2005, the year when EU-SILC was first conducted.

[15]Switzerland, Ireland and France mostly use incomes from registers. Spain and Italy partly link incomes from register and/or apply mixed methods (Jäntti et al.; 2013).

Figure 6: Top-corrected Gini coefficients, European countries



Source: EU-SILC (own calculations) and World Wealth and Income Database (WID).
Note: For Ireland and the Netherlands the pareto alpha is calulated by the income share ratios of top 1 % and top 0.5 %. For these countries, the share of the top 0.1 % is not available on WID at the moment.

5 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, 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 our new top income imputation approach produce rather similar Gini coefficients for 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.

References

Aaberge, R. and Atkinson, A. B. (2010). Top incomes in Norway, *in* A. B. Atkinson and T. Piketty (eds), *Top incomes: a global perspective*, Oxford University Press, pp. 448–482.

Alvaredo, F. (2011). A note on the relationship between top income shares and the gini coefficient, *Economics Letters* **110**: 274–277.

Armour, P., Burkhauser, R. V. and Larrimore, J. (2013). Deconstructing income and income inequality measures: A crosswalk from market income to comprehensive income, *American Economic Review: Papers & Proceedings 2013* **103**(3): 173177.

Atkinson, A. (2007). Measuring top incomes: Methodological issues, *in* A. Atkinson and T. Piketty (eds), *Top Incomes over the Twentieth Century: A Contrast Between Continental European and English-Speaking Countries*, Oxford University Press, Oxford, chapter 2, pp. 18–42.

Atkinson, A. B., Piketty, T. and Saez, E. (2011). Top incomes in the long run of history, *Journal of Economic Literature* **49**(1): 371.

Bach, S., Corneo, G. and Steiner, V. (2009). From Bottom to Top: The Entire Income Distribution in Germany, 1992-2003, *Review of Income and Wealth* **2**: 303–330.

Bartels, C. and Jenderny, K. (2015). The role of capital income for top income shares in germany, *World Top Incomes Database Working Paper Nr.1/2015* .

Bricker, J., Henriques, A., Krimmel, J. and Sabelhaus., J. (2015). Measuring income and wealth at the top using administrative and survey data, *Finance and Economics Discussion Series 2015-030, Federal Reserve Board, Washington* .

Burkhauser, R., Feng, S., Jenkins, S. and Larrimore, J. (2012). Recent trends in top income shares in the united states: Reconciling estimates from march cps and irs tax return data, *Review of Economics and Statistics* **94**(2): 371–388.

Burkhauser, R., Hrault, N., Jenkins, S. and Wilkins., R. (2016). What has been happening to uk income inequality since the mid-1990s? answers from reconciled

and combined household survey and tax return data, *IZA Discussion Paper No. 9718* .

Clementi, F. and Gallegati, M. (2005a). Paretos law of income distribrution: Evidence for germany, the united kingdom, and the united states, *in* S. Y. A. Chakrabarti and B. Chatterjee (eds), *Econophysics of wealth distribution*, Springer Verlag, pp. 3–14.

Clementi, F. and Gallegati, M. (2005b). Power law tails in the italian personal income dis, *Physica A* **350**: 427–439.

Dagum, C. (1997). A new approach to the decomposition of the gini income inequality ratio, *Empirical Economics* **22**: 515–531.

Gerstorf, S. and Schupp, J. (eds) (2015). *SOEP Wave Report 2014*.

Jäntti, M., Törmälehto, V.-M. and Marlier, E. (2013). *The use of registers in the context of EUSILC*, Publications Office of European Union.

Lakner, C. and Milanovic, B. (2013). Global income distribution: from the fall of the berlin wall to the great recession, *Policy Research Working Paper* .

Piketty, T. (2001). *Les hauts revenus en France au XX^{e} sicle: Ingalits et redistributions, 1901-1998*, Grasset.

Piketty, T. (2003). Income inequality in france, 1901-1998, *Journal of Political Economy* **5**: 1004–1042.

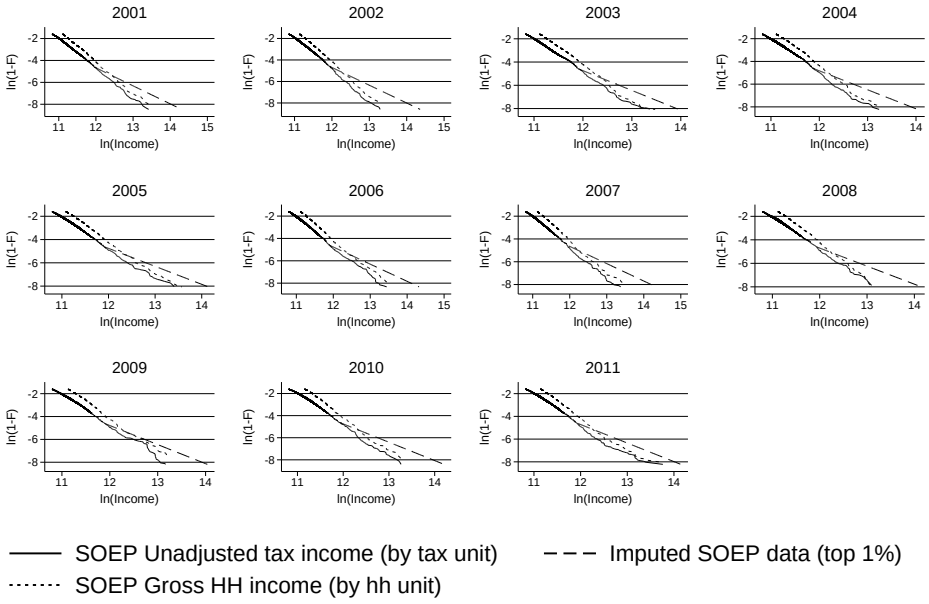
Piketty, T. and Saez, E. (2003). Income inequality in the united states, 1913-1998, *The Quarterly Journal of Economics* **1**: 1–39.

Roine, J., Vlachos, J. and Waldenström, D. (2009). The long-run determinants of inequality: What can we learn from top income data?, *Journal of Public Economics* **93**(78): 974988.

Wagner, G. G., Frick, J. R. and Schupp, J. (2007). The German Socio-Economic Panel Study (SOEP): Scope, evolution and enhancements, *Schmollers Jahrbuch* **127**(1): 139–169.

A Appendix

Figure A.1: Fit of the Pareto distribution

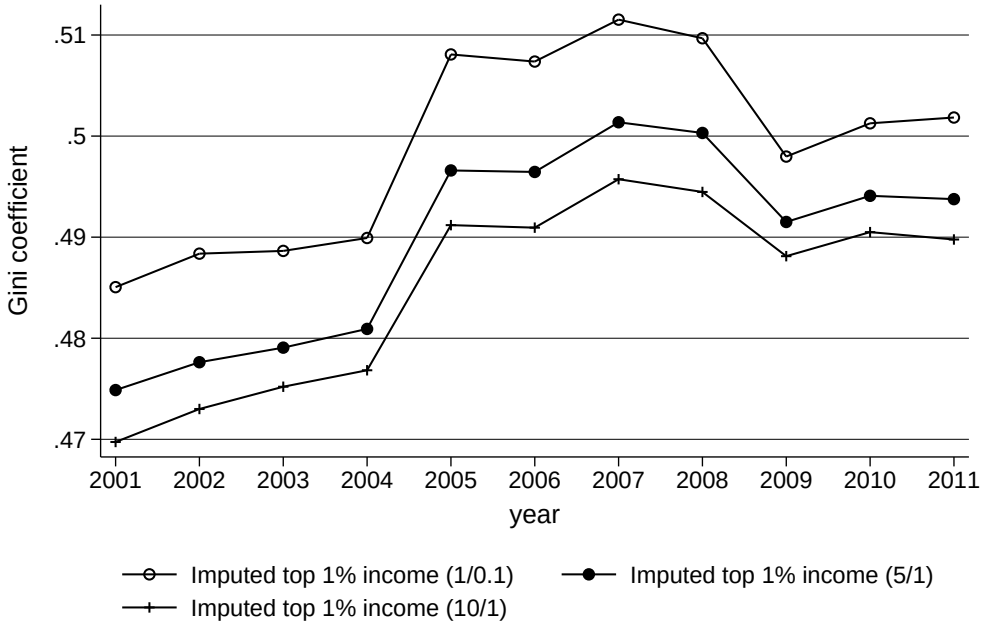


Source: SOEP (own calculations).

Figure A.2: Top income shares (α 1/0.1)

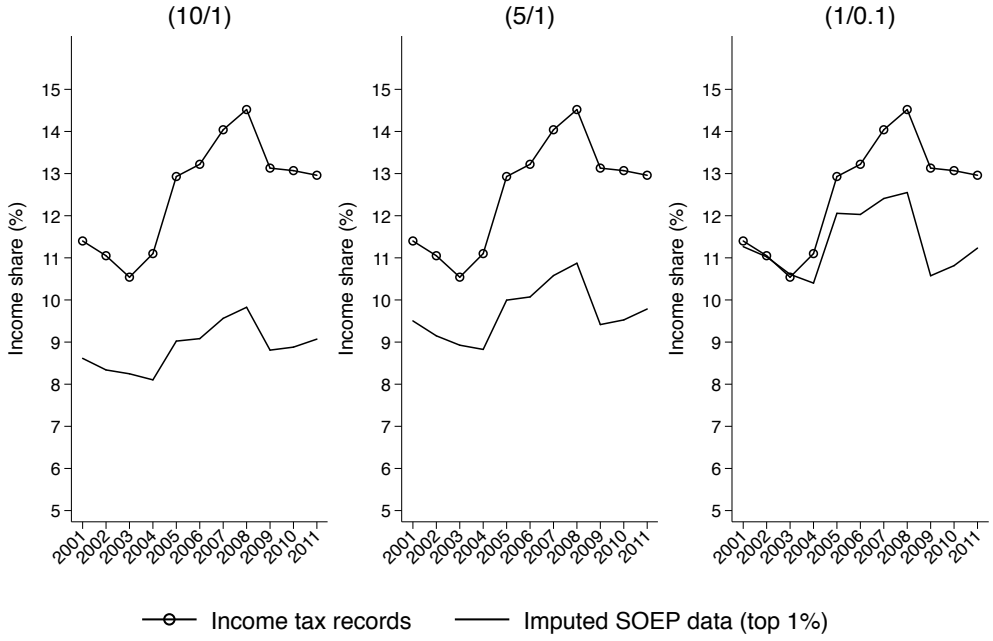
Source: SOEP (own calculations).

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



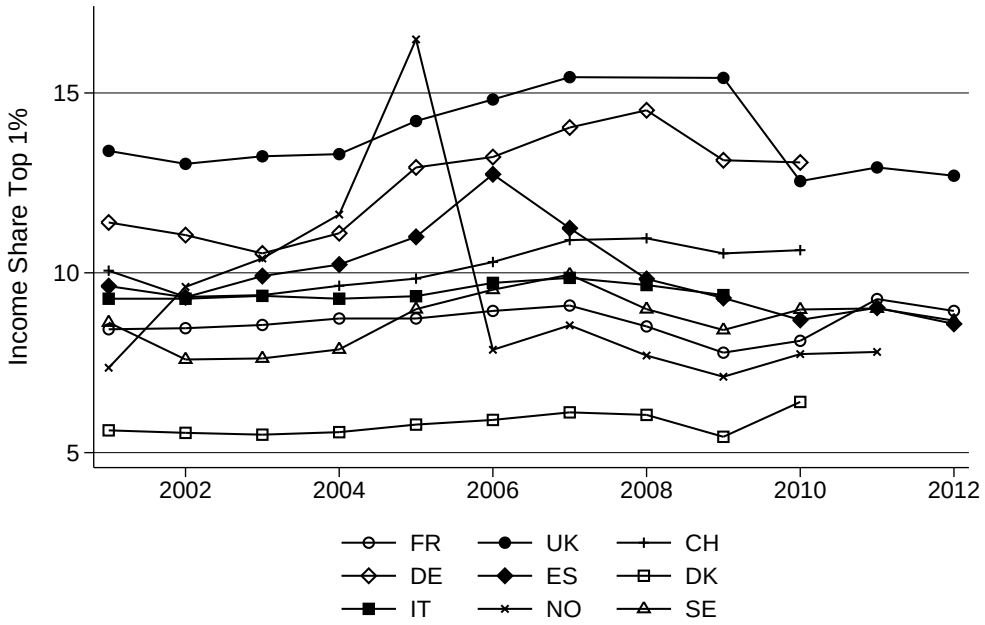
Source: Income tax returns (Bartels and Jenderny; 2015) and SOEP (own calculations).

Figure A.4: Income share of top 1 % with varying α specifications)



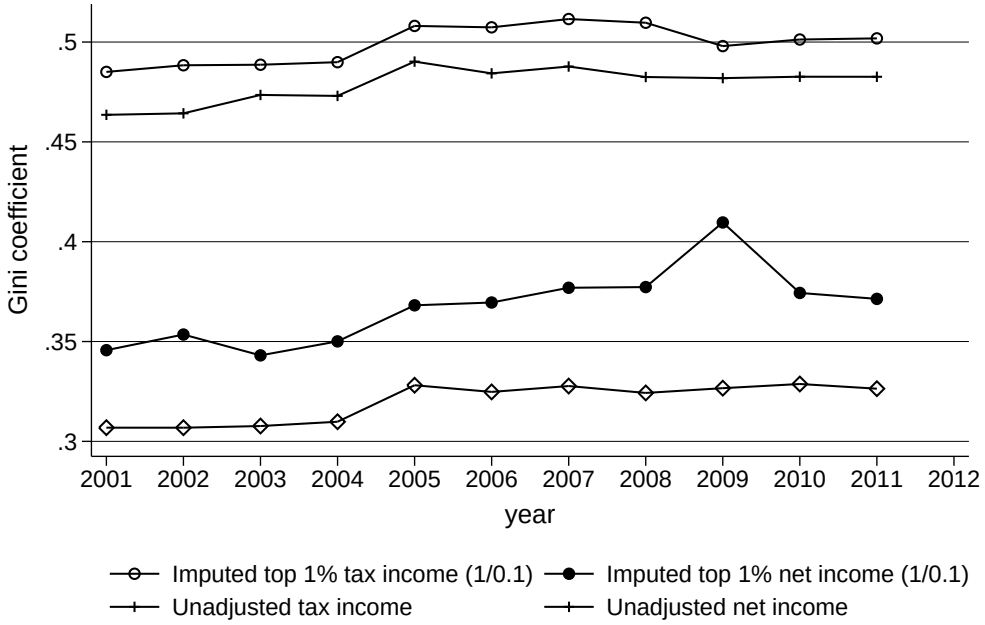
Source: SOEP (own calculations).

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



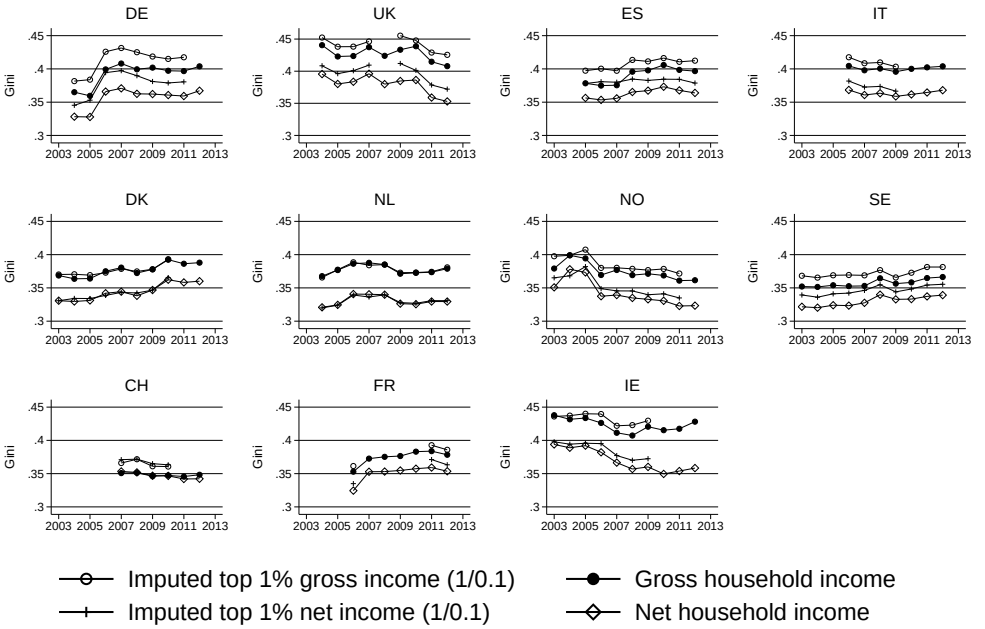
Source: World Wealth and Income Database (WID).

Figure A.6: Top-corrected Gini coefficients (net income), European countries



Source: EU-SILC (own calculations) and World Wealth and Income Database (WID).
Note: For Ireland and the Netherlands the pareto alpha is calulated by the income share ratios of top 1 % and top 0.5 %. For these countries, the share of the top 0.1 % is not available on WID at the moment.

Figure A.7: Top-corrected Gini coefficients (net income), European countries



Source: EU-SILC (own calculations) and World Wealth and Income Database (WID).
Note: For Ireland and the Netherlands the pareto alpha is calulated by the income share ratios of top 1 % and top 0.5 %. For these countries, the share of the top 0.1 % is not available on WID at the moment.

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

10/5		k			
	α	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			
	α	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			
	α	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: α and k are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Thresholds k are in 2010 Euros.

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

10/5		k			
	α	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			
	α	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			
	α	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: α and k are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Thresholds k are in 2010 Euros.

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

10/5		k			
	α	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			
	α	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			
	α	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: α and k are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Thresholds k are in 2010 Euros.

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

10/5		k			
	α	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			
	α	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			
	α	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: α and k are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Thresholds k are in 2010 Euros.

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

10/5		k			
	α	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			
	α	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			
	α	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: α and k are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Thresholds k are in 2010 Euros.

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

10/5		k			
	α	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			
	α	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			
	α	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: α and k are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Thresholds k are in 2010 Euros.

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

10/5		k			
	α	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			
	α	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			
	α	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: α and k are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Thresholds k are in 2010 Euros.

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

10/5		k			
	α	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			
	α	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			
	α	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: α and k are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Thresholds k are in 2010 Euros.

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

10/5		k			
	α	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		k			
	α	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		k			
	α	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: α and k are obtained from top income shares based on income tax returns assuming that top incomes follow the Pareto distribution. Thresholds k are in 2010 Euros.