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Redistribution and insurance in the German welfare state

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Abstract. Welfare states redistribute both between individuals (inter-individual redistribution) reducing annual, cross-sectional inequality and over the life-cycle of an individual (intra-individual redistribution) insuring individuals against income risks in the long-term. But studies measuring redistribution often focus on a one-year period and the second aspect is neglected. To quantify both inter- and intra-individual redistribution in Germany this study uses SOEP data from 1984 to 2009 to construct long-term incomes over a 20-year period. Results show that annual, cross-sectional inequality is higher than inequality in the long-run, but the effect of redistribution is also larger annually than in the long-term. Depending on age the distributional focus of the German welfare state differs. When persons are young, state intervention reduces income differences between individuals mainly through the progressive tax system. Getting older and reaching retirement age income-smoothing redistribution via social security pensions becomes central.

Keywords: Long-term income inequality; Income redistribution; Social security

JEL-Classification: D31; D63; H53; H55.

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1 Introduction

Welfare states redistribute both between individuals (inter-individual redistribution) and over the life-cycle of an individual (intra-individual redistribution). Transfers such as social assistance and housing benefits are clearly aimed at reducing cross-sectional inequality between individuals. In contrast, transfers such as sickness benefits, unemployment benefits and social security pensions follow motives of inter-temporal redistribution within an individual's life-cycle (Pettersson and Pettersson, 2007) insuring individuals against risks. As people are generally assumed to be risk averse preferring a stable income stream over an unstable income stream, state provided insurance aimed at smoothing income profiles generates a welfare gain.

There is a large literature on inequality and welfare states' redistribution. The effect of redistribution is mostly measured as the reduction of annual economic inequality before and after state intervention using gross and net annual incomes. Annual inequality provides a snap shot of the inequality in one year revealing, how the welfare state reduces inter-individual income differences in that particular year. Benefits are viewed as pure transfers and social security contributions as pure taxes (Burkhauser and Warlick, 1981). But redistribution between people measured annually will probably overshoot redistribution taking place in the long-term, since most of the current beneficiaries do not remain beneficiaries throughout their lives and will support other people at a different stage of their life-cycle or of their fortunes (Layard, 1977; Liebman, 2001). On top of this, the influence of welfare state insurance can only be taken into account in the long-term. This is particularly important, since most of the annual aggregate redistribution volume is probably due to intra-individual income smoothing (Sandmo, 1999). In the long-term, social security contributions can be viewed as insurance premiums as well. And pension benefits from German social security can also be seen as annuities equivalent to the contributions paid during working life rather than as intergenerational transfers (Börsch-Supan and Reil-Held, 2001).

This study aims at broadening the view from the annual to the long-term perspective. Taxes and transfers such as income taxes, social security contributions, public transfers and social security pensions are taken into account to tackle their effects on either redistribution between people or redistribution over a part of the individual's life-cycle. Children and elderly are particularly interesting in an analysis of welfare schemes as they depend on intra-household transfers or public benefits not being part of the work force yet or anymore. Therefore, individuals are divided into six age groups reaching

from 1-10 years to 51-60 years in the first year of observation. Hereby, the impact of different welfare state schemes depending on the stage of the life-cycle can be analyzed. The most suitable approach to measure long-term inequality is to look at lifetime income. However, the number of studies enquiring lifetime inequality is limited due to the lack of data encompassing the entire life-cycle of individuals. Björklund (1993) and Bönke et al. (2010) find that males' lifetime income inequality is around 35 to 40 percent lower than males' annual income inequality in Sweden and Germany, respectively. When there is mobility in income over time, long-term inequality will be lower than annual inequality as moving up and down the income distribution will make the distribution of long-term income more equal (Shorrocks, 1978; Kopczuk et al., 2010). Bönke et al. (2010) use German social security earnings data that cover a longer time horizon than standard panel data do, but do not include all information relevant to quantify redistribution. Another strand of literature deals with the different impact of taxes and transfers on inequality when comparing the annual incidence with the life-cycle perspective. Most of these studies use panel data and estimate dynamic income models to simulate lifetime income distributions.[1] This study computes long-term income as the Net Present Value (NPV) of income streams documented by SOEP data over a 20-year period discounted by the yield curve.

The paper is organized as follows. Section 2 describes SOEP data used for the analysis and lays out the methodology. Long-term inequality as measured by the Theil coefficient is decomposed into a between-group (inter-individual) and a within-group (intra-individual) component. Redistribution is identified as the distance between inequality of pre- and post-government income such that differences between the decomposition components reveal estimates of inter-individual and intra-individual redistribution. Section 3 offers a discussion of the results. Section 4 concludes.

2 Data and methodology

2.1 Data

The analysis is based on a subsample from the SOEP survey years 1984 to 2009. The SOEP is a representative panel study containing individual and household data in Germany from 1984 onwards. After German reunification in 1990 the study was expanded to the New German Laender. All household members are interviewed individually once

[1] Examples are Layard (1977) for the U.K., Blomquist (1981), Pettersson and Pettersson (2007) for Sweden, Nelissen (1998) for the Netherlands and Oshio (2005) for Japan.

they reach the age of 16. The sample design ensures representativeness by oversampling special subpopulations. These include subsamples of guest workers from 1984 onwards, immigrants starting in 1994 and high income households from 2002 on. A critical variable in the calculation of taxable income is the year in which reported income is received. In the SOEP as well as in most other surveys, yearly income is asked retrospectively, e.g., the income reported in 1984 belongs to 1983.[2]

To analyze long-term income distribution, a balanced panel is required providing a complete sequence of annual incomes. As a robustness check, seven balanced panels are constructed, each encompassing 20 years: 1983-2002, 1984-2003, 1985-2004, 1986-2005, 1987-2006, 1988-2007, 1989-2008. Consequently, East German households entering the panel after 1990 are not included in the analysis. The sample includes persons that live in households in West Germany. Persons in these households are split into six age groups such that in the first year, persons in the sample are 1 - 60 years old. In the 20th year, persons are 20 - 79 years old. Additionally to observed income, imputed values provided by SOEP are used. Item non-response on income questions in the SOEP is concentrated in the tails of the income distribution (Frick and Grabka, 2005), but only weakly associated with observable variables such as human capital variables, marital status, firm size, being foreign, and employed in public service (Biewen, 2001). According to Frick and Grabka (2005) income inequality and income instability would be underestimated when restricting the sample to observed income components only. Households are dropped if they exhibit a missing income source not replaced by an imputed value. Zero market income is replaced by 0.01 to account for characteristics of inequality measures as the Theil coefficient.

Each age group is treated as a subsample. Thus, individuals are considered at different stages of their life cycle reaching from childhood to retirement. Table 1 presents the numbers of individuals within each age group observed in each single year of the 20-year-period.

Equivalent household income is used to consider income pooling as household members usually share their income.[3] Income pooling within a household contributes to reduce inequality and to stabilize individual incomes provided that there is less than perfect correlation between the income positions of the household members (Björklund and Palme, 2002). Individual income data neglect the effects of income pooling and would thus overestimate redistribution taking place through the welfare state. Indeed, the extent of

[2]See Haisken-DeNew and Frick (2005), Frick (2006) and Wagner et al. (2007) for further details.

[3]Equivalent household income is derived using the OECD modified equivalence scale that assigns a value of 1 to the household head, 0.5 to each additional adult member and 0.3 to each child.

Table 1: **Number of observed individuals**

Age group	age	1983 -2002	1984 -2003	1985 -2004	1986 -2005	1987 -2006	1988 -2007	1989 -2008
1	1-10	579	542	535	517	499	488	452
2	11-20	713	648	590	514	464	429	373
3	21-30	791	783	797	765	740	722	692
4	31-40	798	775	785	761	738	698	630
5	41-50	830	833	783	736	690	661	632
6	51-60	515	486	487	483	489	485	477

Source: SOEP

redistribution through the U.S. social security system is halved, when benefits and taxes are analyzed at the family level because of the large intra-household transfers from men to women (Gustman and Steinmeier, 2001). Second, public transfers and income taxes can be considered using household income, because they are contingent upon the household context in Germany. Compared to nordic countries public benefits for children and elderly in Germany are rather low (Anttonen and Sipilä, 1998). Income pooling within the household may thus be even more important in Germany. However, equivalent income is sensitive to household composition. Any changes in the household composition lead to changes in equivalent income. If, for example, a child is born into a household, gross equivalent household income of all household members declines. At the same time, equivalent social security contributions also decline and do not rise because medical care for a child is granted for free.

2.2 Construction of long-term income

The computation of long-term income follows the NPV method. Each individual i could sell the promise to a market participant today ($t = 0$) of paying him his future income $x_{i,t}$ at time t. If P is the price that the market is willing to pay for this promise, then $\frac{x_{i,t}}{1+i_{0,t}}$ gives P. $i_{0,t}$ is the interest rate for a safe investment today with time to maturity t. The NPV indicates what future income streams accumulated over the 20-year-period are worth today ($t = 0$) and is defined as

$$NPV_i = \sum_{t=0}^{T=19} \frac{x_{i,t}}{d_{0,t}}$$

with

$$d_{0,t} = 1 + i_{0,t}$$

The NPV depends crucially on the discount rate $d_{0,t}$ chosen. One approach is to take into account market participants' expectations today on future interest rates and inflation. The relation between interest rates $i_{0,t}$ and different times to maturity t of zero-coupon bonds without default risk is provided by the so-called yield curve. Since the yield curve allows interest rates to vary with maturity, it is a better approximation for expected market conditions than a constant discount factor would be. But the yield curve function is only known with certainty for a few specific maturity dates, because only very few zero-coupon bonds exist. Hence, the other maturities have to be estimated. Serving as a tool for monetary policy decisions the yield curve is provided by the Bundesbank in Germany.[4] The Bundesbank applies the method of Svensson (1994) which is an extended version of Nelson and Siegel's (1987) approach. Following Svensson (1994) the interest rate is the sum of a constant and three exponential terms to allow for sufficient flexibility:

$$i(t,\beta) = \beta_0 + \beta_1(\frac{1 - exp(-t/\tau_1)}{(t/\tau_1)})$$

$$+\beta_2(\frac{1 - exp(-t/\tau_1)}{(t/\tau_1)} - exp(-\frac{t}{\tau_1}))$$

$$+\beta_3(\frac{1 - exp(-t/\tau_2)}{(t/\tau_2)} - exp(-\frac{t}{\tau_2}))$$

where $\beta_0, \beta_1, \beta_2, \beta_3, \tau_1$ and τ_2 are estimated parameters. Yield curves for the years 1983, 1984, 1985, 1986, 1987, 1988 and 1989 from one up to 19 years to maturity are given in the Appendix.[5] Since the NPV is sensitive to the discount rate, deflated long-

[4]However, the German yield curve is only available as of 1972. Other studies use average interest rates of government bonds (e.g., Bönke et al., 2010) or ad-hoc constant discount rates such as 3 percent (e.g., Börsch-Supan and Reil-Held, 2001).

[5]Yield curves from 1983 to 1988 present a positive, normal slope. But the yield curve of the year 1989 reveals an inverse shape because interest rates are taken from month December, hence, succeeding the event of German reunification in November 1989. The German yield curve after reunification is an often cited example for an inverse shape not being the result of an expected recession but of extraordinary circumstances. It is usually explained by the great demand for liquidity to finance urgent investments. As those were mainly short-term financed, short-term interest rates rose ("einigungsbedingter Zinsanstieg"). Additionally, uncertainties regarding the scope of transfers from the

term incomes using the Consumer Price Index (CPI) are computed alternatively with base year 2005.

2.3 Measurement of redistribution and insurance

A simple, implicit measure for redistribution is provided by the difference between inequality measures of pre- and post-government income concepts as presented in Table 2. Social security pensions are considered separately because pensions state the greatest item in Germany's social budget amounting to about one third of overall expenses. As German social security pensions can also be seen as annuities equivalent to the contributions, they are comparable with private pensions and, hence, an element of gross household income before redistribution.[6] Gross household income including social security pensions is called modified gross household income. Subtracting social security contributions and income taxes and adding public transfers articulates different stages of government intervention. Table 3 gives details on income, tax and transfer measures in the SOEP.

Table 2: **Income concepts**

1	Gross household income (ghi)
2	modified ghi = ghi + social security pensions
3	modified ghi - social security contributions
4	modified ghi - social security contributions - income taxes
5	Net household income = modified ghi - social security contributions - income taxes + public transfers

Source: SOEP

Old to the New German Laender and inflationary pressures because of the ongoing economic boom contributed to increased interest rates in the end of 1989 (Bundesbank, 1991).

[6]Households could decide to invest in housing as alternative to a private pension plan and to enjoy non-monetary returns from this investment (Canberra group, 2001). Adding imputed rental value to gross household income gives slightly lower inequality estimates than for gross household income, especially for intra-individual inequality. The difference tends to grow with age reflecting the rising significance of housing investment, but overall the effect is quite small. Results are available from the author upon request.

Table 3: **From gross to net income in the SOEP**

Gross household income	labor earnings, asset income, private transfers, private pensions
+ **Social security pensions**	payments from old age, disability and widowhood pension schemes
- **Social security contributions**	pension insurance, health-care insurance, and unemployment insurance estimated by routines described by Schwarze (1995)
- **Income taxes**	estimated by routines described by Schwarze (1995)
+ **Public transfers**	housing allowances, child benefits, subsistence assistance, special circumstances benefits, government student assistance, maternity benefits, unemployment benefits, unemployment assistance, unemployment assistance allowance
= **Net household income**	

Source: SOEP

The importance of the income components in long-term net equivalent household income for different age groups in the first 20-year period 1983-2002 is given in Table 4.[7] Because of the use of equivalent income also very young persons display a high share of labor earnings which is generated by their parents. Labor earnings is the most important income source, especially for the middle age groups. Asset income, private pensions and social security pensions become increasingly important with age for the most part. The opposite is true for private and public transfers that loose importance with age.

Table 4: **The share of income components in long-term net household income, 1983-2002**

age group	1	2	3	4	5	6
Labor earnings	117.23	122.53	126.67	125.28	113.72	69.62
Asset income	3.37	2.96	2.97	4.37	5.07	5.76
Private transfers	1.13	0.78	0.67	0.43	0.42	0.55
Private pensions	0.22	0.28	0.27	0.34	1.25	3.98
Public transfers	11.66	9.25	9.11	7.07	5.00	3.82
Social Security Pensions	1.92	3.45	2.54	3.68	12.94	41.59
Income taxes	-16.54	-18.88	-21.04	-21.43	-19.94	-11.62
Social security contributions	-18.99	-20.38	-21.19	-19.75	-18.46	-13.71
Total	100	100	100	100	100	100

Source: SOEP, Own calculations
Note: All numbers are in percent and rounded such that they do not add up to 100 in all cases.

Inequality measures are computed to answer two questions. First, how does redistribution change when extending the measurement period from one to 20 years? Second, to what extent gives the German welfare state priority to insurance over redistribution

[7] Tables for the other 20-year periods are given in the Appendix since the shares do not vary much across periods.

(intra- or inter-individual inequality) in the long-term?

The first question is addressed by computing age-specific inequality measures based on long-term and annual incomes. First, all inequality measures are computed using long-term incomes constructed as explained in 2.2. These measures provide inequality levels over a 20-year period. Second, inequality levels are computed for every single year and then averaged over the 20-year period. Comparing results for the averaged cross-section and for the long-term gives the extent to which inequality changes when extending the measurement period. Redistribution is higher annually, if the difference between pre- and post-government income inequality is higher for the averaged cross-section than in the long-term.

To measure redistribution and insurance in the long-run, an approach by decomposing inequality is chosen. An advantage of the Theil coefficient is its simple decomposability. The Theil coefficient can be rewritten as an additive function of between-group and within-group inequality. Since the SOEP is a panel data set and provides more than one observation per individual, each individual can be interpreted as a subgroup $i(i = 1, 2..n)$ consisting of 20 observations per individual during each 20-year period. Thus, the Theil's between-group component provides a measure for inter-individual inequality and the within-group component for intra-individual inequality. Björklund and Palme (2002) use a similar method deploying Swedish data. Again, inequality measures are calculated separately for age-specific subgroups. The Theil coefficient ranges from 0 to $\sqrt{ln(K)}$, where larger values indicate higher inequality and can be decomposed as follows:

$$\begin{aligned} T &= \frac{1}{K}\sum_{k=1}^{K}\frac{y_k}{\overline{y}}\ln(\frac{y_k}{\overline{y}}), \\ &= T_{between} + T_{within} \\ &= \sum_{i=1}^{n}\nu_i \ln\frac{\nu_i}{w_i} + \sum_{i=1}^{n}\nu_i T_i \end{aligned}$$

where K is the number of observations, y_k is individual equivalent household income and $\overline{y}$ is the mean of individual equivalent household income. n is the number of individuals equal to the number of subgroups, w_i the individual's weight in the total population and ν_i the individual's share of age group specific total income. Individuals are weighted using selection and staying probabilities as given in the SOEP.[8]

[8] To properly account for selection and staying probabilities, individuals are weighted by cross-sectional weights when computing cross-sectional inequality and by longitudinal weights when computing

The between-group component is equivalent to before-measured long-term inequality. To verify the statistical significance of the inequality measures, the bootstrap method is used (Mills and Zandvakili, 1997). 100 random samples with replacement are drawn from all observations within a 20-year period. Each bootstrap sample contains as many sampling units as the original sample. Moreover, stratified bootstrap sampling is implemented to take the different selection probabilities of the SOEP into account. The variable "strat" documented in the SOEP indicates the strata associated with sampling units. Per stratified bootstrap sample, inequality measure are computed. This gives 100 different values of the inequality measures for each income concept and each 20-year-period. Hall's (1994) percentile confidence intervals for the point estimates are then calculated.

3 Results

First, results for annual and long-term redistribution are presented and discussed. Second, results for Theil decomposition of long-term inequality are shown uncovering the role of insurance and redistribution.

3.1 Annual and long-term redistribution

Figures 1 and 2 show long-term and average cross-sectional inequality as measured with the Theil coefficient. Each graph depicts the age-group-specific results for annual and long-term inequality over seven 20-year periods. Three graphs per age group contrast results for gross household income, modified gross household income and net household income. Each individual is assigned an equivalent household income. Long-term inequality is based on the NPV of income streams in the 20-year-period. Average cross-sectional inequality is the 20-year average of annual inequality within the specific age group. All graphs in Figures 1 and 2 confirm that extending the measurement period decreases the measured income inequality, since long-term inequality is lower than cross-sectional inequality in all seven periods for all age groups and all income concepts. This is in line with many studies confirming that inequality automatically declines when extending the measurement period.[9]

long-term inequality.

[9] See, for example, Björklund (1993), Bönke et al. (2010), Burkhauser and Poupore (1997), Creedy (1991), Finkel et al. (2006), Gibson et al. (2001), Kopzcuk et al. (2010), Nelissen (1998) and Shorrocks (1978). See Wodon and Yitzhaki (2003) for a formal proof of the occurrence of this fact.

Furthermore, gross household income is both annually and in the long-term increasingly unequally distributed with age. The oldest age group - aged between 51 and 60 years in each period's beginning and between 70 and 79 years at the end - experiences the highest levels of gross household income inequality, which can partly be explained by some individuals still working and others already being retired receiving no gross household income. To understand how redistribution changes when extending the measurement period from one to 20 years, the distance between gross and net household income inequality is compared for both annual and long-term income. Independent from the measurement period, post-government distributions are more equal than pre-government distributions confirming the results of Blomquist (1981). In the long-term, inequality is reduced by about 30 percent through state intervention, whereas annually the reduction amounts to 35 percent. Hence, the long-term redistributive impact is smaller than the annual incidence insinuates, which coincides with Nelissen (1998).

Children and younger people mostly receive income and transfers through their parents. Gross household income inequality for children and younger persons is reduced from about 0.18 to about 0.1 in the cross-section and from about 0.1 to about 0.06 in the long-term. Income differences between children and younger persons are reduced through income taxes paid by the parents and through public transfers such as child benefits. Public transfers are most important for the youngest age group compared to the others as they contribute more than ten percent to long-term net household income (See Table 4).

The oldest age group not only experiences the highest level of gross household income inequality, but also the highest reduction of both annual and long-term inequality through state intervention. Income differences between elderly are strongly reduced through state intervention from about 0.65 to about 0.1 in the cross-section and from about 0.25 to about 0.08 in the long-term. The main effect can be attributed to the payment of social security pensions which adds to modified gross household income (see middle graph of age group 6 in Figure 2). Social security pensions provide almost one half to net household income of elder persons. Since social security pensions have an effective minimum and maximum level, even though they reflect earnings from former earnings, they are much more compressed. But still some further inequality reduction takes place when adding public transfers and subtracting income taxes and social security contributions. In the view of quite similar levels of net household income inequality throughout the age groups, the welfare state seems to successfully reduce inequality among age groups, especially for older people.

We refrain from the discussing the development over time, since time effects could not be separated properly from cohort effects. Theil coefficients based on CPI-deflated long-term incomes show that the use of deflated long-term incomes states slightly higher long-term inequality for both gross and net household income than when using the yield curve (see Appendix). On the whole, Gini coefficients given in the Appendix reproduce results of Theil coefficients.

[Figure 1 about here]
[Figure 2 about here]

3.2 Redistribution and insurance

Decomposition of total inequality into a between-group component provides measures for inequality and redistribution between persons and a within-group component shows income variation and insurance within an individual's life. Figures 3 to 7 present the results of Theil decomposition for seven 20-year periods computed for five income concepts. Again, the focus lies on the comparison of the magnitude of between- and within-group inequality measures and not on the development of these over time.

Results for the decomposition over the whole population and an adult group 25 years and older are given in Figures 3 and 4, respectively.[10] To take the welfare state into account, five income concepts are considered additionally to gross household income. The effect of specific welfare state measures is revealed by subtracting taxes or subtracting taxes stepwise. The progressive tax system contributes most to even out income differences, a pattern also found by Björklund and Palme (2002) in the Swedish case. Public transfers play the second biggest role in reducing inter-individual inequality. Taxes and public transfers are similarly important to smoothen individual income. In contrast, the results of Björklund and Palme (2002) give public transfers a much higher weight than income taxes on smoothing income. In summary, income taxes play a slightly more important role for redistributing income between people, whereas income taxes and public transfers exhibit similar importance for smoothing income. The larger reduction of intra-individual inequality suggests that the German welfare state possibly puts more emphasis on insurance than on redistribution. Indeed, Bartels and Bönke (2010) find that insurance against transitory labor market risks outweighs the reduction of perma-

[10] Results for the whole population and changes from one income concept to the other are given in a Table in the Appendix.

nent earnings differences in Germany. When considering only the adult population, as presented in Figure 4, income variation within a life-cycle becomes more pronounced than income differences between people. Hence, the welfare states' role as an insurer gains importance as the weight of older age groups increases. For the adult population this component is reduced even more by the welfare state intervention.

[Figure 3 about here]
[Figure 4 about here]

For almost all age groups total inequality of gross household income can be attributed to a greater extent to intra-individual inequality as Figure 5 and 6 present. However, this pattern gets more pronounced with age. About two thirds of total inequality within the oldest age group is explained by intra-individuals' differences meaning that differences within an individual's income stream over 20 years outweighs the differences between persons.

Comparing gross and net household income inequality reveals that between- and within-group inequality is reduced quite differently depending on age.[11] Inter-individual inequality is reduced more (age group 1 and 4) or quite similarly to intra-individual inequality (age group 2 and 3). The role of progressive taxes and public transfers does not differ much from the pattern of the entire population seen in Figure 1.

But the picture changes for the two oldest age groups. For age group 5 and 6 state intervention focusses on insurance reducing the within-group component far more than the between-group component. Not surprisingly, social security pensions become central for the two oldest age groups reaching retirement age within the period. Adding social security pensions to gross household income brings down intra-individual inequality by as much as 70 percent for the oldest age group. This seems plausible since the German pension system is insurance-oriented. German social security pensions include insurance benefits that depend on accumulated relative income points. But the system also includes a redistributive component. Non-insurance benefits are granted for time of unemployment, military service, schooling, child-raising or because of early retirement or a pension below minimum income. Börsch-Supan and Reil-Held (2001) state that 86 percent of male social security pensions are attributable to insurance benefits whereas only 13 percent stem from non-insurance benefits. For women, insurance benefits are 70

[11] Between-group inequality in Figures 5 and 6 corresponds to long-term inequality presented in Figures 1 and 2.

percent and non-insurance benefits 30 percent where non-insurance benefits are mainly due to minimum benefits. Although the authors find that some non-insurance benefits, such as those for education, are given to almost every worker in the sample, they confirm redistribution between permanent earnings quintiles of the pensioners through non-insurance benefits. Indeed, the results for the oldest age group in Figure 6 clearly show the redistributive component: Social security pensions bring down inter-individual inequality by 57 percent. Nelissen (1998) does not distinguish between age groups, but also finds that Dutch old-age pensions have the highest impact on reducing lifetime inequality even though the Dutch system largely provides flat pensions, but the redistributive impact is smaller over the lifetime than the annual incidence suggests. As opposed to younger age groups, public transfers and income taxes play only a minor role for age groups 5 and 6.

Interestingly, adding social security contributions to modified gross household income increases both inter- and intra-individual income differences, except for the two oldest age groups. Social security contributions are payed as a fixed percentage of earnings such that contributions increase with earnings, but only up to a maximum amount. In 2008, the monthly earnings cap was at 3600 Euro for health care and 5300 for unemployment insurance and social security pensions. Wagstaff et al. (1999) confirm that social security contributions for health care have a regressive effect in Germany. But one should note that cash values of in-kind transfers such as medical care and utility gains through, e.g., unemployment insurance are not accounted for in the analysis. Research on this subject documented that including the cash value of in-kind transfers reduces inequality measures since almost half of the welfare state transfers in rich nations consists of in-kind transfers (See, e.g., Garfinkel et al., 2006, and Paulus et al., 2009).

[Figure 5 about here]
[Figure 6 about here]

If only one-person-households of all ages are considered, inequality of gross household income is far higher as can be taken from Figure 7. First, income differences between one-person-households are far higher than between larger households. Second, intra-household income pooling cannot occur to reduce individual income variations. But the result that the welfare states aims more at smoothing income than at redistributing income also remains for one-person-households.

[Figure 7 about here]

4 Conclusion

This paper analyzes the impact of a redistributing welfare state on inter- and intra-individual redistribution by including taxes and transfers such as income taxes, social security contributions and public transfers. Long-term income is measured as the NPV of equivalent household income streams over a 20-year period discounted by the yield curve. The results confirm the literature that inequality in the long-term is lower than annually, but the effect of redistribution is also lower when measured in the long-term. Switching from the annual to the long-term perspective additional impacts such as income smoothing via insurance payments of the social security system appear. A decomposition approach is used to identify inequality between people and income variation within an individual's life (inter- and intra-individual inequality) in a first stage and redistribution between people and income smoothing within a life-cycle in a second stage. Results show that the German welfare states clearly gives priority to insurance over redistribution. The scope of this priority depends on the stage of the life-cycle. When persons are young, state intervention also notably redistributes between people through the progressive tax system and public transfers. Getting older and reaching retirement age intra-individual redistribution via social security pensions becomes central. Social security pensions reduce intra-individual inequality by 70 percent for the oldest age group. In an individual's life-cycle perspective one could thus conclude that the welfare states evolves from being a poverty reliever in earlier years to an insurer in later years. However, the presumably inequality reducing effect of in-kind transfers such as health care and education is not included in the analysis. Overall, in his role as an insurer, social security pensions is the most important instrument of the welfare state in smoothing income over time.

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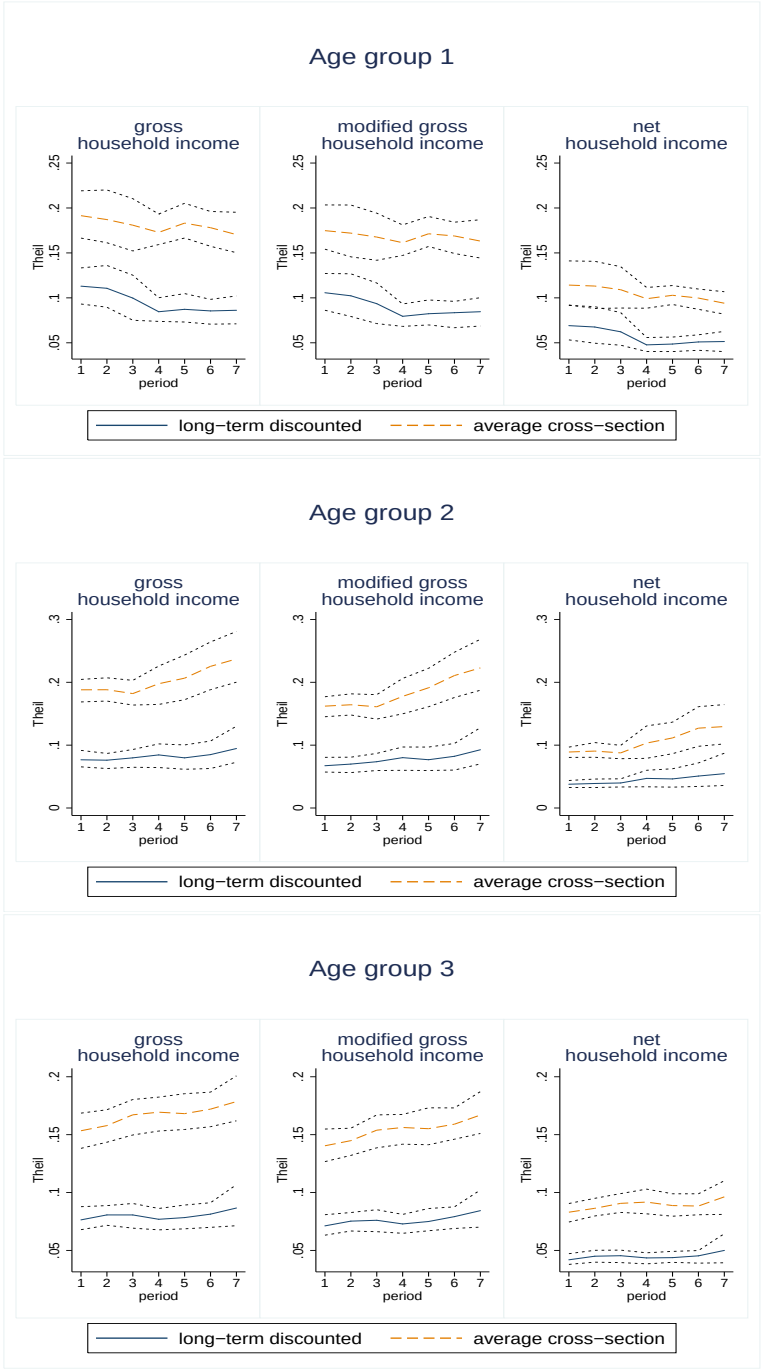
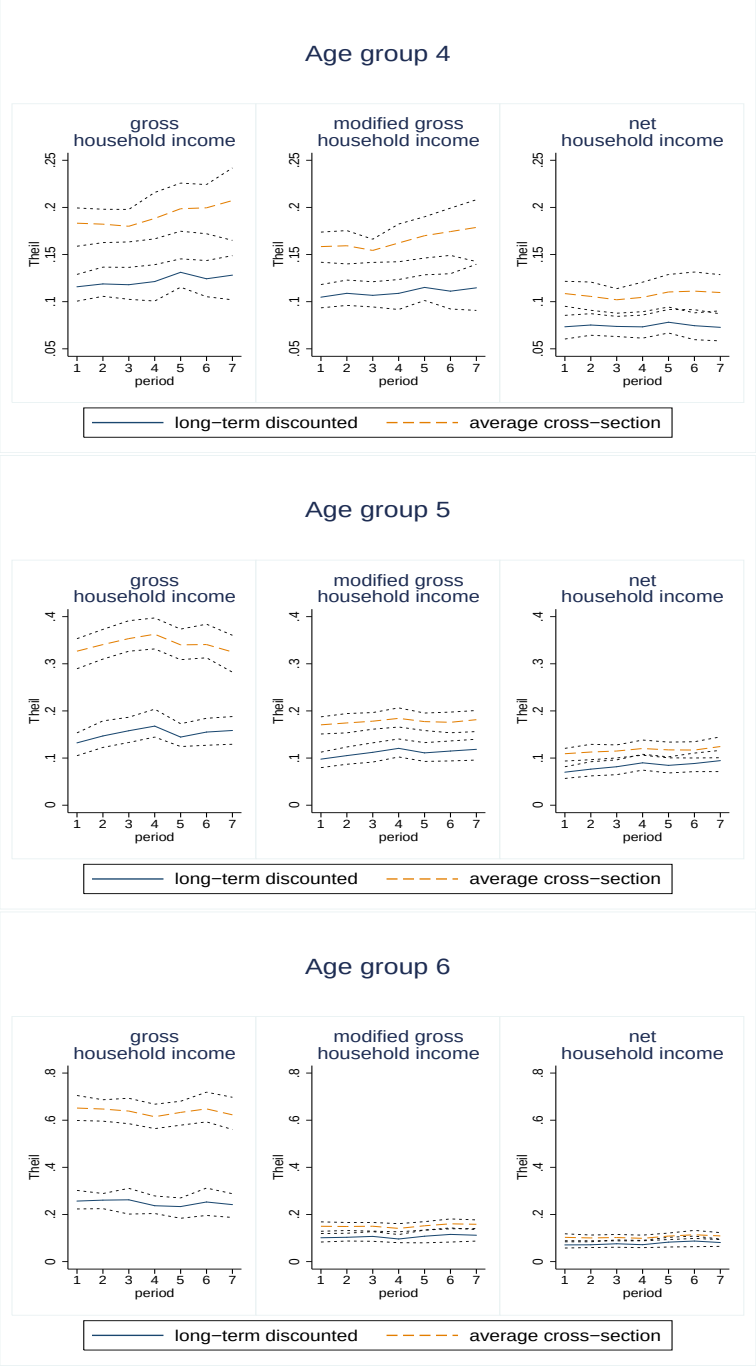
6 Figures

Figure 1: Theil coefficients for gross and net household income, age groups 1-3



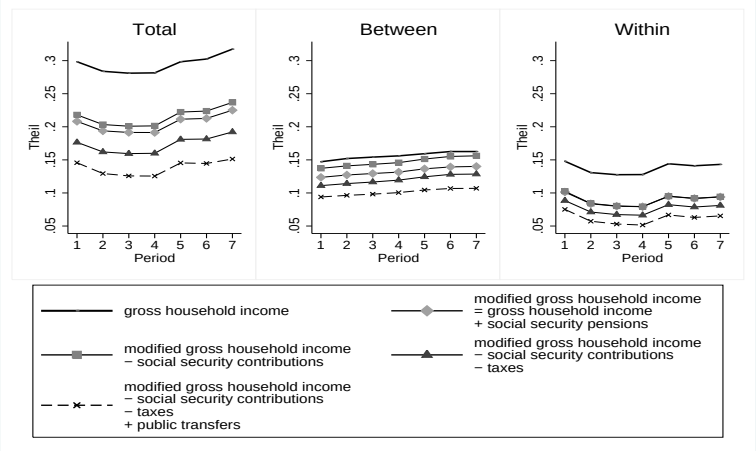
Source: SOEP, Own calculations
Notes: All income concepts are defined as equivalent income using the modified OECD equivalence scale. Dotted lines denote Hall's bootstrap confidence intervals at 95%-level.

Figure 2: Theil coefficients for gross and net household income, age groups 4-6



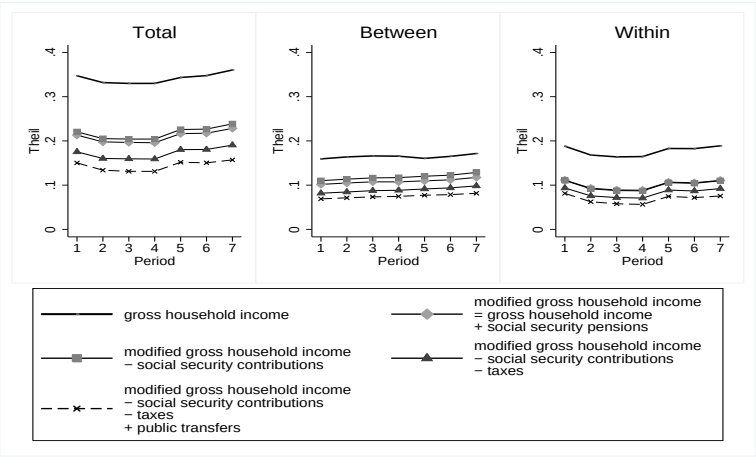
Source: SOEP, Own calculations
Notes: All income concepts are defined as equivalent income using the modified OECD equivalence scale. Dotted lines denote Hall's bootstrap confidence intervals at 95%-level.

Figure 3: Theil decomposition, all ages



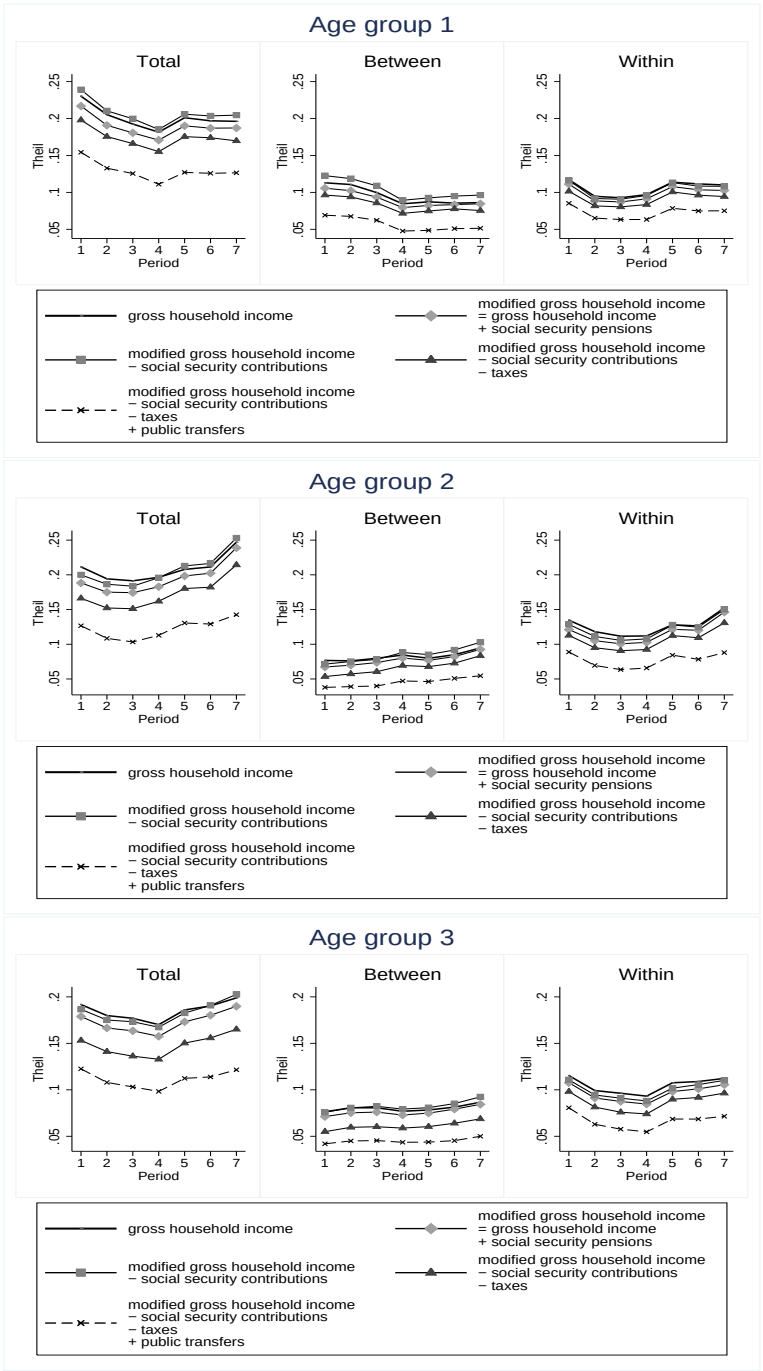
Source: SOEP, Own calculations
Notes: All income concepts are defined as equivalent income using the modified OECD equivalence scale.

Figure 4: Theil decomposition, above 25 years



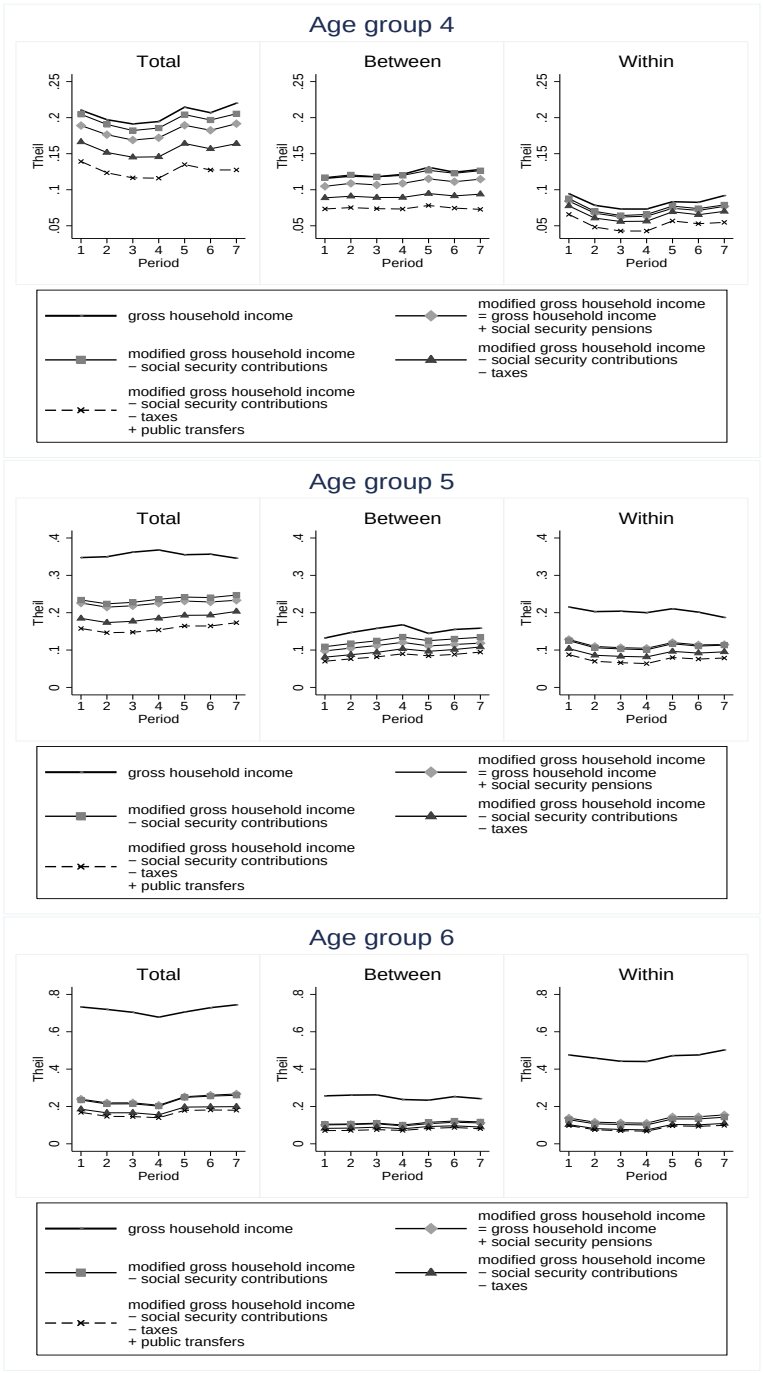
Source: SOEP, Own calculations
Notes: All income concepts are defined as equivalent income using the modified OECD equivalence scale.

Figure 5: Theil decomposition, age groups 1-3



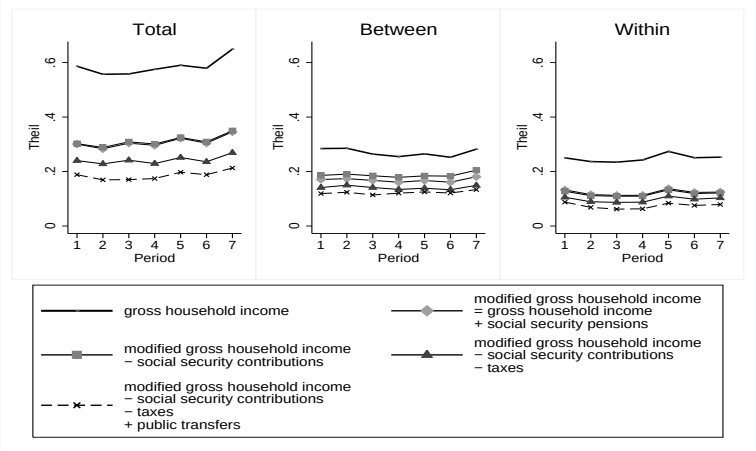
Source: SOEP, Own calculations
Notes: All income concepts are defined as equivalent income using the modified OECD equivalence scale.

Figure 6: Theil decomposition, age groups 4-6



Source: SOEP, Own calculations
Notes: All income concepts are defined as equivalent income using the modified OECD equivalence scale.

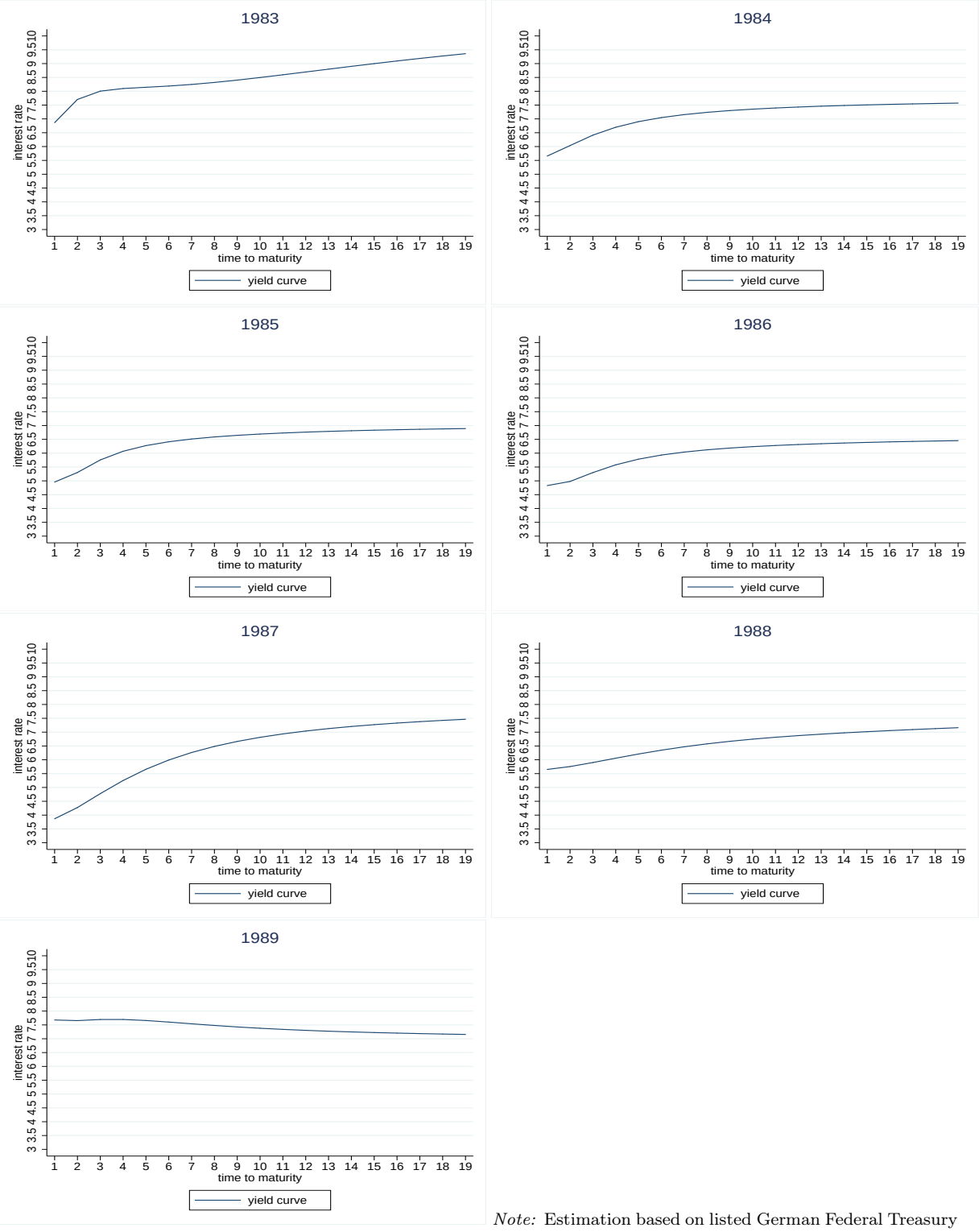
Figure 7: Theil decomposition, one-person-households, all ages



Source: SOEP, Own calculations
Notes: All income concepts are defined as equivalent income using the modified OECD equivalence scale.

7 Appendix

Figure 8: Yield curves for the years 1983 to 1989



Note: Estimation based on listed German Federal Treasury bonds

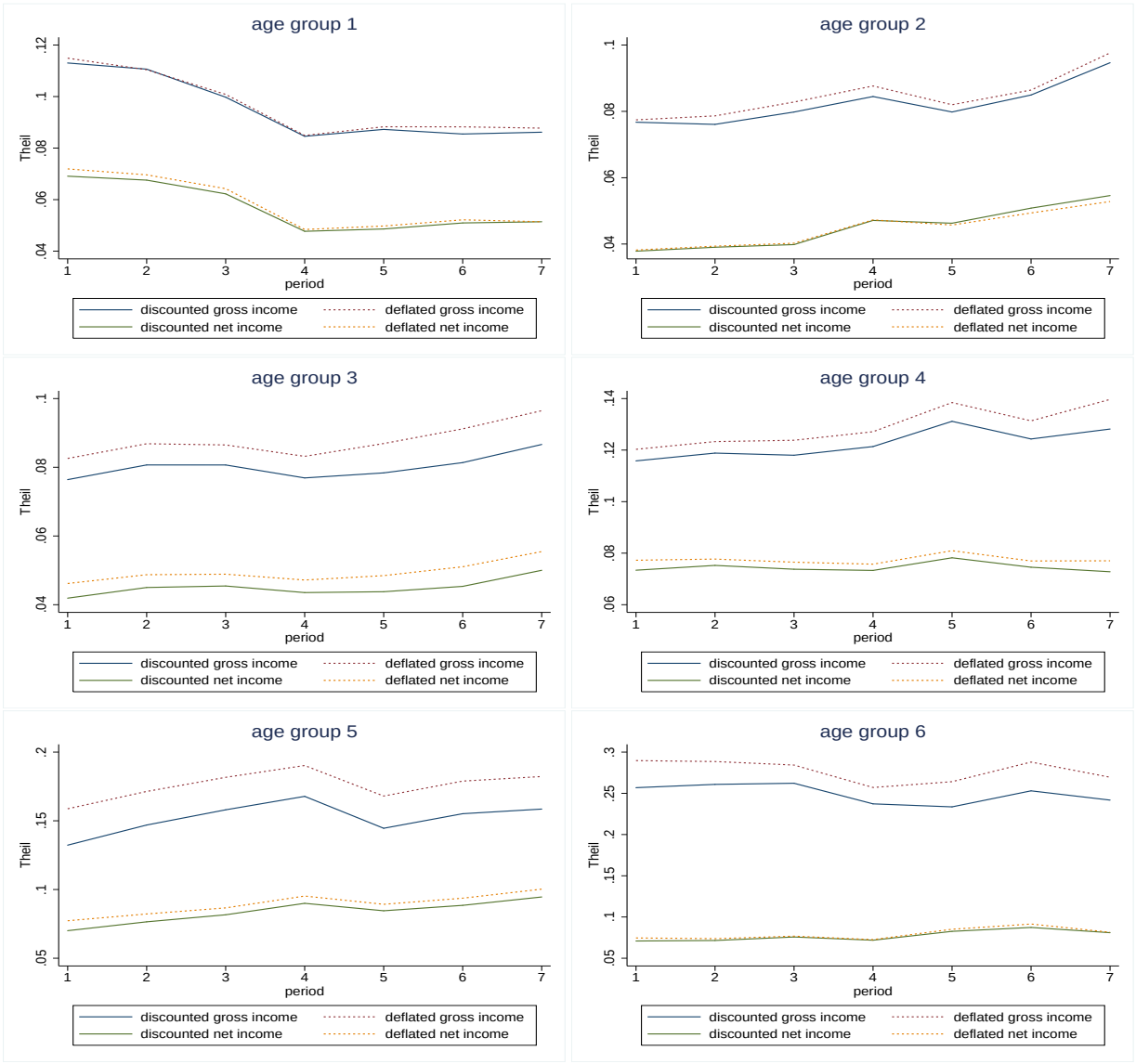
Table 5: **The share of income components in long-term net household income**

age group	1	2	3	4	5	6
1984-2003						
Labor earnings	118.95	123.13	127.17	127.57	111.59	64.84
Asset income	3.43	2.55	2.86	3.47	4.16	5.19
Private transfers	0.93	0.69	0.56	0.36	0.48	0.34
Private pensions	0.22	0.43	0.20	0.24	1.32	4.00
Public transfers	9.48	8.18	7.32	5.73	5.06	3.72
Social Security Pensions	2.27	4.51	2.63	3.64	13.69	45.49
Income taxes	-17.16	-19.33	-20.54	-21.24	-18.31	-10.98
Social security contributions	-18.13	-20.16	-20.20	-19.78	-17.98	-12.61
1985-2004						
Labor earnings	119.13	123.39	126.53	127.77	110.01	64.93
Asset income	3.37	2.53	2.89	3.74	4.48	5.34
Private transfers	0.89	0.74	0.57	0.40	0.49	0.29
Private pensions	0.23	0.34	0.28	0.28	1.45	4.08
Public transfers	9.64	8.48	7.70	5.66	5.13	4.09
Social Security Pensions	2.08	4.27	2.85	3.82	14.62	44.90
Income taxes	-17.07	-19.20	-20.69	-21.44	-18.36	-10.83
Social security contributions	-18.28	-20.54	-20.12	-20.22	-17.82	-12.81
1986-2005						
Labor earnings	118.35	123.26	126.43	127.25	109.63	65.93
Asset income	3.37	2.65	2.99	3.80	4.65	5.71
Private transfers	0.97	0.74	0.57	0.41	0.48	0.29
Private pensions	0.21	0.32	0.24	0.29	1.46	3.96
Public transfers	10.25	8.52	8.04	6.06	5.08	3.65
Social Security Pensions	1.99	4.17	2.78	3.86	14.96	44.60
Income taxes	-16.71	-19.15	-20.78	-21.32	-18.50	-11.10
Social security contributions	-18.43	-20.50	-20.28	-20.36	-17.76	-13.03
1987-2006						
Labor earnings	117.06	124.03	125.84	126.41	111.83	68.96
Asset income	3.54	2.81	3.02	4.10	4.85	5.75
Private transfers	0.96	0.77	0.60	0.39	0.55	0.31
Private pensions	0.21	0.30	0.24	0.28	1.33	3.84
Public transfers	10.90	8.40	8.54	6.31	4.96	3.80
Social Security Pensions	2.05	3.63	2.85	3.95	13.60	42.20
Income taxes	-16.54	-19.19	-20.63	-21.27	-19.14	-11.48
Social security contributions	-18.18	-20.76	-20.46	-20.17	-17.97	-13.38
1988-2007						
Labor earnings	116.32	123.29	125.92	126.46	111.70	68.25
Asset income	3.62	3.03	3.00	4.24	4.73	6.01
Private transfers	1.05	0.71	0.64	0.45	0.40	0.60
Private pensions	0.26	0.31	0.24	0.32	1.30	4.13
Public transfers	11.52	8.76	8.90	6.75	5.14	3.53
Social Security Pensions	2.13	3.58	2.82	3.47	14.16	42.39
Income taxes	-16.33	-19.00	-20.68	-21.58	-19.15	-11.47
Social security contributions	-18.57	-20.68	-20.84	-20.11	-18.28	-13.43
1989-2008						
Labor earnings	117.23	122.53	126.67	125.28	113.72	69.62
Asset income	3.37	2.96	2.97	4.37	5.07	5.76
Private transfers	1.13	0.78	0.67	0.43	0.42	0.55
Private pensions	0.22	0.28	0.27	0.34	1.25	3.98
Public transfers	11.66	9.25	9.11	7.07	5.00	3.82
Social Security Pensions	1.92	3.45	2.54	3.68	12.94	41.59
Income taxes	-16.54	-18.88	-21.04	-21.43	-19.94	-11.62
Social security contributions	-18.99	-20.38	-21.19	-19.75	-18.46	-13.71

Source: SOEP, Own calculations

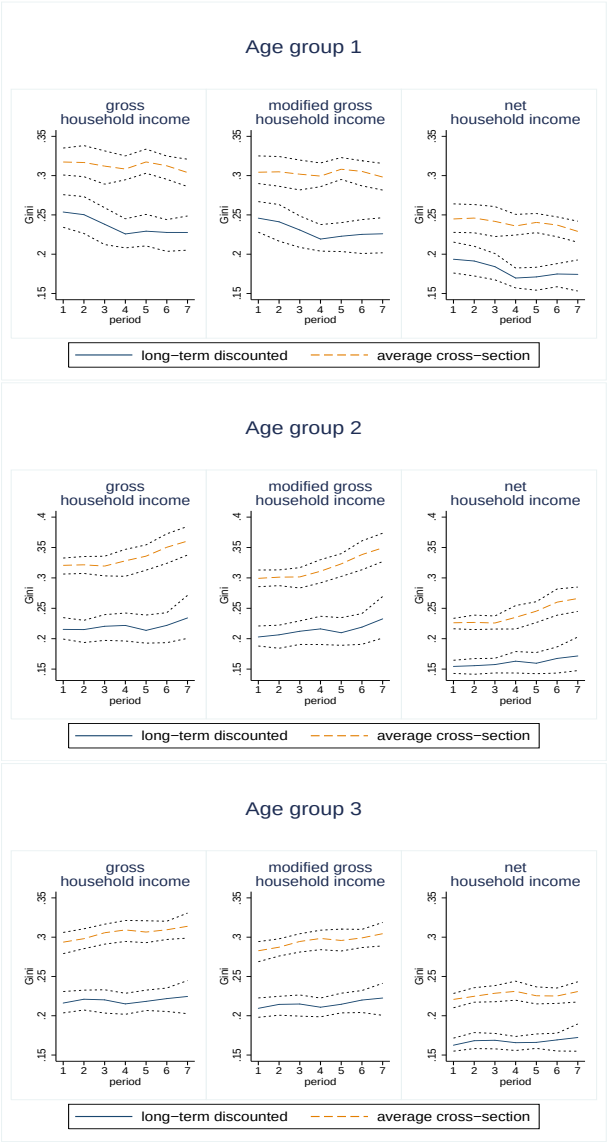
Note: All numbers are in percent and rounded such that they do not add up to 100 in all cases. All income concepts are defined as equivalent income using the modified OECD equivalence scale.

Figure 9: Theil coefficients for deflated and discounted long-term household income



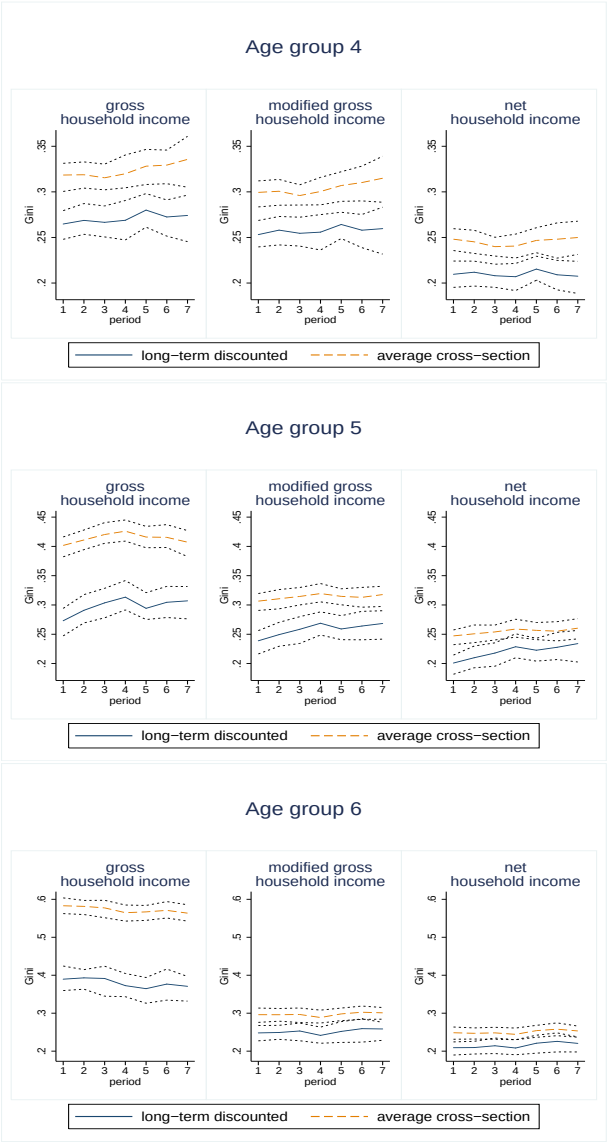
Source: SOEP, Own calculations *Note:* All numbers are in percent and rounded such that they do not add up to 100 in all cases. All income concepts are defined as equivalent income using the modified OECD equivalence scale.

Figure 10: Gini coefficients for gross and net household income, age groups 1-3



Source: SOEP, Own calculations *Note:* All numbers are in percent and rounded such that they do not add up to 100 in all cases. All income concepts are defined as equivalent income using the modified OECD equivalence scale. Dotted lines denote Hall's bootstrap confidence intervals at 95%-level.

Figure 11: Gini coefficients for gross and net household income, age groups 4-6



Source: SOEP, Own calculations *Note:* All numbers are in percent and rounded such that they do not add up to 100 in all cases. All income concepts are defined as equivalent income using the modified OECD equivalence scale. Dotted lines denote Hall's bootstrap confidence intervals at 95%-level.

Table 6: **Theil decomposition, all ages**

income concept	Total	*Change*	Between	*Change*	Within	*Change*
1983-2002						
gross household income	0.30	*0*	0.15	*0*	0.15	*0*
modified ghi = ghi + social security pensions	0.21	*-0.30*	0.12	*-0.16*	0.10	*-0.31*
modified ghi - social security contributions	0.22	*-0.27*	0.14	*-0.07*	0.10	*-0.31*
modified ghi - social security contributions - income taxes	0.18	*-0.41*	0.11	*-0.25*	0.09	*-0.40*
Net household income*	0.15	*-0.51*	0.09	*-0.36*	0.08	*-0.49*
1984-2003						
gross household income	0.28	*0*	0.15	*0*	0.13	*0*
modified ghi = ghi + social security pensions	0.19	*-0.32*	0.13	*-0.16*	0.08	*-0.36*
modified ghi - social security contributions	0.20	*-0.28*	0.14	*-0.07*	0.08	*-0.36*
modified ghi - social security contributions - income taxes	0.16	*-0.43*	0.11	*-0.25*	0.07	*-0.46*
Net household income*	0.13	*-0.54*	0.10	*-0.37*	0.06	*-0.56*
1985-2004						
gross household income	0.28	*0*	0.15	*0*	0.13	*0*
modified ghi = ghi + social security pensions	0.19	*-0.32*	0.13	*-0.16*	0.08	*-0.37*
modified ghi - social security contributions	0.20	*-0.29*	0.14	*-0.07*	0.08	*-0.37*
modified ghi - social security contributions - income taxes	0.16	*-0.43*	0.12	*-0.24*	0.07	*-0.47*
Net household income*	0.13	*-0.55*	0.10	*-0.36*	0.05	*-0.58*
1986-2005						
gross household income	0.28	*0*	0.16	*0*	0.13	*0*
modified ghi = ghi + social security pensions	0.19	*-0.32*	0.13	*-0.16*	0.08	*-0.38*
modified ghi - social security contributions	0.20	*-0.28*	0.15	*-0.07*	0.08	*-0.38*
modified ghi - social security contributions - income taxes	0.16	*-0.43*	0.12	*-0.23*	0.07	*-0.48*
Net household income*	0.13	*-0.55*	0.10	*-0.36*	0.05	*-0.60*
1987-2006						
gross household income	0.30	*0*	0.16	*0*	0.14	*0*
modified ghi = ghi + social security pensions	0.21	*-0.29*	0.14	*-0.14*	0.09	*-0.34*
modified ghi - social security contributions	0.22	*-0.25*	0.15	*-0.05*	0.10	*-0.34*
modified ghi - social security contributions - income taxes	0.18	*-0.39*	0.12	*-0.22*	0.08	*-0.43*
Net household income*	0.15	*-0.51*	0.10	*-0.34*	0.07	*-0.54*
1988-2007						
gross household income	0.30	*0*	0.16	*0*	0.14	*0*
modified ghi = ghi + social security pensions	0.21	*-0.30*	0.14	*-0.14*	0.09	*-0.35*
modified ghi - social security contributions	0.22	*-0.26*	0.16	*-0.05*	0.09	*-0.35*
modified ghi - social security contributions - income taxes	0.18	*-0.40*	0.13	*-0.21*	0.08	*-0.44*
Net household income*	0.14	*-0.52*	0.11	*-0.34*	0.06	*-0.55*
1989-2008						
gross household income	0.32	*0*	0.16	*0*	0.14	*0*
modified ghi = ghi + social security pensions	0.23	*-0.29*	0.14	*-0.14*	0.09	*-0.34*
modified ghi - social security contributions	0.24	*-0.25*	0.16	*-0.04*	0.09	*-0.34*
modified ghi - social security contributions - income taxes	0.19	*-0.39*	0.13	*-0.21*	0.08	*-0.43*
Net household income*	0.15	*-0.52*	0.11	*-0.34*	0.07	*-0.54*

Source: SOEP, Own calculations

Note: All numbers are in percent and rounded such that they do not add up to 100 in all cases. All income concepts are defined as equivalent income using the modified OECD equivalence scale.

*Net household income = modified ghi - social security contributions - income taxes + public transfers

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