Essays on Income Inequality, Poverty and Mobility

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General Introduction

The current cumulative doctoral dissertation consists of four essays. Common aim of all essays is to provide empirically backed insights on different aspects of the distribution of income. The two initial essays address key social problems of the German welfare state. The first essay examines the economic situation of the elderly with a particular focus on pensioners, the second essay investigates poverty. While these two contributions take a cross sectional perspective using cross sectional data, the third essay complements their findings by adding the longitudinal dimension of earnings dynamics in terms of mobility and volatility. In sum, these three essays provide a comprehensive picture on the long run trends of the German income distribution. The fourth essay investigates the conceptual understanding of income distributions, scrutinizing the methodology usually applied when equivalent incomes are investigated as in the first two essays of this thesis.

The first essay entitled *Incomes and Inequality in the Long Run: The Case of German Elderly* is a joined work with Carsten Schröder and Katharina Schulte who each contributed one third to the overall project. Furthermore, it is accepted for publication in the *German Economic Review*. In this essay German Sample Survey income data is used to examine the income distribution for elderly individuals during the period from 1978 to 2003, an era particularly interesting for the development of the statutory German pay-as-you-go (PAYG) pension system as it was subject to several fundamental reforms. Indeed, in the late 1970s, the German PAYG system was expanded to one of the world's most generous ones, in terms of both replacement rates and early retirement provisions. Population aging, German reunification and high unemployment rates, however, caused a raising fiscal imbalance and, in consequence, the eligibility age has been raised, replacement rates have been lowered and subsidies have been introduced to stimulate private old-age provisions. The reforms undertaken and in preparation have direct implications for the financial situation of Germany's actual and future elderly. In order to investigate the implications of these institutional changes, the elderly population, defined as people of age 55 and older, is decomposed by people resident in the Old and New Federal States. Further, we distinguish between persons receiving old-age pensions and persons who do not. Inequality estimates are decomposed by income components, and the bootstrap method is used to test for statistical significance of results. In sum, taking stock of the changes in the income distribution of the elderly in the last decades provides a useful yardstick for taxing the costs and benefits of the ongoing reform process.

In common with the first essay's period under investigation and data source, the second contribution entitled *Poverty in Germany – Statistical Inference and Decomposition* is aimed at completing the overall picture on long-term trends by looking at the bottom of the German income distribution. The essay is a joined work co-authored by Carsten Schroeder (his contribution is fifty percent) and is accepted for publication in the *Journal of Economics and Statistics (Jahrbücher für Nationalökonomie und Statistik)*. Poverty poses a key social problem, both on the individual level as well as for the society as a whole. Therefore, its measurement, explaining its causes and its consequences is on top of the research agenda of scholars from various disciplines. On the individual level, a slim budget not only restrains the actual possibility to consume. Growing up poor is likely to have negative effects on children's learning and social capabilities, and on their future life chances. Medical studies indicate that poverty during infancy and childhood is an important predictor of mortality risk. In addition, the loss of autonomy and social participation can work as a psychological stress for deteriorating health, the so-called status syndrome. As mentioned above, poverty is not only an individual dilemma. High poverty rates are likely to create social costs and lower income growth. Credit constraints may prevent people with low income from undertaking efficient human capital investments. Substantial income and wealth disparities may discourage and frustrate people. In turn, deprived people might withdraw from social life, stop looking for work, or turn their backs on the democratic system. Individuals who feel powerless in view of large economic disparities may see no other chance to improve their economic situation but to infringe social and ethical rules and norms. To investigate poverty in Germany, the second essay provides insights of inter-temporal changes in poverty for Germany from year 1978 to 2003. Again, we employ the bootstrap method to test for the statistical significance of results. All estimates are decomposed by household type and region. Across household types, we find poverty estimates are particularly high for single parents. The regional decomposition reveals that poverty is particularly high in the New states. In addition, a nonlinear Oaxaca-Blinder decomposition is conducted to quantify the separate contribution of regional differences in households' characteristics to the probability of being poor.

Whereas the first and second essays investigate poverty and inequality in (repeated) cross sections, the single-authored third essay entitled *Cohort Earnings Inequality and Mobility: Evidence from German Social Security Records* focuses on the dynamics of earnings. Thus, the findings of the first to essays are complemented by adding the dimension of income mobility and volatility. Again, long run trends in Germany are investigated but different data is deployed. Here, rich longitudinal data on individual earnings biographies obtained from social security administration records is analyzed to research the long-term

evolution of earnings inequality and mobility in Germany for the period 1967 to 2007. Categorized into four age cohorts, West German males' annual earnings are investigated. Each age cohort encompasses ten years. Annual earnings inequality is U-shaped in age and increases steadily for all age cohorts over the period under investigation. Short as well as long-term earnings mobility, in the opposite, has remained stable. The variance in annual log earnings is increasing over the full period. This trend can almost exclusively be explained by an increase in the permanent variance of earnings. In sum, essays one, two and three provide a comprehensive picture on the long term evolution of inequality, poverty and mobility in Germany.

The last essay contributes to the conceptual understanding of income distributions and their implications for the distribution of living standards. The paper is co-authored by Carsten Schröder (his contribution is fifty percent) and is entitled *Country Inequality Rankings and Conversion Schemes*. The essay aims at deepening the insights on the distribution of living standards in a society comprised of heterogeneous households, a topic of interest not only to researchers but to the general public. Thereby, living standard of a household's members is determined by the material comfort derived from available goods and services. Economists consider the income distribution as a close proxy for the distribution of living standard. When heterogeneous household types are involved two complications emerge. First, different household types have different needs. Members of differently sized/structured households with the same household income may attain different living standards. To obtain a measure that reflects differences in living standards across household types, household incomes must be adjusted for differences in needs. Second, household size heterogeneity also raises the issue of an adequate household weighting when the distribution of living standards is derived. Two conversion schemes are usually employed for assessing personal-income inequality from household equivalent incomes: to weight household units by size or by needs. Using data from the Luxembourg Income Study, we show the sensitivity of country inequality rankings to conversion schemes and explain the finding by means of inequality decomposition. A bootstrap approach is implemented to test for statistical significance of our results.

Incomes and Inequality in the Long Run: The Case of German Elderly

1. Introduction

This study investigates the long-run changes in the income distribution for the elderly in Germany, defined as persons of age 55 and older. Among other reasons, this era is interesting as several fundamental reforms of the statutory German pay-as-you-go (PAYG) pension system have been undertaken. Indeed, in the late 1970s, the German PAYG system was expanded to one of the world's most generous ones, in terms of both replacement rates and early retirement provisions. Population aging, German reunification and high unemployment rates, however, caused a raising fiscal imbalance. Policymakers reacted. The eligibility age has been raised, replacement rates have been lowered and subsidies have been introduced to stimulate private old-age provisions.[1] The reforms undertaken and in preparation have direct implications for the financial situation of Germany's actual and future elderly. They also change the legal framework under which individual labor supply, retirement, savings or fertility decisions are made (see e.g. Berkel and Börsch-Supan, 2003; Börsch-Supan et al., 2003; Frommert and Heien, 2006; Hirte, 2002; Schnabel, 1999; Siddiqui, 1997).

Taking stock of the changes in the income distribution of the elderly in the last decades can provide a useful yardstick for taxing the costs and benefits of the ongoing reform process. Already, several empirical studies have provided information on the shape of the income distribution for the elderly, including Biewen (2004), Börsch-Supan et al. (2001), Münnich (2001), Schwarze and Frick (2000) and others. This article builds on these literatures, extending information along two dimensions.

First, we seek to investigate, in detail, the financial situation of elderly persons and its intertemporal evolution. Throughout the period under consideration, we provide price-adjusted annual pretax–post-transfer equivalent incomes and factor shares, the percentage shares of different income components in elderly households' budgets. Second, we examine the intertemporal evolution of income inequality, measured by the Gini index, and how changes in factor shares and income components' distributions contribute to overall inequality. Whereas most previous literatures lack information on statistical inference, we use the bootstrap method to test for statistical significance of results. By means of the Gini elasticity, we further assess the impact of a marginal equiproportionate change in income from a specific component on overall inequality (see Lerman and Yitzhaki, 1985; Rao, 1969). Such estimates are of particular interest for policy-makers who are concerned about the relationship between policy-driven changes of peoples' budgets and the income distribution. All results are provided for four subpopulations of elderly people. Two criteria define these

[1] An overview of the 12 major reforms between 1977 and 2003 can be found in the Supplementing Materials, Table S1.

subpopulations: region of residence (New vs. Old German Federal States, or 'Laender') and (non)receipt of an old-age PAYG or civil servant pension.

The databases underlying our calculations are six cross-sections of the German Sample Survey of Income and Expenditure (German abbreviation: EVS), harmonized in an intertemporally consistent manner.

The remainder of this article is organized as follows. Section 2 introduces the database and describes its processing. Section 3 explains inequality measures, the bootstrap method and statistical test procedures used. The empirical results are provided in Section 4, and Section 5 concludes.

2. Construction of the Database

Our study is based on six EVS cross-sections, collected between 1978 and 2003. The EVS is provided by the German Federal Statistical Office, conducted at five-year intervals, and contains representative household income, wealth and consumption data.[2] Cross-section size ranges between 40,000 and 60,000 household units. Persons living in communal establishments and institutions and households exceeding a specific income cut-off are not included.[3]

From each cross-section, only persons of age 55 and older enter our database. A minority of elderly subjects is not considered as a result of two technical reasons. First, intra family relationships remain unclear in some cases. This especially applies to households with three or more elderly persons. Second, income components sometimes cannot be assigned to the household members without extra assumptions. To reduce resulting inaccuracies, only the first two elderly persons from every EVS household unit are included in the database. The eliminated fraction of elderly persons is small, for example 4.3% in 2003.

Another concern is over- and undersampling. Compared with the German microcensus, the EVS oversamples people in their 70s on the account of subjects of age 80 and older. To fit the German Microcensus statistics, we have adjusted EVS sample weights according to the entropy-based minimum information loss principle.[4]

Income reported throughout this paper is annual pretax-post-transfer equivalent income expressed in year 2003 prices,[5] comprising (a) *employment income*: earned income

[2] For further information, see German Federal Statistical Office (2005).
[3] According to the German Federal Statistical Office (2005), the number of top-income households participating in the EVS is not sufficient to provide reliable information. Monthly household disposable income cut-offs (in prices of 2003) are as follows: €18,811 in 1978; €18,546 in 1983; €17,497 in 1988; €20,788 in 1993; €19,131 in 1998; and €18,000 in 2003.
[4] Details on the reweighting procedure are outlined in Bönke et al. (2009).
[5] Incomes have been adjusted using consumer prices, provided in Bönke et al. (2009, Table S2).

and self-employed income; (b) *retirement income*: retirement pensions from public pension fund, civil servant's pensions, company pensions and other pensions; (c) *transfer income*: benefits related to former employment, social assistance, family-related benefits and other transfers; (d) *investment income*; and (e) *other income*.[6] Other income is a residual that cannot unambiguously be assigned to the previous four income components. Pretax–post-transfer income is the sum of all individual incomes of elderly persons living in a household unit plus a fraction of incomes reported at the household level only, with individual incomes of other household members being ignored. The fraction is given by the number of elderly persons divided by the number of all persons in the original household unit. Finally, to make incomes of elderly household units with one member and two members comparable, pretax-post-transfer incomes are equalized using the *OECD-modified equivalence scale*.[7] The resulting pretax-post-transfer equivalent income is assigned to each elderly person in the household unit.[8]

3. Methodological Considerations

3.1. Measurement of inequality

Inequality estimates provided throughout this paper consider sampling weights. Hence, if an elderly person lives in a household unit with a sampling weight of 50, in all calculations this observation is considered 50 times. Our inequality measure is the Gini index, *G*, twice the area between the Lorenz curve and the equality line. The Gini index gives a relative small weight to 'outliers', i.e. very high incomes, so that biases in the inequality estimates driven by top coding should be small. The Gini index is additively decomposable by income components (see Lerman and Yitzhaki, 1985; Rao, 1969).[9] Such a decomposition is of interest as previous and future pension reforms most likely will alter the composition of elderly peoples' budgets.

To better understand the role that changes in factor shares of different income components $i\,(i=1,...I)$ have for inequality, Gini elasticities are provided. The Gini elasticity of i, η_i, gives the percentage change in the Gini index with respect to an equiproportionate marginal change in equivalent income of i. It is defined as

[6] The income components are constructed from several EVS variables. See Table S3 in the Supplementing Materials for details.

[7] The OECD-modified equivalence scale assigns a value of 1.0 to the one-member household, and an increment of 0.5 to each additional adult household member. See OECD (2009) for details.

[8] The suitability of different income concepts from a welfare perspective is discussed in Podder and Chatterjee (2002). Benefits and strengths of our income concept are discussed in Bönke et al. (2009).

[9] Our presentation is a brief summary of the analysis outlined in Podder (1993) and Podder and Chatterjee (2002), where further details are provided.

$$(1) \qquad \eta_i = \frac{\partial G}{\partial \mu_i}\frac{\mu_i}{G} = \frac{1}{G}\left[\frac{\mu_i}{\mu}\left(C_i - G\right)\right] \text{ with } \sum_{i=1}^{I}\eta_i = 0$$

where μ is mean equivalent income, μ_i is mean equivalent income of income component i and C_i is the respective concentration coefficient. If the elasticity is negative (positive), an increase in mean equivalent income of i reduces (increases) inequality. From (1) it can be seen that an income component affects the Gini index through two different channels: (a) through its relative share in total equivalent income, $w_i = \mu_i / \mu$; and (b) through its spread over the range of total equivalent income, C_i. Let $\Delta G_t = G_t - G_{t-x}$ denote the difference in Gini indices for periods t and $t - x$, and let w_i and C_i be functions of time, then

$$(2) \qquad \Delta G_t \approx \sum_{i=1}^{I}\left(\frac{C_{i,t} + C_{i,t-x}}{2}\right)\Delta w_{i,t} + \sum_{i=1}^{I}\left(\frac{w_{i,t} + w_{i,t-x}}{2}\right)\Delta C_{i,t}$$

for discrete periods.[10] The sum $\sum_{i=1}^{I}\left(C_{i,t} - C_{i,t-x}\right)/2 \cdot \Delta w_{i,t}$ is the change of the Gini index as a result of changes in the shares of different income components in total equivalent income, the *share effect*. The second term, $\sum_{i=1}^{I}\left(w_{i,t} - w_{i,t-x}\right)/2 \cdot \Delta C_{i,t}$, quantifies the impact of changes in concentration coefficients on overall inequality, the *concentration effect* (see Podder and Chatterjee, 2002, p. 8, for details).

3.2. Bootstrap inference and inequality

To test for statistical significance of results, we compute standard errors and confidence intervals using the bootstrap method (see Mills and Zandvakili, 1997). From each cross-section of elderly people, we draw, with replacement, 100 random samples. Each random sample has as many sampling units as the original cross-section, and each sampling unit in the original cross-section has the same probability of being selected. Hence, the bootstrap does not account for differences in sampling weights. Sampling weights, however, are accounted for whenever an income or inequality measure is computed, be it for the calculation of point estimates from the original database or for the calculation of standard errors and confidence intervals from bootstrap samples (see Biewen, 2002).[11]

[10] Podder and Chatterjee (2002, p. 8) have suggested an averaging of the two periods' estimates as a 'compromise – and for a better approximation', as changes can be measured with respect to both periods *t* and *t-x*.

[11] A technical equivalent analysis with two cross-sections of Australian Household Expenditure Survey (AHES) data is conducted by Athanasopoulos and Vahid (2003). Like the EVS, the AHES is a representative cross-sectional database derived from stratified multistage probability sampling.

Our particular interest is the assessment of statistical significance of intertemporal changes. The test procedure is illustrated by means of the Gini index, but applies analogously to other measures derived in the empirical part of this paper. Per cross-section, we compute 100 values of the Gini index, one per random bootstrap sample. This gives 100 Gini differences for each two consecutive cross-sections, $\Delta G_t^{*b} = G_t^{*b} - G_{t-5}^{*b}$, where $b = 1,...,100$. The difference in the Gini point estimates derived from the original EVS database is $\Delta \hat{G}_t = \hat{G}_t - \hat{G}_{t-5}$. Hence, suppressing the period subscripts, Hall's (1994) percentile confidence interval for the Gini difference is $\Pr\left(2\Delta\hat{G} - \Delta G_{high}^{*} \leq \Delta G \leq 2\Delta\hat{G} - \Delta G_{low}^{*}\right) = \left(100 - 2\alpha\right)/100$. The estimate ΔG_{high}^{*} is the 2.5th upper and ΔG_{low}^{*} is the 2.5th lower percentile in the bootstrap distribution of differences, and ΔG is the true difference. The change in the Gini index is statistically significant if the Hall confidence interval does not include zero (see Athanasopoulos and Vahid, 2003, p. 417).

The statistical significance of differences within a cross-section, for example in Gini indices for pensioners and non-pensioners, can be assessed through examining overlaps of confidence intervals for group-specific estimates.

Our bootstrap approach does not account for the fact that the EVS is a stratified sample. In case of stratification, sampling units are selected from the overall population according to household characteristics. Typically, population units belonging to a stratum consisting of many observations have a smaller probability of being included in the original database than units belonging to another stratum with few observations. Then the selected sample is no random sample. To account for this feature of our database, bootstrap samples alternatively could be drawn independently within each stratum and then be merged. Unfortunately, the EVS does not contain a variable indicating the strata associated with sample points. The EVS stratification variables, however, are documented (see German Federal Statistical Office, 2005): region of residence, household type, social situation of the household head and net income class. Using the stratification variables, we have identified the stratum to which each sample point belongs.[12] Drawing bootstrap samples independently within each stratum does not change our conclusions, and so we refrain from reporting results from the second and focus on the estimates of the first bootstrap approach.[13]

[12] As an example, this gives 3,060 strata for year 2003. The German Federal Statistical Office merges neighboring strata if sample size in a stratum is small. Unfortunately, to the best of our knowledge, a guideline on the merging procedure for neighboring strata is publicly not available. Hence, our stratification can only be seen as an approximation.

[13] Athanasopoulos and Vahid (2003) come to similar conclusions. Estimates are summarized in the Supplementing Materials.

4. Empirical Results

The empirical results are edited in two parts. First, we show how the financial situation of the elderly, measured by equivalent incomes and compositions of household budgets, has changed over time. The second part deals with the issue of income inequality. Results are tested for statistical significance, and provided for four different subsamples of the elderly population. For grouping individuals, two partitioning criteria are applied: region of residence (New vs. Old German Federal States) and the receipt or non-receipt of an old-age PAYG or civil servant pension. If an elderly person draws a 'classic' old-age pension (in the form of a PAYG or civil servant pension), she is assigned to the subsample of *pensioners*, else to the *non-pensioners*.[14]14 This distinction does not mean that retirement income of non-pensioners is zero. Besides old-age PAYG or civil servant pensions, retirement income also includes company pensions and pensions due to special regulations (i.e. compensations and assistance for war victims, survivors' pensions and pensions due to early retirement).

Table 1. Unweighted number of household units

Year	Total sample size	Pensioners		Non-pensioners	
		OL	NL	OL	NL
2003	17,104	10,054	2,596	3,581	873
1998	18,643	10,232	3,272	4,150	989
1993	15,334	9,019	1,990	3,150	1,175
1988	16,498	12,408	4,090		
1983	16,349	11,950	4,399		
1978	19,277	14,532	4,745		

Note: Unweighted number of household units with elderly members.
Source: German Sample Survey of Income and Expenditures (1978–2003).

Unweighted numbers of observations by subsample are provided in Table 1. The unweighted total number of household observations ranges between 15,334 and 19,277 per cross-section. Smallest is the group of non-pensioners resident in the New Laender (NL) in 2003, i.e. 873 observations.

4.1. Financial situation of elderly people

The intertemporal evolution of mean pretax–post-transfer equivalent incomes is summarized in Figure 1. The left-hand graph refers to pensioners; the right-hand graph refers to non-pensioners. Dark dashed lines connect point estimates of average CPI-adjusted equivalent incomes for elderly persons resident in the Old Laender (OL), whereas light dashed lines

[14] Of course, several other options for differentiation exist, such as labor market withdrawal, lack of earnings, receipt of retirement incomes and age. The empirical implications are discussed in Smeeding (1990). For Germany, see also Münnich (2001) and Münnich and Illgen (2000).

connect the respective numbers for people living in the NL. Vertical bars indicate 95% Hall confidence intervals given by $\left(2\hat{\mu}-\mu^*_{high};2\hat{\mu}-\mu^*_{low}\right)$, where $\hat{\mu}$ is the point estimate of average equivalent income, μ^*_{high} is the 2.5th upper and μ^*_{low} is the 2.5th lower percentile of the bootstrap distribution. Test statistics on the statistical significance of intertemporal equivalent income change are provided in Table 2. More precisely, Table 2 provides the pair-wise differences in point estimates of annual average equivalent incomes for periods t and $t-5$, $\Delta\mu$, together with Hall confidence intervals of differences $\left(2\Delta\hat{\mu}-\Delta\mu^*_{high};2\Delta\hat{\mu}-\Delta\mu^*_{low}\right)$. An asterisk indicates that an intertemporal change between two consecutive periods is significant at the 5% level.

Figure 1. Evolution of mean equivalent income

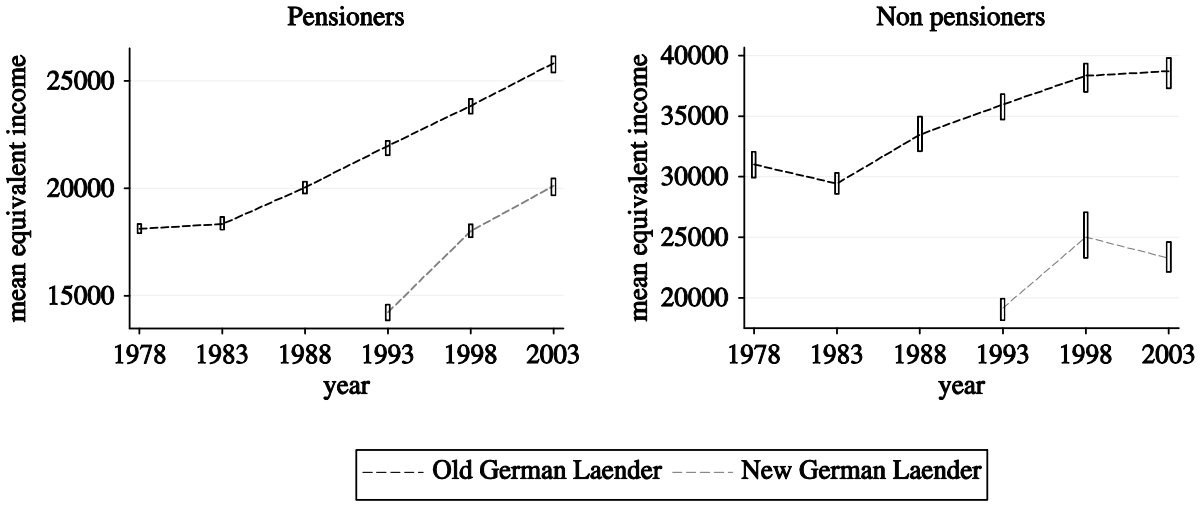


Table 2. Intertemporal changes in CPI-adjusted mean equivalent incomes

	OL					NL	
	1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Pensioners							
$\Delta\hat{\mu}$	215	1,708*	1,938*	1,866*	1,981*	3,774*	2,108*
(95% CI)	(-158;566)	(1,381;2,105)	(1,552;2,259)	(1,440;2,418)	(1,559;2,438)	(3,250;4,244)	(1,526;2,642)
Non-pensioners							
$\Delta\hat{\mu}$	1,580*	4,041*	2,482*	2,379*	359	5,856*	1,756
(95% CI)	(-3,213;294)	(2,292;5,459)	(646;4,231)	(1,089;3,846)	(-1,350;1,909)	(4,124;7,573)	(-4,271;390)

Notes: $\Delta\hat{\mu}$ is the observed change in mean equivalent income between periods *t* and *t*-5. All numbers rounded to full € amounts. CI denotes Hall's confidence interval. *Change is significantly different from zero at the 5% level.
Source: German Sample Survey of Income and Expenditures (1978–2003).

For pensioners, Figure 1 in combination with Table 2 indicates a substantial and significant improvement of the financial situation in both parts of Germany. In the OL, average CPI-adjusted equivalent income grew by 42.56% (17.51%) from 1978 to 2003 (1993

to 2003). Moreover, income growth rates were rather stable, about 8% over a five-year period, except between 1978 and 1983 when it was lower. In the NL, incomes grew even faster, 41.37% from 1993 to 2003, indicating a substantial catch-up process. However, still in year 2003, the regional divide in equivalent incomes is substantial: annual equivalent income for pensioners in the OL is about €5,714 higher.

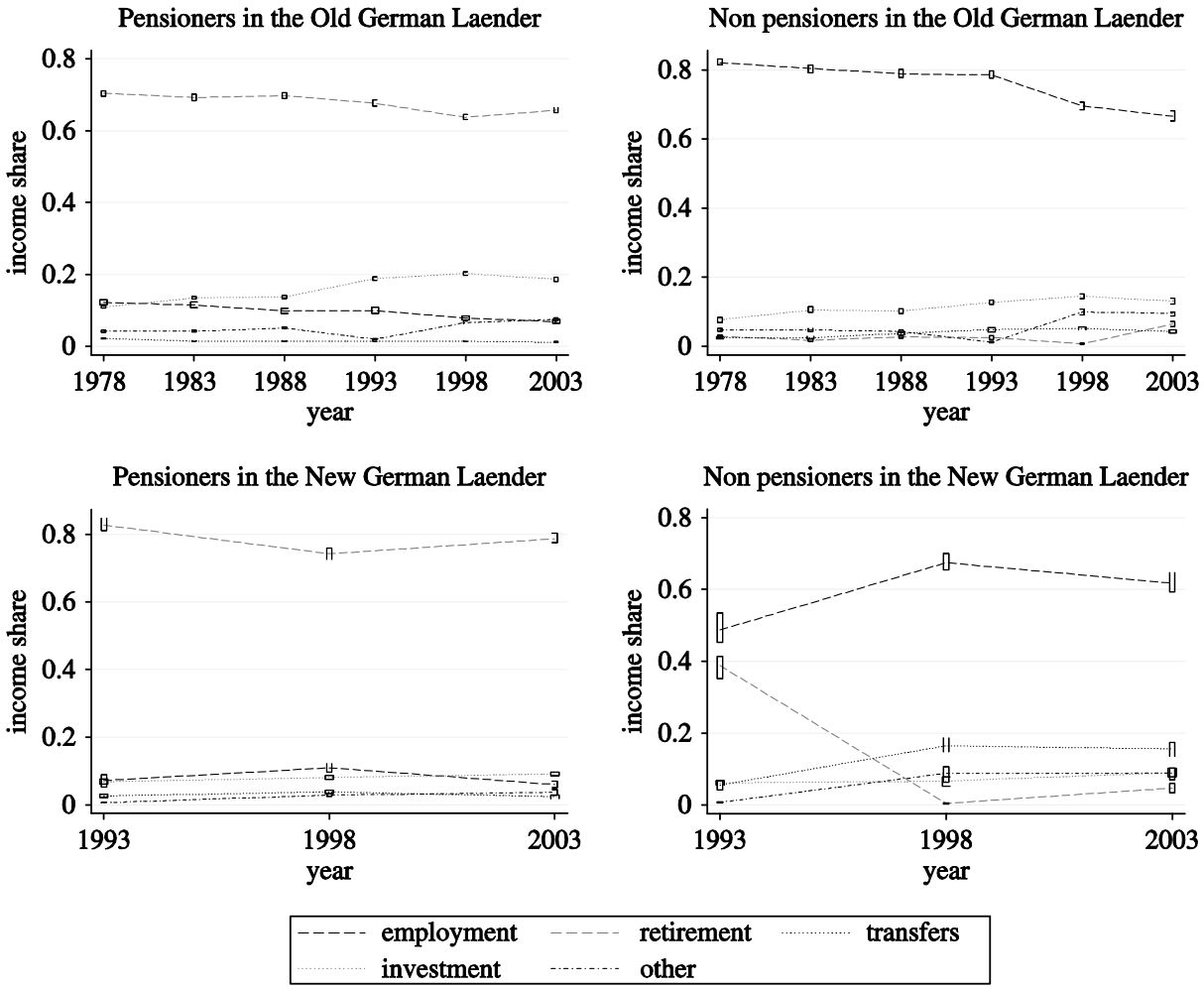
Also non-pensioners experienced significant income growth, yet at lower rates: 24.78% (7.62%) from 1978 (1993) to 2003 in the OL compared with 21.40% from 1993 to 2003 in the NL. Moreover, the growth path is more volatile. Indeed, it tends to mimic the German business cycle.[15] In this sense, the German pension system can be seen as an insurance device against cyclical income variations. Another point is remarkable. Like their counterparts in the OL, incomes of NL non-pensioners stagnate between 1998 and 2003, and the income divide between the regions remains fairly high, amounting to €15,423 in year 2003.

The previous paragraph concluded that all four subsamples experienced significant income growth, but at rather different rates. We proceed by complementary evidence on the composition of elderly peoples' budgets. In Figure 2, four graphs are provided, one for each subsample. Within each graph, lines connect point estimates of factor shares for subsequent periods. Vertical bars indicate 95% Hall confidence intervals of factor shares. Tests of statistical significance of intertemporal change in the shares are provided in Table 3. Here, point estimates of pair-wise differences between the factor shares of periods t and $t-5$, Δw_i, and Hall confidence intervals derived from the bootstrap samples are provided.

We comment on pensioners first. The most important income source for pensioners is retirement income. It never accounts for less than 60% of all income in the OL, and always around 80% in the NL. In the OL, the share of investment income significantly increased until year 1998 at the expense of the retirement income factor share. From 1998 to 2003 the picture reverts, so that OL pensioners' factor shares all in all changed only little. Factor shares in the NL are more volatile. Although changes tend to mitigate one another over time, the figures indicate increasing factor shares of investment and other income to the account of retirement and employment income.

[15] For longitudinal data on the German business cycle, see Buch et al. (2004).

Figure 2. Evolution of income shares



For non-pensioners, incomes from employment make up most of their budget: around 70–80% in the OL compared with around 50–60% in the NL. In the OL, the share has significantly decreased during the observation period, especially in the 1990s. There is no specific single income component compensating for this loss. Most robust is the upward trend in the share of investment income until 1998. In the NL, most remarkable is the sharp decline in the share of retirement incomes between 1993 and 1998 in combination with an increasing share of transfer income. Indeed, surging unemployment rates in the NL since reunification prompted the government back then to introduce special early retirement regulations of limited duration (i.e. 'Altersübergangsgeld' and 'Altersteilzeit') for people of age 55 and older. This explains the high factor share of retirement income for NL non-pensioners in 1993. These regulations eventually phased out and many elderly started receiving 'classic' old-age pension in later years, contributing to the declining factor share of retirement income for NL non-pensioners between 1993 and 1998. The rising share of transfer income between

1993 and 1998 and the decline in the share of employment income between 1998 and 2003 reflect the rise in unemployment rates in Germany's newly formed Laender.

Table 3. Intertemporal changes in CPI-adjusted mean equivalent incomes

	OL					NL	
	1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Pensioners							
Employment							
$\Delta\hat{w}_1$	-0.75	-1.59*	0.07	-2.05*	-1.04*	3.75*	-4.97*
(95% CI)	(-1.99;0.36)	(-2.82;-0.53)	(-1.01;1.21)	(-3.12;-1.08)	(-1.74;-0.32)	(1.44;5.78)	(-6.70;-3.20)
Retirement							
$\Delta\hat{w}_2$	-1.18	0.50	-2.13*	-3.92*	2.05*	-8.49*	4.46*
(95% CI)	(-2.28;0.72)	(-0.73;1.63)	(-3.31;-0.99)	(-5.04;-2.68)	(0.95;3.17)	(-10.97;-6.50)	(2.12;6.67)
Transfers							
$\Delta\hat{w}_3$	-0.68*	0.00	0.01	-0.03	-0.29*	1.21*	-1.41*
(95% CI)	(-0.96;-0.38)	(-0.19;0.22)	(-0.21;0.25)	(-0.25;0.22)	(-0.56;-0.05)	(0.62;1.89)	(-2.17;-0.58)
Investments							
$\Delta\hat{w}_4$	2.62*	0.21	5.13*	1.38*	-1.57*	1.27*	1.07*
(95% CI)	(1.95;3.19)	(-0.44;0.69)	(4.44;5.86)	(0.63;2.08)	(-2.38;-0.71)	(0.27;2.24)	(0.22;1.93)
Other							
$\Delta\hat{w}_5$	-0.01	0.87*	-3.08*	4.62*	0.85*	2.25*	0.85
(95% CI)	(-0.40;0.39)	(0.46;1.33)	(-3.56;-2.85)	(4.22;5.04)	(0.24;1.59)	(1.82;2.65)	(-0.11;1.64)
Non-pensioners							
Employment							
$\Delta\hat{w}_1$	-1.68*	-1.53	-0.34	-8.94*	-3.03*	18.71*	-5.70*
(95% CI)	(-3.35;-0.54)	(-2.78;0.25)	(-2.07;1.38)	(-10.70;-7.52)	(-4.71;-1.19)	(14.31;22.50)	(-9.96;-2.09)
Retirement							
$\Delta\hat{w}_2$	-1.15*	0.99*	-0.16	-1.87*	5.78*	-38.35*	4.28*
(95% CI)	(-1.62;-0.52)	(0.41;1.48)	(-0.84;0.64)	(-2.47;-1.25)	(4.92;6.51)	(-40.89;-34.77)	(2.89;5.70)
Transfers							
$\Delta\hat{w}_3$	-0.03	1.26*	1.12*	0.29	-0.89*	10.96*	-0.88
(95% CI)	(-0.41;0.48)	(0.56;1.78)	(0.33;1.82)	(-0.63;1.21)	(-1.49;-0.37)	(8.35;12.95)	(-4.17;1.98)
Investments							
$\Delta\hat{w}_4$	2.82*	-0.26	2.46*	1.79*	-1.44*	0.55	2.29*
(95% CI)	(1.75;4.05)	(-1.61;0.62)	(1.33;3.79)	(0.71;2.80)	(-2.61;-0.47)	(-1.02;1.78)	(0.57;4.17)
Other							
$\Delta\hat{w}_5$	0.05	-0.46	-3.08*	8.74*	-0.43	8.13*	0.02
(95% CI)	(-0.61;0.76)	(-1.27;0.35)	(-3.75;-2.70)	(7.91;9.63)	(-1.57;0.40)	(5.60;9.98)	(-3.00;3.08)

Notes: $\Delta\hat{w}_i$ denotes the observed change in the share of income component i in total household income between periods *t* and *t*-5. CI denotes Hall's confidence interval. *Change is significantly different from zero at the 5% level. *Source:* German Sample Survey of Income and Expenditures (1978–2003).

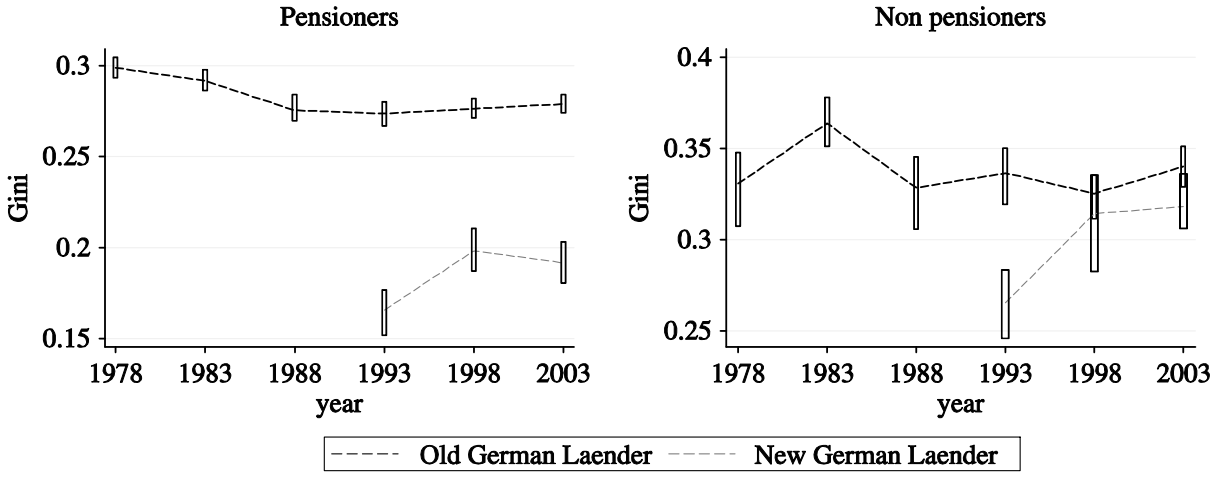
4.2. Income inequality

The results from the previous section indicate a substantial financial improvement for an average elderly person over the last decades. Yet, is it the case that incomes grew equally fast at the bottom, in the middle or at the top of the income distribution? We start off by looking at the issue of income inequality by means of the Gini index. As a relative index, it remains invariant under equiproportionate variation in income, it increases under variations in favor of the 'rich' and it decreases under variations in favor of the 'poor'.

Point estimates of Gini indices and Hall confidence intervals, $\left(2\hat{G}-G^*_{high};2\hat{G}-G^*_{low}\right)$, are provided in Figure 3. Different bar widths are chosen to ensure that confidence intervals are visually distinguishable and have no further meaning.

Gini indices for the OL indicate little change in inequality levels for pensioners and non-pensioners from 1978 onwards. For pensioners, the index slightly decreased by 2 percentage points from 29.89% in 1978 to 27.89% in 2003. For non-pensioners, the index increased by less than 1 percentage point from 33.07% in 1978 to 34.01% in 2003. In the NL, the picture differs: Gini indices increased considerably between 1993 and 1998. However, inequality at the start of the 1990s was fairly low: in 1993 the Gini index for pensioners was 16.56%, echoing a flat income distribution in the former German Democratic Republic. For non-pensioners, it is 26.51% in 1993 compared with 31.78% in 2003. Indeed, overlaps of confidence intervals indicate convergence of inequality levels for non-pensioners across the two regions. As opposed to this, for pensioners the inequality divide between the two regions remains substantial. In 2003, Gini indices still differ by more than 8.5 percentage points (OL: 27.89%; NL: 19.16%).

Figure 3. Evolution of income inequality



The test statistics for pair-wise differences in Gini indices for consecutive observation periods in Table 4 corroborate the descriptive picture. Table 4 summarizes differences in Gini point estimates for consecutive periods, ΔG, together with Hall confidence intervals of these differences. We first comment on the results for the OL. Concerning pensioners, our tests indicate a significant decline of the Gini index for the period 1978–88. From then onwards, differences are insignificant. The distribution of non-pensioners' incomes exhibits more variation. The Gini index rises significantly from 1983 to 1988, and from 1998 to 2003, before falling significantly between 1988 and 1993. Moreover, intertemporal differences in Gini indices are quantitatively larger. For the NL, test statistics reveal a sharp and significant rise in inequality from 1993 to 1998, and stagnation since then. This is equally true for both pensioners and non-pensioners.

Table 4. Intertemporal changes in Gini indices

	OL					NL	
	1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Pensioners							
$\Delta\hat{G}$	-0.73*	-1.62*	-0.18	0.27	0.26	3.25*	-0.66
(95% CI)	(-1.38;-0.03)	(-2.43;-0.78)	(-0.94;0.64)	(-0.45;1.02)	(-0.57;1.04)	(1.75;5.29)	(-2.10;0.93)
Non-pensioners							
$\Delta\hat{G}$	3.31*	-3.54*	0.81	-1.12	1.41*	4.91*	0.39
(95% CI)	(0.54;5.39)	(-6.23;-1.19)	(-1.57;3.67)	(-2.83;0.31)	(0.16;3.10)	(1.30;7.64)	(-2.72;3.77)

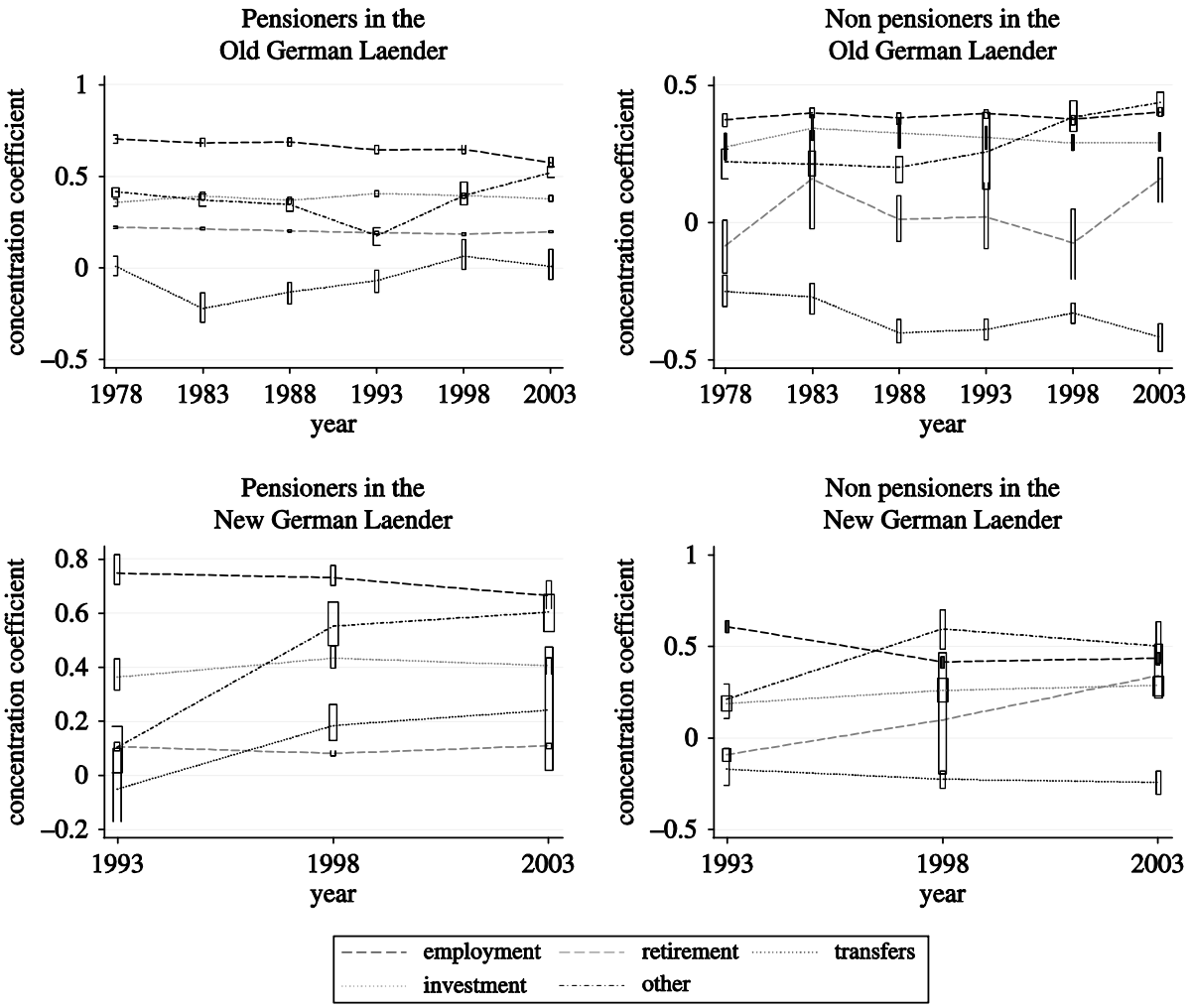
Notes: $\Delta\hat{G}$ is the observed change in mean equivalent income between periods *t* and *t*-5. CI denotes Hall's confidence interval. *Change is significantly different from zero at the 5% level. *Source:* German Sample Survey of Income and Expenditures (1978–2003).

We can conclude from the above results that inequality changed rather little during the observation period in the OL, but it increased rapidly from 1993 to 1998 in the NL. As a result, for non-pensioners, our findings indicate a convergence of inequality levels in the OL and NL.

For better understanding group-specific inequality trends, we proceed with a breakdown of income inequality by income components. More precisely, Figure 4 depicts point estimates of concentration coefficients together with confidence intervals (indicated by vertical bars) at different points in time. Again, differences in bar width (and color) are chosen to offset Hall confidence intervals visually. As a bivariate inequality measure, the concentration coefficient of *i* gives the inequality in *i* related to a household ranking by pretax-post-transfer equivalent income. We find similar results for all four subsamples. Concentration coefficients for employment income, investment income and other incomes are positive, and hence distributed in favor of elderly persons belonging to the upper part of the

income distribution. By contrast, negative concentration indices for transfer and retirement income reveal that both are distributed in favor of elderly people with low pretax-post-transfer equivalent income.

Figure 4. Evolution of income concentration



Tests for statistical significance of intertemporal changes in concentration coefficients are provided in Table 5. For OL pensioners, estimates from 1978 to 1993 indicate a decline in concentration coefficients: out of nine significant changes, seven have a negative sign. On the contrary, between 1993 and 2003 four out of five significant changes are positive. The aggregate effect of these intertemporal changes is the concentration effect, which can be taken from Table 6. Indeed, for OL pensioners this effect is significantly different from zero and negative between 1978 and 1988, and positive when comparing 1998 and 2003. For OL non-pensioners, rising concentration coefficients of retirement and investment income (employment and retirement income) lead to positive concentration effects between 1978 and 1983 (1998 and 2003). A significant decrease of the concentration coefficient for transfer

incomes between 1983 and 1988 goes hand in hand with a negative concentration effect for the same period.

Table 5. Intertemporal changes in CPI-adjusted mean equivalent incomes

	OL					NL	
	1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Pensioners							
Employment							
$\Delta\hat{C}_1$	-2.12	0.54	-4.40*	0.36	-7.30*	-1.65	-6.62*
(95% CI)	(-5.30;0.95)	(-3.17;3.83)	(-7.46;-1.24)	(-2.59;4.08)	(-10.87;-3.83)	(-8.21;4.47)	(-14.36;-1.47)
Retirement							
$\Delta\hat{C}_2$	-0.82	-1.12*	-0.94*	-0.78	1.26*	-2.48*	2.87*
(95% CI)	(-1.63;0.18)	(-2.07;-0.36)	(-1.98;-0.10)	(-2.07;0.38)	(0.17;2.16)	(-4.53;-0.44)	(1.52;4.25)
Transfers							
$\Delta\hat{C}_3$	-23.09*	8.96	6.25	13.31*	-5.61	23.42*	5.71
(95% CI)	(-33.35;-11.86)	(-1.01;18.21)	(-0.46;15.19)	(3.89;24.29)	(-16.78;5.05)	(5.44;40.27)	(-21.43;26.68)
Investments							
$\Delta\hat{C}_4$	3.54*	-2.40*	3.71*	-1.07	-1.76	7.01	-2.74
(95% CI)	(0.65;6.57)	(-4.80;-0.07)	(1.32;6.74)	(-3.18;1.07)	(-3.98;0.58)	(-0.96;14.16)	(-8.79;1.33)
Other							
$\Delta\hat{C}_5$	-4.54*	-2.44	-16.99*	21.96*	12.42*	44.70*	5.17
(95% CI)	(-9.08;-0.47)	(-7.10;1.18)	(-23.13;-10.65)	(13.36;30.51)	(3.67;18.35)	(35.30;55.98)	(-3.27;15.20)
Non-pensioners							
Employment							
$\Delta\hat{C}_1$	2.47	-1.81	1.61	-2.05	2.50*	-19.24*	2.00
(95% CI)	(-1.12;5.43)	(-5.04;0.91)	(-1.07;4.55)	(-4.63;0.28)	(0.56;5.04)	(-24.08;-15.46)	(-3.62;6.08)
Retirement							
$\Delta\hat{C}_2$	24.34*	-14.74	0.95	-9.53	23.40*	18.94	24.20
(95% CI)	(1.57;46.78)	(-33.60;5.10)	(-13.22;14.65)	(-27.93;5.97)	(7.70;38.49)	(-11.78;56.54)	(-2.59;54.91)
Transfers							
$\Delta\hat{C}_3$	-1.96	-13.06*	1.25	5.97	-8.79*	-5.40	-1.65
(95% CI)	(-10.46;5.73)	(-20.34;-4.10)	(-4.75;6.67)	(-0.34;11.24)	(-15.77;-2.21)	(-17.08;4.88)	(-9.91;5.64)
Investments							
$\Delta\hat{C}_4$	6.83*	-1.73	-1.61	-1.99	0.19	7.14	2.72
(95% CI)	(0.48;16.11)	(-8.43;5.75)	(-7.64;6.13)	(-6.84;3.10)	(-5.32;4.35)	(-0.89;14.10)	(-5.94;11.18)
Other							
$\Delta\hat{C}_5$	-0.77	-1.22	5.57	12.62	5.37	38.26*	-9.35
(95% CI)	(-7.91;5.80)	(-7.76;4.41)	(-9.56;20.09)	(-2.25;28.29)	(-1.63;10.52)	(24.53;53.36)	(-25.44;4.96)

Notes: $\Delta\hat{C}_i$ denotes the observed change in the concentration coefficient of income income component *i* in total household income between periods *t* and *t*-5. CI denotes Hall's confidence interval. *Change is significantly different from zero at the 5% level. *Source:* German Sample Survey of Income and Expenditures (1978–2003).

Table 6. Intertemporal Concentration and share effects

	OL					NL	
	1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Pensioners							
Concentration effect	-1.00*	-1.03*	-0.99*	0.45	0.73*	-0.05	1.75*
(95% CI)	(-1.70;-0.28)	(-1.81;-0.38)	(-1.75;-0.37)	(-0.29;1.23)	(0.16;1.40)	(-1.59;1.75)	(0.61;3.26)
Share effect	0.27	-0.59	0.81*	-0.19	-0.47*	3.31*	-2.41*
(95% CI)	(-0.26;0.77)	(-1.16;0.00)	(0.25;1.30)	(-0.73;0.33)	(-0.82;-0.11)	(2.08;4.67)	(-3.56;-1.33)
Non-pensioners							
Concentration effect	3.11*	-2.42*	1.31	-0.94	2.68*	-5.76	1.04
(95% CI)	(0.54;5.20)	(-5.03;-0.24)	(-1.14;3.84)	(-3.20;0.97)	(1.28;4.36)	(-11.99;2.38)	(-2.56;4.10)
Share effect	0.20	-1.12*	-0.50	-0.18	-1.20*	10.66*	-0.65
(95% CI)	(-0.28;0.58)	(-1.65;-0.51)	(-1.41;0.38)	(-1.14;1.04)	(-2.00;-0.46)	(2.48;16.20)	(-3.13;2.02)

Notes: Observed concentration and share effects between periods *t* and *t*-5. CI denotes Hall's confidence interval. *Change is significantly different from zero at the 5% level. *Source:* German Sample Survey of Income and Expenditures (1978–2003).

For the NL, there is no obvious pattern. Only one concentration effect out of four is significant (pensioners, comparison between 1998 and 2003). For this reason, it must be the changes in the income composition that have induced the steep inequality increase in the NL. Indeed, point estimates and confidence intervals of share effects summarized in Table 6 support this conclusion. For 1993 and 1998, share effects are significant and positive for NL households, particularly for non-pensioners. As opposed to this, share effects in the OL are typically insignificant or tend to mitigate concentration effects, so that no significant change in the Gini is observed.

We conclude the empirical analysis with a summary of Gini elasticities. All Gini elasticities reported in Table 7 are point estimates (in %), η_i, together with corresponding Hall confidence intervals. The interpretation of the reported numbers is straightforward. For example, the entry '0.0728' means that a 1% increase in employment income will lead to a 0.0728% increase in the Gini coefficient. Gini elasticities help answering the following type of question: Let there be an equiproportionate rise of retirement incomes, what will be the effect on the Gini index? As such information is particularly useful for evaluating recent policies we restrict attention to the most recent observation period.

For pensioners from both regions, an increase in retirement income causes the strongest decrease in the Gini index. A rise of transfer income lowers inequality only among OL pensioners. However, the effect is quantitatively small. It is insignificant in the NL. In both regions, elasticities for employment income, followed by investment and other income, are positive. It is interesting to note that elasticities, in absolute terms, are higher in the NL (except for transfer income).

Table 7. Table 7 Gini elasticities in year 2003

	OL	NL
Pensioners		
Employment		
$\hat{\eta}_1$	0.0728*	0.1480*
(95% CI)	(0.0622;0.0841)	(0.1167;0.1797)
Retirement		
$\hat{\eta}_2$	-0.1923*	-0.3361*
(95% CI)	(-0.2074;-0.1799)	(-0.3691;-0.3004)
Transfers		
$\hat{\eta}_3$	-0.0114*	0.0062
(95% CI)	(-0.0141;-0.0073)	(-0.0299;0.0308)
Investments		
$\hat{\eta}_4$	0.0662*	0.1025*
(95% CI)	(0.0535;0.0795)	(0.0858;0.1169)
Other		
$\hat{\eta}_5$	0.0646*	0.0794*
(95% CI)	(0.0545;0.0760)	(0.0463;0.1007)
Non-pensioners		
Employment		
$\hat{\eta}_1$	0.1213*	0.2292*
(95% CI)	(0.1016;0.1449)	(0.1677;0.2704)
Retirement		
$\hat{\eta}_2$	-0.0345*	0.0034*
(95% CI)	(-0.0522;-0.0208)	(-0.0172;0.0330)
Transfers		
$\hat{\eta}_3$	-0.0956*	-0.2751*
(95% CI)	(-0.1002;-0.0853)	(-0.3099;-0.2362)
Investments		
$\hat{\eta}_4$	-0.0185*	-0.0088
(95% CI)	(-0.0303;-0.0081)	(-0.0266;0.0040)
Other		
$\hat{\eta}_5$	0.0272*	0.0514*
(95% CI)	(0.0109;0.0374)	(0.0216;0.0834)

Notes: $\hat{\eta}_i$ denotes the observed Gini elasticity of income component *i*. CI denotes Hall's confidence interval. * Elasticity is significantly different from zero at the 5% level. *Source:* German Sample Survey of Income and Expenditures (1978–2003).

For non-pensioners, changes in employment and transfer income have the strongest and opposed effects on inequality: while a rise in employment income is inequality augmenting, the opposite applies to transfer income. Elasticities of retirement and investment income are not significantly different from zero, whereas for other income it is positive.

5. Concluding Remarks

In this article, we have studied intertemporal changes in the income distribution of Germany's elderly between 1978 and 2003. The elderly population, defined as people of age 55 and older, has been decomposed by residence (Old vs. New Federal States), and we have also distinguished elderly persons receiving an old-age PAYG or civil servant pensions (pensioners) and elderly persons who do not (non-pensioners). By means of price-adjusted pretax–post-transfer equivalent income and factor shares we have described changes in the financial situation of elderly people. Gini indices and further complementing information, particularly concentration coefficients and Gini elasticities for different income components, have been provided to shed light on extent and driving sources of inequality. To establish statistical significance of results, we have estimated standard errors and Hall confidence intervals using the bootstrap method. Our findings build on six cross-sections of the EVS.

During the observation period, the financial situation of elderly people improved significantly. Particularly, this applies to pensioners in the NL. Nevertheless, annual average pretax–post-transfer equivalent income in the NL remains significantly below the OL level. On an annual basis, in year 2003 the difference amounts to about €5,700 for pensioners and €15,400 for non-pensioners. It can also be shown that income growth rates are less volatile and higher for pensioners compared with non-pensioners. In this sense, the German pension system is an effective insurance device against aggregate GDP shocks.

Concerning the issue of income inequality, we find that the income distribution of the elderly in the OL is both rather stable and flat. For pensioners, we find a slight but significant decline of the Gini index in the first half of the observation period and stagnation since then. For nonpensioners, there is more variability in Gini indices between consecutive periods. However, due to opposing signs of intertemporal differences, Gini point estimates for 1978 and 2003 differ by less than one percentage point. In the NL, inequality from 1993 to 1998 surged rapidly. As a result, by 2003 the observed divide in inequality levels between non-pensioners in the east and west almost vanished. For pensioners, the divide remains, with inequality being lower among NL pensioners.

Recent reforms of the German pension system include a paradigm shift towards a more funded pension scheme. Moreover, retirement age has been raised from 65 to 67 years. To compensate for resulting future replacement rate reductions, in 2001 the German government started to promote the development of private pensions by means of special saving subsidies and tax incentives, the so-called 'Riester-scheme'. Participation in the Riester scheme is voluntary. Evidence from micro data suggests that the stimulating effect of the Riester scheme on private old-age provision in the case of low income households is small

(for Germany, see Corneo et al., 2009). Hence, together with high and positive Gini elasticities for investment income, the evidence suggests that such a reform is likely to increase inequality among elderly in the future, and that old-age poverty might become a more important issue in future decades. To mitigate these effects, one could try to enhance participation rates of low income households in private retirement plans either through higher saving subsidies or through making participation compulsory.

Finally, some words about the intertemporal comparability of results. As two referees correctly pointed out, our database is cross-sectional in structure, and derived point estimates must be complemented by standard errors or confidence intervals for examining the statistical significance of results. This is what we have done in the present version of this article. In this sense, our results also contribute to closing the 'lack of statistical inference in the literature on measurement of income inequality' (Athanasopoulos and Vahid, 2003, p. 415). To ensure intertemporal comparability of estimates, we have spent a lot effort on ensuring that our income variable, pretax–post-transfer equivalent incomes, which is constructed from various EVS variables, contains intertemporally consistent information. What we have to take as given is the top coding of incomes, potentially resulting in downward-biased inequality estimates, and the exclusion of residents in nursing homes or other institutional accommodations from the database.

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Supplementing Material: Incomes and inequality in the long run: the case of German elderly

1. Income concept: pretax-post-transfer equivalent income

1.1. Definition

The income concept used throughout the paper is *pretax-post-transfer equivalent income* in year 2003 prices. For years 1978 to 1998, incomes have been adjusted by consumer price indices, reported in Table S2, provided in German Federal Statistical Office (2007).

Pretax-post-transfer equivalent income comprises five income components:

(a) *employment income*: earned income and self-employed income;

(b) *retirement income*: retirement pensions from public pension fund, civil servant's pensions, company pensions, and other pensions;

(c) *transfer income*: benefits related to former employment, social assistance, family-related benefits, and other transfers;

(d) *investment income*;

(e) *other income*: which is a residual component that cannot unambiguously be assigned to the previous five income concepts.

For each cross section, each income component has been constructed from several EVS variables. Table S2 summarizes the EVS variables pertaining to each income source. Pretax-post-transfer income is the sum of all *individual* incomes of elderly persons living in a household unit plus a fraction of incomes reported at the household level only, with individual incomes of other household members being ignored. To derive equivalent pretax-post-transfer income, we apply the OECD modified equivalence scale.

1.2. Interpretation

The number of elderly persons in a household unit not necessarily complies with the household size of the original EVS household units. Particularly, in our sample all non-elderly persons and their individual incomes have been discarded from our sample. As a result, we might underestimate the true level of household-size economies and the access of elderly people to financial resources. For example, elderly living with younger high income recipients may benefit from intra-household income pooling. In this sense, our income concept is a lower bound for their 'true' level of material comfort. A benefit of our income definition is that it 'controls' for changes in household arrangements or changes in non elderly household members' incomes.

One might also argue that a pretax-post-transfer income concept is a biased estimate of peoples 'true' living standards, as consumption ultimately depends on *post*-tax-post-transfer income. Yet, observations in our database usually cannot be treated as tax units, and computing post-tax-post-transfer income (especially for different income sources) would urge us to make strong assumptions on individual tax liabilities. Finally, pretax-post-transfer income is less sensitive to changes in the tax code, and thus might be a better indicator for assessing the impacts of previous pension reforms on the financial situation of the elderly.

2. Research Sample and adjustment of EVS sampling weights

The database underlying our calculations is a subset of the EVS waves 1978 – 2003. The non-weighted number of household units in this subset is 103,205. One problem with the EVS database is the fact that it over-samples people in their 70ies on the account of the cohort age 80 and older. To fit the German micro-census statistics, we have adjusted EVS sample weights according to the entropy based *minimum information loss principle*. The minimum information loss principle satisfies a positivity constraint on the sampling weights to be computed. The software we have made use of is *Adjust* (see Merz, 1994, for further information) incorporates a numerical solution by means of a modified Newton-Raphson procedure with a global exponential approximation. Official statistics on the absolute numbers of persons in Germany by age and year have been taken from the online database of the German Federal Statistical Office downloadable from http://www.destatis.de/jetspeed/portal/cms/.

3. Results from the stratified bootstrap approach

Tables S4 to S9 correspond with Tables 2 to 7 in the article, Figures S1 to S4 with Figures 1 to 4.

References

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Merz, J. (1994): Microdata Adjustment by the Minimum Information Loss Principle, Munich Personal RePEc Archive, 7231.

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Table S1. Main pension reforms in the period 1978 – 2003

Year of Passing	Coming Into Effect	Reform act	Individual pension entitlement
1977	01/1978 - 01/1979	20nd Rentenanpassungsgesetz	Reduction of creditable periods (education and training periods) for future pension entitlements
1978	07/1978 - 12/1981	21nd Rentenanpassungsgesetz	Pension entitlements are unlinked from growth of gross wages
1982	01/1983	Haushaltsbegleitgesetz 1983	Further reduction of creditable periods (education and training periods) for future pension entitlements
1985	01/1986	Gleichstellung von Männern und Frauen bei den Hinterbliebenenrenten	Equal treatment of widows and widowers, and reduction of surviving dependants' pension entitlement
1989	01/1992	Rentenreformgesetz 1992	Further reduction of creditable periods (education and training periods) for future pension entitlements Stepwise increase of mandatory retirement age Increase of minimal insurance period qualifying for entitlement Change of pension adjustment procedure to net pension adjustment Introduction of penalties in case of retirement before age 65
1996	10/1996 01/1997	Wachstums- und Beschäftigungsförderungsgesetz	Further reduction of creditable periods (education and training periods) for future pension entitlements More rapid increase of retirement age
1997	07/1998 - 01/2000	Rentenreformgesetz 1999	Introduction of a 'demographic factor': adjustment of pension entitlements to demographic changes Increase of retirement age and lowering of pension levels for several insurant segments (in particular for highly disabled and surviving dependants)
1998	04/1999 - 06/1999	Rentenkorrekturgesetz	Adjournment of the Rentenreformgesetz 1999 until Dec. 31, 2000
1999	04/1999	Gesetz zur Neuregelung der geringfügigen Beschäftigungsverhältnisse	Tax exceptions for active pensioners
1999	01/2000	Gesetz zur Sanierung des Bundeshaushalts	Change of pension adjustment procedure to adjustment equal to inflation rates
2001	01/2001 - 01/2002	Altersvermögensergänzungsgesetz	No pension adjustment for year 2001
2001	01/2002	Gesetz zur Verbesserung des Hinterbliebenenrechts	Increase of surviving dependants' pensions

Table S2. Consumer-price indices for Germany

Year	Old Laender	New Laender
1978	54.36	---
1983	68.92	---
1988	73.05	---
1993	86.08	85.09
1998	93.54	94.62
2003	100.00	100.00

Source. Own calculations from data of German Federal Statistical Office (2009).

Table S3. EVS income variables (80 percent sample)

income component	sub components	EVS field-identification number in year					
		2003	1998	1993	1988	1983	1978
employment income	earned income[a]	99; 100; 102; 103; 104; 108; 133	251-256; 258-263; 272-277; 279-284; 286-291; 314-319; 405-410	303-308; 429-434	186; 188; 190; 192; 299-304	187; 189; 191; 193; 300-305	149; 151; 153; 155; 262-267
	self-employed income	122; 123; 124	328-333; 335-340; 342-347	324-329; 331-336; 338-343; 345-351; 352-357; 359-364	194-199; 201-206; 208-213; 215-220; 222-227; 229-234	195-200; 202-207; 209-214; 216-221; 223-228; 230-235	157-162; 164-169; 171-176; 178-183; 185-190; 192-197
retirement income	PAYG	125; 126; 127	349-354; 377-382; 356-361	366-371; 373-378; 380-385	236-241; 243-248, 250-255	237-242; 244-249; 251-256	199-204; 206-211; 213-218
	civil servant's pensions	158; 159	566-571; 573-578	520-525; 527-532; 534-539	383-388; 390-395; 397-402	377-382; 384-389; 391-396	332-337; 339-344; 346-351
	company pensions	160; 130; 131	580-585; 384-389; 391-396	541-546; 548-553; 387-392; 394-399; 401-406	404-409; 411-416; 278-283; 285-290; 292-297	398-403; 405-410; 279-284; 286-291; 293-298	353-358; 241-246; 248-253; 255-260
	other pensions	132; 147; 150; 156	398-403; 503-508; 524-529; 559-564	408-413; 415-420; 422-427; 485-490; 492-497; 513-518	257-262; 264-269; 271-276; 362-367; 369-374	258-263; 265-270; 272-277; 356-361; 363-368	220-225; 227-232; 234-239; 290-295; 297-302; 304-309
transfer income	former employment related benefits	135; 136; 137; 138; 146; 155	419-424; 426-431; 433-438; 440-445; 496-501; 552-557	436-441; 443-448; 450-455; 592; 593; 478-483; 506-511	306-311; 313-318; 320-325; 455; 466; 334-339; 348-353	307-312; 314-319; 321-326; 448; 459; 328-333; 342-347	269-274; 276-281; 283-288; 394; 410; 325-330; 311-316
	social assistance	141; 143; 144; 157	461-466; 475-480; 482-487	589; 464-469; 596; 597	452; 355-360; 456; 467	445; 349-354; 449; 460	391; 318-323; 395; 411
	family-related benefits	139; 140; 142; 145	447-452; 454-459; 468-473; 489-494	588; 457-462; 471-476	451; 341-346; 327-332	444; 335-340	390
	other transfers	151[b]; 152; 153; 154	531-536[b]; 538-543; 545-550	499-504; 600; 601	376-381; 459; 470;	370-375; 452; 463	325-330; 398; 414
investment income		47; 177; 162	121; 617; 594-599	103; 614; 625	24; 453; 488	33; 446; 481	388; 389; 392; 426
other income		---	---	---	---	---	---

Note. 'Other income' is the income residual that cannot be assigned to the eleven other income sources. [a] In 1978, 1983 and 1988 'earned income' is reported for the household head, the spouse (if present), and 'children' (if present). For 'other' household members, only an aggregate amount is reported. In this case, we divide the aggregate amount by the number of 'other' household members and assign this ratio to each household member age 55 and above that is not the household head and not his/her spouse. [b] Although this position should be classified as 'other pensions' we reclassify it for reasons of better comparison as 'other transfers'. *Source*. German Sample Survey of Income and Expenditures 1978-2003.

Table S4. Inter-temporal changes in CPI adjusted mean equivalent incomes (stratified bootstrap)

		Old Laender					New Laender	
		1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Pensioners	$\Delta\hat{\mu}$	215	1,708*	1,938*	1,866*	1,981*	3,774*	2,108*
	(95% CI)	(-220; 557)	(1,283; 2,133)	(1,570; 2,400)	(1,371; 2,319)	(1,395; 2,466)	(3,249; 4,333)	(1,619; 2,549)
Non pensioners	$\Delta\hat{\mu}$	-1,580*	4,041*	2,482*	2,379*	359	5,856*	1,756*
	(95% CI)	(-3,009; -354)	(2,519; 5,623)	(644; 3,883)	(917; 3,859)	(-1,383; 1,910)	(4,029; 7,313)	(-3,844; -160)

Note. $\Delta\hat{\mu}$ is the observed change in mean equivalent income between periods t and t-5. All numbers rounded to full € amounts. CI denotes Hall's confidence interval. * denotes that the change is significantly different from zero at the 5% level. *Source*. German Sample Survey of Income and Expenditures 1978-2003.

Table S5. Inter-temporal changes in factor shares (stratified bootstrap)

			Old Laender					New Laender	
			1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Pensioners	employment	$\Delta\hat{w}_1$	-0.75	-1.59*	0.07	-2.05*	-1.04*	3.75*	-4.97*
		(95% CI)	(-1.89; 0.13)	(-2.66; -0.73)	(-1.24; 1.19)	(-3.14; -0.97)	(-1.85; -0.28)	(2.08; 5.89)	(-6.38; -3.46)
	retirement	$\Delta\hat{w}_2$	-1.18	0.50	-2.13*	-3.92*	2.05*	-8.49*	4.46*
		(95% CI)	(-2.13; 0.13)	(-0.55; 1.74)	(-3.40; -0.86)	(-5.05; -2.69)	(0.83; 3.01)	(-10.86; -6.82)	(2.83; 6.33)
	transfers	$\Delta\hat{w}_3$	-0.68*	0.00	0.01	-0.03	-0.29*	1.21*	-1.41*
		(95% CI)	(-0.97; -0.41)	(-0.16; 0.22)	(-0.19; 0.19)	(-0.23; 0.15)	(-0.51; -0.06)	(0.48; 1.78)	(-2.26; -0.60)
	investments	$\Delta\hat{w}_4$	2.62*	0.21	5.13*	1.38*	-1.57*	1.27*	1.07*
		(95% CI)	(2.05; 3.19)	(-0.54; 0.70)	(4.54; 5.80)	(0.76; 2.11)	(-2.45; -0.89)	(0.36; 2.18)	(0.09; 1.63)
	other	$\Delta\hat{w}_5$	-0.01	0.87*	-3.08*	4.62*	0.85*	2.25*	0.85
		(95% CI)	(-0.41; 0.39)	(0.42; 1.21)	(-3.43; -2.74)	(4.07; 5.00)	(0.37; 1.64)	(1.93; 2.68)	(-0.12; 1.63)
Non pensioners	employment	$\Delta\hat{w}_1$	-1.68	-1.53*	-0.34	-8.94*	-3.03*	18.71*	-5.70*
		(95% CI)	(-3.42; 0.20)	(-3.01; -0.11)	(-1.59; 1.30)	(-10.98; -7.42)	(-4.82; -1.38)	(15.37; 23.13)	(-10.23; -1.19)
	retirement	$\Delta\hat{w}_2$	-1.15*	0.99*	-0.16	-1.87*	5.78*	-38.35*	4.28*
		(95% CI)	(-1.74; -0.57)	(0.38; 1.56)	(-0.80; 0.58)	(-2.43; -1.42)	(4.94; 6.65)	(-41.74; -35.29)	(2.78; 5.47)
	transfers	$\Delta\hat{w}_3$	-0.03	1.26*	1.12*	0.29	-0.89*	10.96*	-0.88
		(95% CI)	(-0.39; 0.44)	(0.57; 1.75)	(0.40; 1.88)	(-0.60; 0.87)	(-1.48; -0.17)	(8.37; 13.42)	(-3.45; 2.32)
	investments	$\Delta\hat{w}_4$	2.82*	-0.26	2.46*	1.79*	-1.44*	0.55	2.29*
		(95% CI)	(1.38; 3.94)	(-1.57; 1.16)	(1.29; 3.46)	(0.69; 2.81)	(-2.43; -0.74)	(-1.03; 1.87)	(0.50; 4.11)
	other	$\Delta\hat{w}_5$	0.05	-0.46	-3.08*	8.74*	-0.43	8.13*	0.02
		(95% CI)	(-0.69; 0.81)	(-1.05; 0.30)	(-3.59; -2.63)	(7.94; 9.40)	(-1.56; 0.75)	(5.65; 9.55)	(-2.43; 2.84)

Note. $\Delta\hat{w}_i$ denotes the observed change in the share of income component *i* in total household income between periods t and t-5. CI denotes Hall's confidence interval. * denotes that the change is significantly different from zero at the 5% level. *Source*. German Sample Survey of Income and Expenditures 1978-2003.

Table S6. Inter-temporal changes in Gini indices (stratified bootstrap)

		Old Laender					New Laender	
		1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Pensioners	$\Delta\hat{G}$	-0.73	-1.62*	-0.18	0.27	0.26	3.25*	-0.66
	(95% CI)	(-1.56; 0.18)	(-2.76; -0.81)	(-1.03; 0.67)	(-0.59; 0.96)	(-0.44; 1.26)	(1.92; 4.81)	(-2.20; 0.56)
Non pensioners	$\Delta\hat{G}$	3.31*	-3.54*	0.81	-1.12	1.41*	4.91*	0.39
	(95% CI)	(1.13; 5.61)	(-5.87; -1.58)	(-1.17; 2.89)	(-2.49; 0.29)	(0.08; 2.91)	(2.09; 7.59)	(-1.81; 3.68)

Note. $\Delta\hat{G}$ is the observed change in the Gini index between periods t and t-5. CI denotes Hall's confidence interval. * denotes that the change is significantly different from zero at the 5% level. *Source*. German Sample Survey of Income and Expenditures 1978-2003.

Table S7. Inter-temporal changes in concentration coefficients (stratified bootstrap)

			Old Laender					New Laender	
			1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Pensioners	employment	$\Delta\hat{C}_1$	-2.12	0.54	-4.40*	0.36	-7.30*	-1.65	-6.62*
		(95% CI)	(-5.09; 1.08)	(-2.83; 4.07)	(-7.58; -1.26)	(-3.27; 4.44)	(-11.54; -2.75)	(-7.62; 3.57)	(-11.47; -0.40)
	retirement	$\Delta\hat{C}_2$	-0.82	-1.12*	-0.94*	-0.78	1.26*	-2.48*	2.87*
		(95% CI)	(-1.62; 0.07)	(-1.99; -0.39)	(-1.96; -0.06)	(-1.98; 0.35)	(0.26; 2.59)	(-4.64; -0.77)	(1.07; 4.34)
	transfers	$\Delta\hat{C}_3$	-23.09*	8.96	6.25	13.31*	-5.61	23.42*	5.71
		(95% CI)	(-32.53; -13.49)	(-0.56; 16.26)	(-1.83; 14.55)	(4.00; 22.34)	(-15.79; 4.55)	(9.05; 37.79)	(-8.92; 28.01)
	investments	$\Delta\hat{C}_4$	3.54*	-2.40*	3.71*	-1.07	-1.76	7.01	-2.74
		(95% CI)	(0.53; 6.80)	(-5.02; -0.04)	(1.03; 6.54)	(-3.75; 1.52)	(-4.50; 0.78)	(-0.26; 14.00)	(-7.83; 1.67)
	other	$\Delta\hat{C}_5$	-4.54	-2.44	-16.99*	21.96*	12.42*	44.70*	5.17
		(95% CI)	(-8.90; 0.49)	(-6.37; 1.77)	(-23.30; -10.46)	(14.26; 27.76)	(5.54; 18.50)	(34.26; 55.38)	(-6.75; 15.17)
Non pensioners	employment	$\Delta\hat{C}_1$	2.47	-1.81	1.61	-2.05	2.50*	-19.24*	2.00
		(95% CI)	(-0.15; 4.96)	(-4.70; 0.79)	(-0.79; 4.00)	(-4.23; 0.53)	(0.34; 4.17)	(-22.86; -14.45)	(-2.02; 6.53)
	retirement	$\Delta\hat{C}_2$	24.34*	-14.74	0.95	-9.53	23.40*	18.94	24.20
		(95% CI)	(3.45; 46.43)	(-36.54; 1.72)	(-15.84; 15.98)	(-26.46; 8.08)	(10.27; 36.08)	(-6.79; 55.28)	(-8.93; 50.34)
	transfers	$\Delta\hat{C}_3$	-1.96	-13.06*	1.25	5.97*	-8.79*	-5.40	-1.65
		(95% CI)	(-10.516; 5.12)	(-20.90; -4.14)	(-4.92; 7.35)	(0.12; 10.72)	(-13.92; -3.95)	(-18.18; 5.83)	(-8.41; 7.25)
	investments	$\Delta\hat{C}_4$	6.83	-1.73	-1.61	-1.99	0.19	7.14	2.72
		(95% CI)	(-0.75; 12.73)	(-8.70; 5.27)	(-9.19; 5.20)	(-6.79; 2.89)	(-4.44; 3.34)	(-1.53; 14.23)	(-4.16; 11.07)
	other	$\Delta\hat{C}_5$	-0.77	-1.22	5.57	12.62	5.37	38.26*	-9.35
		(95% CI)	(-8.89; 6.97)	(-8.20; 4.72)	(-7.81; 19.27)	(-1.13; 27.32)	(-1.01; 10.92)	(23.31; 51.58)	(-21.73; 2.68)

Note. $\Delta\hat{C}_i$ denotes the observed change in the concentration coefficient of income component i between periods t and t-5. CI denotes Hall's confidence interval. * denotes that the change is significantly different from zero at the 5% level. *Source*. German Sample Survey of Income and Expenditures 1978-2003.

Table S8. Concentration and share effects (stratified bootstrap)

		Old Laender					New Laender	
		1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Pensioners	concentration effect	-1.00*	-1.03*	-0.99*	0.45	0.73*	-0.05	1.75*
	(95% CI)	(-1.60; -0.16)	(-1.85; -0.43)	(-1.51; -0.33)	(-0.46; 1.28)	(0.05; 1.67)	(-2.01; 1.66)	(0.33; 2.87)
	share effect	0.27	-0.59*	0.81*	-0.19	-0.47*	3.31*	-2.41*
	(95% CI)	(-0.28; 0.73)	(-1.12; -0.18)	(0.11; 1.37)	(-0.80; 0.30)	(-0.83; -0.06)	(2.37; 4.87)	(-3.55; -1.58)
Non pensioners	concentration effect	3.11*	-2.42*	1.31	-0.94	2.68*	-5.76	1.04
	(95% CI)	(1.01; 5.36)	(-4.67; -0.12)	(-0.82; 3.31)	(-3.01; 0.56)	(0.92; 4.35)	(-13.58; 1.56)	(-2.86; 4.92)
	share effect	0.20	-1.12*	-0.50	-0.18	-1.20*	10.66*	-0.65
	(95% CI)	(-0.45; 0.62)	(-1.60; -0.64)	(-1.13; 0.22)	(-1.01; 0.90)	(-1.85; -0.48)	(3.75; 15.87)	(-2.98; 1.36)

Note. Observed concentration and share effects between periods t and t-5. CI denotes Hall's confidence interval. * denotes that the change is significantly different from zero at the 5% level. *Source*. German Sample Survey of Income and Expenditures 1978-2003.

Table S9. Gini elasticities in year 2003 (stratified bootstrap)

			Old Laender	New Laender
Pensioners	employment	$\hat{\eta}_1$	0.0728*	0.1480*
		(95% CI)	(0.0639; 0.0821)	(0.1172; 0.1775)
	retirement	$\hat{\eta}_2$	-0.1923*	-0.3361*
		(95% CI)	(-0.2054; -0.1797)	(-0.3712; -0.2981)
	transfers	$\hat{\eta}_3$	-0.0114*	0.0062
		(95% CI)	(-0.0146; -0.0078)	(-0.0163; 0.0300)
	investments	$\hat{\eta}_4$	0.0662*	0.1025*
		(95% CI)	(0.0555; 0.0785)	(0.0833; 0.1137)
	other	$\hat{\eta}_5$	0.0646*	0.0794*
		(95% CI)	(0.0561; 0.0759)	(0.0562; 0.1042)
Non pensioners	employment	$\hat{\eta}_1$	0.1213*	0.2292*
		(95% CI)	(0.1035; 0.1380)	(0.1782; 0.3036)
	retirement	$\hat{\eta}_2$	-0.0345*	0.0034
		(95% CI)	(-0.0488; -0.0196)	(-0.0163; 0.0226)
	transfers	$\hat{\eta}_3$	-0.0956*	-0.2751*
		(95% CI)	(-0.1047; -0.0854)	(-0.3112; -0.2371)
	investments	$\hat{\eta}_4$	-0.0185*	-0.0088
		(95% CI)	(-0.0271; -0.0098)	(-0.0223; 0.0100)
	other	$\hat{\eta}_5$	0.0272*	0.0514*
		(95% CI)	(0.0159; 0.0360)	(0.0181; 0.0687)

Note. $\hat{\eta}_i$ denotes the observed Gini elasticity of income component i. CI denotes Hall's confidence interval. * Elasticity is significantly different from zero at the 5% level. *Source*. German Sample Survey of Income and Expenditures 2003.

Figure S1. Evolution of mean equivalent income (stratified bootstrap)

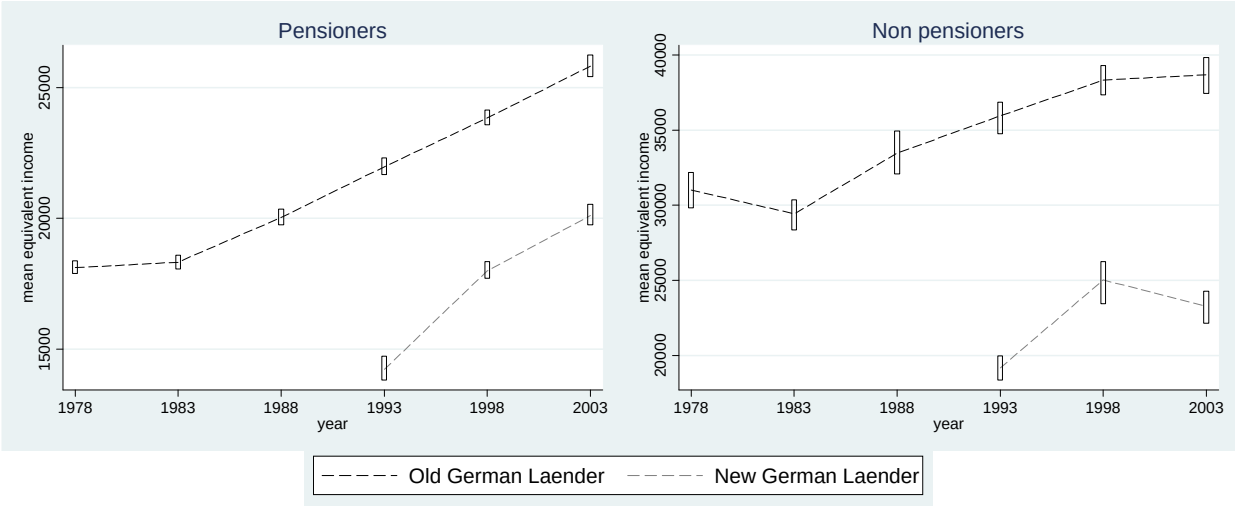


Figure S2. Evolution of income shares (stratified bootstrap)

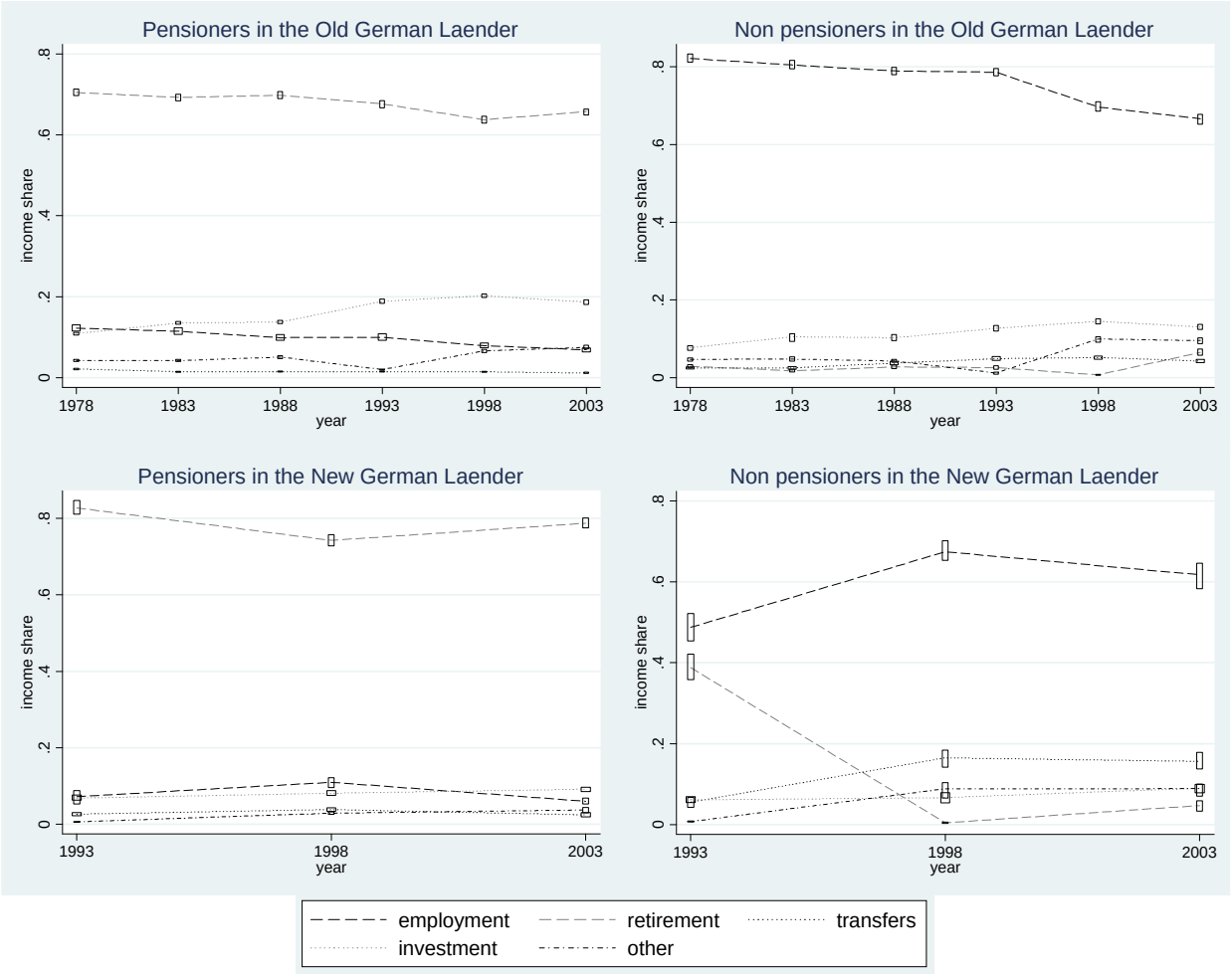


Figure S3. Evolution of income inequality (stratified bootstrap)

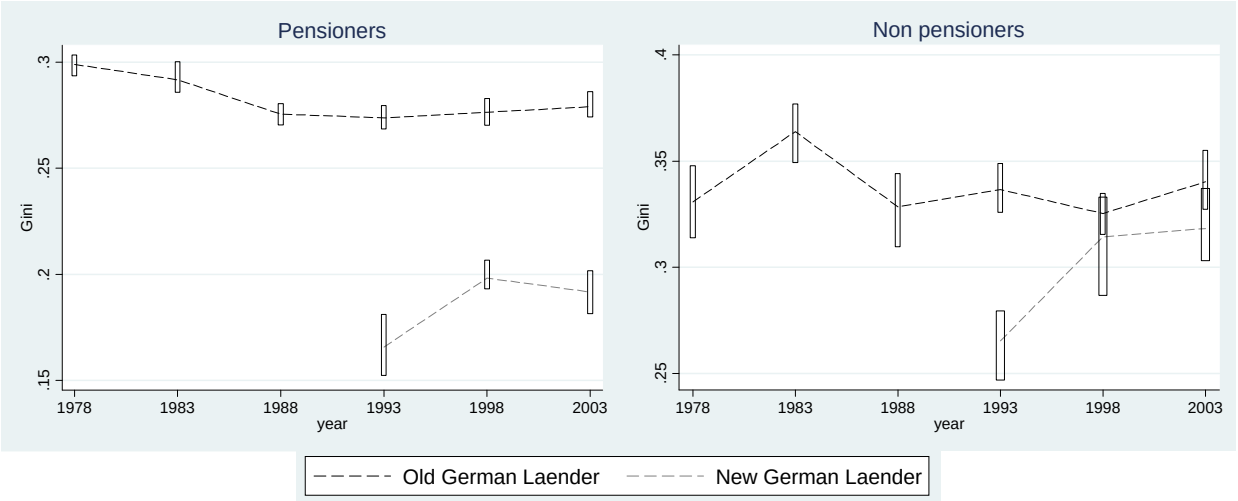
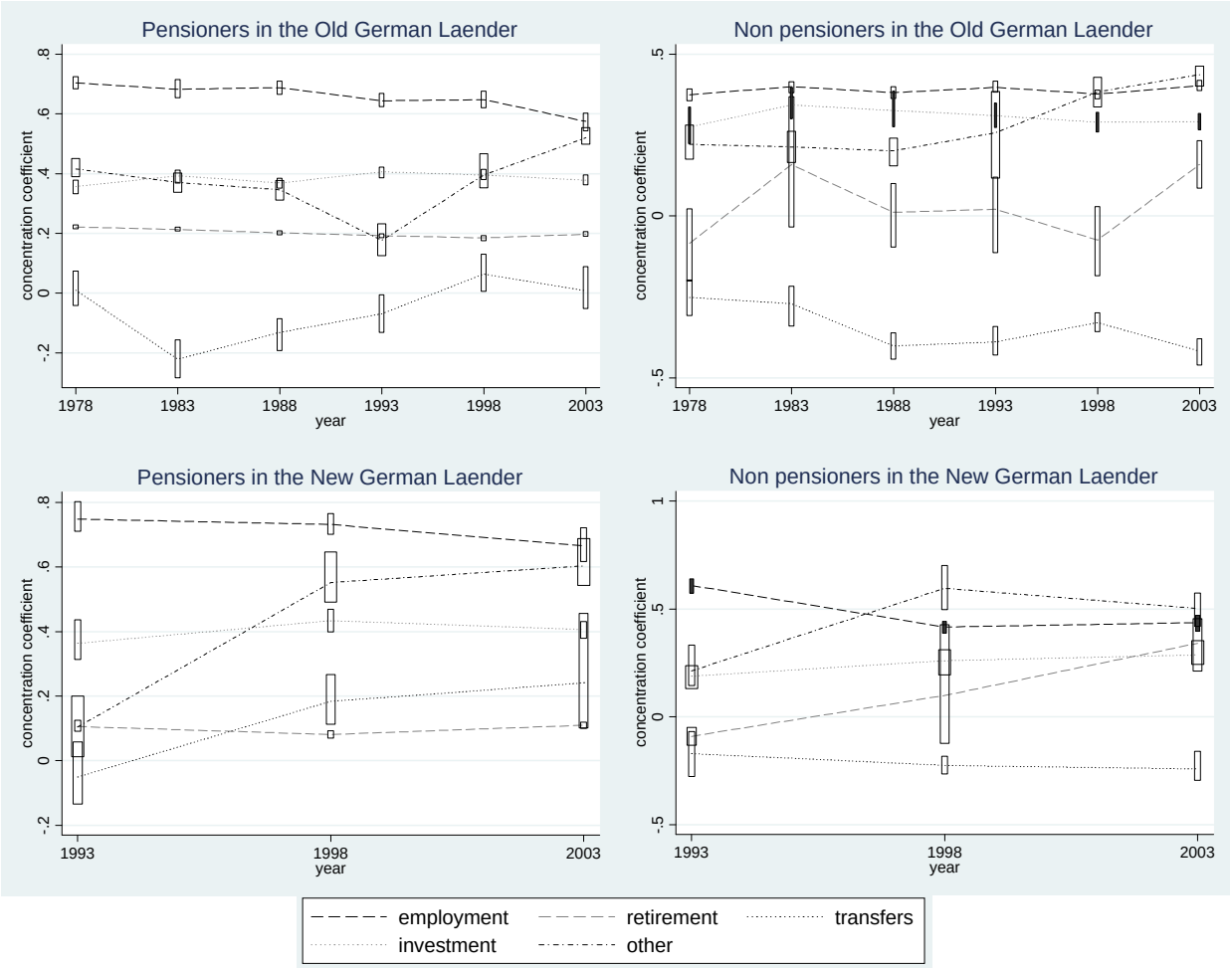


Figure S4. Evolution of income concentration (stratified bootstrap)



Poverty in Germany – Statistical Inference and Decomposition

1. Introduction

Poverty and child poverty in particular are recognized as key social problems. On the individual level, a slim budget not only restrains the actual possibility to consume. Duncan and Brooks-Gunn (1997) and later studies like Gregg and Machin (2000) suggest that growing up poor is likely to have negative effects on children's learning and social capabilities, and on their future life chances. Poor families' children are more likely to become teen and sole parents, are less successful in school (see, for example, Paxson and Schady, 2007) and in the labor market (see, for example, Chase-Landsdale and Brooks-Gunn, 1995, Rodgers and Pryor, 1998, or Oreopoulos et al., 2008). According to medical studies, poverty during infancy and childhood is an important predictor of mortality risk (see, for example, Nelson, 1992, Nersesian et al., 1985, and Wise et al., 1985). Similarly, Marmot (2004) finds that scarce resources not only restrain individual access to health services. The loss of autonomy and social participation can work as a psychological stressor deteriorating health, the so-called status syndrome. Other studies find positive correlations between peoples' economic situation on the one hand and drug use and crime rates on the other (see Patterson, 2006).

Poverty is not only an individual dilemma. High poverty rates are likely to create social costs and lower income growth. Credit constraints may prevent people with low income from undertaking efficient human capital investments.[1] Substantial income and wealth disparities may discourage and frustrate people. In turn, deprived people might withdraw from social life, stop looking for work, or turn their backs on the democratic system. Individuals who feel powerless in view of large economic disparities may see no other chance to improve their economic situation but to infringe social and ethical rules and norms. All this is as true in rich as in poor countries. Measuring poverty, explaining its causes and consequences is thus on top of the research agenda of scholars from various disciplines.

This study investigates poverty in Germany since the late 1970th. Six waves of the German Sample Survey of Income and Expenditures from year 1978 to 2003 form our database. A particular focus of our study is a poverty decomposition by region of residence (newly-formed vs. old German Federal States) and household type. As a threshold, we use both a relative and an absolute poverty line. The head-count ratio is used to determine the incidence of poverty, while we use the normalized poverty-gap ratio to assess the intensity of poverty. To ensure comparability of household disposable incomes across time and regions (New states vs. Old states), we consider region-specific consumer-price indices (CPIs) and

[1] See Okun (1975) or Welch (1999) for opposite arguments.

purchasing powers (PP). Moreover, differences in needs are taken into account by means of the OECD modified equivalence scale.[2] The resulting equivalent income is comparable across households, time and regions. So we refrain from specifying household-type or region specific poverty lines.[3]

Several empirical studies have explored poverty in Germany. Examples include Burkhauser et al. (1996), Smeeding et al. (2000), Schluter (2001), Jenkins et al. (2003), Jenkins and Schluter (2003), Valletta (2006), and Corak et al. (2008). For a comprehensive literature review see Hauser and Becker (2003).

This article builds upon aforementioned literatures, extending it along two dimensions. First, the bootstrap method is applied for testing the statistical significance of all our results. In the context of inequality and poverty, the bootstrap approach was first applied by Mills and Zandvakili (1997), and its validity has been shown in Biewen (2002). Our results contribute to close an apparent lack of statistical inference in the empirical poverty literature. Two results from our analysis are particularly remarkable. From all household types single parents with children have by far the highest poverty risk. Most striking, however, is the regional poverty divide between New and Old states: The incidence and the intensity of poverty are substantially higher in the New compared to the Old states.

Concerning the East/West poverty divide, several nonexclusive explanations have been provided. One line of research stresses the role of external constraints, i.e. of factors not being in the individual sphere of influence. Particularly, the transfer of West German labor market institutions to the East may play a prominent role. Despite productivity levels in the East being low, unions and employers rapidly raised wages in the New states causing high unemployment rates (see Sinn, 2002). At the same time, unemployment and social welfare benefits have been raised close to West German standards, weakening individual incentives to undertake human capital investments. Resulting unemployment-, low-skill and poverty traps have been investigated in Snower and Merkl (2006).[4] Another line of research highlights the role of intrinsic factors, i.e. aspirations and beliefs, for individual poverty risks: The rapid change in all socio-political spheres might have negatively affected East Germans' aspirations and self-confidence, and this in turn may have limited their ability to successfully participate

[2] See Section 2.1 for details.

[3] We are indebted to three anonymous referees and the Editor for valuable comments regarding the definition of an appropriate income aggregate. Another possible strategy would be the application of distinct poverty lines for East and West Germany as derived from the region-specific income distributions. Further insights into the debate can be found, for example, in Corak (2005) or Jenkins et al. (2003). As a robustness check, the Supplementing Materials provide all our results for the case that the PP-adjustment remains undone.

[4] Further external constraints potentially affecting poverty levels include credit/insurance market imperfections (e.g., Loury, 1981, Galor and Zeira, 1993, Banerjee and Newman, 1993, or Torvik, 1993), coordination problems (e.g., Da Rin and Hellman, 2002, or Kremer, 1993, and other institutional or governmental failures (e.g., Bardham, 1997).

in the system and improve their own conditions (for such an other arguments see Mookherjee, 2003, or Stern et. al., 2005).[5] A third line stresses the role of East-to-West migration of the young and better educated, i.e. of people with low poverty risks.[6] As a result, the non-migrating New states residents may carry personal characteristics associated with high poverty risks.

Our second contribution is the investigation of regional differences in distributions of personal or household characteristics for the risk of being poor. Particularly, we assess how much of the East/West poverty divide is related to differences in observed characteristics between New and Old state households, such as the level of education, employment status, etc., and how much is related to other "unexplained" factors. As technical workhorse, we apply a non-linear Oaxaca-Blinder poverty decomposition. It is based on logit regressions which econometrically link the likelihood of being poor to households' socioeconomic and demographic characteristics. The Oaxaca-Blinder decomposition reveals how much of the East/West poverty divide results from differences in such observables, the so-called (aggregate) characteristics effect. The remaining part of the divide, the (aggregate) coefficient effect, indicates how differences in group-specific processes or non-quantified endowments contribute to the poverty divide.

The characteristics effect is zero in year 1993. Accordingly, differences in the distributions of characteristics between the New and the Old states cannot explain even a small fraction of the 1993 poverty divide. Instead, the divide must be related to other factors, most likely the Unification shock turning the New states economy upside down from a command to a market economy. Over time, however, the characteristics effect becomes more relevant. In year 2003, it explains more than 50 percent of the poverty divide. Migration of well-educated and well-trained people from the New to the Old states, may be one reason underlying the pattern. Another likely reason is discouraging social and labor market policies and substantial wealth and income disparities leading to inefficiently low human-capital investments in the New States.

The paper is structured as follows. Section 2 explains the poverty measures, the use of the bootstrap method, and the Oaxaca-Blinder decomposition approach. Section 3 portraits inter-temporal poverty trends including tests of significance. Section 4 summarizes the results from the non-linear Oaxaca-Blinder decomposition approach, and Section 5 concludes.

[5] A related emerging strand of literature seeks to explain poverty with insights from behavioral economics (see Bertrand et al., 2004).

[6] Migration models supporting this conjecture are presented in Roy (1951) and Borjas (1987). Empirical evidence is provided in and Burda and Hunt (2001).

2. Methodological considerations

2.1. Conventions related to poverty measurement

Our analysis builds on six inter-temporally harmonized waves of the German Sample Survey of Household Income and Expenditure (EVS) collected at 5-year intervals between 1978 and 2003.[7] The EVS is provided by the German Federal Statistical Office, and contains representative household data on income, taxes, social security contributions, social transfers, wealth, inventories, and expenditure, as well as several other socioeconomic and demographic characteristics. Per cross section, sample size ranges between 40,000 to 60,000 household units.

The assessment of poverty necessitates several conventions with immediate implications for the data processing.[8] The first convention concerns the income concept. Following standard international practice, all estimates are derived from *CPI-PP-adjusted equivalent disposable household incomes* (henceforth "equivalent incomes"), computed from the EVS variable *disposable household income* (gross earnings, capital and self-employment income, plus public transfers and imputed rents, minus income taxes and social security contributions). Equivalent income is always expressed in year 2003 prices, it is adjusted for changes in region-specific consumer price indices (CPI) and differences in purchasing power (PP) in East and West.[9] The *OECD modified scale* is applied to adjust for differences in need across household types.[10]

The second convention relates to the choice of the poverty line. In Germany, an official poverty line does not exist. We apply both a *relative* and an *absolute* poverty line. Before Unification, poverty lines are derived from the Old states population, and from the Old and New states population since then.[11] The construction of the *relative poverty line* (RPL) follows the recommendation of the European Statistical Office.[12] People with an income below 60-percent-of-median equivalent income are assessed as poor. The RPL ties down the minimum acceptable income to what other people get. Hence, derived poverty estimates remain unchanged if incomes of all households grow at same rate. A decrease in poverty essentially mirrors an improving economic situation of low income relative to high income

[7] See Bönke et al. (2010) for details.
[8] See also Deaton (2004).
[9] Concerning the price and purchasing-power adjustments see Table A1 in the Supplementing Materials for details. For detailed information on region-specific price levels see Kosfeld et al. (2007) as well as Dreger and Kosfeld (2010).
[10] The OECD modified scale assigns a value of 1.0 to the first adult household member, of 0.5 (0.3) to each further person of age 14 and above (below 14 years).
[11] Alternatively, distinct region-specific poverty lines could have been applied (for a discussion see Corak et al., 2008). As average equivalent income is lower in the New states, the procedure would imply lower poverty estimates in the New States and higher in the Old states.
[12] See Eurostat (2000) as well as Brewer and Gregg (2002) for details.

households. For all years, we define the *absolute poverty line* (APL) as the CPI-PP corrected Euro-equivalent of the 2003 RPL. Accordingly, our APL is not defined via the costs of a basket of goods, but it is an "at-risk-of-poverty rate anchored at a fixed moment in time."[13] When APL is applied, poverty remains constant if the income poor do not experience real income growth.

The third convention relates to the unit of analysis, i.e. households vs. individuals. All our poverty estimates are assessed on the individual level. Accordingly, we do not compute the weighted number of (non) poor households, but the respective weighted numbers of individuals actually living in (non) poor households. Technically speaking, if an EVS household with a frequency weight of 50 consists of four members and equivalent income is below (above) the poverty line, 200 people are classified as (non) poor.

A fourth convention relates to the poverty measure. We employ a class of indices introduced by Foster et al. (1984). The class covers two popular poverty measures with complementary features. Let z denote the poverty line (in money units), and y_i the equivalent income of household unit i. Moreover, let $i = 1,...,q$ denote poor household units with $y_i < z$, then the index is,

$$(1) \qquad I(\alpha) = \frac{1}{N} \cdot \sum_{i=1}^{q} (w_i \cdot n_i) \cdot \left(1 - \frac{y_i}{z}\right)^{\alpha} = \frac{1}{N} \cdot \sum_{i=1}^{q} (w_i \cdot n_i) \cdot \left(\frac{z - y_i}{z}\right)^{\alpha}.$$

In equation (1), w_i denotes the EVS frequency weight for household unit i consisting of n_i members. Population size, N, is defined as $N = \sum_i w_i \cdot n_i$. The term $z - y_i$ is the poverty gap for i. For $\alpha = 0$, equation (1) is the head-count ratio, $I(0) = \frac{1}{N} \cdot \sum_{i=1}^{q} (w_i \cdot n_i)$. The head-count ratio is a pure incidence measure, providing the fraction of the population classified as poor while ignoring "the depth and distribution of poverty" (see Foster, 1998, p. 336). If $\alpha = 1$, we have the poverty-gap ratio, $I(1) = \frac{1}{N} \cdot \sum_{i=1}^{q} (w_i \cdot n_i) \cdot \left(\frac{z - y_i}{z}\right)$. It is the head-count ratio weighted by average poverty gap. Gap measures add an important dimension to incidence measures, the intensity of poverty, i.e., how far the incomes of the income poor fall below the poverty line.

The fifth convention concerns the level of aggregation. We provide poverty estimates by region of residence (New and Old states) and household type. Altogether, eight household types are distinguished: single parents with one as well as with two or more children; (married or non-married) couples with one, two, and three or more children; childless single adults, childless couples, and other childless household units. Throughout the paper, we define

[13] For further information see Eurostat at http://eur-lex.europa.eu/.

children as persons below 18 years. The sample composition (non-weighted) is provided in Table A2 in the Supplementing Materials.

2.2 Bootstrap inference and poverty

To test for statistical significance of differences in poverty indices, we compute bias-corrected confidence intervals using the bootstrap method. Our approach relies on the theoretical framework outlined in Biewen (2002). We draw, with replacement, $B = 1,000$ random samples. Each random sample has as many sampling units as the original cross section, and each sampling unit in the original cross section has the same probability of being selected. EVS sampling weights are accounted for whenever a poverty measure is computed. For technically equivalent empirical applications see Athanasopoulos and Vahid (2003) or Bönke et al. (forthcoming). As income distributions typically give biased estimators, confidence intervals are bias corrected.

More precisely, for each cross section we compute B bootstrapped poverty indices, one index, I^b, per bootstrap sample, b. Confidence intervals are computed following Hall (1994). Hall's confidence interval at the 95 percent level for the true index value, I, is given by $\Pr\left(2\hat{I}^c - I^b_{high} \le I \le 2\hat{I}^c - I^b_{low}\right) = (100-2\alpha)/100$, where $\hat{I}^c$ denotes the bootstrap bias-corrected estimate, while I^b_{high} (I^b_{low}) denotes the 2.5$^{\text{th}}$ upper (lower) percentile in the bootstrap index distribution. The bootstrap bias-corrected estimator is $\hat{I}^c = \hat{I} - Bias$, where $\hat{I}$ is the index derived from the original sampling distribution and $Bias = \frac{1}{B}\cdot\sum_{b=1}^{B} I^b - \hat{I}$. The bias-corrected confidence interval has advantages compared to standard confidence intervals in case of a skewed distribution (Hall, 1994).

To test for significance of inter-temporal change in poverty estimates, we compute B index differences $\Delta I(\alpha)^b_t = I(\alpha)^b_t - I(\alpha)^b_{t-5}$, where $I(\alpha)^b_t$ ($I(\alpha)^b_{t-5}$) denotes the poverty estimate from bootstrap distribution b in period t ($t-5$). The difference in point estimates is $\Delta\hat{I}_t$, and $\Delta\hat{I}^c_t = \Delta\hat{I}_t - \Delta Bias_t$ with $\Delta Bias_t = \frac{1}{B}\cdot\sum_{b=1}^{B}\Delta I^b_t - \Delta\hat{I}_t$ denoting the bias-corrected estimate. Then Hall's (1994) bias-corrected confidence interval is $\Pr\left(2\Delta\hat{I}^c_t - \Delta I^b_{t,high} \le \Delta I_t \le 2\Delta\hat{I}^c_t - \Delta I^b_{t,low}\right) = (100-2\alpha)/100$. The term $\Delta I^b_{t,high}$ denotes the 2.5$^{\text{th}}$ upper and $\Delta I^b_{t,low}$ the 2.5$^{\text{th}}$ lower percentile in the bootstrap distribution of differences, and ΔI_t

is the true difference. An index difference is statistically different from zero if Hall's bias-corrected confidence interval does not include zero.

2.3 The non-linear Oaxaca-Blinder decomposition approach

We conduct an Oaxaca-Blinder decomposition for nonlinear regressions (see Oaxaca, 1973, Blinder, 1973, and Fairlie, 2005) to investigate whether differences in the regional distributions of socioeconomic characteristics are capable to econometrically explain the East/West poverty divide.

The basic idea of the Blinder-Oaxaca decomposition is to explain differences in outcomes of groups by differences in characteristics and in regression coefficients. The Blinder-Oaxaca decomposition technique is particularly suited for estimating the separate contributions of group differences in measurable characteristics, such as education, household composition, geographical location, etc. in outcomes. Typically, the methodology is applied to continuous outcomes but, as illustrated in Fairlie (2005), it can also be modified to deal with binary outcomes. In the latter case, the Oaxaca-Blinder decomposition builds on logit or probit models.

In the poverty context, the dependent dummy variable is equal to 1 if a household unit is poor and zero else. Mutually-exclusive groups $g \in \{0,1\}$ are constructed according to region of residence (New vs. Old states). Accordingly, the head-count ratio of a particular group equals the average predicted probability of the group, and the decomposition quantifies the separate contribution of group differences in individual or household characteristics to the probability of being poor *controlling for all other characteristics* (see Fairlie, 2005).[14] When interpreting the results it should be kept in mind that the decomposition quantifies a statistical and not a causal relationship.

In the logit model, the likelihood of a household unit i being poor is,

$$(2) \qquad P_i^g = \Pr\left(y_i^g < z\right) = F\left(x_i^g \beta^g\right) = \exp\left(x_i^g \beta^g\right) \Big/ \left[1 + \exp\left(x_i^g \beta^g\right)\right],$$

where x is a vector of household and its members' characteristics, and F is the cumulative distribution function from the logistic distribution. Based on the logit estimates, the difference in the poverty rates between the groups is,

[14] Analyses technically similar to ours have been conducted by Gradín (2008 and 2009) to investigate differences in poverty rates between minorities in the United States and Brazil; by Gang et al. (2008) and Bhaumik (2006) for inter-group poverty comparisons in India and Kosovo; and by Biewen and Jenkins (2005) as well as Quintano and D'Agostino (2006) for exploring poverty gaps across countries.

$$(3) \qquad \overline{P^1} - \overline{P^0} = \underbrace{\left[\sum_{i=1}^{N^1} \frac{F\left(x_i^1 \hat{\beta}^1\right)}{N^1} - \sum_{i=1}^{N^0} \frac{F\left(x_i^0 \hat{\beta}^1\right)}{N^0} \right]}_{\textit{characteristics effect}} + \underbrace{\left[\sum_{i=1}^{N^0} \frac{F\left(x_i^0 \hat{\beta}^1\right)}{N^0} - \sum_{i=1}^{N^1} \frac{F\left(x_i^0 \hat{\beta}^0\right)}{N^0} \right]}_{\textit{coefficient effect \& unobservables}}$$

(see Fairlie, 2005). In equation (3), $\overline{P^1}$ $\left(\overline{P^0}\right)$ denotes the poverty rate in group $g = 1$ $(g = 0)$, and $\hat{\beta}^g$ is the vector of coefficient estimates for g. The first term in brackets is the so-called aggregate characteristics effect, the part of the poverty resulting from different distributions of independent variables. The second term captures the part of the poverty divide which can be explained by differences in group processes determining poverty, or by differences in non-quantified endowments between groups. As it mixes up coefficient effects and the impact of non-observables (see Jones, 1983, and Cain, 1986), it lacks a clear interpretation. For this reason, we refrain from commenting on the second term in what follows.

In the decomposition we apply the logit estimates derived from Old state residents. Accordingly, the decomposition builds on the correlation of socioeconomic variables with poverty risk in the Old states, and answers the following question: "Given that the correlation between socioeconomic characteristics and poverty were the same in East and West, how much of the East/West poverty divide can be explained by differences in the distributions of socioeconomic characteristics between the two regions?"

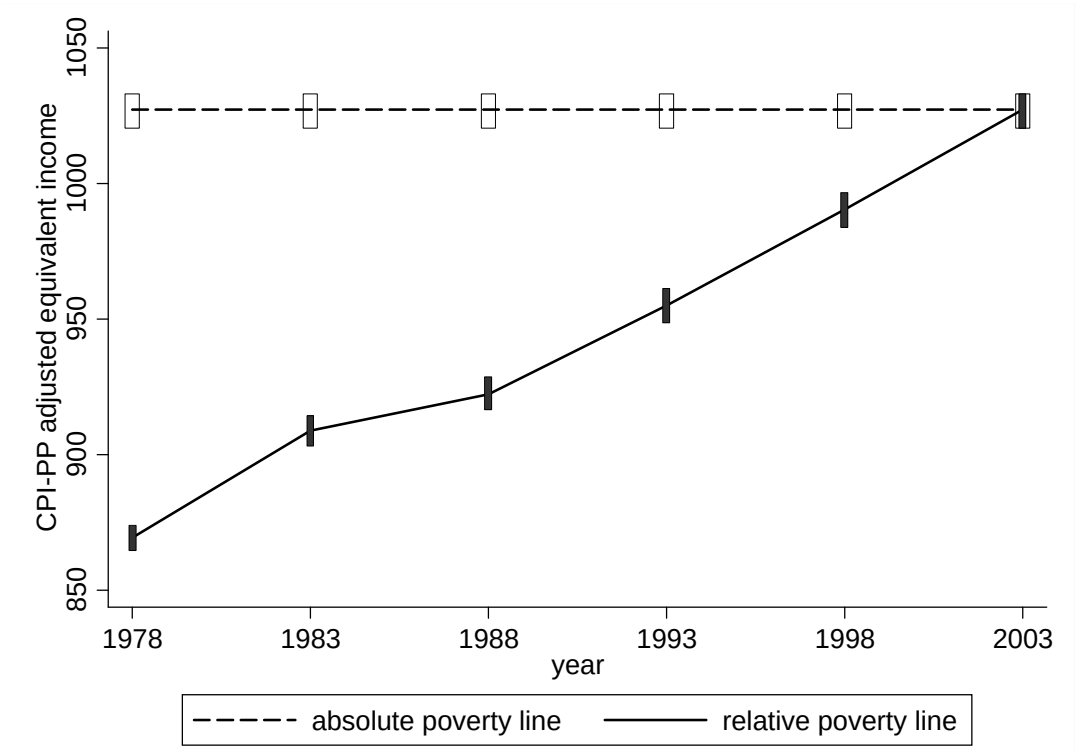
In addition to the aggregate characteristics effect, also the role of differences in distributions of a particular variable (or group of variables) can be assessed, the so-called detailed decomposition. The detailed decomposition identifies how the average predicted probability of being poor changes when the Old states distribution of a particular variable (group of variables) is replaced by the New states distribution while holding distributions of other variables constant (see Fairlie, 2005).

3. Long-run poverty trends

Before commenting on the results, some brief remarks concerning the actual monetary levels of poverty lines. Figure 1 gives the two poverty lines underlying all our calculations (expressed in CPI-PP-adjusted Euros). The solid line connects point estimates corresponding to the 60-percent-of-median RPL, and the dashed line connects APL point estimates derived from the sample distribution. Vertical bars indicate 95 percent bias-corrected Hall confidence intervals $\left(2\hat{z}^c - z^b_{high}; 2\hat{z}^c - z^b_{low}\right)$, where z^b_{high} is the 2.5th upper and z^b_{low} is the 2.5th lower percentile of the bootstrap distribution of poverty lines. Different bar widths and colors are chosen to ensure confidence intervals to be visually distinguishable. The monetary equivalent

of the RPL significantly increases over time, from around 860 Euros in 1978 to slightly above 1000 Euros in 2003. By construction, the APL remains constant over time, and coincides with the 2003 RPL.[15]

Figure 1. Income levels associated with poverty lines.



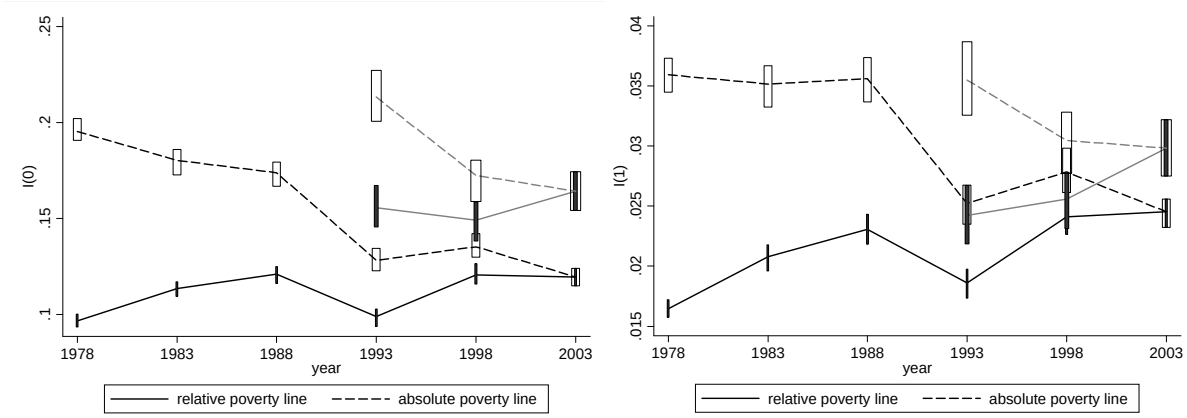
Note. Vertical bars indicate bias-corrected Hall confidence intervals.*Data.* German Sample Survey of Income and Expenditure.

3.1 The general picture

Figure 2 provides region-specific RPL and APL based head-count ratios, $I(0)$, and poverty-gap ratios, $I(1)$. Dark lines connect estimates for the Old states, whereas light lines connect New states estimates. Solid lines refer to RPL-based indices. APL-based point estimates are connected by dashed lines. As in Figure 1, vertical bars depict 95 percent bias-corrected Hall confidence intervals of estimates, and different bar styles are chosen to ensure that confidence intervals are distinguishable.

[15] Without the PP-adjustment, patterns are very similar except for the slight decrease of RPL between 1988 and 1993 (see Figure B1 in the Supplementing Materials).

Figure 2. Incidence and intensity of poverty in the overall population.



Note. Left figure: head count ratio. Right figure: poverty gap ratio. Vertical bars indicate bias-corrected Hall confidence intervals. *Data.* German Sample Survey of Income and Expenditure.

Looking at estimates from the same cross section, most eye-catching is a substantial difference in poverty levels between the two German regions, with regional differences in head-count ratios and poverty-gap ratios being particularly large in year 1993. In the New states, poverty estimates average at substantially higher levels. For example, in year 1993 about 16 percent of the New states population fall below the RPL as opposed to only 10 percent of the population living in the Old states. In fact, the 1993 APL-based head-count ratio for the New states reaches almost 21 percent (Old states: about 13 percent). Concerning the intensity of poverty, the picture is similar. When the RPL (APL) is applied, the New states poverty-gap ratio exceeds the Old states counterpart by about 30 (41) percent.[16] In Section 4, we further scrutinize the East/West divide in head-count ratios by means of Oaxaca-Blinder decomposition.

Concerning inter-temporal patterns, Figure 2 suggests that APL-based poverty estimates decline over time. The decline indicates an improvement in the absolute living conditions in both parts of Germany. Most prominent is the decline in the Old states between 1988 and 1993. This reduction, of course, is artificial, resulting from Unification and low incomes in the New states. But also in the New states APL-based poverty estimates decrease over time, at least between 1993 and 1998. Comparing East and West, results indicate a convergence of APL-based poverty gap ratios, but head count ratios in the New states exceed Old states estimates by far. Put simply, absolute living standards of the poor in East and West converge, but the poor fraction of the population remains higher in the New states. While the APL-based estimates indicate an inter-temporal poverty reduction in both parts of Germany, the picture is less positive when the RPL is applied. From the late 1970s onwards, Old states

[16] Differences are even more pronounced in absence of PP adjustment (see Figure B2 in the Supplementing Materials).

head count and poverty gap ratio first go up, reaching a high point in the late 1980s, decline again between 1988 and 1993 due to German Unification, and then rise again. In the New states, the graphs suggest quite stable head-count and slightly rising poverty-gap ratio.[17] In case of the RPL, both the incidence and intensity of poverty are systematically higher in the New states.[18] So, we still face divergent relative living conditions in East and West.

Tests of significance of inter-temporal changes are reported in Table 1. More precisely, the Table gives the differences in poverty point estimates derived from two consecutive EVS cross sections, $\Delta\hat{I} = \hat{I}_t - \hat{I}_{t-5}$, together with the respective 95 percent bias-corrected bootstrapped Hall confidence interval. So, the coefficients provided are differences in point estimates from a recent year to a base year. A positive (negative) sign indicates an inter-temporal increase (decrease) in the poverty measure between period $t-5$ and t, and two stars indicate that the change is significant (at the 5 percent level). For example, take the entry "2.18**" in column "*Old states, 1998 % 1993*", row "*relative,* $\Delta\hat{I}(0)$". It indicates a significant rise in the RPL-based head-count ratio between 1993 and 1998 in the Old states by 2.18 percentage points.

Table 1. Inter-temporal changes in poverty, all households

		Old states					New states	
Poverty line	Poverty index	1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	1.69**	0.75**	-2.23**	2.18**	-0.10	-0.66	1.52**
	(95% CI)	(1.15; 2.21)	(0.17; 1.34)	(-2.82; -1.57)	(1.44; 2.83)	(-0.78; 0.56)	(-2.07; 0.84)	(0.13; 2.92)
	$\Delta\hat{I}(1)$	0.43**	0.23**	-0.45**	0.55**	0.04	0.13	0.42**
	(95% CI)	(0.30; 0.57)	(0.05; 0.38)	(-0.61; -0.27)	(0.35; 0.75)	(-0.15; 0.24)	(-0.21; 0.48)	(0.08; 0.76)
Absolute	$\Delta\hat{I}(0)$	-1.51**	-0.65	-4.57**	0.71	-1.58**	-4.08**	-0.82
	(95% CI)	(-2.16; -0.84)	(-1.42; 0.05)	(-5.33; -3.86)	(-0.11; 1.49)	(-2.29; -0.84)	(-5.57; -2.39)	(-2.25; 0.44)
	$\Delta\hat{I}(1)$	-0.08	0.04	-1.04**	0.26**	-0.33**	-0.50**	-0.06
	(95% CI)	(-0.25; 0.11)	(-0.18; 0.24)	(-1.25; -0.83)	(0.04; 0.49)	(-0.53; -0.11)	(-0.88; -0.09)	(-0.39; 0.25)

Note. $\Delta\hat{I}(.)$ denotes the observed change in poverty indices between periods *t* and *t*-5. CI denotes Hall's bias-corrected confidence interval. ** denotes that the change is significantly different from zero at the 5 percent level.
Source. German Sample Survey of Income and Expenditures 1978-2003. Own calculations.

We comment on the Old states first. In sum, test statistics corroborate the visual impression from Figure 2. RPL-based head-count and poverty-gap ratios rise significantly between 1978 and 1988, decline between 1988 and 1993,[19] rise again between 1993 and 1998, and stagnate between 1998 and 2003. APL-based poverty indices significantly decrease

[17] Figure B2 in the Supplementing Materials reconfirms the inter-temporal decline in poverty in absence of PP adjustment. Then RPL based poverty-gap ratios in the New states tend to decrease over time as well.
[18] Only 1998 poverty gap ratios do not significantly differ.
[19] As mentioned above, the pronounced decline between 1988 and 1993 is driven by German unification, leading to many low income households entering the sample.

between 1978 and 1983, between 1988 and 1993 and also between 1998 and 2003. Only between 1993 and 1998 the APL-based poverty-gap ratio exhibits a positive sign. In the New states, APL-based measures slightly fall in the early years after Unification and stagnate since then. On the contrary, RPL-based measures stagnate between 1993 and 1998 and rise over the two later years.[20]

3.2 Poverty estimates by household-type

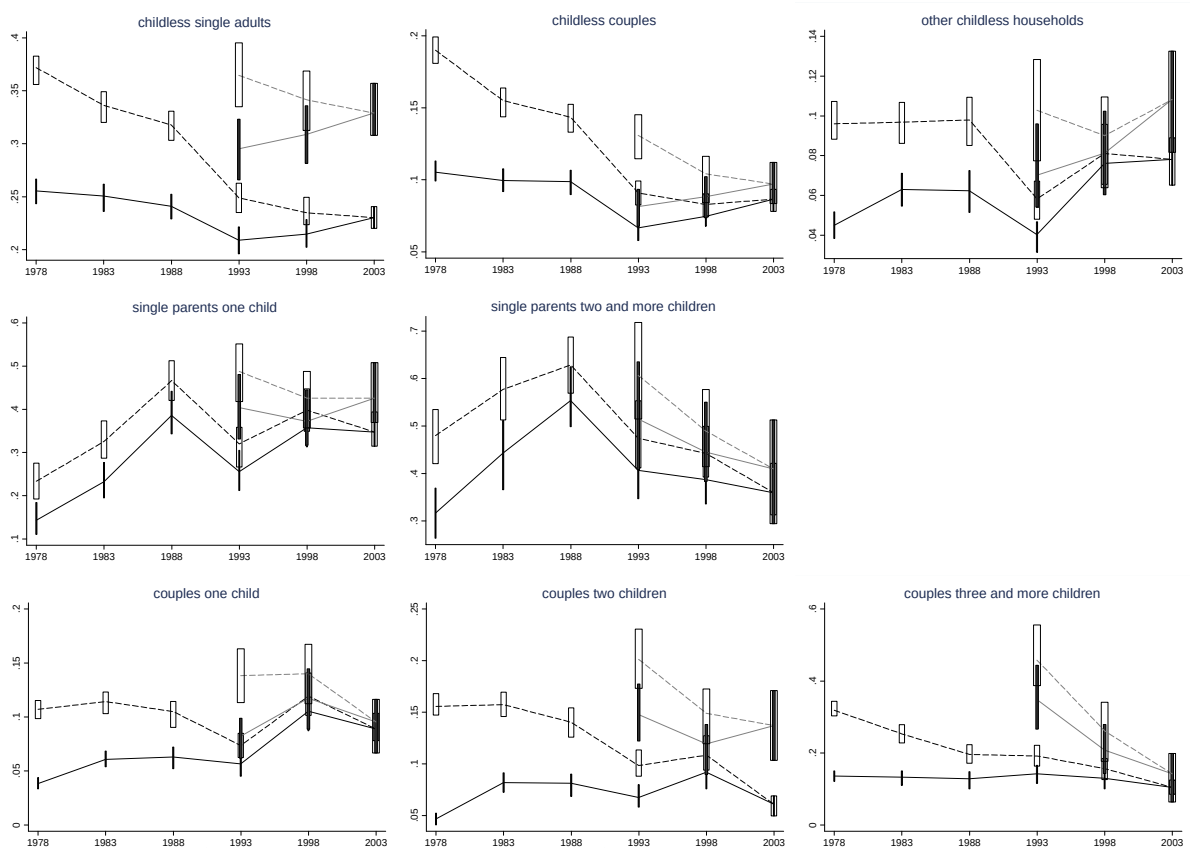
We next turn to the questions whether results from Section 3.1 equally apply to all household types, and whether poverty levels differ by household type. We start of answering these questions using the same measures as in Figure 2, broken down by household types as defined in Section 2.1. Head-count ratios are depicted in Figure 3a, poverty-gap ratios in Figure 3b. Within each figure, eight graphs are provided, one for each household type. Again solid (dashed) lines refer to the relative (absolute) poverty line. Differences in bar width and color are chosen to offset bias-corrected Hall confidence intervals visually. The scaling of ordinates in the graphs is chosen so as to optimize readability of each graph. As a result, scaling of ordinates differs across household types. Visual comparisons should be made with adequate care.

There are striking differences across household types concerning the incidence and intensity of poverty. Single parent households are most vulnerable to poverty. As can be seen from Figure 3a, about 26 percent (32 percent) of Old states single parents with one child fall below the RPL (APL) in year 1993, around 40 percent (49 percent) in the New states. Point estimates suggest that single parents with two or more children have the highest poverty risk: RPL-based (APL-based) head-count ratios in 1993 are 41 percent (47 percent) in the Old and 51 percent (61 percent) in the New states. Confidence intervals, however, indicate particularly high standard errors for single parents, calling for conservative interpretation. Also the poverty intensity is particularly high for single parents. As can be seen from Figure 3b, poverty-gap ratios for single parents outrange estimates for all other household types by far. In sum, all the figures indicate a particularly high poverty risk for single parent compared to other household types.[21]

[20] All the patterns for the Old states also hold in absence of PP-adjustment. In the New states, however, CPI-adjusted estimates indicate a significant decrease both in the incidence and intensity of poverty (see Table B1 in the Supplementing Materials).

[21] The statistical differences, of course, do not necessarily imply causal relationships. For example, with regard to the poverty risk of single parents the causality might run the other way round. For various reasons, partners might tend to leave a poor household more often than a non poor one.

Figure 3a. Head count ratios by household type.



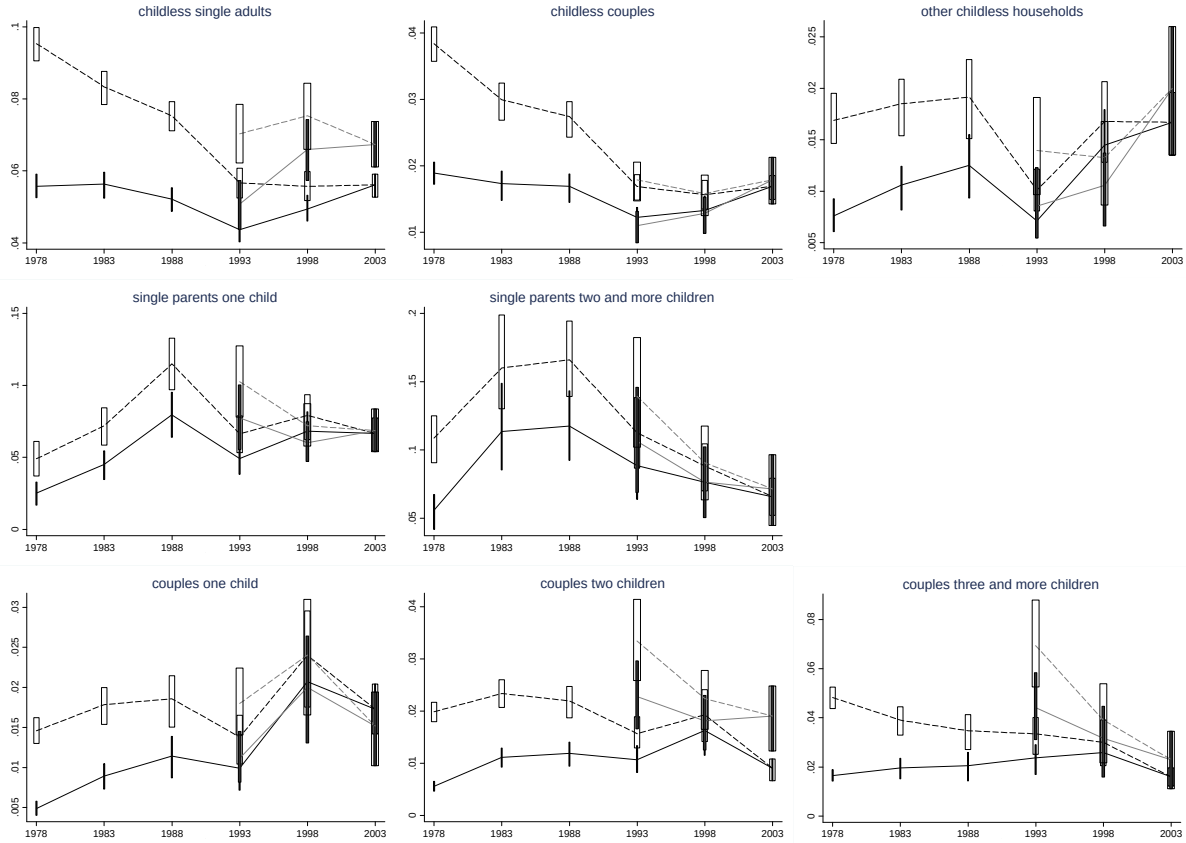
Note. Vertical bars indicate bias-corrected Hall confidence intervals. Dashed lines refer to absolute poverty line; solid lines refer to relative poverty line. *Data.* German Sample Survey of Income and Expenditure.

Inter-temporal changes in poverty estimates are particularly interesting. Tables 2a to 2h, in analogy to Table 1, complement the graphic exposition with tests for significance. For example, take the entry "0.74^{**}" in Table 2a, column "*Old states, 1998 % 1993*", row "*relative,* $\Delta\hat{I}(1)$". The coefficient indicates a rise in poverty intensity for "other childless households" between 1993 and 1998.

We comment on the Old states first. Between 1978 and 1983, head-count and poverty-gap ratios rise significantly for five out of eight household types, i.e., for other childless households, single parents with one and two or more children and couples with one or two children. For childless single adults and couples as well as for couples with three or more children, RPL-based measures remain constant whereas APL-based measures decline significantly. Estimates usually remain quite stable between 1983 and 1988. However, during the same period RPL and also APL based poverty rates and gaps of single parents are significantly on the rise. As outlined above, the adjacent poverty reduction from 1988 to 1993 is a statistical artifact. Between 1993 and 1998, poverty again is on the rise for other childless households, (single) parents with one child and couples with two children. For the other household types, differences are usually insignificant. Finally, between 1998 and 2003,

poverty indices systematically decrease for couples with two or three children. APL-based measures decrease for single parents with two or more children while RPL-based measures rise for childless couples. For all other household types, no systematic inter-temporal patterns can be observed.

Figure 3b. Poverty gap ratios by household type.



Note. Vertical bars indicate bias-corrected Hall confidence intervals. Dashed lines refer to absolute poverty line; solid lines refer to relative poverty line. *Data*. German Sample Survey of Income and Expenditure.

Table 2a. Inter-temporal changes in poverty, other childless households

		Old states					New states	
Poverty line	Poverty index	1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	1.79**	-0.06	-2.21**	3.59**	0.20	1.11	2.70
	(95% CI)	(0.78; 2.79)	(-1.31; 1.32)	(-3.53; -0.81)	(1.85; 5.27)	(-1.64; 2.17)	(-1.79; 4.30)	(-0.50; 6.02)
	$\Delta\hat{I}(1)$	0.30**	0.19	-0.54**	0.74**	0.22	0.20	0.94**
	(95% CI)	(0.06; 0.59)	(-0.19; 0.58)	(-0.90; -0.18)	(0.34; 1.13)	(-0.25; 0.72)	(-0.29; 0.74)	(0.17; 1.68)
Absolute	$\Delta\hat{I}(0)$	0.08	0.11	-3.97**	2.28**	-0.29	-1.27	1.82
	(95% CI)	(-1.25; 1.56)	(-1.40; 1.73)	(-5.47; -2.33)	(0.49; 3.96)	(-2.18; 1.65)	(-4.55; 2.19)	(-1.52; 5.11)
	$\Delta\hat{I}(1)$	0.16	0.07	-0.90**	0.67**	-0.01	-0.07	0.67
	(95% CI)	(-0.17; 0.52)	(-0.40; 0.54)	(-1.36; -0.46)	(0.22; 1.13)	(-0.50; 0.52)	(-0.70; 0.56)	(-0.14; 1.45)

Note and source. See Table 1.

Table 2b. Inter-temporal changes in poverty, childless single adult

Poverty line	Poverty index	Old states 1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	New states 1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	-0.49	-0.95	-3.22**	0.60	1.54	1.39	2.01
	(95% CI)	(-2.27; 1.26)	(-2.70; 0.68)	(-4.99; -1.48)	(-1.40; 2.38)	(-0.10; 3.19)	(-2.49; 5.40)	(-1.92; 5.55)
	$\Delta\hat{I}(1)$	0.06	-0.41	-0.85**	0.58**	0.67**	1.52**	0.14
	(95% CI)	(-0.44; 0.56)	(-0.92; 0.06)	(-1.35; -0.38)	(0.06; 1.12)	(0.20; 1.16)	(0.44; 2.59)	(-0.93; 1.17)
Absolute	$\Delta\hat{I}(0)$	-3.56**	-1.84**	-6.89**	-1.40	-0.47	-2.32	-1.25
	(95% CI)	(-5.49; -1.63)	(-3.67; -0.14)	(-8.86; -5.03)	(-3.39; 0.47)	(-2.15; 1.18)	(-6.14; 1.87)	(-5.14; 2.21)
	$\Delta\hat{I}(1)$	-1.20**	-0.81**	-1.86**	-0.10	0.04	0.50	-0.80
	(95% CI)	(-1.81; -0.58)	(-1.40; -0.25)	(-2.47; -1.32)	(-0.66; 0.48)	(-0.44; 0.53)	(-0.68; 1.63)	(-1.87; 0.26)

Note and source. See Table 1.

Table 2c. Inter-temporal changes in poverty, single parent with one child

Poverty line	Poverty index	Old states 1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	New states 1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	8.98**	15.33**	-13.04**	10.13**	-0.96	-3.17	5.38
	(95% CI)	(3.29; 14.29)	(8.65; 21.32)	(-19.62; -6.20)	(2.96; 17.03)	(-7.70; 5.60)	(-13.37; 6.61)	(-4.35; 14.77)
	$\Delta\hat{I}(1)$	1.99**	3.45**	-3.03**	1.88**	-0.15	-1.71	0.84
	(95% CI)	(0.69; 3.27)	(1.68; 5.27)	(-4.95; -1.05)	(0.06; 3.88)	(-1.99; 1.75)	(-4.25; 0.70)	(-1.32; 2.96)
Absolute	$\Delta\hat{I}(0)$	9.23**	14.05**	-14.62**	7.81**	-5.08	-6.16	-0.03
	(95% CI)	(3.15; 14.81)	(7.91; 20.39)	(-20.74; -7.92)	(0.55; 14.32)	(-11.88; 1.07)	(-15.47; 3.43)	(-10.14; 9.09)
	$\Delta\hat{I}(1)$	2.30**	4.29**	-4.86**	1.28	-1.26	-3.06**	-0.34
	(95% CI)	(0.46; 3.94)	(2.17; 6.44)	(-7.11; -2.57)	(-0.77; 3.46)	(-3.19; 0.69)	(-5.84; -0.33)	(-2.46; 1.83)

Note and source. See Table 1.

Table 2d. Inter-temporal changes in poverty, single parent with two or more children

Poverty line	Poverty index	Old states 1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	New states 1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	12.63**	11.09**	-14.74**	-1.92	-2.75	-6.96	-3.56
	(95% CI)	(3.20; 21.55)	(1.14; 20.16)	(-24.24; -5.43)	(-11.05; 7.34)	(-11.04; 4.85)	(-21.10; 7.20)	(-17.27; 11.40)
	$\Delta\hat{I}(1)$	5.78**	0.39	-2.90	-1.21	-1.05	-2.98	-0.51
	(95% CI)	(2.07; 9.00)	(-3.56; 4.489	(-6.20; 0.50)	(-4.11; 1.67)	(-3.25; 0.97)	(-7.69; 1.66)	(-4.06; 3.41)
Absolute	$\Delta\hat{I}(0)$	9.73**	5.15**	-15.48**	-3.17	-8.27**	-11.77	-7.99
	(95% CI)	(0.61; 18.31)	(-3.46; 13.73)	-(25.15; -6.78)	(-11.88; 6.32)	(-16.59; -1.16)	(-25.02; 1.41)	(-21.64; 6.74)
	$\Delta\hat{I}(1)$	5.13**	0.59	-5.34**	-2.43	-2.25**	-4.86	-1.91
	(95% CI)	(1.19; 8.73)	(-3.60; 4.78)	(-8.91; -1.73)	(-5.60; 0.71)	(-4.53; -0.14)	(-9.70; 0.18)	(-5.44; 2.13)

Note and source. See Table 1.

Table 2e. Inter-temporal changes in poverty, childless couple

Poverty line	Poverty index	Old states 1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	New states 1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	-0.58	-0.09	-3.20**	0.81	1.19**	0.70	0.88
	(95% CI)	(-1.58; 0.49)	(-1.18; 1.12)	(-4.31; -2.07)	(-0.31; 1.72)	(0.18; 2.31)	(-1.29; 2.54)	(-1.32; 2.97)
	$\Delta\hat{I}(1)$	-0.16	-0.04	-0.47**	0.10	0.36**	0.18	0.50**
	(95% CI)	(-0.42; 0.11)	(-0.33; 0.27)	(-0.73; -0.21)	(-0.16; 0.37)	(0.11; 0.62)	(-0.21; 0.54)	(0.07; 0.96)
Absolute	$\Delta\hat{I}(0)$	-3.50**	-1.15	-5.26**	-0.80	0.37	-2.67**	-0.70
	(95% CI)	(-4.68; -2.21)	(-2.51; 0.20)	(-6.57; -4.11)	(-1.91; 0.32)	(-0.69; 1.44)	(-4.98; -0.51)	(-3.04; 1.38)
	$\Delta\hat{I}(1)$	-0.84**	-0.25	-1.05**	-0.12	0.13	-0.21	0.21
	(95% CI)	(-1.17; -0.49)	(-0.62; 0.13)	(-1.39; -0.74)	(-0.42; 0.17)	(-0.14; 0.40)	(-0.67; 0.21)	(-0.26; 0.68)

Note and source. See Table 1.

Table 2f. Inter-temporal changes in poverty, couple with one child

Poverty line	Poverty index	Old states 1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	New states 1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	2.22**	0.23	-0.64	4.89**	-1.65	3.52	-2.21
	(95% CI)	(1.32; 3.12)	(-0.99; 1.62)	(-1.98; 0.81)	(2.75; 7.02)	(-4.07; 0.55)	(-0.09; 6.92)	(-5.71; 1.62)
	$\Delta\hat{I}(1)$	0.41**	0.25	-0.15	1.08**	-0.34	0.89**	-0.48
	(95% CI)	(0.23; 0.59)	(-0.06; 0.57)	(-0.52; 0.21)	(0.49; 1.73)	(-1.01; 0.26)	(0.13; 1.65)	(-1.24; 0.33)
Absolute	$\Delta\hat{I}(0)$	0.72	-0.93	-3.14**	4.58**	-3.05**	0.17	-4.47**
	(95% CI)	(-0.40; 2.06)	(-2.36; 0.70)	(-4.88; -1.64)	(2.37; 6.81)	(-5.40; -0.72)	(-3.55; 3.81)	(-7.96; -0.60)
	$\Delta\hat{I}(1)$	0.33**	0.07	-0.48**	1.02**	-0.67**	0.61	-0.89**
	(95% CI)	(0.07; 0.60)	(-0.32; 0.49)	(-0.93; -0.06)	(0.38; 1.73)	(-1.36; -0.01)	(-0.24; 1.44)	(-1.70; -0.03)

Note and source. See Table 1.

Table 2g. Inter-temporal changes in poverty, couple with two children

Poverty line	Poverty index	Old states 1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	New states 1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	3.51**	-0.08	-1.38**	2.46**	-3.10**	-2.85	1.78
	(95% CI)	(2.44; 4.64)	(-1.40; 1.45)	(-3.00; -0.05)	(0.72; 4.60)	(-4.89; -1.33)	(-6.23; 1.19)	(-2.35; 5.65)
	$\Delta\hat{I}(1)$	0.55**	0.08	-0.12	0.56**	-0.72**	-0.46	0.09
	(95% CI)	(0.35; 0.78)	(-0.21; 0.36)	(-0.46; 0.21)	(0.07; 1.14)	(-1.23; -0.23)	(-1.28; 0.38)	(-0.71; 0.95)
Absolute	$\Delta\hat{I}(0)$	0.18	-1.71	-4.19**	1.01	-4.76**	-5.22**	-1.19
	(95% CI)	(-1.38; 1.73)	(-3.35; 0.00)	(-6.07; -2.49)	(-0.90; 3.28)	(-6.61; -2.77)	(-8.79; -1.22)	(-5.50; 2.87)
	$\Delta\hat{I}(1)$	0.35**	-0.14	-0.63**	0.36	-1.02**	-1.10**	-0.34
	(95% CI)	(0.05; 0.67)	(-0.52; 0.25)	(-1.05; -0.22)	(-0.17; 0.98)	(-1.55; -0.49)	(-2.01; -0.12)	(-1.19; 0.56)

Note and source. See Table 1.

Table 2h. Inter-temporal changes in poverty, couple with three or more children

Poverty line	Poverty index	Old states					New states	
		1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	-0.35	-0.43	1.39	-1.25	-2.54	-14.03**	-6.62
	(95% CI)	(-2.73; 2.26)	(-3.49; 2.69)	(-2.30; 4.96)	(-5.18; 2.78)	(-6.11; 0.75)	(-24.94; -3.13)	-(15.17; 3.20)
	$\Delta\hat{I}(1)$	0.31	0.10	0.32	0.21	-0.99**	-1.26	-0.87
	(95% CI)	(-0.15; 0.82)	(-0.57; 0.88)	(-0.48; 1.21)	(-0.96; 1.33)	(-1.98; -0.08)	(-3.34; 0.80)	(-2.77; 1.01)
Absolute	$\Delta\hat{I}(0)$	-6.56**	-5.71**	-0.44	-3.51	-5.22**	-19.65**	-11.94**
	(95% CI)	(-9.38; -3.39)	(-9.46; -2.23)	(-4.41; 3.66)	(-7.41; 0.72)	(-8.76; -1.73)	(-30.92; -7.34)	-(22.03; -0.91)
	$\Delta\hat{I}(1)$	-0.92**	-0.43	-0.12	-0.35	-1.41**	-3.04**	-1.61
	(95% CI)	(-1.56; -0.23)	(-1.30; 0.54)	(-1.10; 0.92)	(-1.59; 0.91)	(-2.47; -0.45)	(-5.59; -0.46)	(-3.60; 0.41)

Note and source. See Table 1.

Concerning the New states, household-type specific poverty estimates for 1993 and 1998 remain quite stable. Particularly, RPL-based measures exhibit little variation, while both APL-based measures decline for three household types. The effect is most pronounced for parents with three or more children. Between 1998 and 2003 head-count and poverty-gap ratios hardly differ. Only five out of 32 differences are significant, and three out of the 32 differences suggest a decrease in poverty.

In conclusion, systematic differences in poverty levels exist across household types and regions. Incidence and intensity of poverty are higher among New compared to Old states households. Across household types, poverty rates and intensity are the highest among single parent households. Over time, most eye-catching is the decrease in APL-based poverty estimates. Moreover, there is some evidence in favor of a slight convergence of East German to West German poverty levels, at least between 1993 and 1998.[22]

4. Explaining the East/West poverty divide

4.1. Specification of logit regressions and regression estimates

The non-linear Oaxaca-Blinder decomposition relies on multivariate logit regressions explaining the likelihood of a household being poor, conditioned on a set of explanatory variables. Given that being poor means lacking income to pass the poverty line, we included among the explanatory variables a number of characteristics of the household head, the bread winner, potentially relevant for the determination of his/her capability to generate income. These variables include the head's gender, age (by cohort), family status, labor force status,

[22] The interested reader may consult Tables B2a-h in the Supplementing Materials for the respective PP-unadjusted estimates.

and highest educational degree.[23] As an example, if the household head is young and at an early stage of her employment career, earnings are likely to be low and this may translate into a higher poverty risk. The second set of variables refers to the household level. These variables may influence the income-generating capability of the head or determine the earnings-generating capability of other household members. The variable set comprises: household type; number of earners; and number of other household members belonging to a specific age cohort. For example, children may create an additional poverty risk as they rise household needs but not the household's earnings capability. Table 3 lists the explanatory variables and their items. An extensive sample breakdown is provided in Table A2-4 in the Supplementing Materials. Following standard convention in decomposition literature, regressions are estimated separately for each group, i.e. separately for households resident in the New and Old states.

Table 3. Socioeconomic characteristics

Characteristics of the household head		Type of variable	Reference category
Gender	male; female	dummy	male
Martial status	unmarried; married; widowed; divorced	dummy variables 1: status applies 0: else	unmarried
Labor force status	self-employed or farmer; civil servant; white-collar worker; blue-collar worker; unemployed; non-working	dummy variables 1: status applies 0: else	white collar
Highest educational degree	university; university of applied sciences; equivalent to engineering school; apprenticeship etc.; no occupational degree or still in job training	dummy variables 1: status applies 0: else	equivalent to engineering school
Age cohort	age cohort (in years: 20-29; 30-39; 40-49; 50-59; 60-69; 70 and above)	dummy variables 1: age cohort applies 0: else	age 30-39 years
Household-level characteristics			
Number of other household members belonging to a specific age cohort	(in years: 0-4; 5-9; 10-19; 20-29; 30-39; 40-49; 50-59; 60-69; 70 and above)	one covariate per age cohort	one-member household
Family type	single adults with 0, 1, 2+ children; couple with 0, 1, 2, 3+ children; other childless	dummy variables 1: type applies 0: else	childless couple
Number of earners	0-3+	dummy variables 1: number applies 0: else	

[23] Despite their common history, education systems in FRG and GDR differed by a large extent. A detailed comparison of the two German systems can be found in Krueger and Pischke (1992). After Unification, the former West German system replaced the East German system. When preparing the EVS database, the German Federal Statistical Office seeks to ensure that the education variable conveys information that is comparable across the two parts of Germany. By choosing a broad classification of education attainments, we seek to limit potential biases in the decomposition analysis.

Tables 4a and 4b summarize the logit-regression results. Table 4a refers to an RPL-based distinction of poor and non-poor households, Table 4b to an APL-based distinction. In each table, results from six regressions are reported, per cross section (1993, 1998, 2003) one for residents in the Old states and one for New states residents. For each variable, the regression coefficient together with its standard error and significance level is reported. In between the region-specific regressions, χ^2 test statistics indicate whether regression coefficients are different for Old and New states residents. The regression benchmark is a childless couple (unmarried) with a single earner; the household head is a male white-collar worker, age 30 to 39, holding an engineering school degree (or equivalent).

Before commenting on the regression coefficients in detail, some words on the broad picture. First, regression coefficients in Tables 4a and 4b are rather close, indicating that regressors, irrespective of the poverty line, have a similar effect on poverty risks. Second, apart from a few exemptions, socioeconomic and demographic variables play a similar role for New and Old state residents. Moreover, differences in region-specific regression coefficients (indicated by significant χ^2 test statistics) over time become smaller or vanish. At the same time, Old states coefficients do not exhibit systematic inter-temporal variation. In combination, the two regularities suggest that individual/household characteristics start playing a more similar role for poverty risks in the two parts of Germany.

Let us now turn to the link between characteristics of household heads and poverty risk. Compared with the regression benchmark, a male headed couple, the poverty risk is higher if the household head is female or divorced, and lower when widowed. Concerning the employment status, self-employees and blue-collar workers are more likely to be poor than white-collar workers while the opposite holds for civil servants. As expected, the poverty risk is also higher if the household head is unemployed or non-working. Education has a poverty reducing effect. The age of the household head again is negatively related with the likelihood of being poor.

Concerning household-level characteristics, poverty risk tends to be systematically higher for households with members of age 10 to 19. One plausible reason is that raising children demands a considerable amount of parental time, obliging parents to work shorter hours. In line with the previous results (see Figure 3a), the regression coefficients indicate particularly high poverty risks for single parents. Research from family economics indicates that parents face additional opportunity costs upon deciding to start working full time,

lowering their incentives to work (e.g., Koulovatianos, 2009). Finally, the number of earners has a strong and negative effect on the likelihood of being poor.[24]

Table 4a. Logistic regressions, relative poverty line

	1993			1998			2003		
Household head	Old states	Diff. test	New states	Old states	Diff. test	New states	Old states	Diff. test	New states
Female	0.210**	0.693	0.107	0.185**	1.022	0.306**	0.194***	1.637	0.348***
	(0.071)		*(0.106)*	*(0.063)*		*(0.099)*	*(0.059)*		*(0.103)*
Married	-0.214	1.043	-0.491*	-0.191	0.183	-0.089	-0.427***	1.180	-0.19
	(0.153)		*(0.218)*	*(0.133)*		*(0.199)*	*(0.112)*		*(0.189)*
Widowed	-0.721***	29.271***	-1.889***	-0.857***	24.835***	-2.007***	-0.786***	34.024***	-2.366***
	(0.106)		*(0.195)*	*(0.106)*		*(0.205)*	*(0.104)*		*(0.256)*
Divorced	0.298**	1.649	0.083	0.085	0.580	0.193	0.029	6.366**	0.383**
	(0.095)		*(0.143)*	*(0.079)*		*(0.119)*	*(0.074)*		*(0.123)*
Self-employed	1.202***	2.878*	1.721***	1.095***	1.451	0.739**	1.165***	5.757**	0.392
	(0.125)		*(0.268)*	*(0.114)*		*(0.274)*	*(0.110)*		*(0.294)*
Civil servant	-2.055***	2.848*	-0.955	-1.579***	1.103	-2.351**	-1.413***	0.005	-1.453**
	(0.287)		*(0.601)*	*(0.212)*		*(0.718)*	*(0.222)*		*(0.520)*
Blue-collar worker	0.561***	1.391	0.782***	0.685***	0.371	0.587***	0.862***	0.000	0.859***
	(0.101)		*(0.150)*	*(0.086)*		*(0.132)*	*(0.085)*		*(0.144)*
Unemployed	1.683***	4.326**	1.117***	1.874***	3.693*	1.309***	2.090***	0.903	1.819***
	(0.173)		*(0.204)*	*(0.166)*		*(0.239)*	*(0.152)*		*(0.233)*
Non-working	0.731***	0.223	0.593*	1.099***	0.014	1.061***	1.115***	0.071	1.196***
	(0.163)		*(0.241)*	*(0.167)*		*(0.266)*	*(0.155)*		*(0.254)*
University degree	-0.622***	4.989**	-1.153***	-0.373***	3.801*	-0.724***	-0.368***	14.586***	-1.063***
	(0.138)		*(0.191)*	*(0.104)*		*(0.147)*	*(0.089)*		*(0.156)*
Univ. of applied sciences degree	-0.644***	0.020	-0.612***	-0.426***	0.212	-0.513***	-0.670***	0.309	-0.770***
	(0.148)		*(0.172)*	*(0.115)*		*(0.148)*	*(0.103)*		*(0.148)*
In apprenticeship	0.360***	0.269	0.456**	0.538***	2.947*	0.771***	0.244***	2.254	0.435***
	(0.092)		*(0.159)*	*(0.075)*		*(0.112)*	*(0.064)*		*(0.112)*
No degree	1.373***	0.831	1.125***	1.449***	0.000	1.450***	1.212***	0.676	1.438***
	(0.102)		*(0.245)*	*(0.098)*		*(0.228)*	*(0.094)*		*(0.248)*
Age 20-29 years	0.463***	2.656	0.131	0.502***	0.008	0.520**	0.575***	0.017	0.545**
	(0.103)		*(0.174)*	*(0.091)*		*(0.174)*	*(0.096)*		*(0.196)*
Age 40-49 years	-0.336***	6.691***	0.131	-0.353***	9.149***	0.119	-0.220**	2.943*	0.062
	(0.102)		*(0.153)*	*(0.080)*		*(0.131)*	*(0.079)*		*(0.144)*
Age 50-59 years	-0.553***	3.818*	-0.111	-0.739***	23.121***	0.194	-0.547***	15.812***	0.243
	(0.117)		*(0.194)*	*(0.100)*		*(0.166)*	*(0.096)*		*(0.174)*
Age 60-69 years	-1.243***	31.457***	0.187	-1.219***	7.821***	-0.560**	-1.119***	9.736***	-0.378
	(0.125)		*(0.222)*	*(0.110)*		*(0.204)*	*(0.106)*		*(0.206)*
Age 70+ years	-1.108***	27.544***	0.35	-1.307***	7.283***	-0.622**	-1.118***	3.382*	-0.632**
	(0.127)		*(0.249)*	*(0.117)*		*(0.226)*	*(0.116)*		*(0.237)*
Household level									
Number other members age 0-4	0.200	4.628**	0.728***	0.229*	0.000	0.226	0.124	1.000	-0.204
	(0.119)		*(0.191)*	*(0.107)*		*(0.200)*	*(0.119)*		*(0.268)*
Number other members age 5-9	0.129	1.253	0.380*	0.171	0.337	0.297	0.096	3.837*	-0.547*
	(0.112)		*(0.171)*	*(0.101)*		*(0.178)*	*(0.111)*		*(0.271)*
Number other members age 10-14	0.385***	0.083	0.449**	0.351***	0.062	0.297	0.064	1.787	-0.363
	(0.111)		*(0.173)*	*(0.100)*		*(0.175)*	*(0.109)*		*(0.261)*
Number other members age 15-19	0.707***	10.066***	1.365***	0.586***	2.786*	0.877***	0.556***	5.044**	-0.002
	(0.098)		*(0.160)*	*(0.085)*		*(0.142)*	*(0.087)*		*(0.199)*
Number other members age 20-29	0.467***	0.032	0.519*	0.413***	0.003	0.401*	0.386***	5.128**	-0.169
	(0.120)		*(0.239)*	*(0.111)*		*(0.177)*	*(0.103)*		*(0.201)*
Number other members age 30-39	0.404*	2.157	-0.107	-0.019	0.104	-0.122	0.035	1.376	-0.365
	(0.167)		*(0.288)*	*(0.151)*		*(0.257)*	*(0.153)*		*(0.274)*

[24] Our conclusions also hold in absence of PP adjustment (see Tables B4a and B4b in the Supplementary Materials).

Table 4a. continued

Number other members age 40-49	0.246 *(0.181)*	1.252	-0.153 *(0.292)*	0.000 *(0.156)*	0.380	-0.184 *(0.239)*	0.045 *(0.147)*	0.885	-0.244 *(0.244)*
Number other members age 50-59	0.184 *(0.182)*	3.437*	-0.509 *(0.304)*	-0.404* *(0.161)*	0.544	-0.182 *(0.257)*	0.056 *(0.144)*	3.386*	-0.516* *(0.261)*
Number other members age 60-69	0.188 *(0.185)*	8.502***	-0.970** *(0.324)*	-0.590*** *(0.166)*	4.437**	-1.292*** *(0.293)*	-0.360* *(0.152)*	17.183***	-1.868*** *(0.309)*
Number other members age 70+	0.387* *(0.186)*	11.589***	-1.101** *(0.376)*	-0.317 *(0.178)*	2.553	-0.939** *(0.354)*	-0.256 *(0.169)*	11.084***	-1.741*** *(0.390)*
Other childless household	0.191 *(0.150)*	0.084	0.100 *(0.254)*	0.306* *(0.142)*	0.066	0.374 *(0.216)*	0.103 *(0.129)*	0.168	0.211 *(0.219)*
Single adult, childless	0.855*** *(0.154)*	0.416	0.631* *(0.282)*	0.561*** *(0.150)*	1.590	0.924*** *(0.233)*	0.422** *(0.133)*	0.066	0.349 *(0.229)*
Single parent, 1 child	0.787*** *(0.222)*	1.134	0.331 *(0.336)*	0.844*** *(0.195)*	0.603	0.555 *(0.295)*	0.921*** *(0.182)*	0.143	0.771* *(0.313)*
Single parent, 2+ children	0.905** *(0.305)*	2.303	-0.007 *(0.463)*	0.351 *(0.272)*	0.131	0.542 *(0.418)*	0.823** *(0.272)*	0.696	1.356* *(0.530)*
Couple, 1 child	0.479** *(0.177)*	2.528	-0.100 *(0.274)*	0.232 *(0.158)*	0.004	0.214 *(0.266)*	0.383* *(0.156)*	0.052	0.299 *(0.309)*
Couple, 2 children	0.564* *(0.245)*	0.397	0.252 *(0.376)*	0.105 *(0.217)*	0.800	0.499 *(0.366)*	0.101 *(0.230)*	5.778**	1.587** *(0.504)*
Couple, 3+ children	0.590 *(0.364)*	0.309	0.169 *(0.583)*	0.119 *(0.328)*	0.109	0.352 *(0.588)*	0.459 *(0.347)*	2.087	1.797* *(0.770)*
Number of earners: 0	1.801*** *(0.151)*	0.000	1.796*** *(0.203)*	1.346*** *(0.159)*	1.121	1.043*** *(0.236)*	1.180*** *(0.144)*	0.468	0.997*** *(0.218)*
Number of earners: 2	-1.276*** *(0.115)*	0.727	-1.439*** *(0.151)*	-1.230*** *(0.096)*	2.117	-1.487*** *(0.144)*	-1.204*** *(0.096)*	1.660	-1.461*** *(0.170)*
Number of earners: 3+	-1.896*** *(0.302)*	0.956	-2.442*** *(0.460)*	-1.845*** *(0.302)*	2.725*	-2.734*** *(0.442)*	-1.150*** *(0.229)*	0.242	-1.388** *(0.423)*
Constant	-4.450*** *(0.200)*	7.765***	-3.267*** *(0.344)*	-3.809*** *(0.177)*	0.158	-3.672*** *(0.282)*	-3.309*** *(0.157)*	1.890	-2.838*** *(0.284)*
$P > \chi^2$	0.000		0.000	0.000		0.000	0.000		0.000
Log likelihood	-5764.69		-2091.98	-7081.69		-2382.81	-7253.44		-2065.45
Pseudo R^2	0.293		0.303	0.287		0.33	0.286		0.38
N	31389		8374	39010		10261	33797		8596

Note. Dependent variable: dummy poor. N denotes the number of non-weighted observations.
Source. German Sample Survey of Income and Expenditures 1993-2003. Own calculations.

Table 4b. Logistic regressions, absolute poverty line

	1993			1998			2003		
Household head	Old states	Diff. test	New states	Old states	Diff. test	New states	Old states	Diff. test	New states
Female	0.246*** *(0.065)*	2.316	0.079 *(0.090)*	0.232*** *(0.061)*	0.004	0.239* *(0.094)*	0.194*** *(0.059)*	1.637	0.348*** *(0.103)*
Married	-0.175 *(0.136)*	3.060*	-0.588** *(0.186)*	-0.172 *(0.125)*	0.247	-0.061 *(0.186)*	-0.427*** *(0.112)*	1.180	-0.190 *(0.189)*
Widowed	-0.736*** *(0.096)*	32.767***	-1.866*** *(0.176)*	-0.872*** *(0.101)*	26.490***	-1.992*** *(0.191)*	-0.786*** *(0.104)*	34.024***	-2.366*** *(0.256)*
Divorced	0.183* *(0.088)*	3.121*	-0.092 *(0.133)*	0.074 *(0.077)*	0.296	0.148 *(0.114)*	0.029 *(0.074)*	6.366**	0.383** *(0.123)*
Self-employed	1.096*** *(0.108)*	1.673	1.447*** *(0.236)*	1.018*** *(0.106)*	2.694	0.559* *(0.260)*	1.165*** *(0.110)*	5.757**	0.392 *(0.294)*
Civil servant	-1.884*** *(0.213)*	2.606	-1.081* *(0.471)*	-1.571*** *(0.190)*	2.136	-2.637*** *(0.716)*	-1.413*** *(0.222)*	0.005	-1.453** *(0.520)*
Blue-collar worker	0.569*** *(0.084)*	0.754	0.701*** *(0.124)*	0.700*** *(0.079)*	0.422	0.604*** *(0.121)*	0.862*** *(0.085)*	0.000	0.859*** *(0.144)*
Unemployed	1.687*** *(0.152)*	8.269***	1.018*** *(0.173)*	2.081*** *(0.155)*	10.192***	1.196*** *(0.228)*	2.090*** *(0.152)*	0.903	1.819*** *(0.233)*
Non-working	0.719*** *(0.140)*	0.473	0.546** *(0.206)*	1.161*** *(0.156)*	0.415	0.965*** *(0.255)*	1.115*** *(0.155)*	0.071	1.196*** *(0.254)*

Table 4b. continued.

University degree	-0.629***	4.248**	-1.048***	-0.365***	5.274**	-0.748***	-0.368***	14.586***	-1.063***
	(0.120)		*(0.159)*	*(0.097)*		*(0.137)*	*(0.089)*		*(0.156)*
Univ. of applied	-0.732***	1.207	-0.514***	-0.446***	0.067	-0.401**	-0.670***	0.309	-0.770***
sciences degree	*(0.130)*		*(0.146)*	*(0.107)*		*(0.136)*	*(0.103)*		*(0.148)*
In apprenticeship	0.394***	0.127	0.453***	0.505***	3.281*	0.735***	0.244***	2.254	0.435***
	(0.079)		*(0.137)*	*(0.070)*		*(0.105)*	*(0.064)*		*(0.112)*
No degree	1.391***	0.535	1.205***	1.441***	0.156	1.344***	1.212***	0.676	1.438***
	(0.090)		*(0.227)*	*(0.093)*		*(0.225)*	*(0.094)*		*(0.248)*
Age 20-29 years	0.503***	3.577*	0.161	0.561***	0.205	0.476**	0.575***	0.017	0.545**
	(0.093)		*(0.151)*	*(0.087)*		*(0.165)*	*(0.096)*		*(0.196)*
Age 40-49 years	-0.305***	4.806**	0.039	-0.351***	12.013***	0.159	-0.220**	2.943*	0.062
	(0.088)		*(0.135)*	*(0.075)*		*(0.123)*	*(0.079)*		*(0.144)*
Age 50-59 years	-0.652***	10.896***	-0.001	-0.768***	23.512***	0.138	-0.547***	15.812***	0.243
	(0.106)		*(0.170)*	*(0.097)*		*(0.158)*	*(0.096)*		*(0.174)*
Age 60-69 years	-1.203***	45.722***	0.341	-1.189***	6.410**	-0.612**	-1.119***	9.736***	-0.378
	(0.113)		*(0.198)*	*(0.106)*		*(0.196)*	*(0.106)*		*(0.206)*
Age 70+ years	-1.092***	38.728***	0.468*	-1.232***	5.252**	-0.670**	-1.118***	3.382*	-0.632**
	(0.116)		*(0.224)*	*(0.112)*		*(0.218)*	*(0.116)*		*(0.237)*
Household level									
Number other	0.163	10.138***	0.809***	0.282**	0.114	0.360	0.124	1.000	-0.204
members age 0-4	*(0.104)*		*(0.174)*	*(0.100)*		*(0.187)*	*(0.119)*		*(0.268)*
Number other	0.115	7.576***	0.639***	0.208*	0.358	0.335*	0.096	3.837*	-0.547*
members age 5-9	*(0.098)*		*(0.158)*	*(0.095)*		*(0.170)*	*(0.111)*		*(0.271)*
Number other	0.336***	1.362	0.560***	0.355***	0.000	0.352*	0.064	1.787	-0.363
members age 10-14	*(0.097)*		*(0.158)*	*(0.095)*		*(0.166)*	*(0.109)*		*(0.261)*
Number other	0.664***	16.006***	1.358***	0.549***	4.695**	0.907***	0.556***	5.044**	-0.002
members age 15-19	*(0.086)*		*(0.145)*	*(0.081)*		*(0.134)*	*(0.087)*		*(0.199)*
Number other	0.509***	0.460	0.676***	0.443***	0.005	0.428**	0.386***	5.128**	-0.169
members age 20-29	*(0.101)*		*(0.199)*	*(0.105)*		*(0.166)*	*(0.103)*		*(0.201)*
Number other	0.310*	0.366	0.128	-0.027	0.368	-0.207	0.035	1.376	-0.365
members age 30-39	*(0.142)*		*(0.240)*	*(0.142)*		*(0.239)*	*(0.153)*		*(0.274)*
Number other	0.052	0.095	0.147	-0.030	0.664	-0.257	0.045	0.885	-0.244
members age 40-49	*(0.157)*		*(0.243)*	*(0.147)*		*(0.224)*	*(0.147)*		*(0.244)*
Number other	0.307*	5.084**	-0.413	-0.436**	1.112	-0.139	0.056	3.386*	-0.516*
members age 50-59	*(0.155)*		*(0.257)*	*(0.153)*		*(0.241)*	*(0.144)*		*(0.261)*
Number other	0.144	7.773***	-0.791**	-0.566***	6.730***	-1.375***	-0.360*	17.183***	-1.868***
members age 60-69	*(0.160)*		*(0.271)*	*(0.157)*		*(0.276)*	*(0.152)*		*(0.309)*
Number other	0.293	12.441***	-1.034**	-0.288	5.075**	-1.127***	-0.256	11.084***	-1.741***
members age 70+	*(0.162)*		*(0.315)*	*(0.169)*		*(0.341)*	*(0.169)*		*(0.390)*
Other childless	0.239	0.931	-0.018	0.276*	0.032	0.321	0.103	0.168	0.211
household	*(0.130)*		*(0.217)*	*(0.136)*		*(0.204)*	*(0.129)*		*(0.219)*
Single adult, childless	0.784***	0.336	0.613*	0.588***	1.841	0.957***	0.422**	0.066	0.349
	(0.137)		*(0.242)*	*(0.143)*		*(0.221)*	*(0.133)*		*(0.229)*
Single parent, 1 child	1.098***	2.739*	0.481	0.981***	1.063	0.615*	0.921***	0.143	0.771*
	(0.198)		*(0.292)*	*(0.187)*		*(0.281)*	*(0.182)*		*(0.313)*
Single parent, 2+	1.128***	4.578**	0.011	0.548*	0.003	0.576	0.823**	0.696	1.356*
children	*(0.273)*		*(0.414)*	*(0.260)*		*(0.398)*	*(0.272)*		*(0.530)*
Couple, 1 child	0.513***	4.681**	-0.131	0.289	0.030	0.239	0.383*	0.052	0.299
	(0.155)		*(0.237)*	*(0.149)*		*(0.249)*	*(0.156)*		*(0.309)*
Couple, 2 children	0.810***	5.039**	-0.112	0.216	0.448	0.498	0.101	5.778**	1.587**
	(0.214)		*(0.338)*	*(0.205)*		*(0.345)*	*(0.230)*		*(0.504)*
Couple, 3+ children	0.884**	3.058*	-0.210	0.245	0.001	0.222	0.459	2.087	1.797*
	(0.317)		*(0.525)*	*(0.309)*		*(0.557)*	*(0.347)*		*(0.770)*
Number of earners: 0	1.747***	0.145	1.662***	1.233***	0.071	1.161***	1.180***	0.468	0.997***
	(0.131)		*(0.177)*	*(0.148)*		*(0.227)*	*(0.144)*		*(0.218)*
Number of earners: 2	-1.234***	1.895	-1.448***	-1.139***	3.503*	-1.437***	-1.204***	1.660	-1.461***
	(0.094)		*(0.123)*	*(0.086)*		*(0.129)*	*(0.096)*		*(0.170)*
Number of earners: 3+	-1.585***	2.853*	-2.300***	-1.720***	4.454**	-2.712***	-1.150***	0.242	-1.388**
	(0.228)		*(0.343)*	*(0.275)*		*(0.389)*	*(0.229)*		*(0.423)*

Table 4b. continued.

Constant	-4.056***	14.744***	-2.680***	-3.705***	0.910	-3.397***	-3.309***	1.890	-2.838***
	(0.175)		*(0.292)*	*(0.168)*		*(0.265)*	*(0.157)*		*(0.284)*
$P > \chi^2$	0.000		0.000	0.000		0.000	0.000		0.000
Log likelihood	-7047.45		-2689.58	-7767.21		-2641.35	-7253.44		-2065.45
Pseudo R^2	0.283		0.283	0.286		0.326	0.286		0.380
N	31389		8374	3901		10261	33797		8596

Note. Dependent variable: dummy poor. N denotes the number of non-weighted observations.
Source. German Sample Survey of Income and Expenditures 1993-2003. Own calculations.

4.2. Results from the non-linear Oaxaca-Blinder decomposition

The results from the non-linear Oaxaca-Blinder decomposition are summarized in Tables 5a and 5b. Estimates are provided for all three cross sections and for both poverty lines. To make the read more convenient, the top rows in the first panel of the tables repeat head-count ratios from Section 3 and differences in the levels between West and East. The second panel reports the characteristics effects from the decomposition by eight groups of variables, analogously to the eight sets distinguished in Tables 4a and 4b. Each reported coefficient reveals how differences in distributions of a specific variable contribute to the East/West poverty divide. In all our calculations, Old states residents serve as reference and New states residents as the comparison group.[25] As separate contributions from independent variables may be sensitive to ordering of variables, it is randomized to approximate results over all possible orderings (see Fairlie, 2005, for details).[26] The third panel summarizes the aggregate characteristics effect. It is the total explanatory contribution of group differences in regressors (first row), i.e. the fraction of the poverty divide actually explained by the decomposition.

As indicated by aggregate characteristics effects, the decomposition cannot explain even a small fraction of the East/West poverty divide in year 1993. For both poverty lines, the aggregate characteristics effects in year 1993 are very small and carry the wrong sign. The ongoing transition of the East German command economy into a western-style market economy, however, should alleviate the explanatory power of the decomposition. Indeed, in year 1998 the aggregate characteristics effect explains already 13.309 percent (14.285 percent) of the East/West poverty divide when the RPL (APL) is applied: Had New states residents the same characteristics as Old states residents, regional differences in poverty rates

[25] The choice of the reference and of the comparison group can change the decomposition results. However, in our decomposition analysis we do not find such effects, and hence refrain from stating results from scenarios where reference and comparison group are reversed. All estimates can be provided by the authors upon request.
[26] Alternative approaches to overcome this dependency are suggested by Even and Macpherson (1993), Nielson (1998), and Yun (2005). These authors seek to overcome the dependency by determining the relative contribution of each variable to each component using appropriately constructed weights.

would be of -0.023 (-0.032) as opposed to -0.028 (-0.037). In 2003, the aggregate characteristics effect already explains more than half of the divide, i.e. 55.995 percent.

Table 5. Non-linear decomposition of East/West poverty divide

	Relative poverty line			Absolute poverty line		
	1993	1998	2003	1993	1998	2003
Head-count ratio, Old states	0.099	0.121	0.119	0.128	0.135	0.119
Head-count ratio, New states	0.156	0.149	0.164	0.213	0.172	0.164
Difference	-0.057	-0.028	-0.045	-0.085	-0.037	-0.045
	Characteristics effects by groups of variables					
Gender of household head	-0.002***	-0.004***	-0.002***	-0.002***	-0.005***	-0.002***
	-120.78	*-273.92*	*-181.28*	*-158.78*	*-297.70*	*-180.76*
Marital status of household head	-0.002***	-0.003***	-0.004***	-0.003***	-0.003***	-0.004***
	-187.68	*-247.52*	*-222.52*	*-212.93*	*-255.70*	*-215.73*
Age cohort household head	-0.003***	-0.001***	-0.003***	-0.004***	-0.002***	-0.002***
	-95.44	*-42.97*	*-52.59*	*-112.49*	*-46.58*	*-49.36*
Labor force status of household head	-0.014***	-0.008***	-0.016***	-0.015***	-0.011***	-0.017***
	-341.69	*-224.16*	*-323.91*	*-373.86*	*-261.00*	*-326.00*
Highest educational degree of household head	0.023***	0.013***	0.008***	0.027***	0.014***	0.009***
	843.11	*810.65*	*530.99*	*958.86*	*834.80*	*530.34*
Household age composition	-0.002***	-0.001***	-0.003***	-0.003***	-0.001***	-0.002***
	-43.02	*-23.14*	*-66.14*	*-55.50*	*-12.67*	*-44.79*
Family type	-0.000***	-0.001***	0.000***	-0.001***	-0.000***	0.000***
	-4.51	*-31.61*	*5.60*	*-23.23*	*-11.66*	*3.35*
Number of earners	0.002***	0.002***	-0.006***	0.005***	0.002***	-0.006***
	27.56	*27.78*	*-89.10*	*77.93*	*34.07*	*-98.53*
	Aggregate characteristics effects (total explained)					
Total explained	0.002	-0.005	-0.025	0.004	-0.005	-0.025
Explained in percent	0	13.309	55.995	0	14.285	55.995

Note. Decomposition results are based on 500 replications using randomized ordering of variables. HHH denotes household head; HH denotes HH type. t statistics in italics. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. *Source*. German Sample Survey of Income and Expenditures 1993-2003.

From the considered set of socioeconomic variables, differences in the labor force status are a key determinant of the East/West poverty divide. The share of unemployed household heads in the New states is about twice the share in the Old states. In recent years, an exodus of high-skilled and young New states residents further contributed to this difference (e.g., Burda, 1993). That in the New states the fraction of civil servants, a group with a particularly low poverty risk, is small (especially in the early years after German Unification) also contributes to the poverty divide. Another source driving the divide is the higher fraction of female-headed and divorced households. Finally, East/West differences in the age distributions of other household members contribute to the East/West poverty divide. In the opposite direction works the variable education.

Distributional differences in other household-level variables hardly matter. An interesting result, however, pertains the variable “number of earners”. Over the observation period, the associated decomposition coefficient switches from positive to negative. While

high employment rates of females in the new federal states lowered the poverty risk in the early 1990s, high unemployment and early retirement rates dominated in years 1998 and 2003.

Summing up the decomposition results, there is an apparent inter-temporal pattern. In 1993 the aggregate characteristics effect is incapable even to explain a small part of the East/West poverty divide. Poverty risks were quasi randomly distributed among New states residents Given the huge Unification shock, turning the New states economy upside down from a command to a market economy, and numerous firm liquidations, this may not come as a big surprise. Already in year 2003, regional differences in the distributions of poverty-relevant characteristics explain more than half of the East/West poverty divide. Accordingly, the distribution of poverty-relevant socioeconomic characteristics in the New states inheres a higher poverty risk compared to the Old states distribution.[27] This may be due to the fact that people with low poverty risks are leaving the economic week regions of Eastern Germany. Then, the transitory divide is likely to become a persistent phenomenon.[28]

5. Conclusion

A major goal of welfare states all over the world, including Germany, is poverty reduction. We quantify head-count and poverty-gap ratio to assess whether the situation, indeed, improved since 1978 in Germany's Old states. When the partitioning criterion is a relative poverty line (60-percent-of-median equivalent income), our answer is "no:" there is no significant trend of poverty reduction. Our conclusion is different when an inter-temporally constant absolute poverty line serves as the partitioning criterion. Here, our answer is "yes:" poverty declines significantly during the observation period. However, the positive picture, most of all, is a technical artifact. It results from the choice of deriving the poverty line from the income distribution for overall Germany together with average equivalent income being substantially lower in Eastern Germany.

A specific goal in Germany is the creation of similar living circumstances across states. Our estimates, however, reveal substantial regional differences in poverty rates. New states' head-count and poverty-gap ratios exceed Old states' estimates by far. Evidence in favor of an inter-temporal convergence of poverty rates is limited. While the poverty East/West poverty divide reduces moderately between 1993 and 1998, there is no further convergence since then. A non-linear Oaxaca-Blinder decomposition of poverty rates for the

[27] See Table A2-A4 in the Supplementing Materials for a summary of the inter-temporal changes in the distributions of personal and household characteristics.
[28] The results from the decomposition for non-PP adjusted incomes are provided in Table 5B in the Supplementing Materials, and are supporting our conclusions.

two parts of Germany indicates that the poverty divide, first of all, is owed to macroeconomic differences between the two regions. Particularly in the early years after Unification, regional differences in the distributions of socioeconomic characteristics play a minor role. In later years, however, differences in poverty-relevant characteristics substantially contribute to the poverty divide.

Across household types, poverty rates of single parents are the highest. Over the observation period, little improvement has been made in this respect, although the basic problems of single parents are well understood. They rely on the earnings of a single person, in many cases hired for a low-skilled part time job. Accordingly, earnings are typically low whereas unemployment risk is high. Moreover, child-rearing requires a substantial amount of parental time and affordable childcare facilities are scarce. Hence, parents, and single parents in particular face additional opportunity costs upon deciding to work, lowering their labor market participation rates.[29]

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[29] Francesconi and van der Klaauw (2007) or Tekin (2007), for example, investigate policies to break this vicious circle.

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Supplementing Materials: Poverty in Germany – statistical inference and decomposition

Structure of the materials

The supplementing material is split in two parts. Part A contains technical details concerning the database and its preparation. Part B provides poverty and decomposition estimates when incomes in the New states are not adjusted for purchasing-power differences compared to the Old states.

PART A. Database and data processing

A.1 Working sample

Our working sample includes all EVS household observations corresponding to one of the eight defined household types as described in the article. From these observations we have discarded a small number of households if "disposable income" is not reported in the database or if it is negative. Over the entire observation period, this leaves us with 263,227 non-weighted household observations (for further details on the sample composition see Table A2 below).

A.1 Income adjustments for changes in consumer prices and differences in purchasing power

Income adjustments for changes in consumer prices (CPIs) rely on datasets provided by the German Federal Statistical Office (see http://www-genesis.destatis.de/genesis/online). Data on differences in purchasing power (PPs) are taken from Nierhaus (2001). CPI and PP factors can be taken from Table A1 below.

Table A1. Consumer prices and purchasing powers

	CPI		PP
Year	Old states	New states	
1978	54.3	---	---
1983	68.8	---	---
1988	72.9	---	---
1993	85.9	86.4	90.3
1998	93.4	94.9	92.3
2003	100.0	100.0	92.0

In the main body of the paper, incomes are adjusted by region-specific CPIs and PPs. In addition, in Part B of the Supporting Materials, we conduct an equivalent analysis to the one

carried out in the main body with the single difference that incomes are adjusted by means of CPI but *not* by PP factors.

A.2 Description of the sample

This subsection provides further descriptive statistics on our database complementing the figures in the main body of the article. Particularly, Table A2 gives relative non-weighted frequencies of household types by year and region of residence. Underneath total numbers of observations (non-weighted) are reported. Altogether, sample sizes should always be sufficient large to ensure reliability of derived poverty indices.

Table A2. Sample composition (relative frequencies and total numbers of observations, non-weighted)

	Year								
	1978	1983	1988	1993		1998		2003	
Household type	Old states	Old states	Old states	Old states	New states	Old states	New states	Old states	New states
Other childless	10.64	12.68	15.29	10.73	8.78	9.19	10.41	9.49	13.05
Childless single adult	16.36	18.07	19.92	24.47	17.02	22.80	19.43	25.14	20.81
Single parent, 1 child	1.15	1.71	1.65	1.93	3.56	2.50	4.10	2.40	3.09
Single parent, 2+ children	0.81	0.79	0.84	1.05	1.67	1.61	2.00	1.32	1.24
Childless couple	28.27	24.82	26.45	28.77	31.94	30.03	33.22	33.90	36.98
Couple, 1 child	18.11	19.13	15.61	12.47	16.28	12.42	14.56	10.55	14.34
Couple, 2 children	17.65	17.58	15.17	13.18	17.08	15.41	14.07	12.56	8.47
Couple, 3+ children	7.01	5.20	5.07	7.40	3.68	6.05	2.20	4.64	2.00
Number of observation	45,786	42,560	43,454	31,389	8,374	39,010	10,261	33,797	8,596

Note. Own calculations.
Source. German Sample Survey of Income and Expenditures 1978-2003.

A breakdown of the sample including all the variables entering the logit regressions is given in Tables A3 and A4. All reported frequencies are computed using EVS frequency weights. The upper panel of the table summarizes individual information of the household head, while the lower panel contains household-level information.

Table A3. Breakdown of the sample (relative frequencies of all households, weighted)

		1993		1998		2003	
Characteristics of the household head		Old states	New states	Old states	New states	Old states	New states
Gender	female	32.58	43.48	34.20	43.38	36.18	46.35
	male	67.42	56.52	65.80	66.62	63.82	53.65
Marital status	unmarried	18.52	14.16	22.67	19.20	25.54	24.47
	married	55.92	60.00	52.53	54.09	50.19	47.65
	widowed	15.67	13.22	11.11	8.97	8.77	7.28
	divorced	9.90	12.62	13.69	17.74	15.50	20.60
Labor force status	self-employed or farmer	7.52	2.45	6.42	4.12	5.99	4.62
	civil servant	5.87	0.88	5.27	2.24	4.59	2.93
	white-collar worker	22.89	27.10	28.64	27.63	30.28	25.72
	blue-collar worker	21.26	23.78	19.18	21.28	16.68	18.29
	unemployed	3.64	10.42	4.55	8.96	4.40	10.00
	non-working[A]	38.81	35.37	35.93	35.77	38.05	38.43
Highest level of education	university	9.11	19.10	11.58	19.12	13.21	19.86
	univ. of applied sciences	8.87	24.81	9.70	15.48	10.51	17.32
	engineering school[B]	12.34	7.57	14.68	16.10	17.62	17.63
	apprenticeship	55.07	45.08	56.19	46.05	51.96	41.36
	no degree	14.62	3.44	7.85	3.25	6.70	3.83
Age cohort	20-29 years	10.83	10.10	8.71	7.92	9.44	9.53
	30-39 years	20.25	21.81	21.96	19.60	18.98	16.06
	40-49 years	16.74	17.96	18.36	20.95	21.07	23.35
	50-59 years	18.27	21.62	17.43	17.78	15.71	15.11
	60-69 years	15.17	15.70	15.12	15.98	16.14	17.06
	70+ years	18.75	12.81	18.41	17.77	18.65	18.89
Characteristics of the household							
Family type	Other childless	11.04	7.93	10.70	12.88	9.78	11.62
	Childless single adult	34.77	28.65	36.37	32.18	37.19	36.62
	Single parent, 1 child	1.89	3.31	2.07	3.14	2.48	3.34
	Single parent, 2+ children	1.03	1.60	1.03	1.32	1.20	1.32
	Childless couple	27.56	30.12	29.29	29.70	29.49	30.15
	Couple, 1 child	10.76	13.80	8.29	9.95	7.98	9.81
	Couple, 2 children	9.22	12.22	9.11	9.48	8.71	5.82
	Couple, 3+ children	3.74	2.38	3.13	1.35	3.18	1.32
Number of earners	0	37.33	39.71	38.20	42.39	40.46	46.42
	1	37.23	31.34	36.74	29.99	35.68	29.88
	2	22.43	26.26	22.74	23.67	21.63	20.90
	3+	3.01	2.69	2.32	3.95	2.23	2.79

Source. German Sample Survey of Income and Expenditures 1993-2003.
Note. Own calculations. [A] Includes pensioners, housemen/wives, etc. [B] Also includes similar degrees.

Table A4. Household composition by number of persons belonging to a specific age cohort (relative frequencies of all households, weighted)

		1993		1998		2003	
Number of household members of		Old states	New states	Old states	New states	Old states	New states
Age 0-5	0	89.78	91.57	90.42	94.85	92.00	94.61
	1	8.16	7.41	7.64	4.46	6.55	4.70
	2	1.92	1.00	1.82	0.67	1.38	0.69
	3	0.14	0.02	0.12	0.03	0.06	0.01
	4	0.00	0.00	0.00	0.00	0.00	0.00
Age 6-10	0	89.20	86.41	89.87	91.97	90.03	94.42
	1	8.16	11.22	7.73	7.02	7.51	4.82
	2	2.45	2.13	2.25	0.97	2.30	0.73
	3	0.17	0.23	0.14	0.04	0.15	0.03
	4	0.01	0.00	0.01	0.00	0.01	0.00
Age 10-14	0	89.58	84.98	91.16	87.20	90.22	91.18
	1	8.17	12.38	6.80	10.71	7.43	7.74
	2	2.08	2.47	1.90	2.02	2.18	1.04
	3	0.16	0.16	0.13	0.07	0.17	0.04
	4	0.01	0.01	0.01	0.00	0.00	0.00
Age 15-19	0	90.80	87.75	91.92	86.03	90.92	86.60
	1	7.50	10.55	6.56	12.01	7.32	11.50
	2	1.58	1.64	1.42	1.88	1.61	1.76
	3	0.11	0.06	0.10	0.07	0.14	0.14
	4	0.01	0.00	0.00	0.01	0.01	0.00
age 20-29	0	84.22	86.20	87.36	87.01	88.86	88.46
	1	14.36	13.43	11.64	11.91	10.13	10.77
	2	1.26	0.37	0.91	1.08	0.94	0.72
	3	0.14	0.00	0.08	0.01	0.07	0.06
	4	0.02	0.00	0.00	0.00	0.00	0.00
	5	0.00	0.00	0.00	0.00	0.00	0.00
Age 30-39	0	83.65	84.33	84.47	86.36	86.70	89.77
	1	16.27	15.66	15.52	13.64	13.30	10.23
	2	0.07	0.01	0.01	0.00	0.00	0.01
	3	0.01	0.00	0.00	0.00	0.00	0.00
Age 40-49	0	87.47	87.57	88.07	85.56	86.90	85.59
	1	12.51	12.42	11.91	14.36	13.06	14.30
	2	0.02	0.01	0.02	0.07	0.04	0.12
	3	0.00	0.00	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.00	0.00	0.00	0.00
Age 50-59	0	86.89	83.76	87.92	86.96	90.12	90.17
	1	13.09	16.23	11.92	12.93	9.77	9.64
	2	0.01	0.01	0.15	0.11	0.11	0.20
	3	0.00	0.00	0.01	0.00	0.00	0.00
Age 60-69	0	91.31	90.02	90.22	88.61	89.07	88.27
	1	8.66	9.96	9.56	11.19	10.82	11.49
	2	0.03	0.02	0.22	0.20	0.11	0.24
Age 70+	0	95.09	96.26	94.35	94.86	93.32	93.10
	1	4.84	3.71	5.57	5.12	6.60	6.88
	2	0.07	0.02	0.08	0.06	0.08	0.02
	3	0.00	0.00	0.00	0.00	0.00	0.00

Note. Own calculations.
Source. German Sample Survey of Income and Expenditures 1993-2003.

PART B. Purchasing-power corrected estimates

Part B of the Supplementing Materials contains estimates complementing the results from the main body of the article *without* correction for East/West differences in purchasing power. Particularly, Tables B1, B2a-h, B4a-b and Table B5 are equivalent with Tables 1, 2a-h, 4a-b and Table 5 in the article. Figures B1 to B3b are equivalent with Figures 1 to 3b.

Table B1. Inter-temporal changes in poverty, all households

		Old states					New states	
Poverty line	Poverty index	1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	1.69**	0.75**	-4.24**	3.18**	0.22	-9.14**	-3.48**
	(95% CI)	(1.15; 2.21)	(0.17; 1.34)	(-4.83; -3.60)	(2.49; 3.83)	(-0.40; 0.95)	(-10.95; -7.17)	(-5.19; -1.83)
	$\Delta\hat{I}(1)$	0.43**	0.23**	-0.88**	0.71**	0.17	-1.79**	-0.43**
	(95% CI)	(0.30; 0.57)	(0.05; 0.38)	(-1.03; -0.71)	(0.52; 0.89)	(-0.01; 0.37)	(-2.28; -1.28)	(-0.86; -0.04)
Absolute	$\Delta\hat{I}(0)$	-1.27**	-0.62	-4.40**	0.76	-1.59**	-18.75**	-7.41**
	(95% CI)	(-1.91; -0.61)	(-1.40; 0.13)	(-5.13; -3.71)	(-0.04; 1.58)	(-2.31; -0.82)	(-20.40; -16.89)	(-9.18; -5.84)
	$\Delta\hat{I}(1)$	-0.06	0.06	-0.98**	0.25**	-0.31**	-4.45**	-1.49**
	(95% CI)	(-0.23; 0.12)	(-0.17; 0.25)	(-1.19; -0.78)	(0.03; 0.47)	(-0.51; -0.10)	(-4.93; -3.86)	(-1.90; -1.09)

Note. $\Delta\hat{I}(.)$ denotes the observed change in poverty indices between periods t and t-5. CI denotes Hall's bias-corrected confidence interval. ** denotes that the change is significantly different from zero at the 5% level.
Source. German Sample Survey of Income and Expenditures 1978-2003. Own calculations.

Table B2a. Inter-temporal changes in poverty, other childless households

		Old states					New states	
Poverty line	Poverty index	1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	1.79**	-0.06	-3.24**	3.96**	0.46	-2.94	0.02
	(95% CI)	(0.78; 2.79)	(-1.31; 1.32)	(-4.50; -1.95)	(2.32; 5.47)	(-1.34; 2.37)	(-6.90; 1.17)	(-4.18; 4.25)
	$\Delta\hat{I}(1)$	0.30**	0.19	-0.71**	0.73**	0.31	-0.68	0.56
	(95% CI)	(0.06; 0.59)	(-0.19; 0.58)	(-1.06; -0.37)	(0.38; 1.11)	(-0.14; 0.78)	(-1.50; 0.21)	(-0.42; 1.46)
Absolute	$\Delta\hat{I}(0)$	0.22	0.04	-3.72**	2.46**	-0.47	-9.50**	-3.31
	(95% CI)	(-1.08; 1.64)	(-1.60; 1.57)	(-5.29; -2.15)	(0.69; 4.23)	(-2.41; 1.44)	(-14.09; -4.62)	(-7.56; 0.70)
	$\Delta\hat{I}(1)$	0.16	0.06	-0.86**	0.64**	0.00	-2.12**	-0.13
	(95% CI)	(-0.15; 0.51)	(-0.39; 0.52)	(-1.30; -0.42)	(0.21; 1.08)	(-0.48; 0.51)	(-3.13; -1.04)	(-1.12; 0.83)

Note and source. See Table B1.

Table B2b. Inter-temporal changes in poverty, childless single adult

Poverty line	Poverty index	Old states					New states	
		1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	-0.49	-0.95	-6.55**	2.49**	1.99**	-9.34**	-4.20**
	(95% CI)	(-2.27; 1.26)	(-2.70; 0.68)	(-8.34; -4.80)	(0.59; 4.26)	(0.39; 3.71)	(-13.42; -4.78)	(-8.10; -0.66)
	$\Delta\hat{I}(1)$	0.06	-0.41	-1.77**	1.02**	0.88**	-1.19	-1.35**
	(95% CI)	(-0.44; 0.56)	(-0.92; 0.06)	(-2.24; -1.31)	(0.53; 1.50)	(0.42; 1.37)	(-2.57; 0.20)	(-2.62; -0.10)
Absolute	$\Delta\hat{I}(0)$	-3.60**	-1.65**	-6.81**	-1.39	-0.56	-17.61**	-8.69**
	(95% CI)	(-5.50; -1.68)	(-3.50; -0.01)	(-8.56; -4.94)	(-3.38; 0.53)	(-2.21; 1.06)	(-21.58; -13.64)	(-12.70; -5.13)
	$\Delta\hat{I}(1)$	-1.16**	-0.79**	-1.78**	-0.08	0.05	-4.66**	-3.05**
	(95% CI)	(-1.76; -0.55)	(-1.37; -0.26)	(-2.38; -1.26)	(-0.62; 0.48)	(-0.42; 0.52)	(-6.09; -3.17)	(-4.35; -1.76)

Note and source. See Table B1.

Table B2c. Inter-temporal changes in poverty, single parent with one child

Poverty line	Poverty index	Old states					New states	
		1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	8.98**	15.33**	-18.17**	12.56**	-0.74	-8.90**	2.20
	(95% CI)	(3.29; 14.29)	(8.65; 21.32)	(-24.89; -11.50)	(5.21 18.36)	(-6.87; 6.47)	(-18.13; -0.30)	(-7.50; 11.74)
	$\Delta\hat{I}(1)$	1.99**	3.45**	-4.11**	2.15**	0.25	-4.91**	-0.85
	(95% CI)	(0.69; 3.27)	(1.68; 5.27)	(-5.92; -2.19)	(0.46 3.95)	(-1.51; 2.08)	(-8.08; -1.79)	(-3.33; 1.64)
Absolute	$\Delta\hat{I}(0)$	8.89**	14.28**	-14.35**	6.69	-5.63	-17.19**	-3.16
	(95% CI)	(3.21; 14.73)	(7.59; 20.42)	(-20.76; -7.91)	(-0.15 13.75)	(-12.28; 0.55)	(-24.81; -9.28)	(-12.73; 5.46)
	$\Delta\hat{I}(1)$	2.20**	4.13**	-4.70**	1.19	-1.19	-8.47**	-2.99**
	(95% CI)	(0.42; 3.79)	(2.05; 6.21)	(-6.93; -2.46)	(-0.81 3.32)	(-3.06; 0.70)	(-11.91; -4.92)	(-5.59; -0.38)

Note and source. See Table B1.

Table B2d. Inter-temporal changes in poverty, single parent with two or more children

Poverty line	Poverty index	Old states					New states	
		1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	12.63**	11.09**	-22.00**	3.07	-2.03	-14.44**	-14.80**
	(95% CI)	(3.20; 21.55)	(1.14; 20.16)	(-31.01; -12.18)	(-5.71; 12.00)	(-10.14; 5.54)	(-25.17; -2.74)	(-28.70; -0.16)
	$\Delta\hat{I}(1)$	5.78**	0.39	-4.66**	-0.35	-0.60	-7.55**	-3.13
	(95% CI)	(2.07; 9.00)	(-3.56; 4.48)	(-7.97; -1.33)	(-3.13; 2.38)	(-2.73; 1.36)	(-12.67; -2.19)	(-7.30; 1.55)
Absolute	$\Delta\hat{I}(0)$	10.14**	5.38	-17.65**	-3.93	-6.57	-19.66**	-23.14**
	(95% CI)	(1.33; 18.70)	(-3.12; 14.15)	(-26.57; -8.62)	(-12.75; 4.97)	(-14.77; 0.86)	(-27.62; -9.55)	(-36.60; -9.64)
	$\Delta\hat{I}(1)$	5.06**	0.52	-5.16**	-2.41	-2.16**	-11.78**	-5.74**
	(95% CI)	(1.09; 8.58)	(-3.67; 4.69)	(-8.70; -1.60)	(-5.51; 0.64)	(-4.36; -0.09)	(-16.77; -6.21)	(-9.79; -1.02)

Note and source. See Table B1.

Table B2e. Inter-temporal changes in poverty, childless couple

Poverty line	Poverty index	Old states 1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	New states 1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	-0.58	-0.09	-4.44**	1.37**	1.44**	-8.17**	-2.80**
	(95% CI)	(-1.58; 0.49)	(-1.18; 1.12)	(-5.47; -3.35)	(0.30; 2.28)	(0.49; 2.57)	(-11.11; -5.54)	(-5.30; -0.12)
	$\Delta\hat{I}(1)$	-0.16	-0.04	-0.76**	0.23	0.43**	-1.16**	-0.07
	(95% CI)	(-0.42; 0.11)	(-0.33; 0.27)	(-1.01; -0.51)	(-0.02; 0.48)	(0.17; 0.69)	(-1.79; -0.62)	(-0.66; 0.54)
Absolute	$\Delta\hat{I}(0)$	-3.22**	-1.37	-4.95**	-0.58	0.33	-20.09**	-6.11**
	(95% CI)	(-4.37; -1.99)	(-2.68; 0.00)	(-6.23; -3.86)	(-1.65; 0.46)	(-0.71; 1.46)	(-23.25; -17.40)	(-8.65; -3.31)
	$\Delta\hat{I}(1)$	-0.80**	-0.24	-0.99**	-0.12	0.12	-3.47**	-0.79**
	(95% CI)	(-1.13; -0.46)	(-0.59; 0.14)	(-1.32; -0.69)	(-0.41; 0.17)	(-0.13; 0.39)	(-4.19; -2.78)	(-1.41; -0.14)

Note and source. See Table B1.

Table B2f. Inter-temporal changes in poverty, couple with one child

Poverty line	Poverty index	Old states 1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	New states 1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	2.22**	0.23	-2.11**	5.74**	-1.93	-4.23	-7.75**
	(95% CI)	(1.32; 3.12)	(-0.99; 1.62)	(-3.48; -0.80)	(3.77; 7.82)	(-4.07; 0.32)	(-8.74; 0.08)	(-11.80; -3.30)
	$\Delta\hat{I}(1)$	0.41**	0.25	-0.39**	1.08**	-0.20	-0.21	-1.41**
	(95% CI)	(0.23; 0.59)	(-0.06; 0.57)	(-0.75; -0.06)	(0.50; 1.71)	(-0.85; 0.40)	(-1.34; 0.89)	(-2.39; -0.38)
Absolute	$\Delta\hat{I}(0)$	0.99	-0.85	-2.77**	4.16**	-3.25**	-12.98**	-10.86**
	(95% CI)	(-0.13; 2.25)	(-2.32; 0.68)	(-4.44; -1.19)	(1.93; 6.35)	(-5.38; -0.96)	(-17.58; -8.40)	(-15.29; -6.53)
	$\Delta\hat{I}(1)$	0.32**	0.09	-0.44**	0.97**	-0.63	-2.29**	-2.34**
	(95% CI)	(0.07; 0.59)	(-0.30; 0.49)	(-0.88; -0.03)	(0.35; 1.66)	(-1.31; 0.01)	(-3.53; -1.11)	(-3.35; -1.22)

Note and source. See Table B1.

Table B2g. Inter-temporal changes in poverty, couple with two children

Poverty line	Poverty index	Old states 1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	New states 1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	3.51**	-0.08	-3.32**	3.33**	-2.37**	-9.68**	-6.68**
	(95% CI)	(2.44; 4.64)	(-1.40; 1.45)	(-4.81; -2.00)	(1.62; 5.28)	(-4.16; -0.64)	(-14.14; -5.28)	(-11.40; -2.31)
	$\Delta\hat{I}(1)$	0.55**	0.08	-0.40**	0.62**	-0.59**	-2.38**	-0.81
	(95% CI)	(0.35; 0.78)	(-0.21; 0.36)	(-0.71; -0.08)	(0.17; 1.17)	(-1.08; -0.12)	(-3.52; -1.21)	(-1.80; 0.30)
Absolute	$\Delta\hat{I}(0)$	0.31	-1.75**	-3.90**	1.08	-4.31**	-19.73**	-10.82**
	(95% CI)	(-1.20; 1.76)	(-3.29; -0.06)	(-5.65; -2.30)	(-0.81; 3.31)	(-6.23; -2.47)	(-23.84; -14.81)	(-15.92; -6.48)
	$\Delta\hat{I}(1)$	0.35**	-0.11	-0.57**	0.35	-0.97**	-5.09**	-1.89**
	(95% CI)	(0.07; 0.66)	(-0.47; 0.26)	(-0.98; -0.18)	(-0.18; 0.97)	(-1.50; -0.45)	(-6.38; -3.74)	(-2.96; -0.78)

Note and source. See Table B1.

Table B2h. Inter-temporal changes in poverty, couple with three or more children

Poverty line	Poverty index	Old states					New states	
		1983 %1978	1988 %1983	1993 %1988	1998 %1993	2003 %1998	1998 %1993	2003 %1998
Relative	$\Delta\hat{I}(0)$	-0.35	-0.43	-1.76	0.16	-1.90	-27.74**	-9.69
	(95% CI)	(-2.73; 2.26)	(-3.49; 2.69)	(-5.42; 1.55)	(-3.65; 4.17)	(-5.56; 1.33)	(-37.74; -16.14)	(-20.65; 2.16)
	$\Delta\hat{I}(1)$	0.31	0.10	-0.31	0.54	-0.83	-6.44**	-2.38
	(95% CI)	(-0.15; 0.82)	(-0.57; 0.88)	(-1.04; 0.51)	(-0.54; 1.59)	(-1.76; 0.02)	(-9.49; -3.16)	(-4.79; 0.05)
Absolute	$\Delta\hat{I}(0)$	-6.19**	-5.32**	-0.67	-2.93	-5.33**	-36.50**	-17.86**
	(95% CI)	(-9.02; -3.02)	(-8.92; -1.76)	(-4.49; 3.25)	(-6.91; 1.13)	(-8.92; -1.92)	(-46.04; -26.83)	(-28.61; -5.34)
	$\Delta\hat{I}(1)$	-0.84**	-0.35	-0.12	-0.30	-1.35**	-11.30**	-3.86**
	(95% CI)	(-1.44; -0.16)	(-1.19; 0.59)	(-1.08; 0.89)	(-1.51; 0.92)	(-2.38; -0.42)	(-14.60; -7.57)	(-6.36; -1.18)

Note and source. See Table B1.

Table B4a. Logistic regressions, relative poverty line

	1993			1998			2003		
Household head	Old states	Diff. test	New states	Old states	Diff. test	New states	Old states	Diff. test	New states
Female	0.189*	2.533	0.017	0.180**	0.069	0.152	0.199***	1.779	0.350***
	(0.076)		*(0.076)*	*(0.065)*		*(0.083)*	*(0.060)*		*(0.096)*
Married	-0.227	1.005	-0.470**	-0.286*	0.028	-0.250	-0.434***	0.300	-0.320
	(0.171)		*(0.162)*	*(0.137)*		*(0.157)*	*(0.115)*		*(0.170)*
Widowed	-0.834***	14.217***	-1.567***	-0.871***	45.709***	-2.282***	-0.778***	53.310***	-2.702***
	(0.117)		*(0.162)*	*(0.109)*		*(0.174)*	*(0.107)*		*(0.246)*
Divorced	0.270**	4.739**	-0.077	0.065	0.224	0.002	0.051	1.892	0.241*
	(0.102)		*(0.128)*	*(0.082)*		*(0.107)*	*(0.075)*		*(0.118)*
Self-employed	1.240***	0.617	1.031***	1.175***	12.005***	0.280	1.212***	8.465***	0.343
	(0.146)		*(0.209)*	*(0.120)*		*(0.228)*	*(0.113)*		*(0.261)*
Civil servant	-2.285***	4.379**	-1.217***	-1.569***	2.217	-2.313***	-1.354***	0.004	-1.385**
	(0.388)		*(0.344)*	*(0.232)*		*(0.458)*	*(0.227)*		*(0.429)*
Blue-collar worker	0.522***	1.647	0.728***	0.714***	1.596	0.535***	0.877***	0.057	0.839***
	(0.122)		*(0.101)*	*(0.092)*		*(0.103)*	*(0.088)*		*(0.129)*
Unemployed	1.878***	13.608***	0.981***	2.003***	8.922***	1.199***	2.119***	1.348	1.802***
	(0.190)		*(0.151)*	*(0.171)*		*(0.202)*	*(0.157)*		*(0.213)*
Non-working	0.905***	2.025	0.533**	1.201***	1.033	0.903***	1.137***	0.316	1.301***
	(0.182)		*(0.179)*	*(0.172)*		*(0.228)*	*(0.161)*		*(0.233)*
University degree	-0.507**	10.835***	-1.176***	-0.363***	6.875***	-0.780***	-0.358***	24.503***	-1.211***
	(0.156)		*(0.128)*	*(0.109)*		*(0.116)*	*(0.091)*		*(0.144)*
Univ. of applied	-0.491**	0.460	-0.629***	-0.477***	1.155	-0.298**	-0.660***	1.643	-0.881***
sciences degree	*(0.165)*		*(0.120)*	*(0.122)*		*(0.114)*	*(0.106)*		*(0.136)*
In apprenticeship	0.389***	0.700	0.255*	0.507***	3.142*	0.721***	0.244***	2.054	0.416***
	(0.106)		*(0.115)*	*(0.078)*		*(0.093)*	*(0.065)*		*(0.103)*
No degree	1.434***	0.425	1.261***	1.380***	1.485	1.678***	1.231***	0.044	1.173***
	(0.116)		*(0.226)*	*(0.101)*		*(0.223)*	*(0.096)*		*(0.248)*
Age 20-29 years	0.252*	0.243	0.162	0.521***	1.175	0.328*	0.575***	0.216	0.673***
	(0.114)		*(0.134)*	*(0.094)*		*(0.150)*	*(0.098)*		*(0.184)*
Age 40-49 years	-0.365**	11.056***	0.172	-0.333***	8.855***	0.085	-0.214**	3.107*	0.060
	(0.115)		*(0.115)*	*(0.084)*		*(0.109)*	*(0.081)*		*(0.134)*
Age 50-59 years	-0.624***	15.100***	0.136	-0.714***	27.558***	0.224	-0.555***	19.637***	0.280
	(0.129)		*(0.149)*	*(0.104)*		*(0.142)*	*(0.098)*		*(0.164)*
Age 60-69 years	-1.344***	58.466***	0.384*	-1.200***	17.804***	-0.278	-1.160***	17.571***	-0.210
	(0.137)		*(0.179)*	*(0.114)*		*(0.182)*	*(0.108)*		*(0.196)*
Age 70+ years	-1.132***	37.402***	0.364	-1.274***	15.719***	-0.331	-1.209***	4.716**	-0.662**
	(0.138)		*(0.203)*	*(0.121)*		*(0.203)*	*(0.119)*		*(0.226)*
Household level									
Number other	0.062	7.243***	0.625***	0.220	0.689	0.401*	0.043	0.084	0.127
members age 0-4	*(0.137)*		*(0.164)*	*(0.113)*		*(0.166)*	*(0.123)*		*(0.238)*
Number other	0.135	5.250**	0.577***	0.116	0.220	0.213	0.021	1.724	-0.356
members age 5-9	*(0.129)*		*(0.152)*	*(0.107)*		*(0.153)*	*(0.114)*		*(0.239)*
Number other	0.276*	4.513**	0.686***	0.330**	0.004	0.342*	0.040	0.001	0.030
members age 10-14	*(0.127)*		*(0.153)*	*(0.106)*		*(0.149)*	*(0.112)*		*(0.230)*
Number other	0.714***	10.242***	1.265***	0.589***	2.488	0.847***	0.536***	1.544	0.262
members age 15-19	*(0.112)*		*(0.134)*	*(0.090)*		*(0.121)*	*(0.089)*		*(0.176)*
Number other	0.404**	0.446	0.564***	0.408***	0.030	0.442**	0.355***	3.130*	-0.047
members age 20-29	*(0.139)*		*(0.169)*	*(0.117)*		*(0.143)*	*(0.106)*		*(0.180)*
Number other	0.377	2.653	-0.112	-0.015	0.406	-0.191	0.016	1.473	-0.370
members age 30-39	*(0.193)*		*(0.202)*	*(0.160)*		*(0.202)*	*(0.158)*		*(0.245)*
Number other	0.201	3.140*	-0.348	-0.031	0.363	-0.191	-0.004	1.235	-0.321
members age 40-49	*(0.210)*		*(0.203)*	*(0.165)*		*(0.191)*	*(0.152)*		*(0.218)*
Number other	0.190	10.292***	-0.838***	-0.368*	0.134	-0.270	0.018	2.114	-0.408
members age 50-59	*(0.207)*		*(0.217)*	*(0.169)*		*(0.208)*	*(0.148)*		*(0.229)*
Number other	0.168	12.630***	-0.991***	-0.634***	10.632***	-1.580***	-0.345*	19.378***	-1.798***
members age 60-69	*(0.210)*		*(0.227)*	*(0.176)*		*(0.233)*	*(0.156)*		*(0.268)*
Number other	0.387	22.338***	-1.317***	-0.331	6.369**	-1.172***	-0.229	11.094***	-1.509***
members age 70+	*(0.210)*		*(0.261)*	*(0.189)*		*(0.276)*	*(0.174)*		*(0.325)*

Table continues

Table continued

Other childless households	0.177 *(0.169)*	0.062	0.242 *(0.183)*	0.248 *(0.149)*	0.538	0.423* *(0.176)*	0.116 *(0.132)*	0.363	0.265 *(0.197)*
Single adult, childless	0.870*** *(0.172)*	3.639*	0.319 *(0.207)*	0.517*** *(0.157)*	0.348	0.671*** *(0.194)*	0.396** *(0.136)*	0.243	0.264 *(0.207)*
Single parent, 1 child	0.711** *(0.247)*	1.256	0.289 *(0.259)*	0.724*** *(0.204)*	0.000	0.723** *(0.249)*	0.829*** *(0.187)*	0.112	0.705* *(0.288)*
Single parent, 2+ children	0.846* *(0.341)*	2.379	0.029 *(0.382)*	0.298 *(0.285)*	1.250	0.847* *(0.359)*	0.796** *(0.279)*	0.021	0.710 *(0.483)*
Couple, 1 child	0.468* *(0.201)*	0.515	0.253 *(0.210)*	0.258 *(0.166)*	0.607	0.472* *(0.215)*	0.374* *(0.161)*	0.352	0.174 *(0.276)*
Couple, 2 children	0.543 *(0.281)*	0.599	0.218 *(0.315)*	0.087 *(0.229)*	2.394	0.717* *(0.306)*	0.223 *(0.236)*	2.553	1.104* *(0.446)*
Couple, 3+ children	0.678 *(0.416)*	0.392	0.283 *(0.487)*	0.103 *(0.347)*	0.300	0.456 *(0.496)*	0.588 *(0.356)*	1.016	1.409* *(0.677)*
Number of earners: 0	1.707*** *(0.165)*	0.258	1.825*** *(0.160)*	1.288*** *(0.163)*	0.611	1.081*** *(0.203)*	1.215*** *(0.148)*	0.874	0.974*** *(0.201)*
Number of earners: 2	-1.329*** *(0.142)*	1.297	-1.527*** *(0.100)*	-1.186*** *(0.103)*	1.749	-1.385*** *(0.105)*	-1.163*** *(0.099)*	3.328*	-1.488*** *(0.145)*
Number of earners: 3+	-1.814*** *(0.354)*	3.112*	-2.594*** *(0.279)*	-1.732*** *(0.315)*	3.947**	-2.583*** *(0.288)*	-1.148*** *(0.241)*	0.701	-1.515*** *(0.362)*
Constant	-4.727*** *(0.226)*	78.257***	-1.634*** *(0.247)*	-3.889*** *(0.185)*	17.519***	-2.622*** *(0.229)*	-3.381*** *(0.161)*	8.921***	-2.430*** *(0.255)*
$P > \chi^2$	0.000		0.000	0.000		0.000	0.000		0.000
Log likelihood	-4825.69		-3482.05	-6530.97		-3300.58	-6949.18		-2348.49
Pseudo R^2	0.298		0.286	0.291		0.308	0.290		0.378
N	31389			8374	3901		10261	33797	

Note. Dependent variable: dummy poor. N denotes the number of non-weighted observations.
Source. German Sample Survey of Income and Expenditures 1993-2003. Own calculations.

Table B4b. Logistic regressions, absolute poverty line

	1993			1998			2003		
Household head	Old states	Diff. test	New states	Old states	Diff. test	New states	Old states	Diff. test	New states
Female	0.232***	2.529	0.079	0.221***	1.063	0.118	0.199***	1.779	0.350***
	(0.066)		*(0.069)*	*(0.062)*		*(0.077)*	*(0.060)*		*(0.096)*
Married	-0.130	1.862	-0.422**	-0.105	2.741*	-0.432**	-0.434***	0.300	-0.320
	(0.140)		*(0.148)*	*(0.129)*		*(0.144)*	*(0.115)*		*(0.170)*
Widowed	-0.708***	20.477***	-1.544***	-0.877***	52.505***	-2.282***	-0.778***	53.310***	-2.702***
	(0.098)		*(0.163)*	*(0.103)*		*(0.162)*	*(0.107)*		*(0.246)*
Divorced	0.203*	6.805***	-0.196	0.091	1.697	-0.077	0.051	1.892	0.241*
	(0.089)		*(0.129)*	*(0.078)*		*(0.104)*	*(0.075)*		*(0.118)*
Self-employed	1.119***	1.245	0.858***	1.072***	14.669***	0.127	1.212***	8.465***	0.343
	(0.110)		*(0.186)*	*(0.109)*		*(0.216)*	*(0.113)*		*(0.261)*
Civil servant	-1.931***	5.824**	-1.141***	-1.574***	1.856	-2.136***	-1.354***	0.004	-1.385**
	(0.227)		*(0.247)*	*(0.200)*		*(0.366)*	*(0.227)*		*(0.429)*
Blue-collar worker	0.555***	1.972	0.732***	0.700***	2.060	0.515***	0.877***	0.057	0.839***
	(0.087)		*(0.090)*	*(0.082)*		*(0.096)*	*(0.088)*		*(0.129)*
Unemployed	1.719***	7.213***	1.138***	1.964***	8.457***	1.220***	2.119***	1.348	1.802***
	(0.154)		*(0.146)*	*(0.161)*		*(0.193)*	*(0.157)*		*(0.213)*
Non-working	0.740***	0.634	0.563***	1.116***	0.620	0.899***	1.137***	0.316	1.301***
	(0.143)		*(0.165)*	*(0.162)*		*(0.218)*	*(0.161)*		*(0.233)*
University degree	-0.675***	6.932***	-1.121***	-0.377***	10.643***	-0.856***	-0.358***	24.503***	-1.211***
	(0.123)		*(0.115)*	*(0.100)*		*(0.108)*	*(0.091)*		*(0.144)*
Univ. of applied sciences degree	-0.725***	0.223	-0.644***	-0.464***	2.118	-0.243*	-0.660***	1.643	-0.881***
	(0.133)		*(0.111)*	*(0.111)*		*(0.105)*	*(0.106)*		*(0.136)*
In apprenticeship	0.361***	0.429	0.271*	0.526***	4.024**	0.752***	0.244***	2.054	0.416***
	(0.081)		*(0.108)*	*(0.072)*		*(0.087)*	*(0.065)*		*(0.103)*
No degree	1.355***	0.015	1.321***	1.426***	0.617	1.615***	1.231***	0.044	1.173***
	(0.092)		*(0.247)*	*(0.095)*		*(0.220)*	*(0.096)*		*(0.248)*
Age 20-29 years	0.510***	1.695	0.297*	0.543***	1.734	0.318*	0.575***	0.216	0.673***
	(0.095)		*(0.124)*	*(0.089)*		*(0.143)*	*(0.098)*		*(0.184)*
Age 40-49 years	-0.296**	9.555***	0.134	-0.319***	10.739***	0.112	-0.214**	3.107*	0.060
	(0.091)		*(0.104)*	*(0.077)*		*(0.103)*	*(0.081)*		*(0.134)*
Age 50-59 years	-0.605***	27.935***	0.303*	-0.799***	39.003***	0.258	-0.555***	19.637***	0.280
	(0.108)		*(0.134)*	*(0.099)*		*(0.135)*	*(0.098)*		*(0.164)*
Age 60-69 years	-1.203***	59.821***	0.398*	-1.227***	29.736***	-0.085	-1.160***	17.571***	-0.210
	(0.115)		*(0.170)*	*(0.108)*		*(0.175)*	*(0.108)*		*(0.196)*
Age 70+ years	-1.095***	43.298***	0.409*	-1.263***	25.189***	-0.117	-1.209***	4.716**	-0.662**
	(0.118)		*(0.195)*	*(0.114)*		*(0.196)*	*(0.119)*		*(0.226)*
Household level									
Number other members age 0-4	0.113	12.829***	0.828***	0.286**	0.248	0.389*	0.043	0.084	0.127
	(0.107)		*(0.166)*	*(0.103)*		*(0.158)*	*(0.123)*		*(0.238)*
Number other members age 5-9	0.082	10.864***	0.692***	0.215*	0.011	0.194	0.021	1.724	-0.356
	(0.101)		*(0.156)*	*(0.097)*		*(0.147)*	*(0.114)*		*(0.239)*
Number other members age 10-14	0.309**	3.930**	0.671***	0.388***	0.014	0.366*	0.040	0.001	0.030
	(0.100)		*(0.156)*	*(0.096)*		*(0.143)*	*(0.112)*		*(0.230)*
Number other members age 15-19	0.629***	13.582***	1.203***	0.565***	2.233	0.794***	0.536***	1.544	0.262
	(0.089)		*(0.132)*	*(0.082)*		*(0.115)*	*(0.089)*		*(0.176)*
Number other members age 20-29	0.503***	0.012	0.524***	0.388***	0.158	0.317*	0.355***	3.130*	-0.047
	(0.103)		*(0.148)*	*(0.108)*		*(0.133)*	*(0.106)*		*(0.180)*
Number other members age 30-39	0.287*	0.872	0.058	-0.079	2.082	-0.442*	0.016	1.473	-0.370
	(0.146)		*(0.180)*	*(0.146)*		*(0.188)*	*(0.158)*		*(0.245)*
Number other members age 40-49	0.050	0.655	-0.155	-0.040	0.668	-0.238	-0.004	1.235	-0.321
	(0.161)		*(0.179)*	*(0.151)*		*(0.176)*	*(0.152)*		*(0.218)*
Number other members age 50-59	0.280	17.616***	-0.803***	-0.465**	0.324	-0.324	0.018	2.114	-0.408
	(0.159)		*(0.191)*	*(0.158)*		*(0.190)*	*(0.148)*		*(0.229)*
Number other members age 60-69	0.148	17.097***	-0.956***	-0.636***	13.239***	-1.588***	-0.345*	19.378***	-1.798***
	(0.164)		*(0.202)*	*(0.162)*		*(0.211)*	*(0.156)*		*(0.268)*
Number other members age 70+	0.313	22.014***	-1.064***	-0.360*	13.253***	-1.483***	-0.229	11.094***	-1.509***
	(0.166)		*(0.228)*	*(0.174)*		*(0.259)*	*(0.174)*		*(0.325)*

Table continues

Table continued

Other childless households	0.260 *(0.134)*	0.446	0.115 *(0.162)*	0.351* *(0.138)*	1.201	0.591*** *(0.162)*	0.116 *(0.132)*	0.363	0.265 *(0.197)*
Single adult, childless	0.838*** *(0.139)*	6.446**	0.218 *(0.186)*	0.591*** *(0.147)*	0.510	0.419* *(0.180)*	0.396** *(0.136)*	0.243	0.264 *(0.207)*
Single parent, 1 child	1.184*** *(0.202)*	4.808**	0.464 *(0.243)*	0.892*** *(0.191)*	0.525	0.660** *(0.235)*	0.829*** *(0.187)*	0.112	0.705* *(0.288)*
Single parent, 2+ children	1.192*** *(0.280)*	1.589	0.581 *(0.382)*	0.351 *(0.265)*	1.286	0.877* *(0.344)*	0.796** *(0.279)*	0.021	0.710 *(0.483)*
Couple, 1 child	0.581*** *(0.158)*	4.357**	0.045 *(0.197)*	0.226 *(0.152)*	1.745	0.561** *(0.201)*	0.374* *(0.161)*	0.352	0.174 *(0.276)*
Couple, 2 children	0.838*** *(0.220)*	4.910**	-0.007 *(0.312)*	0.095 *(0.209)*	4.012**	0.854** *(0.290)*	0.223 *(0.236)*	2.553	1.104* *(0.446)*
Couple, 3+ children	0.979** *(0.327)*	2.530	0.062 *(0.482)*	0.100 *(0.316)*	1.614	0.867 *(0.468)*	0.588 *(0.356)*	1.016	1.409* *(0.677)*
Number of earners: 0	1.717*** *(0.133)*	0.423	1.850*** *(0.152)*	1.322*** *(0.154)*	1.964	0.971*** *(0.194)*	1.215*** *(0.148)*	0.874	0.974*** *(0.201)*
Number of earners: 2	-1.203*** *(0.097)*	2.064	-1.392*** *(0.089)*	-1.148*** *(0.090)*	1.416	-1.308*** *(0.096)*	-1.163*** *(0.099)*	3.328*	-1.488*** *(0.145)*
Number of earners: 3+	-1.588*** *(0.236)*	5.167**	-2.297*** *(0.217)*	-1.747*** *(0.283)*	3.530*	-2.459*** *(0.250)*	-1.148*** *(0.241)*	0.701	-1.515*** *(0.362)*
Constant	-4.152*** *(0.179)*	116.612***	-0.944*** *(0.223)*	-3.782*** *(0.172)*	35.659***	-2.124*** *(0.212)*	-3.381*** *(0.161)*	8.921***	-2.430*** *(0.255)*
$P > \chi^2$	0.000		0.000	0.000		0.000	0.000		0.000
Log likelihood	-6787.74		-4037.50	-7456.08		-3677.00	-6949.18		-2348.49
Pseudo R^2	0.282		0.283	0.286		0.298	0.290		0.378
N	31389		8374	3901		10261	33797		8596

Note. Dependent variable: dummy poor. N denotes the number of non-weighted observations. *Source*. German Sample Survey of Income and Expenditures 1993-2003. Own calculations.

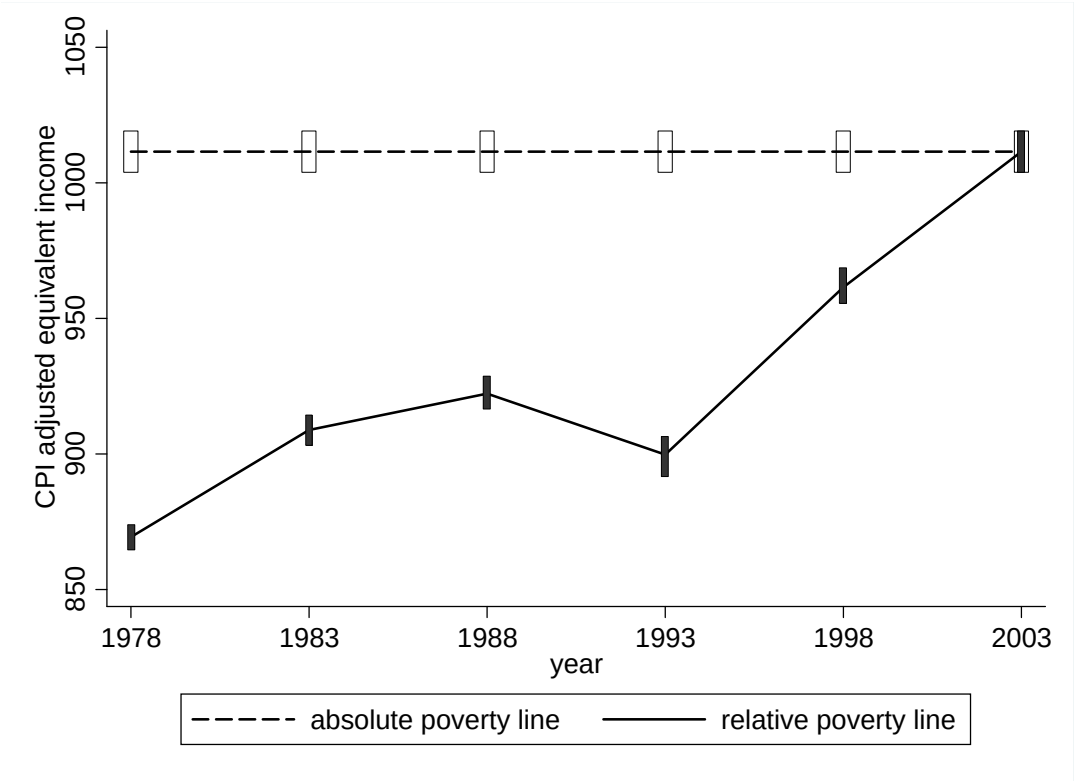
Table B5. Non-linear decomposition of East/West poverty divide

	Relative poverty line			Absolute poverty line		
	1993	1998	2003	1993	1998	2003
Poverty rate, Old states	0.079	0.110	0.113	0.121	0.128	0.113
Poverty rate, New states	0.329	0.237	0.202	0.464	0.276	0.202
Difference	-0.250	-0.127	-0.091	-0.343	-0.148	-0.091
	Characteristics effects by variable groups					
Gender of household head	-0.001*** *-98.33*	-0.004*** *-257.10*	-0.002*** *-175.03*	-0.002*** *-145.38*	-0.005*** *-290.63*	-0.002*** *-176.70*
Marital status of household head	-0.003*** *-191.41*	-0.003*** *-248.24*	-0.004*** *-216.83*	-0.003*** *-194.64*	-0.003*** *-233.09*	-0.004*** *-219.62*
Age cohort household head	-0.004*** *-112.40*	-0.001*** *-39.88*	-0.004*** *-71.33*	-0.005*** *-124.46*	-0.001*** *-43.67*	-0.002*** *-41.20*
Labor force status of household head	-0.015*** *-383.51*	-0.009*** *-228.64*	-0.016*** *-320.01*	-0.014*** *-358.64*	-0.009*** *-234.63*	-0.017*** *-339.07*
Highest educational degree of household head	0.021*** *771.00*	0.013*** *810.41*	0.008*** *536.23*	0.026*** *928.06*	0.013*** *832.96*	0.008*** *539.58*
Household age composition	-0.002*** *-48.60*	-0.001*** *-15.00*	-0.004*** *-84.95*	-0.003*** *-61.32*	-0.001*** *-21.24*	-0.003*** *-76.44*
Family type	0.000*** *8.62*	-0.001*** *-27.65*	0.001*** *18.53*	-0.002*** *-37.41*	-0.001*** *-32.25*	0.001*** *24.99*
Number of earners	0.002*** *38.48*	0.001*** *14.84*	-0.005*** *-78.40*	0.007*** *95.52*	0.003*** *45.68*	-0.006*** *-99.49*
	Aggregate characteristics effects					
Total explained	-0.002	-0.005	-0.026	0.003	-0.005	-0.026
Explained in percent	0.693	4.087	28.579	0	3.233	28.579

Note. Decomposition results are based on 500 replications using randomized ordering of variables. t statistics in italics. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level. *Source*. German Sample Survey of Income and Expenditures 1993-2003.

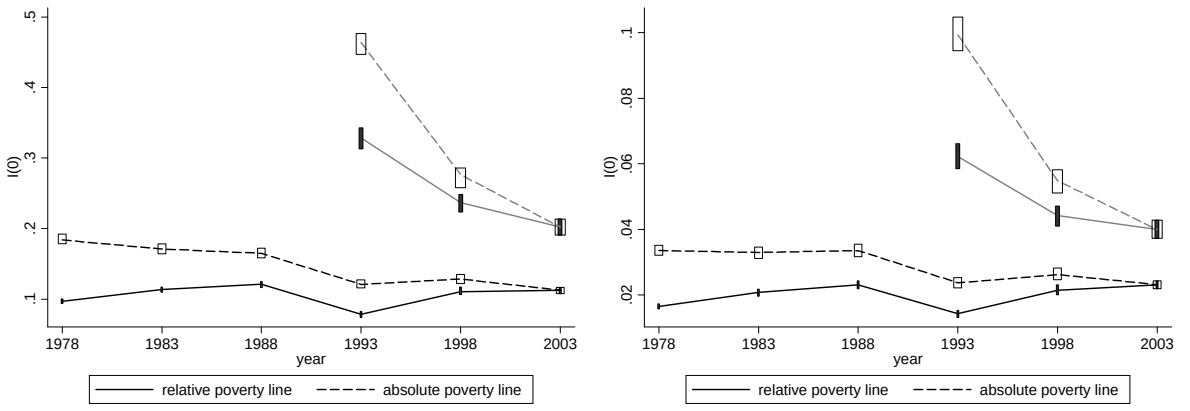
Figures

Figure B1. Income levels associated with poverty lines.



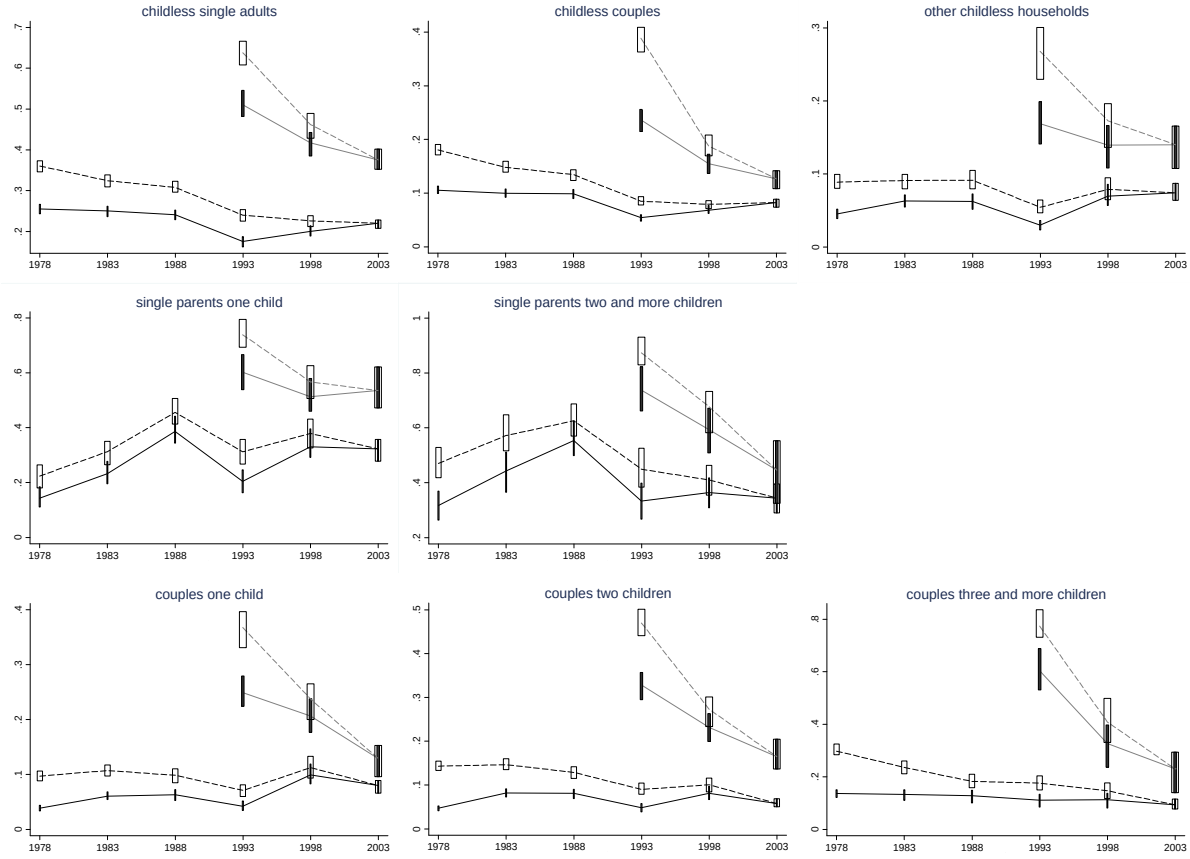
Note. Vertical bars indicate bias-corrected Hall confidence intervals. *Data.* German Sample Survey of Income and Expenditure

Figure B2. Incidence and intensity of poverty in the overall population.



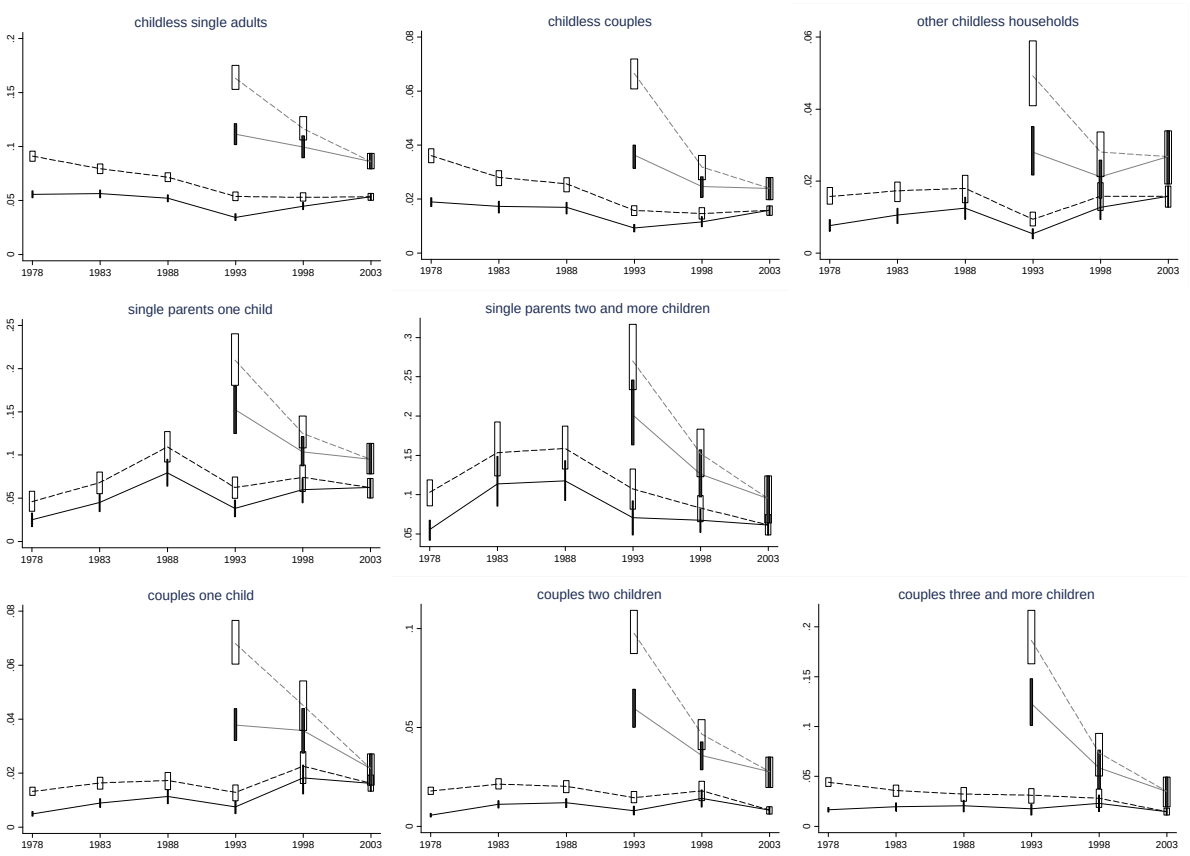
Note. Left figure: head count ratio. Right figure: poverty gap ratio. Vertical bars indicate bias-corrected Hall confidence intervals. *Data.* German Sample Survey of Income and Expenditure.

Figure B3a. Head count ratios by household type.



Note. Vertical bars indicate bias-corrected Hall confidence intervals. Dashed lines refer to absolute poverty line; solid lines refer to relative poverty line. *Data.* German Sample Survey of Income and Expenditure.

Figure B3b. Poverty gap ratios by household type.



Note. Vertical bars indicate bias-corrected Hall confidence intervals. Dashed lines refer to absolute poverty line; solid lines refer to relative poverty line. *Data.* German Sample Survey of Income and Expenditure.

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Cohort Earnings Inequality and Mobility: Evidence from German Social Security Records

1. Introduction

In terms of earnings inequality and mobility, Germany's post war social market economy has often been perceived as an island of bliss. Comparing labor earnings and their evolution between Germany and prototype anglo-saxon market economies like the U.S. or Great Britain, two major findings emerge. First, while the wage structure in the U.S. experienced growing inequality and instability, it remaind "unbearable stable" in Germany (Prasad, 2004). The second finding concerns the level of mobility. While recent studies find strong similarities between Germany's, Great Britain's, and the U.S.'s structure of labor earnings, Germany shows the lowest level for both persistent earnings inequality and earnings instability (Chen, 2009, Daly and Valletta, 2008, Maasoumi and Trede, 2001, Trede 1998). Thus, earnings mobility is higher in Germany. All in all, at first glance Germany's social market economy seems to perform better in terms of inequality prevention and earnings dynamics than her anglo-saxon counterparts.

A closer look at the post war evolution of West German earnings inequality reveals that it is U-shaped and recently increasing, a long-term pattern very similar to the one observed in the U.S. since 1937 (Kopzcuk et al., 2010). Breaking down this pattern, three major phases can be distinguished: a phase of inequality reduction, a phase of stability, and a phase of growth. The first phase begins in the years of the German economic miracle around 1950 and ends in the early 1970s. During this period Germany experienced a slight reduction in inequality (Birkel, 2006). The second phase encompasses the late 1970s to the mid 1990s and is characterized by stable labor earnings distributions (Birkel, 2006, Steiner and Wagner, 1998, Prasad, 2004).[1] The subsequent third phase commences in the mid 1990s. From there on, several studies for reunified Germany find increasing inequality (Bach et al., 2009, Gernandt and Pfeiffer, 2006) which is still ongoing (Fuchs-Schündeln et al., 2010). In sum, empirical findings for Germany and a large body of research on cross sectional income distributions in a number of countries state an increase in earnings inequality over the last three decades (Atkinson, 2008).

From an individual's point of view not only the level of cross sectional inequality, but also the opportunities to better one's economic situation over a lifetime is of interest. For instance, the predominant share of surveyed adults in West Germany, Great Britain and the U.S. and a majority in Japan agreed with the statement "It's fair if people have more money and wealth, but only if there are equal opportunities" (Jencks and Tach, 2006). In earnings distributions opportunities are reflected by the degree earnings mobility. If mobility is high, this might indicate that individuals face more or equal opportunities to move up in the income distribution through own effort or luck. On the contrary, if opportunities are very unequal, own effort is not rewarded with economic advancement and earnings are virtually immobile. Therefore, in the perception of citizens the fairness of society is connected to the degree of mobility and a simple cross sectional picture

[1] However, Dustman et. al. (2009) challenge this view and find growing income disparities in the upper part of the earnings distribution.

of earnings inequality is inadequate in capturing the true degree of inequality faced by individuals during their lifetime. And although a high level of cross sectional inequality might be an indicator for lifetime inequality as it is negatively correlated with social mobility (Andrew and Leigh, 2009), a complete picture of earnings inequality necessitates the inclusion of earnings volatility.

Motivated by the observed rise of cross sectional income inequality, two key strands of literature have emerged: the decomposition of overall earnings volatility into a permanent and transitory component (e.g. Gottschalk and Moffitt, 1994, Cappellari, 2007), and the investigation of intragenerational earnings mobility.[2] Concerning intragenerational mobility and the volatility of earnings in Germany, empirical research has established following key facts: First, recent studies suggest the predominant share of overall income inequality to be permanent. In addition, since the 1990s transitory earnings volatility has gained in size relative to the permanent component (e.g. Biewen, 2005, Myck et al., 2008). Second, the level of overall earnings mobility remained remarkably constant over time, and third, the highest degree of mobility is experienced by young individuals starting their working life career and is decreasing thereafter (e.g. Maasoumi and Trede, 2001, Van Kerm, 2004).

The aim of this study is to complement the aforementioned research along several lines. Deploying longitudinal data obtained from social security administration records, precise information on individual earnings over an extensive period (at best lifetime) dating back to the 1950s can be exploited. As panel mortality and other shortcomings of survey data virtually do not exist, this data enables researchers to provide information on long run trends in cross sectional earnings inequality,[3] as well as earnings volatility and mobility.[4] Considering West German prime age men between 20 and 59, the period under investigation spans from 1967 to 2007. All in all, a comprehensive picture on the long-term evolution of earnings inequality linking cross-sectional inequality to mobility will be drawn. Furthermore, an age cohort approach is chosen where observations are categorized into four age cohorts, mirroring their working life career. The youngest age cohort encompasses individuals at the beginning of their working life career at age 20 to 29. The early mid career stage and the late mid career stage are covert by age cohorts comprised of individuals aged 30 to 39 and 40 to 49 respectively. The oldest cohort considered are the 50 to 59 year old at the end of their working life career. For each cohort, inequality and intragenerational mobility is investigated and patterns over time are identified.

The paper is organized as follows. Section 2 shortly reviews the conceptual framework

[2]For a detailed overview on mobility measures see Fields (2007).

[3]In a recent study Dustman et al. (2009) investigate the West German wage inequality with similar data from 1975 to 2004. However, they focus primarily on the wage structure as well as the composition of the work force to explain trends in cross sectional inequality and do not link their findings to mobility.

[4]To study earnings volatility or mobility, panel data is required, and therefore, empirical studies on the German case are limited. The main data source is provided by the German Socio-Economic Panel (GSOEP) starting in 1984. In addition, some studies on mobility utilize administrative data reaching back further in time but covering only part of the population (Fachinger, 1991, Schmähl, 1983).

linking long and short-term inequality with mobility. Section 3 presents the administrative data and the preparation to ensure time consistency. In section 4 results on earnings inequality and mobility are provided. Section 5 concludes by reviewing the major findings. To complement the findings, an extensive sensitivity analysis is provided in the Appendix.

2. Long-term inequality, short-term inequality and mobility

The implications of mobility in the context of long-term inequality and short-term inequality have been well established (e.g. Creedy, 1992). Intragenerational earnings mobility effects lifetime earnings. Typically, inequality of lifetime earnings will be lower than annual earnings inequality. Therefore, short-term inequality is likely to overestimate the true degree of inequality experienced by individuals over their life cycle.

Consider $i = 1, ..., I$ individuals with earnings $w_{i,t} > 0$ in each period $t = 1, ..., T$, where individual earnings are indexed with nominal average wage growth. Thus, average individual earnings across all T periods are $\bar{w}_i = \frac{1}{T}\sum_{t=1}^{T} w_{i,t}$. Then, an inequality measure M can be calculated from the vector of earnings $\mathbf{w}_t = w_{1,t}, ..., w_{I,t}$ and short-term inequality in t is derived. If M is computed on the vector of average earnings $\bar{\mathbf{w}} = \bar{w}_1, ..., \bar{w}_I$, M evaluates the level of long-term inequality. Shorrocks (1978) shows, that the following condition holds:[5]

$$M(\bar{\mathbf{w}}) \leq \frac{1}{T}\sum_{t=1}^{T} M(\mathbf{w}_t) \tag{1}$$

Equation (1) captures the equalizing effect of mobility in the income distribution: if mobility exits, movements of individual earnings up and down the income ladder will equalize the long-term earnings distribution. The Shorrocks mobility index $S \in [0, 1]$ formalizes this relationship:

$$1 - S = \frac{M(\bar{\mathbf{w}})T}{\sum_{t=1}^{T} M(\mathbf{w}_t)} \tag{2}$$

The interpretation of $1 - S$ is straightforward. If $1 - S = 1$, the relative relations of individual earnings do not change over time and there is no mobility. In addition, the smaller $1 - S$, the more mobile individual earnings are. Appealing to this approach of mobility measurement is the direct linkage of short-term to long-term inequality. However, the Shorrocks mobility index is an indirect measure of mobility.

An alternative method is to measure earnings mobility directly. Direct measures of mobility are based on the individual's positional movement in the income distribution between to points in time, t and $t+p$. They have the advantage of being more transparent and concrete then indirect measures (Fields, 2007). Direct mobility indices include the Spearman rank correlation $\rho \in [-1, 1]$, measuring the concordance of individual ranks

[5] This only holds for inequality measures convex in $\mathbf{w}$ and homogenous of degree zero. These conditions are satisfied for both inequality measures applied in the present work, the Gini and the variance of log earnings.

in two periods t and $t+p$. In the case of $\rho = 1$, individual ranks in t and $t+p$ are perfectly concordant and there is perfect immobility. Further on, the lower ρ, the higher the degree of mobility. Another direct measure are quintile mobility matrices, estimating the probability to observe inter-quintile positional movements between years t to $t+p$. These direct measures are closely related to the Shorrocks mobility index as re-ranking between periods causes the difference in long-term inequality compared to short-term inequality.

Connected to the subject of the relationship between long-term inequality and short-term inequality is the decomposition of overall inequality into a permanent and a transitory component (Gottschalk and Moffitt, 1994). Focussing on the inequality measures applied in the current study, the variance of log earnings is easily decomposed. According to variance of log earnings, overall inequality in period t is defined as:

$$v_t^{all} = var\left(\log(w_{i,t})\right) \tag{3}$$

where the variance is taken across all I individuals. Assume individual earnings averaged over a five-period-window mirror the permanent component of individual earnings. Then, the permanent variance of log earnings is defined as the variance calculated on the average log earnings centered around reference period t across all individuals:

$$v_t^{perm} = var\left(\frac{\sum_{s=t-2}^{t+2}\log(w_{i,s})}{5}\right) \tag{4}$$

The transitory component in the variance of earnings is calculated as the deviation between overall variance and permanent variance. For the transitory variance of log earnings in period t one has:

$$v_t^{trans} = var\left(\log(w_{i,t}) - \frac{\sum_{s=t-2}^{t+2}\log(w_{i,s})}{5}\right) \tag{5}$$

Even though linking permanent and transitory variance to the Shorrocks mobility index or the direct mobility measures is not as straightforward (Kopczuk et al., 2010), the implications are clear. If the transitory (permanent) component is high, mobility measures should indicate a high (low) degree of mobility. However, a change in permanent or transitory variance does not necessarily translate into a change in mobility (Gottschalk and Moffitt, 2009).

3. Data

We deploy administrative data collected for Germany to calculate individual claims to the pay-as-you-go pension system. The pension system is of the Bismarckian variety, i.e. based on the equivalence principle and for each employee a complete history of earnings is covered. Besides information on earnings, some socio-economic variables are available.

Since the data collection process is an official administrative task, typical shortcomings of survey datado not occur and and the predominant share of the working population is covered.[6] Panel mortality may occur on account of administrative reasons. Still, for the overwhelming part of the population earnings biographies are gapless. However, the single purpose of the data is to record all relevant information to calculate individual insurance claims. Therefore, very few details of the household or family situation are provided. This restricts the data to research rather on the individual than on the household level.

The analysis is based on an excerpt of this administrative data, namely the *Insurance Account Sample (Versicherungskontenstichprobe)*. Initially, the Insurance Account Sample was prepared for internal use and to support governmental tasks only. The population of this stratified random sample are all individuals that: (1) live in Germany; (2) have at least one entry in their individual insurance record; and (3) are aged between 15 and 67 in the reference year. Data collecting is designed as a panel and the first reference year assembled is 1983.[7] For reference years 2005, 2006 and 2007 the Insurance Account Sample is provided as scientific-use-file for research purposes by the Data Research Center (*Forschungsdatenzentrum*) at the German Federal Pension Insurance (*Deutsche Rentenversicherung Bund*).

Each scientific-use-file is based on about 25 % of the observations originally contained in the Insurance Account Sample. Furthermore, due to the validation process of insurance records only individuals which are at least 30 in the respective reference year are included.[8] Altogether, the scientific-use-files are comprised of 59,475 records in 2005, 60,304 records in 2006, and 60,821 records in 2007. Our research task draws mainly on the unique information on individual earnings biographies. On a monthly basis the history of employment, unemployment, type of pension insurance, periods of sickness et cetera are accounted for. The record covers the biography from the year the insured reaches age 14 until the year he turns 66. In sum, detailed information for up to 624 months is available. To enable the largest possible coverage of birth cohorts, data from the three reference years is merged. Information on birth cohorts 1938 to 1946 is picked from reference year 2005, reference year 2006 provides birth cohort 1947 and birth cohorts 1948 to 1977 are taken from reference year 2007.

Albeit the data is of high quality, some limitations remain. First, administrative data is always subject to changes in laws and regulations. Before putting the data to use, possible inconsistencies have to be corrected (Dustman et al., 2009). Second, as in many social security systems, earnings as assessment basis are only considered up to a contribution ceiling. Hence, earnings are top coded. In order to investigate earnings inequality, assumptions concerning earnings above the contribution ceiling have to be made. In the following subsection those issues are discussed in detail.

[6] Limitations of survey data may include interviewer bias,panel mortality, and non response or recollection errors of self reported items.

[7] A detailed data documentation is provided in Deutsche Rentenversicherung Bund (2008).

[8] Accordingly, reference year 2005 contains birth cohorts 1938 to 1975, reference year 2006 contains birth cohorts 1939 to 1976 and reference year 2007 contains birth cohorts 1940 to 1977.

3.1. Time Consistency Issues

The contribution assessment basis according to German social security legislation changed over time.[9] More precisely, in order to ensure a consistent time series of earnings, three major obstacles have to be tackled: (1) starting in year 2003 new regulations regarding the insurable earnings from low income employment (*minijobs*) are in place; (2) the basis of assessment was extended to one-time payments in 1984; (3) the (relative) contribution assessment ceiling in relation to average insured income changed over time.

The obstacle mentioned first affects the lower part of the income distribution. As many inequality measures are sensitive to this part in particular, a time consistent trimming of the earnings distributions bottom is indispensable (Kopzcuk et al., 2010). The introduced regulation exempts low employment incomes from social insurance contributions if they do not exceed the monthly threshold of 400 Euro.[10] The result is an effective bottom coding of the annual earnings distribution at a nominal value of 4,800 Euro from 2003 onwards. To ensure time consistency, this threshold is indexed by average nominal wage growth for years preceding and succeeding 2003. From there, annual employment earnings below this threshold are not considered and regarded as "missing" in the present study.[11]

The second obstacle is the structural break in 1984. As Steiner and Wagner (1998) point out, the inclusion of one-time payments in the basis of assessment after 1984 leads to an artificial increase in inequality compared to observations dating 1983 and before. Therefore, the data has to be corrected. Facing the same problem for comparable data, Fitzenberger (1999) suggests to meet this structural break by estimating quantile specific deviations from the median growth rate between 1983 and 1984.[12]

Then, imputation of one-time payments for observations before 1984 is accomplished in four steps. (1) Construction of 20 quantiles from the distribution of annual earnings in 1984. (2) Estimation of quantile specific earnings growth rates between 1983 and 1984 by ordinary linear regression. (3) Assuming growth up to the median not to be spurious, excessive growth due to the structural break for the quantiles above the median is identified. Now, the excessive growth factor is calculated as difference between estimated quantile specific growth and median growth. (4) Depending on their positions in the 1984 income distribution, individual earnings are corrected by the quantile specific excessive growth factor for years predating 1984.[13]

[9] The German social security scheme splits contributions between employer and employee. Throughout this study, the sum of all contributions levied on gross income are considered. Furthermore, employer's contributions are apportioned to employee's gross earnings to yield comprehensive remuneration.

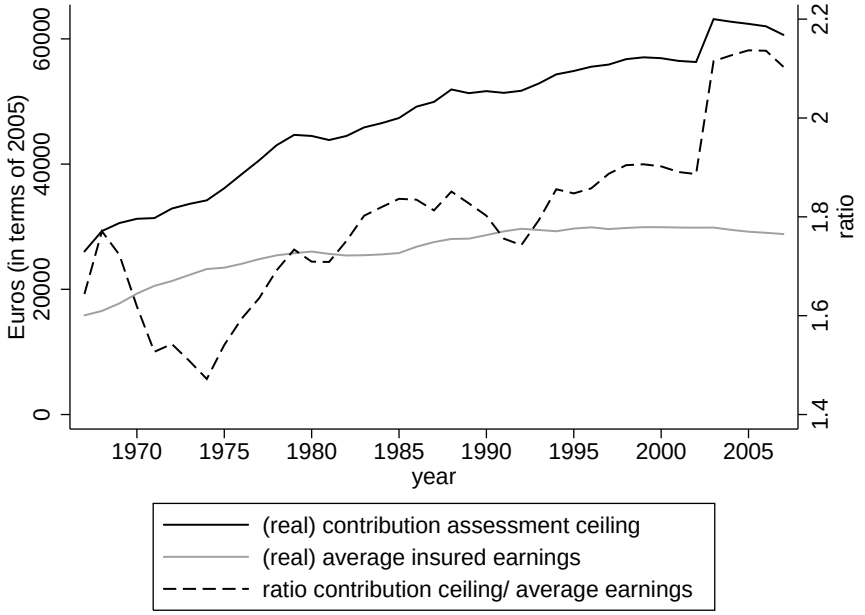
[10] For minor employment all social security contributions and taxes are paid as a flat rate contribution by the employer an cannot be matched to an employee. For a detailed description of the German tax benefit system see Bönke and Eichfelder (2010).

[11] The trimming is based on hypothetical annual incomes. If less than twelve month are accounted for, average monthly earnings are used to predict annual earnings under the assumption of a constant twelve month employment at average earnings. Likewise is the procedure when imputing right censored observations.

[12] Fitzenbergers (1999) study is based on the *IAB Beschäftigtenstichprobe*, also obtained from social security administration data.

[13] A more detailed description can be found in Fitzenberger (1999), pp. 224 - 225.

Figure 1: Evolution of the Contribution Ceiling from 1967 to 2007



Source: Appendices 1 and 2 of Social Code VI (*Sozialgesetzbuch VI*), own calculations; see Table A.1 in the Appendix for raw numbers.

The last obstacle is the variation of the contribution ceiling over time and the resulting differences in top coding of the annual earnings distribution. Moreover, as depicted in Figure 1 the ceiling was fundamentally altered in real terms over the period from 1967 to 2007. Looking at the ratio of the contribution ceiling to average insured income (dashed line) reveals wide fluctuations. Over the period under consideration the ratio ranges from a minimum of about 1.5 in 1974 to a maximum of 2.15 in 2005. These fluctuations have an immediate effect on the reported earnings of the insured. For instance, in year 1992 almost 9.5 % out of West Germany's insured male population had earnings at or above the contribution ceiling; by contrast, in 2003 only 6.95 % of the same underlying population were affected (Bönke, 2010). To ensure time consistency and to enable the inclusion of the earnings distributions upper tail in the analysis, top coded incomes are imputed.[14]

The imputation of incomes for top coded observation assumes the upper tail of the income distribution to follow a Pareto-distribution. Several studies investigating income distributions in various countries indicate that the assumption of a Pareto-distributed upper tail of income distributions is a good approximation. For example, Piketty and Saez (2003) utilize a Pareto-based imputation method to study inequality in U.S. tax data. Kopczuk et al. (2010) base their analysis on data obtained from U.S. social security records which are top coded as well. They employ the parameters of the Pareto-distribution estimated by Piketty and Saez (2003) to impute earnings income for right

[14] Another way to implement time consistency is to enforce a minimal cut off procedure by capping the equal real contribution ceiling on all annual earnings distribution. Here, the 1974 contribution ceiling is adopted and all earnings exceeding this ceiling a capped. The disadvantage of this procedure is the information loss in the earnings distribution's top. Nevertheless, the minimal cut of procedure is important to verify robustness and respective results are reported in the Appendix.

censored observations. Atkinson (2008) studies the earnings inequality in OECD countries and also finds the upper tail of earnings distributions to be Pareto-distributed.[15]

Assume individual earnings w_i exceeding $\tilde{w}$ are Pareto-distributed. Then, the probability to observe an income greater or equal to $w_i > \tilde{w}$ is given by

$$1 - F(w_i) = \left(\frac{w_i}{\tilde{w}}\right)^{-\alpha}, \tag{6}$$

where $F(w_i)$ denotes the cumulative probability density function. Consider n to be the number of earners with $w_i > \tilde{w}$ and $i = 1, ..., n$. Furthermore, earners i are ranked in ascending order according to their income. From equation (6) each individual's rank r_i in the income distribution is determined as

$$r_i = nF(w_i) = n\left(1 - \left(\frac{w_i}{\tilde{w}}\right)^{-\alpha}\right). \tag{7}$$

In top coded data individual earnings are only correctly accounted for up to the contribution ceiling z. If an individual earns an amount greater or equal to the contribution ceiling z, reported earning is $w_i = z$. Consider m out of the n earners to receive an income above the contribution ceiling $z > \tilde{w}$. Since for m earners neither r_i nor w_i is observable, we need to estimate the parameters of the Pareto-distribution based on the interval $[\tilde{w}, z)$. Rearranging equation (7) yields

$$\ln\left(1 - \frac{r_i}{n}\right) = -\alpha \ln\left(\frac{w_i}{\tilde{w}}\right). \tag{8}$$

Equation (8) allows for a given $\tilde{w}$ to estimate the Pareto-coefficient $\hat{\alpha}$. The estimation procedure is implemented as follows. First, we suppose at least the top 10% of individual earnings w_i in the interval $[0, z)$ to be Pareto-distributed. Accordingly, $\tilde{w}$ is assigned the value of the 90^{th} percentile in the respective distribution of earnings below z. Second, the Pareto-coefficient is estimated by means of OLS regression without constant. The regression is conducted separately for all years t and birth cohorts c. Hence, the cohort and year specific Pareto-coefficient $\hat{\alpha}_{c,t}$ is derived for $c = 1938, ..., 1977$ and $t = 1967, ..., 2007$ distributions.[16]

With the estimated Pareto-coefficient at hand, unobserved earnings above the contribution ceiling z can be estimated by rearranging (7):

$$\hat{w}_i = \tilde{w}\left(1 - \frac{\hat{r}_i}{n}\right)^{-\frac{1}{\hat{\alpha}}}, \tag{9}$$

where $\hat{w}_i$ denotes the estimated earned income and $\hat{r}_i$ the assumed rank. The conjectures regarding $\hat{r}_i$ have an immediate affect on measures of income mobility and, therefore, are crucial when investigating earnings dynamics. We choose $\hat{r}_i$ under the minimal mobility

[15] Next to these studies, many more work with the assumption that high incomes follow a Pareto-distribution. Examples are Dell (2005) for Germany and Switzerland, as well Altzinger (2008) for Austria.

[16] Summary statistics of regression results for $\hat{\alpha}_{c,t}$ are provided in Table A.2 and Table A.3 for selected birth cohorts in the Appendix.

assumption. Thereby, the rank $\hat{r}_i$ is based on the last observable rank in relation to all individuals at or above the contribution ceiling in the birth cohort specific earnings distribution.[17] This imputation procedure leads to plausible annual earnings distributions: Comparing the obtained annual earnings distributions upper tail to (almost) uncapped survey based micro data reveals a good fit (see Bönke, 2009). However, to test for robustness all results are also derived for unaltered earnings and reported in the Appendix.

3.2. Sample Selection

The sample selected is comprised of the prime age males between 20 and 59 always resident in West Germany. Although the public pay-as-you-go pension insurance scheme was expanded to East Germany after reunification, earnings predating reunification are hardly comparable and are excluded due to the long-term nature of the analysis. Earnings are defined as annual earnings from employment subject to social security contributions. Therefore, neither self employed nor civil servants are considered. In addition, earnings below the indexed minijob threshold are excluded.

Table 1: Number of observation

Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	
Cohort 20 - 29	3,814	3,853	3,892	3,902	3,870	3,864	4,047	4,067	4,043	4,136	
Year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	
Cohort 20 - 29	4,225	4,280	4,364	4,376	4,447	4,498	4,324	4,393	4,487	4,576	
Cohort 30 - 39	3,793	3,837	3,856	3,903	3,943	3,984	3,919	3,972	4,014	4,098	
Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	
Cohort 20 - 29	4,604	4,719	4,848	4,888	4,856	4,982	4,933	4,888	4,855	4,925	
Cohort 30 - 39	4,178	4,203	4,291	4,367	4,509	4,756	4,823	4,934	5,021	5,074	
Cohort 40 - 49	3,589	3,609	3,633	3,692	3,724	3,881	3,953	3,978	4,019	4,089	
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cohort 20 - 29	5,162										
Cohort 30 - 39	5,149	5,219	5,398	5,474	5,424	5,407	5,358	5,289	5,299	5,274	5,325
Cohort 40 - 49	4,155	4,186	4,292	4,356	4,451	4,548	4,627	4,701	4,838	4,879	4,872
Cohort 50 - 59	3,372	3,362	3,405	3,436	3,464	3,496	3,569	3,558	3,617	3,668	3,690

Table 1 displays the numbers of observations with a non missing or zero data set entry for annual earnings by age cohorts. To construct time consistent cohorts as required by

[17] For illustration consider two earnings distributions in subsequent periods $t-1$ and t made out of three individuals a, b and c. Suppose the following ordering of earnings in $t-1$: $w_{a,t-1} < w_{b,t-1} < z_{t-1} < w_{c,t-1}$ and resulting ranks $r_{a,t-1} = 1$, $r_{b,t-1} = 2$ and the estimated rank $\hat{r}_{c,t-1} = 3$ since c's earnings exceed z_{t-1}. In t individual a has earnings above the contribution ceiling such that $w_{b,t} < z_t$ and $w_{a,t}, w_{c,t} > z_t$ where it is not observable whether a or c earns more. Then, the ranking order in t is $r_{b,t} = 1$, $\hat{r}_{a,t} = 2$ and $\hat{r}_{c,t} = 3$ because of $\hat{r}_{c,t-1} > r_{a,t-1}$. Thus, the relative ordering of a and c remains unchanged for future years unless either a's or c's earnings fall below the contribution ceiling. To establish whether mobility results are robust, two alternative mobility scenarios are calculated: a random ordering and a maximum mobility scenario. In the maximum mobility scenario, the ranking order is reversed between years t and $t+1$. Results from the two alternative mobility scenarios can be obtained from the author upon request and reveal robustness with respect to the mobility assumption.

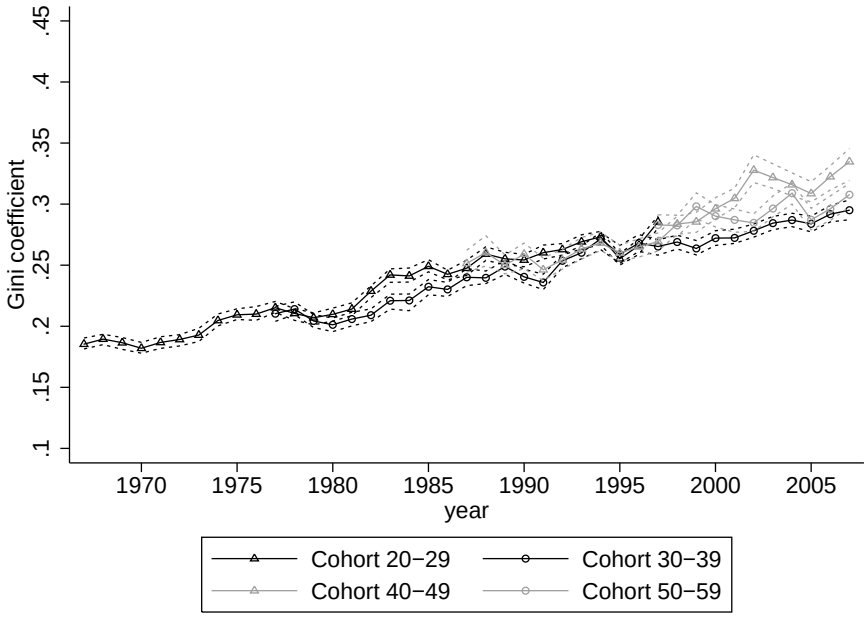
the mobility analysis (Atkinson et al., 1988), observations for all ten years covered by a cohort must be available. Consequently, the first year under consideration is 1967 for the youngest cohort. In 1967 the first observations for 29 year old born in 1938 are available. Moreover, because the last birth year accounted for is 1977, the youngest cohort ceases in 1997.

4. Results

All presented results refer to imputed earnings. In order to asses robustness, all results are disclosed for two additional income concepts (unchanged and minimal cut off) in the Appendix. This section first focusses on the evolution of annual earnings inequality. Afterwards, findings on earnings mobility and volatility are presented. The section concludes with a glimpse on long-term mobility.

4.1. Annual Earnings Inequality

Figure 2: Annual Gini coefficients



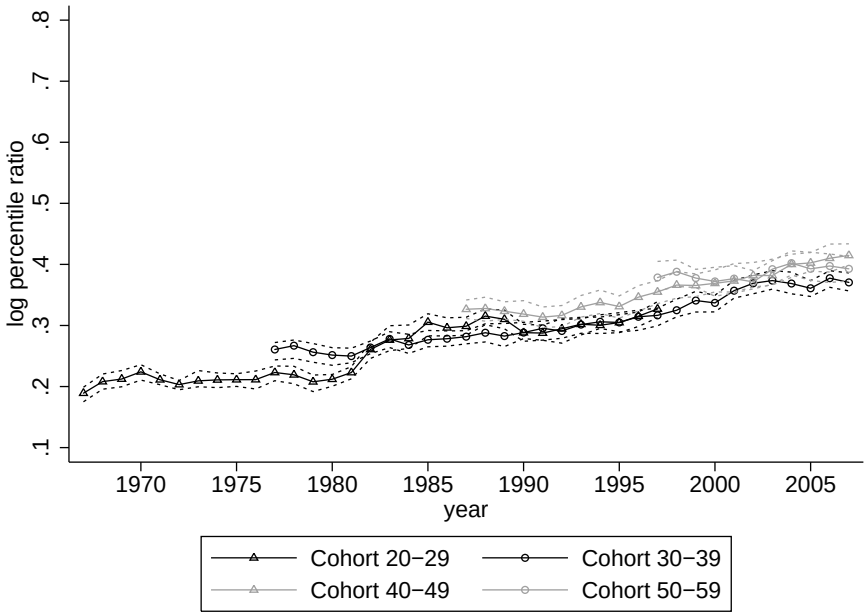
Note: The figure displays the Gini coefficient for cross section t. Dashed lines depict the Hall's confidence interval at the 95% level.

Figure 2 displays the evolution of Gini coefficients based on annual earnings for the four age cohorts at different stages of their professional live. The dashed lines display the according bias corrected Hall's confidence intervals at 5%-level around the point estimates of the respective Gini coefficient.[18]

[18]The Hall's confidence interval is based on bootstrap estimates. From the distribution of bootstrap estimates the lower 2.5-percentile and the upper 97.5-percentile are calculated and the bias corrected confidence intervals at a 5% level are obtained. See Bönke et al. (2010) for a detailed description and Biewen (2002) for the bootstrap method in context with inequality measures and balanced panel data.

The annual Gini coefficient series for the age cohort 20 to 29 is displayed by black triangles. Available information on annual inequality ranges from 1967 to 1997. Over these 30 years, an increase in inequality as measured by the Gini coefficient occurs. First, the Gini coefficient remains stable at a level around 0.18 from 1967 to 1973. The next ten years are marked by a steep rise of 7 percentage points. From 1983 to the end of the series in 1997 the increase is somewhat slower, reaching 0.28 to the end 1997. Altogether, inequality among working life career starters has increased by roughly 50% in 30 years. While all cohorts experience a rise in inequality over the period under investigation, comparing the cohorts reveals different levels in Gini coefficients. The lowest earnings inequality is found for the early mid career stage from age 30 to 39. The highest inequality is found amongst the earnings in the early and late career stages. This U-shaped pattern is common and fits into previous research (e.g. Fuchs-Schündeln et al., 2010). In sum, all cohorts experience a substantial surge in inequality.

Figure 3: P80/P50 percentile log earnings ratio



Note: The figure displays the $\log(P80/P50)$ ratio for cross section t. Dashed lines depict the Hall's confidence interval at the 95% level.

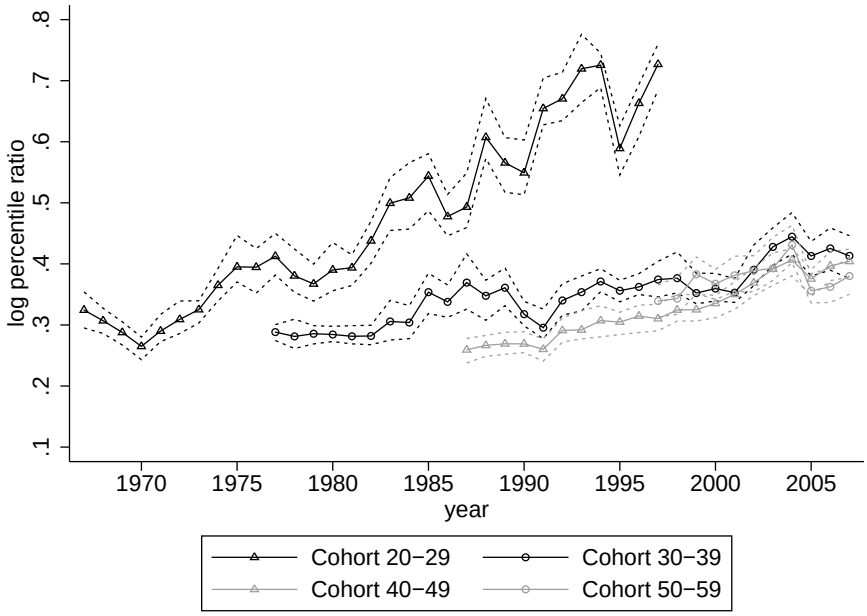
Complementing the picture of cross sectional inequality, we now turn to where in the income distribution the evolution depicted in Figure 2 originates. Starting at the top of the income distribution, Figure 3 displays the log annual earnings ratio of the 80^{th} percentile to the 50^{th} percentile, P80/P50.[19] The P80/P50 measures inequality in the upper half of the income distribution.

As Figure 3 reveals, dispersion is growing in the upper half of the income distribution. For all cohorts a steady increase is revealed, a finding similar to Dustman et al. (2009).

[19] In order to avoid sensitivity to the imputation procedure, the P80/P50 is depicted rather then the more common choice P90. See Kopczuk et al. (2010). Results for unaltered earnings are provided in Figure A.2.

Lowest P80/P50 values are observed for the youngest age cohort. As the P80/P50 is increasing in cohort age, inequality in the upper half of the income distribution becomes more pronounced in later career stages. Obviously, the modest increase of inequality in the upper part of the income distribution cannot explain the overall trend in inequality as depicted in Figure 2 for the youngest cohort. The opposite is true in case of the three older cohorts. Here, the observed pattern in overall inequality partially resurfaces. However, the P80/P50 cannot explain the overall evolution in cohort specific Gini coefficients.[20]

Figure 4: P50/P20 percentile log earnings ratio



Note: The figure displays the $\log(P50/P20)$ ratio for cross section t. Dashed lines depict the Hall's confidence interval at the 95% level.

As measure of inequality in the lower part of the distribution serves the log earnings ratio between the 50^{th} and the 20^{th} percentile as depicted in Figure 4. For the youngest cohort the P50/P20 reveals the origin of the dramatic increase in inequality. In contrast to the development in the upper half of the earnings distribution, between 1967 and 1997 the 20 to 29 year old experience a threefold increase in P50/P20 levels. The development in the other cohorts gives an alternate picture. For the three older cohorts, P50/P20 levels and trends are very similar in magnitude to P80/P20 findings with values between 0.25 and 0.40.[21] The gap between the youngest and the three older age cohorts is attributed to a set of labor market developments. Dustman et al. (2009) identify a decline in unionization and a shift in demand from low-skilled to high-skilled labor accompanied by an increase of low-skilled labor supply due to German unification. While these developments affect wage differentials between the low- and the high-skilled in all cohorts, the impact is most

[20]This interpretation assumes that the cohort specific patterns also hold up controlling for period and cohort effects.

[21]Dynan et al. (2007) document similar findings for the U.S. as they find a widening of income dispersion, particularly at the bottom of the income hierarchy.

pronounced in youngest age cohort as unionization is lowest and the share of low-skilled workers is the highest.[22]

Table 2: Annual earnings inequality

Year	Gini	Variance of log earnings	Log percentile earnings ratios		Earnings percentiles lower boundaries			Average earnings
			P80/P50	P50/P20	P80	P50	P20	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cohort 20 to 29								
1967	0.185	0.207	0.189	0.324	21,261	17,597	12,721	17,126
1977	0.215	0.286	0.223	0.413	32,903	26,326	17,427	25,516
1987	0.248	0.335	0.299	0.493	35,915	26,639	16,269	26,595
1997	0.285	0.489	0.327	0.727	36,582	26,377	12,751	25,839
Cohort 30 to 39								
1977	0.210	0.241	0.261	0.288	43,644	33,628	25,204	34,606
1987	0.240	0.287	0.282	0.369	49,124	37,064	25,617	38,254
1997	0.265	0.364	0.317	0.374	53,651	39,092	26,885	41,871
2007	0.295	0.402	0.371	0.413	56,070	38,708	25,609	42,904
Cohort 40 to 49								
1987	0.251	0.266	0.327	0.259	55,871	40,305	31,100	45,111
1997	0.269	0.317	0.355	0.310	60,028	42,094	30,861	47,318
2007	0.335	0.406	0.415	0.404	67,563	44,624	29,790	53,544
Cohort 50 to 59								
1997	0.283	0.206	0.379	0.339	60,596	41,499	29,561	47,554
2007	0.308	0.350	0.393	0.380	64,035	43,235	29,565	50,205

Having established where in the income distribution the rise in inequality originates, it is interesting to know, why the ratios have developed as observed. Table 2 summarizes some statistics for selected years by cohorts. Columns 6 to 8 give the lower boundaries of the 20^{th}, 50^{th} and 80^{th} percentile in real terms (in Euro to the base of 2005). Strikingly, the evolution for the three percentiles follow three different trends. First, the P80 boundary is increasing for each year and cohort, indicating real income growth. Second, the P50 boundary remains virtually stable in real terms for cohort 20 to 29 with the only exception from year 1967 to 1977, while all other cohorts realize a very modest income growth. Third, the dominant pattern of the P20 boundary is a decreasing trend in case of the youngest cohort and virtually stable for all others.

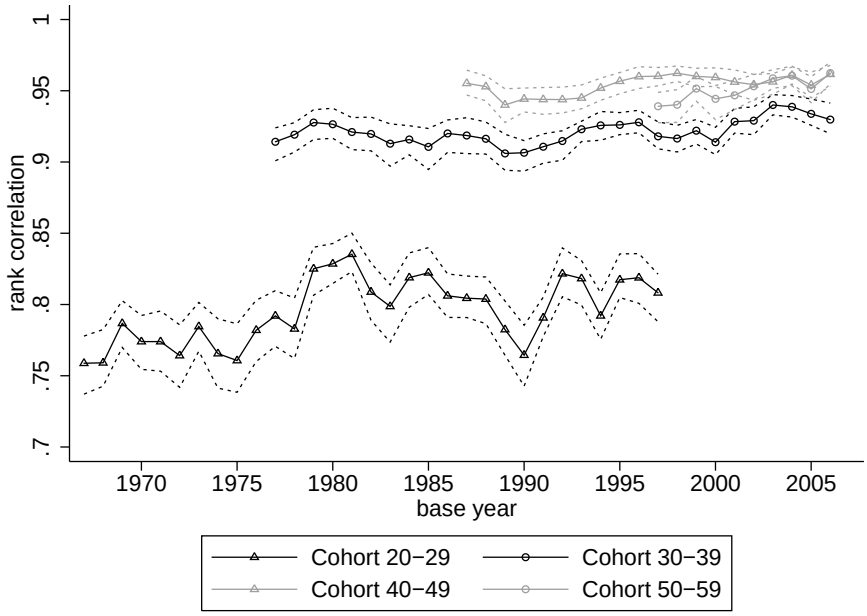
In sum, earnings inequality has seen a substantial increase over the period under investigation. In case of the youngest cohort, this increase is almost solely due to the widening of incomes in the lower part of the earnings distribution where earnings inequality in the upper half of the income distribution only plays a minor role. Moreover, the income dispersion is growing for all cohorts. While the earnings in the upper part of the distribution realizes real growth, the bottom experiences zero or even negative growth.

[22] These results are less pronounced but hold if the 20 to 25 year old are excluded from the youngest age cohort.

4.2. Earnings mobility and volatility

Having drawn a picture of earnings inequality evolution, the aim of this section is to investigate the dynamics of earnings. If the surge of inequality is accompanied by increasing mobility, cross sectional inequality is not a good indicator for lifetime inequality. In this line of argument, the rising cross sectional inequality is a sign of a more dynamic labor market. In this dynamic labor market, opportunities might become more equally distributed and earnings inequality is temporary, evening out cross sectional inequality over the life cycle.

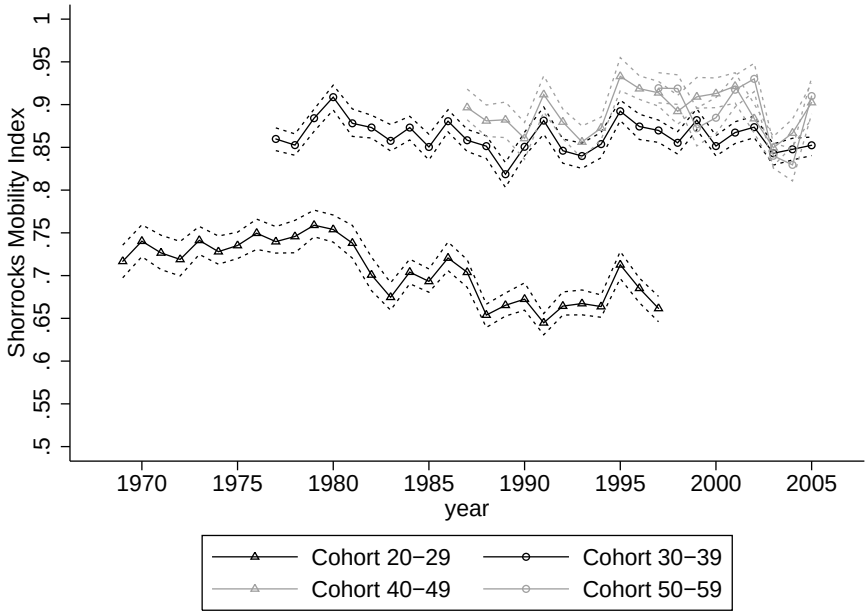
Figure 5: Short-term mobility: Rank Correlation



Note: The figure displays the Spearman rank correlation ρ of earnings in base year t compared to $t+1$. The rank correlation is estimated on individuals with positive earnings in both years. Dashed lines depict Hall's confidence interval at the 95% level.

Figure 5 shows the Spearman rank correlation for earnings after one year. The lowest rank correlation is estimated for the youngest cohort, starting at a level of about 0.75 and modestly rising up to around 0.81 in 1997. However, taking confidence intervals at the 95%-level into consideration this slight reduction in mobility is insignificant. Immobility for the three older cohorts is significantly higher and remarkably stable over time. While the rank correlation of the 30 to 39 year old is about 0.9, the two oldest cohorts experience the highest levels of immobility with a rank correlation around 0.95. Mobility as measured by the Spearman rank correlation is falling in age. Almost the same insight is given by the Shorrocks index as displayed in Figure 6.

Figure 6: Short-term mobility: Shorrocks



Note: The figure displays Shorrocks mobility index $1-S$ in year t defined as one minus the ratio of the 5 year earnings (from $t-2$ to $t+2$) Gini coefficient to the annual Gini coefficient. Dashed lines depict Hall's confidence interval at the 95% level.

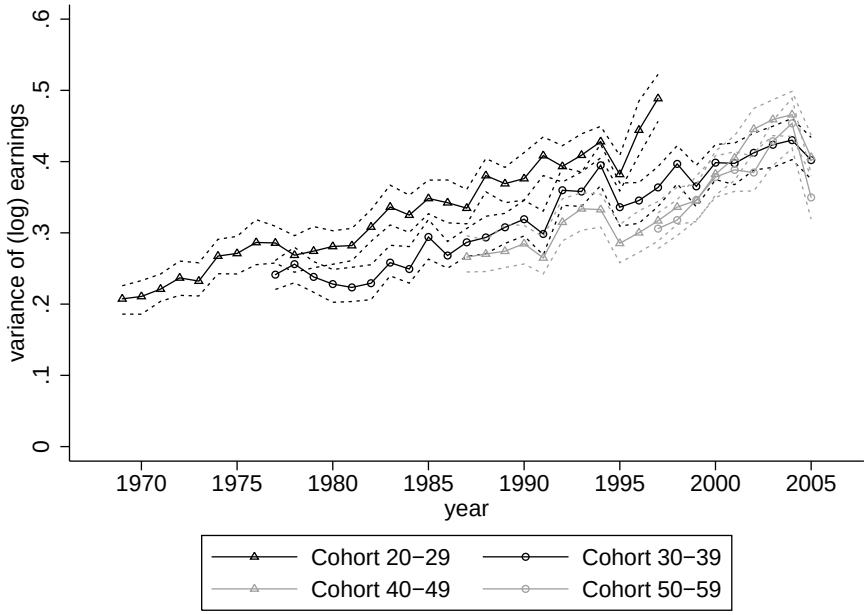
The picture is conclusive: The longer individuals take part in the labor market, the less mobile is their position within their age cohort. This mirrors the employee's choices when entering the job market after completing apprenticeship or tertiary education. Even if they have the same level of education, employees in their early career stage can realize steeper earnings pathes when they are mobile and change jobs. Furthermore, this window of opportunity closes with higher levels of experience on the job and changes become more costly in terms of earnings for later movers (for Germany see Boughas and Georgellis, 2004). What is remarkable is the stability. Despite the surge in inequality and the changes in labor market legislation, within cohort mobility remains almost unchanged.[23] Hence, the conjecture of a more dynamic labor market does not hold.

While cross sectional inequality has been on the rise, the short-term mobility has been stable. This leads to the presumption that the observed surge in inequality is permanent and not transitory. Figure 7 displays the total variance of annual log earnings by cohorts. The variance of year t is calculated based on all individuals in the respective cohort with strictly positive earnings in years $t-2, ..., t+2$. Analogously to Figure 2, an increase in overall variance within each cohort is found over the period under investigation.[24] In contrast to inequality findings based on the Gini coefficient, measured inequality is strictly decreasing in age.

[23] Bonhomme and Robin (2009) observe a similar situation in France for 1992 - 2002. They find mobility of employees to be less than the whole population. The Shorrocks mobility index (five years) is close to 0.9 over the period under investigation.

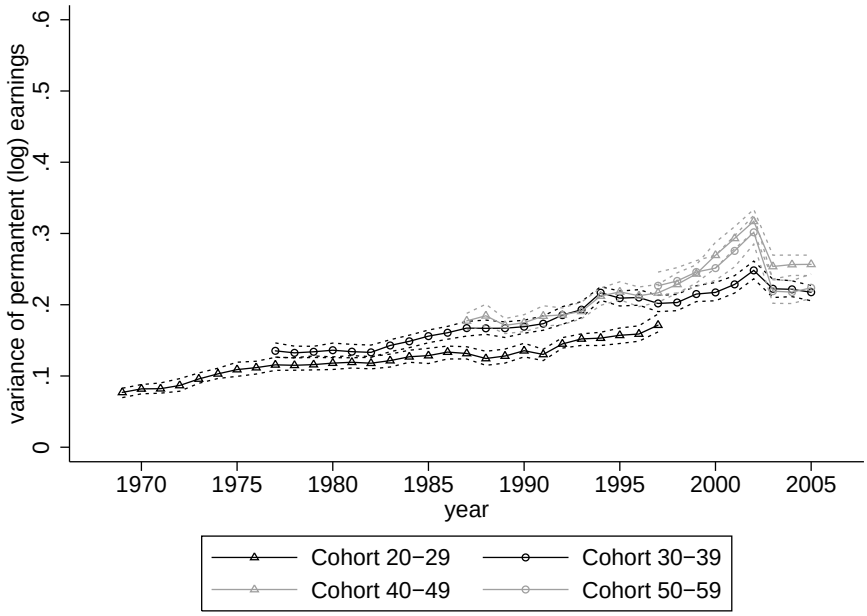
[24] A comparable development concerning the increase in labor earnings volatility is observed in the U.S. and documented inter alia by Dynan et al. (2007) or Moffitt and Gottschalk (2009).

Figure 7: Variance of log earnings



Note: The figure displays total variance of log earnings. Total variance in year t is estimated based on individuals with positive earnings in years $t-2$ to $t+2$. Dashed lines depict Hall's confidence interval at the 95% level.

Figure 8: Variance of permanent log earnings



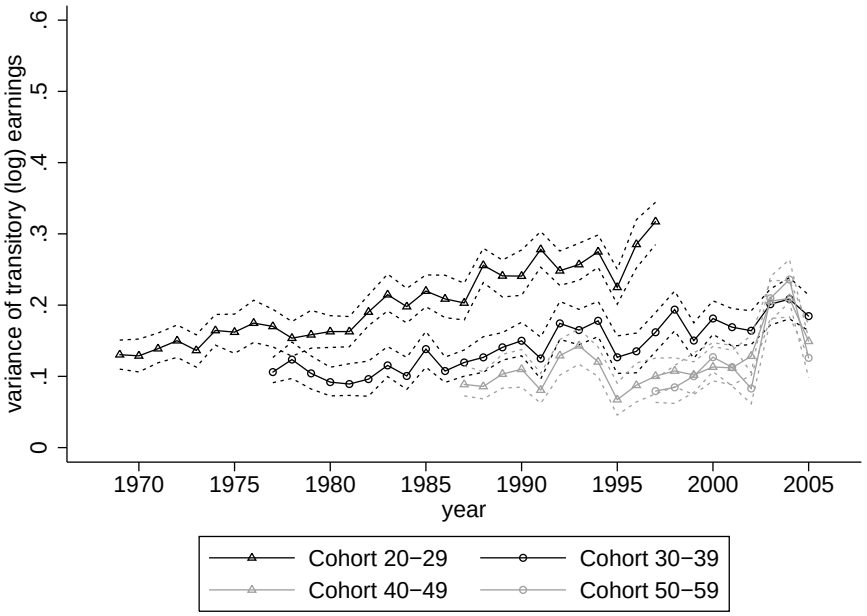
Note: The figure displays permanent variance of log earnings. Permanent variance in year t is estimated based on the individual 5 year average log earnings including years $t-2$ to $t+2$. Dashed lines depict the Hall's confidence interval at the 95% level.

In Figure 8 the permanent inequality of log earnings by cohorts is displayed. The permanent variance of log earnings is defined as the variance across individual 5 year average of annual log earnings centered around reference year t according to Equation (4). Again, an increasing trend is observed. However, contrasting the case of overall variance,

the pattern across age cohorts is opposite. Here, the lowest level of permanent inequality is experienced by the youngest age cohort, and rising over time from 0.1 to around 0.15 over the period under investigation. In addition, permanent inequality rises in age and is most pronounced in the oldest cohort.

Of interest is the peak in permanent inequality in year 2002 and the subsequent reduction: In 2003, new legislation concerning minijobs is introduced (see Section 3) with the incentive for employers to shift remuneration formerly above a certain threshold to a lower level. As a result, an artificial reduction of low income receivers at the bottom of the distribution occurs. The findings on permanent inequality are consistent with the mobility pattern. Analogously to the findings on short-term mobility, permanent inequality is highest for the oldest age cohorts. However, the mobility findings are contrasted in one way. While mobility remains stable over time, permanent inequality is increasing for all age cohorts.

Figure 9: Variance of transitory log earnings



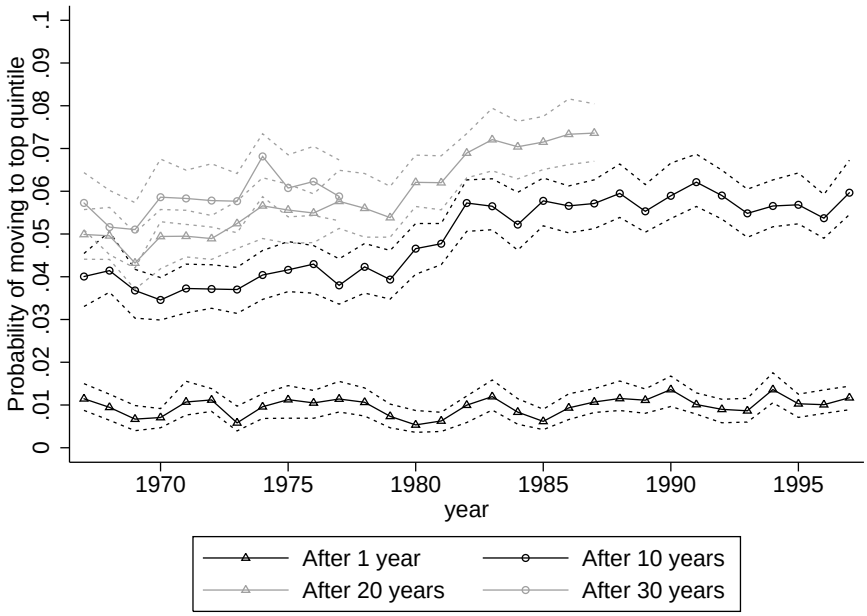
Note: The figure displays the transitory variance of log earnings. Transitory variance is calculated as difference of total to permanent variance in year t. Dashed lines depict the Hall's confidence interval at the 95 % level.

The deviation between total variance and permanent variance gives the transitory component of overall variance as calculated from Equation (5). The transitory variance depicted in Figure 9 confirms the findings on short-term mobility, which is highest for the youngest cohort. While transitory variance for the three oldest cohorts differs nearly not significantly and remains almost stable over time, the youngest cohort experiences an increase by 18 percentage points from 0.12 in 1969 to 0.30 in 1997. Like it is the case for the permanent variance, this surge does not translate into a higher degree of mobility and therefore, is a sign for growing economic insecurity. The overall pattern in age of decreasing transitory and increasing permanent variance is common in industrialized

countries (e.g. Bonhomme and Robin, 2009, for France, Gottschalk and Moffitt, 1994, for the U.S.).

With these results at hand, we can establish the link between mobility and inequality. While inequality as measured by the Gini has surged for all age cohorts over the period under investigation, short-term mobility has remained unchanged. Neither the rank correlation nor the Shorrocks Index suggest any significant trend in short-term mobility. Therefore, an equalizing effect of earnings mobility exists but it has not increased over time and, consequently, long-term inequality is on the rise. Decomposing inequality in permanent and transitory variance of log earnings reveals, that indeed the surge in inequality is permanent. To complement our findings, the empirical analysis concludes with a glimpse at long-term mobility. Due to sample design and long-term nature, this analysis is restricted to the youngest age cohort. Looking at this cohort we try to asses, whether young individuals starting their career experience a similar environment in terms of (long-term) upward and downward mobility in 1997 as their counterparts did up to 30 year earlier or whether opportunities have changed.

Figure 10: Upward mobility

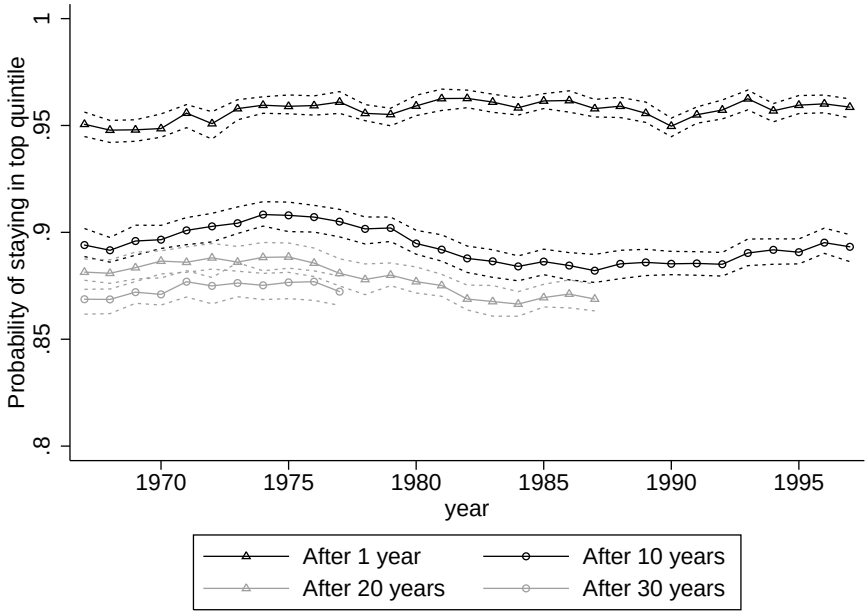


Note: The figure displays the probability at the starting career stage (cohort 20 - 29) to move from the two bottom quintiles to the top quintile between base year t and $t+p$. Dashed lines depict Hall's confidence interval at the 95 % level.

The evolution of upward mobility for employees at the beginning of their working life career is presented in Figure 10. Upward mobility is defined as the probability of moving from the bottom two quintiles of the cohort specific earnings distribution to the top quintile and is a measure of opportunity. The series marked by solid black triangles depicts this upward mobility between base year t and $t+1$. Not surprisingly, with approximately 1% the chances to jump from the bottom to the top of the distribution within a year are rather slim. However, as theoretically expected (Aktinson et al., 1988) chances of

upward mobility increase with probabilities between 4% (ten years) and 7% (thirty years) if the time horizon is expanded. In addition, young employees who have started their working life career more recently experienced slightly better opportunities as slopes for ten-, twenty- and thirty-year upward mobility measures modestly increase over time.[25]

Figure 11: Downward mobility



Note: The figure displays the probability of staying in the top quintile between base year t and $t + p$ for individuals at the starting career stage (cohort 20 - 29). Dashed lines depict Hall's confidence interval at the 95 % level.

Figure 11 explores the downward mobility for individuals starting their working life career. Thereby, downward mobility is defined as the probability of staying in the top quintile of the earnings distribution between base year t and $t+p$. Consequently, downward mobility is measured as persistence. Of course, the probability of remaining in the top quintile is decreasing if the period of investigation is expanded. Whereas the year to year probability is at a constant 95%, it reduces to 90% (87%) if a ten year (thirty year) period is considered.

In sum, up- and downward mobility show a great level of persistence. Over the life cycle, chances for an individual starting the working life career at the bottom of the earnings distribution to reach the top quintile are 7% at best. Furthermore, employees beginning their career at the top of the earnings distribution are very likely to remain there. In connection with our previous findings we can state that the overall situation of individuals at the earnings distribution's bottom has worsened as permanent inequality is on the rise, the dispersion of earnings getting more pronounced at the bottom in particular, and chances to climb to the top when starting out at the bottom are very slim.

[25] These results are robust to a variation of the age cohorts composition, e.g. exclusion of the 20 to 25 year old.

5. Conclusion

This paper has deployed longitudinal data on individual earnings biographies obtained from social security administration records. Though typical shortcomings of survey data do not apply, before putting the data to use some issues had to be solved carefully. After processing the data, an analysis of the long-term evolution of cross sectional earnings inequality and mobility of prime age West German males for the period 1967 to 2007 was conducted. Furthermore, an age cohort approach was chosen and the population was categorized into four age cohorts, mirroring their working life career. The youngest age cohort encompassed individuals at the beginning of their working life career at age 20 to 29. The early mid career stage and the late mid career stage were covered by age cohorts comprised of individuals aged 30 to 39 and 40 to 49 respectively. The oldest cohort considered were the 50 to 59 year old at the end of their working life career.

The original data was adjusted in many ways to fit the research purposes and, in particular, high incomes were imputed. This aroused the question whether the imputation is likely to drive results. Consequently, results obtained from unaltered incomes were provided and it could be established that results are robust with respect to imputation. Furthermore, the necessary ranking of censored observations relied on the "minimal mobility assumption". To establish whether the mobility analysis was sensitive to this assumption, alternative ranking scenario were calculated: a maximal mobility scenario and a random ordering of censored observations. Again, the results of the mobility analysis turned out to be robust with respect to the ordering method applied. However, results were sensitive to the minimal cut off procedure.

We find that earnings inequality as measured by the Gini and the variation of log earnings has surged for all cohorts over time. Thereby, we observe an a U-shaped inequality pattern in age, with inequality highest among young and old age cohorts. In addition, we can state growing income dispersion, in particular at the earnings distributions' bottom and most pronounced for the youngest cohort. Decomposing inequality into permanent and transitory variance of log earnings reveals the growth in inequality to be permanent.

Despite the trends in inequality, we do not find evidence in favor of a more dynamic labor market. Showing the expected patterns across age cohorts, all direct and indirect intragenerational mobility measures remained fairly stable over time. Linking cross sectional inequality to mobility, expectations on long-term inequality can be derived. With unchanged short-term earnings mobility, nearly non existing mobility over the life cycle, and the permanent component of overall inequality on the rise, trends in cross-sectional inequality will translate into a more pronounced long-term inequality and, ultimately, inequality of lifetime earnings.

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A. Appendix

Table A.1: Determinants of the German social security scheme 1967 - 2007

Year	Average	Pension		Health care		Unemployment		long-term care	CPI
	earnings[a]	ceiling	rate	ceiling	rate[b]	ceiling [c]	rate	rate[d]	(base 2005)
1967	10,219	16,800	7.00	10,800	5.05	10,650	0.65	.	32.97
1968	10,842	19,200	7.50	10,800	5.10	15,600	0.65	.	33.49
1969	11,839	20,400	8.00	11,250	5.25	18,000	0.65	.	34.10
1970	13,343	21,600	8.50	14,400	4.10	21,600	0.65	.	35.32
1971	14,931	22,800	8.50	17,100	4.10	22,800	0.65	.	37.15
1972	16,335	25,200	8.50	18,900	4.20	25,200	0.85	.	39.16
1973	18,295	27,600	9.00	20,700	4.60	27,600	0.85	.	41.95
1974	20,381	30,000	9.00	22,500	4.70	30,000	0.85	.	44.83
1975	21,808	33,600	9.00	25,200	5.20	33,600	1.00	.	47.53
1976	23,335	37,200	9.00	27,900	5.60	37,200	1.50	.	49.54
1977	24,945	40,800	9.00	30,600	5.70	40,800	1.50	.	51.37
1978	26,242	44,400	9.00	33,300	5.70	44,400	1.50	.	52.76
1979	27,685	48,000	9.00	36,000	5.60	48,000	1.50	.	54.94
1980	29,485	50,400	9.00	37,800	5.70	50,400	1.50	.	57.91
1981	30,900	52,800	9.25	39,600	5.90	52,800	1.50	.	61.57
1982	32,198	56,400	9.00	42,300	6.00	56,400	2.00	.	64.80
1983	33,293	60,000	9.08	45,000	5.90	60,000	2.30	.	66.89
1984	34,292	62,400	9.25	46,800	5.70	62,400	2.30	.	68.55
1985	35,286	64,800	9.45	48,600	5.90	64,800	2.15	.	69.95
1986	36,627	67,200	9.60	50,400	6.10	67,200	2.00	.	69.86
1987	37,726	68,400	9.35	51,300	6.30	68,400	2.15	.	70.03
1988	38,896	72,000	9.35	54,000	6.50	72,000	2.15	.	70.90
1989	40,063	73,200	9.35	54,900	6.50	73,200	2.15	.	72.91
1990	41,946	75,600	9.35	56,700	6.30	75,600	2.15	.	74.83
1991	44,421	78,000	8.98	58,500	6.10	78,000	3.09	.	77.62
1992	46,820	81,600	8.85	61,200	6.40	81,600	3.15	.	80.67
1993	48,178	86,400	8.75	64,800	6.70	86,400	3.25	.	83.55
1994	49,142	91,200	9.60	68,400	6.60	91,200	3.25	.	85.82
1995	50,665	93,600	9.30	70,200	6.60	93,600	3.25	0.50	87.21
1996	51,678	96,000	9.60	72,000	6.70	96,000	3.25	0.85	88.35
1997	52,143	98,400	10.15	73,800	6.80	98,400	3.25	0.85	90.00
1998	52,925	100,800	10.15	75,600	6.80	100,800	3.25	0.85	90.79
1999	53,507	102,000	9.85	76,500	6.80	102,000	3.25	0.85	91.40
2000	54,256	103,200	9.65	77,400	6.80	103,200	3.25	0.85	92.70
2001	55,216	104,400	9.55	78,300	6.80	104,400	3.25	0.85	94.50
2002	28,626	54,000	9.55	40,500	7.00	54,000	3.25	0.85	95.90
2003	28,938	61,200	9.75	41,400	7.20	61,200	3.25	0.85	96.90
2004	29,060	61,800	9.75	41,856	7.20	61,800	3.25	0.85	98.50
2005	29,202	62,400	9.75	42,300	7.10	62,400	3.25	1.10	100.00
2006	29,494	63,000	9.75	42,756	6.70	63,000	3.25	1.10	101.60
2007	29,951	63,000	9.95	42,756	7.00	63,000	2.10	1.10	103.90

Sources: Appendices 1 and 2 of Social Code VI, Federal Ministry of Labour and Social Affairs, Federal Statistical Office. *Notes:* Average earnings and contribution ceilings denoted in current prices and currency (1967 - 2001 in DM, 2002 - 2007 in Euro), reported rates are employer's contribution rates. [a] Subject to social security contributions. [b] Average contribution rate. [c] Pension insurance and unemployment insurance contribution ceilings coincide from 1970 onwards. [d] long-term care insurance and pension insurance contribution ceilings coincide.

Table A.2: Pareto-parameter regression results, birth cohorts 1940 and 1950

Year	Birth cohort 1940				Birth cohort 1950			
	$\hat{\alpha}_{1940,t}$	SE	R^2	N	$\hat{\alpha}_{1950,t}$	SE	R^2	N
1967	10.465	0.227	0.983	35	.	.	.	.
1968	10.448	0.601	0.940	36	.	.	.	.
1969	12.219	0.323	0.986	36	.	.	.	.
1970	10.976	0.221	0.988	35	11.134	0.328	0.986	37
1971	13.061	0.241	0.992	33	12.172	0.416	0.980	37
1972	10.583	0.190	0.989	32	11.619	0.684	0.956	36
1973	8.655	0.329	0.970	31	10.654	0.770	0.918	39
1974	6.389	0.275	0.958	31	13.331	0.355	0.990	39
1975	6.885	0.169	0.985	31	10.530	0.190	0.991	38
1976	6.374	0.108	0.994	31	9.933	0.169	0.991	38
1977	7.642	0.192	0.982	30	9.545	0.138	0.996	38
1978	8.726	0.130	0.994	32	10.084	0.277	0.983	40
1979	7.346	0.201	0.983	32	8.977	0.187	0.988	41
1980	7.072	0.230	0.975	31	8.737	0.124	0.994	41
1981	7.570	0.121	0.992	31	8.571	0.163	0.989	40
1982	5.482	0.227	0.960	31	7.848	0.062	0.998	40
1983	5.035	0.108	0.991	29	7.264	0.174	0.986	38
1984	3.986	0.077	0.991	27	5.078	0.055	0.997	36
1985	4.126	0.040	0.997	27	4.127	0.072	0.993	36
1986	4.493	0.116	0.981	27	4.352	0.095	0.982	34
1987	5.718	0.080	0.995	27	4.728	0.102	0.993	33
1988	5.740	0.163	0.988	27	3.997	0.054	0.995	33
1989	4.620	0.083	0.993	27	4.143	0.070	0.992	33
1990	6.288	0.170	0.984	26	4.065	0.070	0.993	33
1991	4.896	0.098	0.993	25	4.169	0.059	0.996	32
1992	3.086	0.040	0.997	26	4.419	0.039	0.996	32
1993	3.241	0.093	0.987	26	3.514	0.057	0.994	33
1994	3.771	0.108	0.980	26	3.294	0.043	0.994	33
1995	4.093	0.138	0.972	25	2.897	0.043	0.995	32
1996	4.417	0.135	0.975	25	3.085	0.041	0.996	33
1997	3.919	0.074	0.992	25	2.891	0.053	0.992	33
1998	4.328	0.080	0.991	25	2.719	0.048	0.987	32
1999	2.821	0.053	0.993	23	2.741	0.038	0.994	32
2000	.	.	.	.	2.762	0.066	0.988	30
2001	.	.	.	.	2.905	0.037	0.997	29
2002	.	.	.	.	3.843	0.045	0.997	29
2003	.	.	.	.	3.625	0.118	0.967	31
2004	.	.	.	.	3.815	0.069	0.990	31
2005	.	.	.	.	3.740	0.078	0.992	28
2006	.	.	.	.	5.093	0.087	0.989	27
2007	.	.	.	.	2.919	0.077	0.976	26

Notes: OLS estimates for Pareto-parameter $\hat{\alpha}_{c,t}$ for cohort $c = 1940, 1950$ and $t =$ year based on observed earnings in $[\tilde{w}_{c,t}, z_t)$. N is the number of observation in the interval $[\tilde{w}_{c,t}, z_t)$.

Table A.3: Pareto-parameter regression results, birth cohorts 1960 and 1970

Year	Birth cohort 1960				Birth cohort 1970			
	$\hat{\alpha}_{1960,t}$	SE	R^2	N	$\hat{\alpha}_{1970,t}$	SE	R^2	N
1980	10.125	0.408	0.979	42	.	.	.	.
1981	9.588	0.495	0.965	44	.	.	.	.
1982	10.721	0.362	0.978	41	.	.	.	.
1983	11.512	0.565	0.972	36	.	.	.	.
1984	10.959	0.261	0.990	37	.	.	.	.
1985	10.931	0.315	0.979	37	.	.	.	.
1986	7.805	0.116	0.996	38	.	.	.	.
1987	7.831	0.133	0.995	39	.	.	.	.
1988	7.307	0.150	0.992	42	.	.	.	.
1989	5.116	0.146	0.979	42	.	.	.	.
1990	5.760	0.114	0.989	41	9.508	0.408	0.973	45
1991	3.584	0.124	0.963	41	9.598	0.320	0.981	49
1992	3.515	0.136	0.947	41	12.148	0.460	0.981	48
1993	3.415	0.088	0.983	41	11.174	0.432	0.977	46
1994	3.972	0.088	0.988	41	9.600	0.373	0.985	46
1995	4.551	0.096	0.986	40	9.035	0.357	0.980	47
1996	3.807	0.067	0.990	40	9.508	0.227	0.989	48
1997	3.251	0.034	0.996	38	9.035	0.210	0.988	52
1998	3.031	0.068	0.987	39	6.623	0.170	0.979	53
1999	3.545	0.047	0.994	38	7.625	0.155	0.989	55
2000	2.006	0.037	0.985	36	5.876	0.058	0.994	53
2001	2.360	0.038	0.992	36	4.538	0.044	0.996	51
2002	1.943	0.049	0.978	36	4.952	0.063	0.989	50
2003	2.113	0.051	0.984	37	4.477	0.070	0.988	51
2004	3.261	0.063	0.989	37	4.329	0.035	0.997	49
2005	3.181	0.065	0.985	33	3.213	0.049	0.994	47
2006	1.757	0.056	0.969	33	3.281	0.034	0.996	46
2007	1.564	0.056	0.967	32	2.952	0.035	0.994	44

Notes: OLS estimates for Pareto-parameter $\hat{\alpha}_{c,t}$ for cohort $c = 1960, 1970$ and $t =$ year based on observed earnings in $[\tilde{w}_{c,t}, z_t)$. N is the number of observation in the interval $[\tilde{w}_{c,t}, z_t)$.

Figure A.1: Annual Gini coefficient

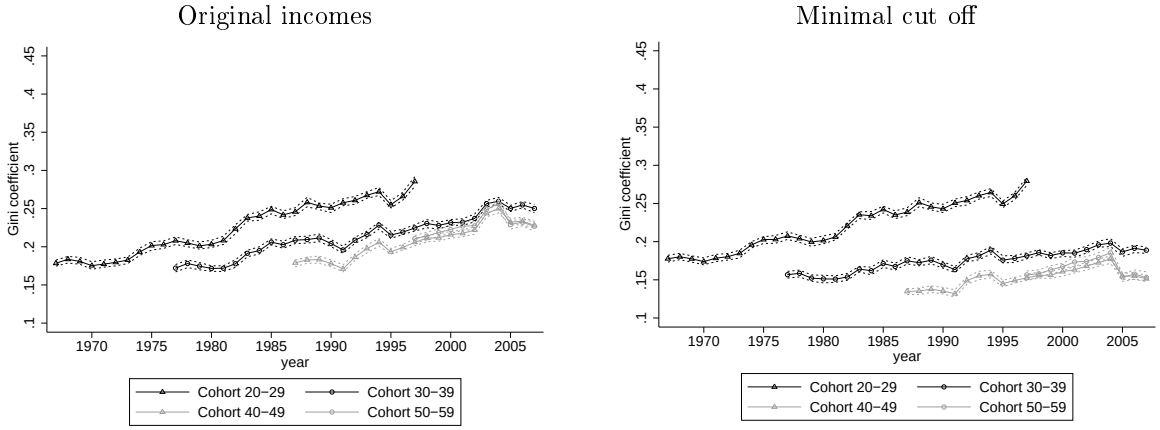
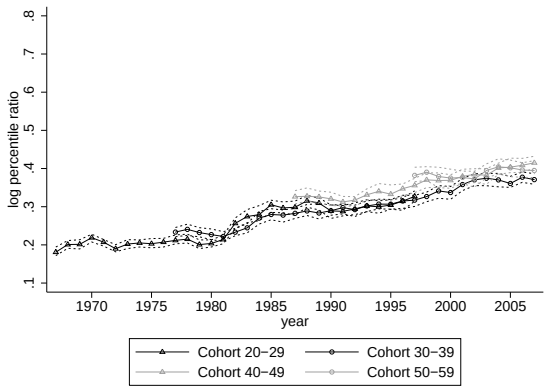


Figure A.2: Percentile log earnings ratios: P80/P50

Original incomes



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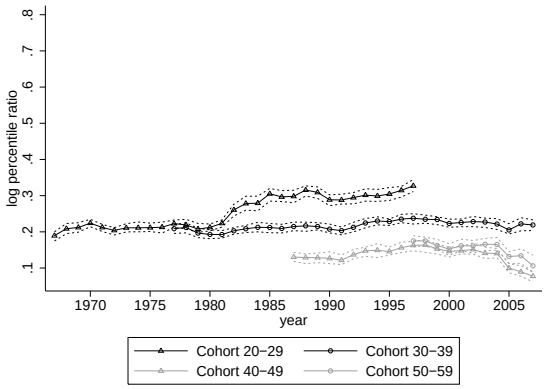
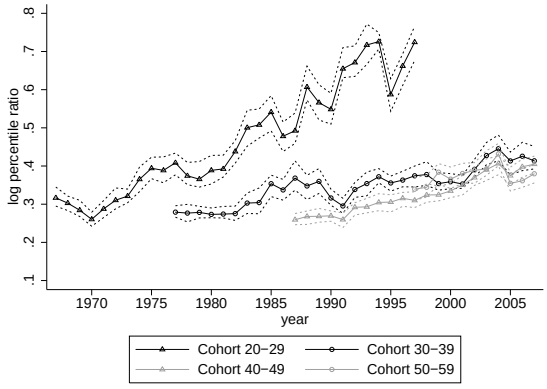


Figure A.3: Percentile log earnings ratios: P50/P20

Original incomes



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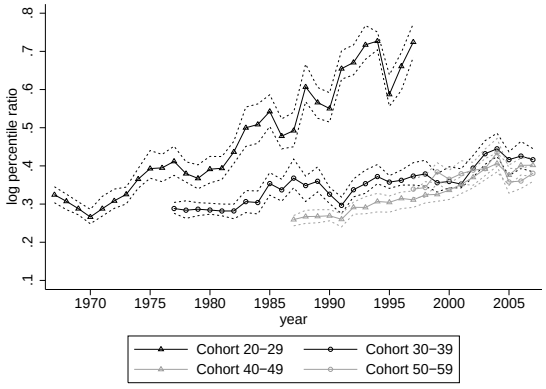
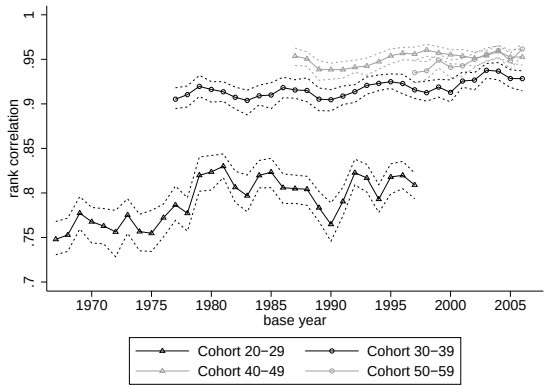


Figure A.4: Rank correlation after on year

Original incomes



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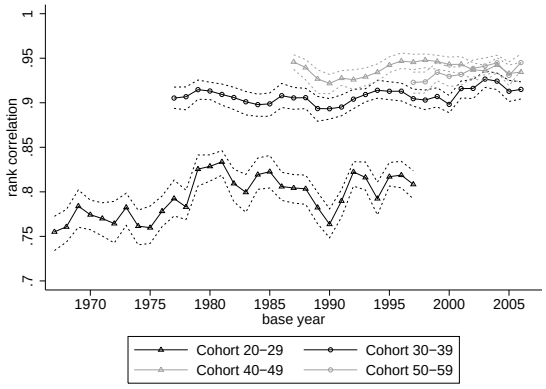
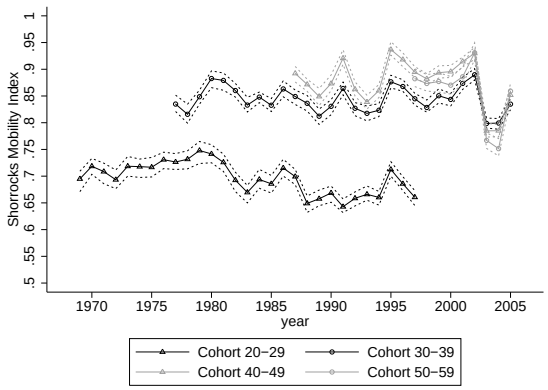


Figure A.5: Shorrocks Mobility Index

Original incomes



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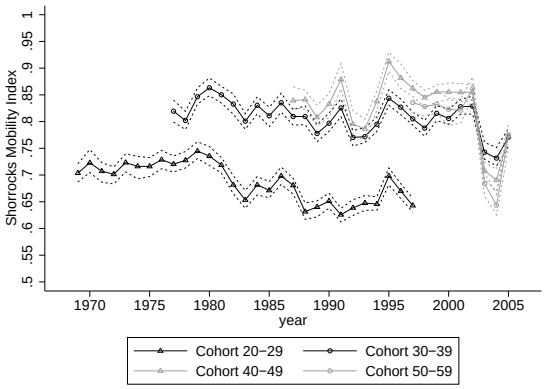
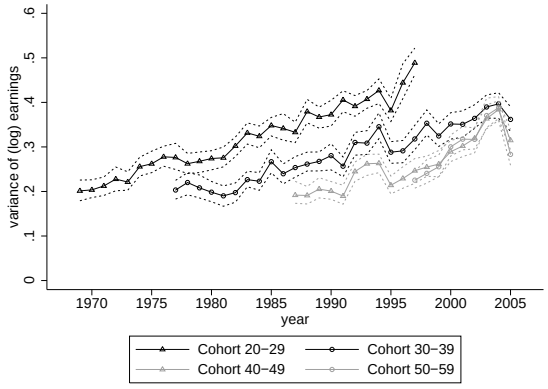


Figure A.6: Variance of log earnings

Original incomes



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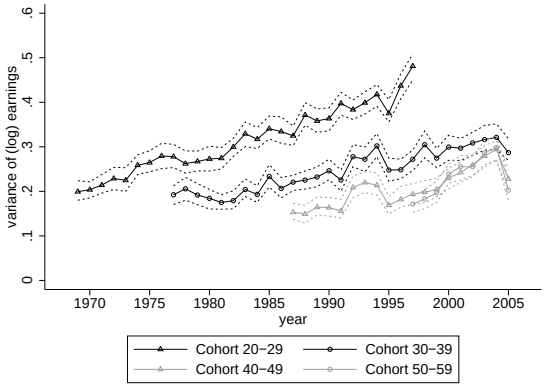
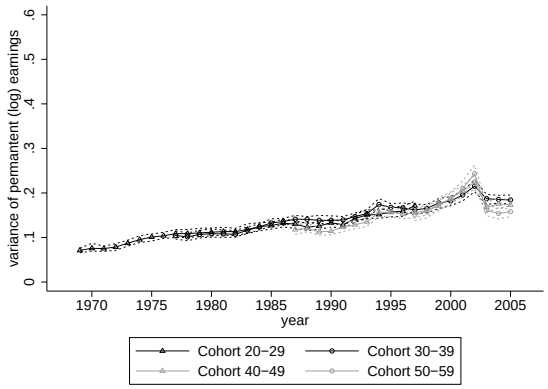


Figure A.7: Variance of permanent log earnings

Original incomes



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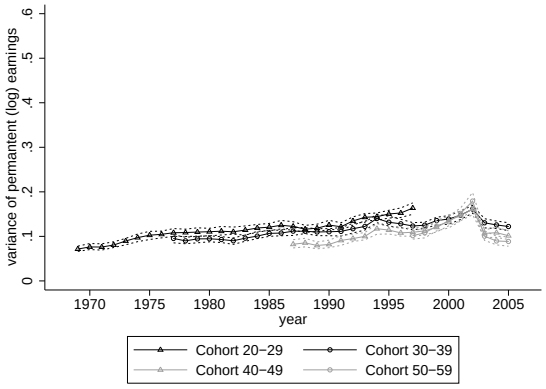
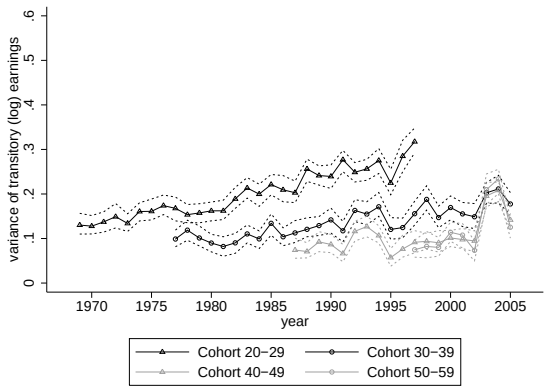


Figure A.8: Variance of transitory log earnings

Original incomes



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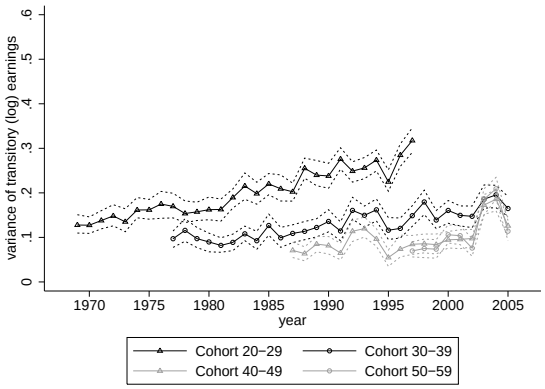
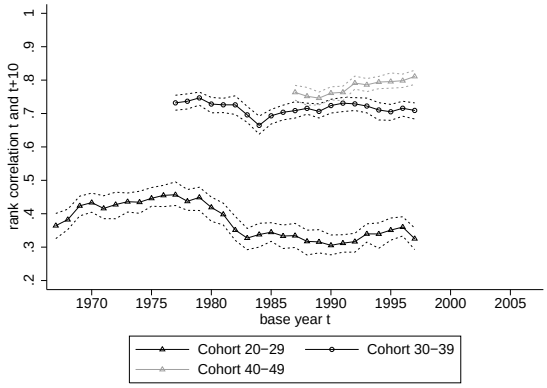


Figure A.9: Rank correlation after 10 years

Original incomes



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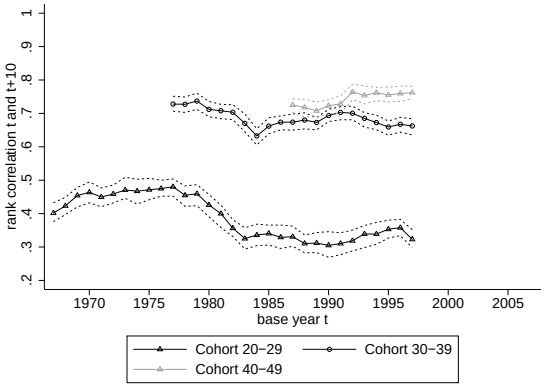
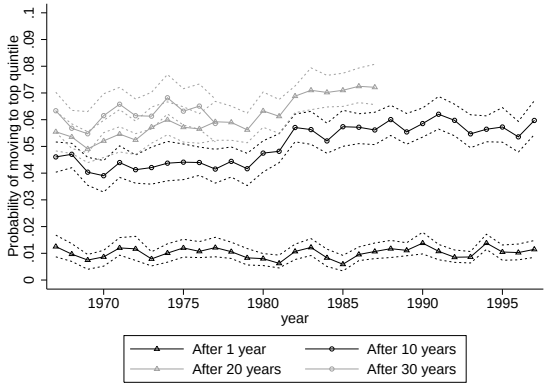


Figure A.10: Upward mobility

Original incomes



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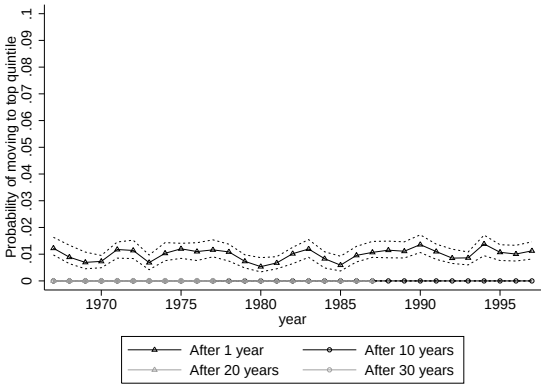
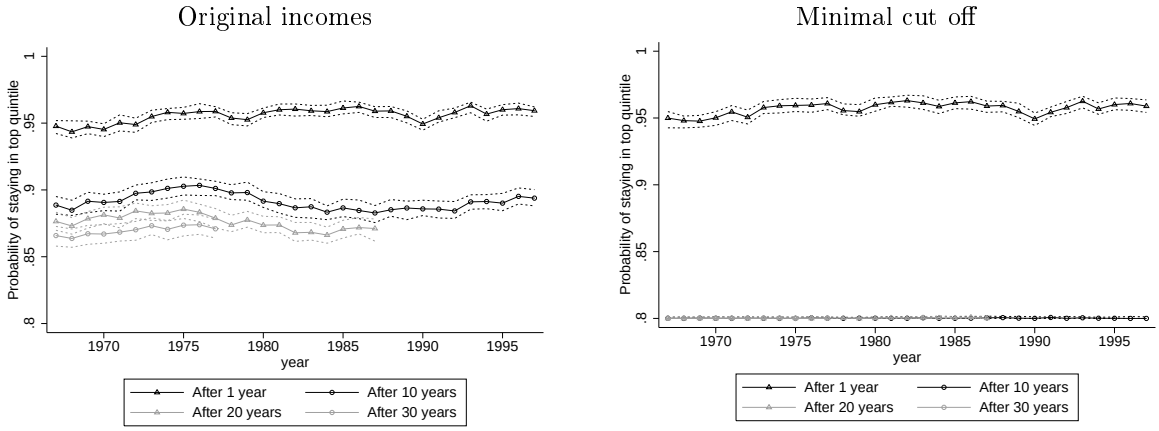


Figure A.11: Downward mobility



Country Inequality Rankings and Conversion Schemes

1. Introduction

Researchers and the public are eager to know about the distribution of living standards in a society. Living standard of a household's members is determined by the material comfort derived from available goods and services. Economists consider the income distribution as a close proxy for the distribution of living standard. When heterogeneous household types are involved two complications emerge. First, different household types have different needs. Members of differently sized/structured households with the same household income may attain different living standards. To obtain a measure that reflects differences in living standards across household types, household incomes must be adjusted for differences in needs. Second, for reasons concerning possible violations of axiomatic properties of inequality measures,[1] household size heterogeneity also raises the issue of an adequate household weighting when the distribution of living standards is derived.

A broad consensus exists concerning the differences-in-needs adjustment procedure. Usually, household incomes are deflated by so-called equivalence scales. Equivalence scales are measures of intra-household sharing potential and differences in family members' needs (i.e., of adults vs. children). Normalizing the equivalence scale of a childless one-adult household to a value of one, an equivalence scale gives the percentage change in household income required to maintain the household's living standard as household members are added. Accordingly, equivalence scales measure household-size economies. Dividing household income by equivalence scale gives the needs-adjusted *equivalent income* of the household.

Concerning the household-weighting procedure, the traditional approach in inequality measurement is a weighting of households by *household size*.[2] As an example, when the Theil index is derived from a distribution of needs-adjusted equivalent incomes, a one-member household is weighted by one and a four-member household by four. Size weighting accommodates the principle of normative individualism: any person is considered as important as any other and is assigned the same weight. Accordingly, the size-weighted equivalent-income distribution depicts differences in living standards among individuals.

Although size weighting seems straightforward and intuitive, there is a lively debate, since decades ago, about its foundation in the context of inequality, poverty, redistribution and horizontal equity analyses (see, for example, Vickrey, 1947, Bruno and Habib, 1976, Pyatt, 1990, Bottiroli Civardi and Martinetti Chiappero, 1995, and Cowell, 2000).

[1] For a rigorous analysis regarding the possibility of such violations of axiomatic principles in inequality measurement, see, for example, Ebert and Moyes (2003).
[2] Weighting by size, for example, is recommended by the *World Institute for Development Economics and Research* (undated) and also by the *Luxembourg Income Study*, 2009.

Particularly, some authors advocate a weighting of households *by needs*, i.e. by households' equivalence scales.[3] The so derived needs-weighted equivalent-income distribution depicts differences in living standards of equivalent adults. The specific characteristic of a needs weighted distribution is that income transfers between households leave the aggregate equivalent income unaltered. This property is violated if units are size-weighted and income transfers involve heterogeneous household types. Consider the following household income distributions:

Income	Number of household members	Equivalence scale
1	1	1
3	3	2

In this example, total equivalent income amounts to $1\cdot(1/1)+(3/2)\cdot 2=4$ in case of needs weighting, as opposed to $1\cdot(1/1)+(3/2)\cdot 3=5.5$ when households are weighted by size. Now, let there be a transfer of 0.3 income units from the three-member to the one-member household. The transfer leaves total equivalent income unaffected when households are needs weighted: $1\cdot(1.3/1)+(2.7/2)\cdot 2=4$. On the contrary, size weighting indicates a reduction in total equivalent income: $1\cdot(1.3/1)+(2.7/2)\cdot 3=5.4$ as opposed to 5.5 before the transfer. The reduction in total equivalent income results from the fact that the one-member household has no economies of household size and is thus a rather inefficient vehicle for converting income into equivalent income units.[4] Characterizations of size and needs weighted distributions can be found in the theoretical works of Ebert (1999, 2004), Ebert and Moyes (2003), and Shorrocks (2004).[5]

The problem we are concerned with here is the role of weighting schemes in ranking personal-income inequality across countries. Our first contribution is to provide a systematic sensitivity analysis of country inequality rankings to the two weighting schemes mentioned above, a weighting by size versus needs. In particular, we want to answer questions of the

[3] Or by a factor that is proportional to an equivalence scale.

[4] Size weighted total equivalent income increases when income is redistributed from the less efficient (one-member) to the more efficient (multi-member) household unit.

[5] Albeit its properties being appealing in some contexts, the information content of a needs weighted distribution is open to debate. As O'Higgins, Schmaus and Smeeding (1990, p. 26) stressed and Podder and Chatterjee (2002, p. 11) later reechoed: "Equivalent adults do not exist, unlike families or individuals, although a family or an individual may have an equivalent income." Bruno and Habib (1976, p. 63) express a similar discomfort using the words of one of their colleagues, Yoram Ben-Porath: "If it costs less to make a person happy it still does not make him less a person."

following type: “For a given inequality index and equivalence scale, do positions of the United States and France in inequality rankings differ when households are weighted by needs rather than size?” The sensitivity of country rankings to weighting procedure is scrutinized for different inequality indices at different levels of household-size economies. Rankings are derived from a set of 20 countries from the Luxembourg Income Study, and bootstrapping techniques are applied to testing for significance of the results. To our knowledge, this is the first systematic sensitivity analysis of cross-country inequality rankings to using alternative weighting schemes.

Indeed, country inequality rankings turn out to be sensitive to the choice of weighting schemes. Apart from very low levels of household-size economies, Kendall’s tau is always significantly different from 1, indicating that the correlation of size and needs weighted country inequality rankings is not perfect. Moreover, the correlation tends to become weaker with the presumed level of household size economies.

Our second contribution is the identification of the mechanics underlying the differences in rankings obtained from size and needs weighted distributions. An inequality decomposition by household types serves as the technical workhorse. The decomposition expresses overall inequality as the sum of inequality within and between population subgroups (household types). Both the within-group and the between-group component are sensitive to changing household weighting. We show that the quantitative effect hinges on the interplay of household-type specific inequality levels (and differences in the levels across household types), household-type specific mean incomes, and the relative frequencies of households of specific type. All these factors are country-specific. Consequently, switching from one weighting scheme to another may well affect measured inequality differently in one country compared to another, with implications for the positions of the countries in inequality rankings.

Here is a roadmap to our paper. Section 2 introduces the database. Section 3 introduces all the concepts, including the applied inequality indices, the bootstrap method, and the inequality decomposition by population subgroups. Section 4 summarizes our findings concerning the sensitivity of country rankings to weighting procedure. Section 5 explores the underlying mechanics by means of inequality decomposition. Section 6 concludes the paper.

2. Database and data preparation

Our empirical examination is based on Luxembourg Income Study (LIS) data. For 30 countries and several years, the LIS provides representative micro-level information on private households’ incomes and demographic characteristics (e.g., number, age and gender of

each family member). To keep the empirical analysis tractable, we consider 20 countries (the United States and 19 European countries) from a single cross section.[6] Additionally, the analysis is restricted to data from nine household types: one- and two-adult households with zero up to three children, and childless three-adult households.[7] Tables A1 and A2 in the Appendix provide the country codes and several non-weighted country-specific characteristics.[8]

Our computations rely on the LIS variable 'household disposable income'. Household disposable income is harmonized across countries, covers labor earnings, property income, and government transfers in cash minus income and payroll taxes.[9] It is denoted in local currencies. We have removed household observations with missing information or with negative values of disposable income. Moreover, to avoid outlier-driven biases of inequality estimates, we have trimmed the data following standard conventions: the one percent observations with the highest and with the lowest incomes have been discarded.

To derive equivalent income from household disposable income, we apply a parametric equivalence scale suggested in Buhmann et al. (1988). It allows for variations in household-size economies through a single parameter, the so-called 'equivalence-scale elasticity.' The Buhmann et al. (1988) equivalence scale is $ES(n_i,\theta)=(n_i)^{\theta}$, where n_i denotes the number of household members living in household unit i. Hence, household-size economies are captured by the parameter θ, with $0\le\theta\le 1$. Accordingly, equivalent income is $y_i\left(y_i^d,n_i,\theta\right)=y_i^d/ES\left(n_i,\theta\right)$ where y_i^d denotes household i's disposable income.

Concerning the level of household size economies, two extreme cases can be considered. If $\theta=0$, equivalent income and disposable income are the same for all household types since $ES(n_i,0)=1\;\forall i$. Due to perfect household-size economies, 'n household members live as cheap as one' and the same weight – irrespective of household size – is assigned to all household units in the needs weighted distribution. If $\theta=1$, household-size economies cannot be achieved and 'one n-member household lives as cheap as n one-member households.' In this special case, size and needs weighting assign identical household weights as $ES(n_i,1)=n_i\;\forall i$.

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[6] The underlying LIS datasets from years 1999/2000 are surveyed in Table A1 in the Appendix.
[7] We use the LIS variables 'd4' and 'd27' to distinguish adults from children, where 'd27' gives the number of household members of age below 18 and 'd4' denotes the total number of household members.
[8] We provide the non-weighted number of observations to give the reader a clear picture of the actual numbers of observations provided by LIS. Of course, all calculations are conducted on the basis of weighted distributions.
[9] For the exact definition of disposable household income see Luxembourg Income Study (2006), and for its cross-country comparability Burkhauser et al. (1996) and references therein.

3. Measurement concepts

3.1. Inequality indices, country rankings and rank correlation

We measure inequality with indices from the generalized entropy class, $GE(a)$, derived from the analogy between income distribution and information theory. The parameter a determines the sensitivity of $GE(a)$ with respect to changes at the top of the income distribution. The larger is a, the more sensitive is $GE(a)$. Consider a population of $i = 1,...,I$ households with equivalent incomes $y_i\left(y_i^d, n_i, \theta\right)$. Each observation i is assigned a weight w_i^t with $t \in \{S, N\}$, where S denotes size and N needs weighting. In case of S-weighting, a household's weight is $w_i^S = n_i \cdot f_i \Big/ \left(\sum_{i=1}^{I} n_i \cdot f_i\right)$, with f_i denoting the LIS frequency weight. In case of N-weighting, the weight is $w_i^N = ES(n_i,\theta)\cdot f_i \Big/ \left(\sum_{i=1}^{I} ES(n_i,\theta)\cdot f_i\right)$. The Generalized Entropy class of inequality indices is given by

$$(1a)\quad GE(a;t,\theta) = \frac{1}{a\cdot(a-1)}\cdot\left[\sum_{i=1}^{I} w_i^t \cdot \left(\left(\frac{y_i\left(y_i^d, n_i, \theta\right)}{\mu(t,\theta)}\right)^a - 1\right)\right], \quad a \neq 0,1$$

$$(1b)\qquad GE(1;t,\theta) = \sum_{i=1}^{I} w_i^t \cdot \frac{y_i\left(y_i^d, n_i, \theta\right)}{\mu(t,\theta)} \cdot \log\left(\frac{y_i\left(y_i^d, n_i, \theta\right)}{\mu(t,\theta)}\right)$$

$$(1c)\qquad GE(0;t,\theta) = \sum_{i=1}^{I} w_i^t \cdot \log\left(\frac{\mu(t,\theta)}{y_i\left(y_i^d, n_i, \theta\right)}\right)$$

where $\mu(t,\theta) = \left(\sum_{i=1}^{I} y_i \cdot w_i^t\right) \Big/ \sum_{i=1}^{I} w_i^t$ denotes mean equivalent income – per individual in case of size weighting and per equivalent adult in case of needs weighting. For $a = 0$ we have the mean logarithmic deviation; for $a = 1$, we have the Theil coefficient; and for $a = 2$ we have half the square of the coefficient of variation.

Ordering all the countries in decreasing order of $GE(a;t,\theta)$ gives the country inequality ranking for a specific a, a specific weighting procedure t and a specific level household-size economies θ. With $r^l(a;t,\theta)$ we denote the rank of country $l = 1,...,L$. For a given a and θ, we assess the strength of the relationship between the S- and N-weighted country inequality ranking by means of Kendall's tau, τ. Kendall's tau, like the Spearman rank correlation, is carried out on the ranks of data. Particularly, it is determined by the probability of observing concordant and discordant rank-pairs.

For pairs of ranks $\left(r^l(a;S,\theta), r^l(a;N,\theta)\right)$ and $\left(r^m(a;S,\theta), r^m(a;N,\theta)\right)$ of countries $l \neq m$ define them as concordant if $\left(r^l(a;S,\theta) - r^m(a;S,\theta)\right)\cdot\left(r^l(a;N,\theta) - r^m(a;N,\theta)\right) > 0$, and discordant if the product is negative.[10] Let $P(a;\theta)$ and $Q(a;\theta)$ denote the number of concordant respectively discordant pairs, then

$$(2) \quad \tau(a;\theta) = \frac{P(a;t,\theta) - Q(a;t,\theta)}{L\cdot(L-1)/2}.$$

Kendall's tau takes values between -1 and +1, with a positive (negative) value indicating that ranks obtained from S- and N-weighted distributions are positively (negatively) correlated. For $\tau = 1$, the positive correlation is perfect, i.e. S- and N-weighted ranks of all countries coincide.

3.2. Inequality decomposition

To understand the mechanics underlying the differences in size and needs weighted country inequality rankings, i.e. $\tau \neq 1$, we conduct an inequality decomposition by household types. Suppose there is an exhaustive partition of the population into mutually-exclusive subgroups $k = 1,...,K$. The basic idea is to express overall inequality as a function of inequality within and between population subgroups. We partition the population into nine subgroups, distinguished by household composition.

Decomposability of an inequality index implies a coherent relationship between inequality in the whole population and inequality in its constituent mutually exclusive subgroups. An index is additively decomposable if it can be written as a weighted sum of the within-subgroup inequality indices plus a between-subgroup term based on mean equivalent incomes and subgroup sizes. Indices of the generalized-entropy family are additively decomposable and can be written as

$$(3) \quad GE(a;s,\theta) = GEW(a;s,\theta) + GEB(a;s,\theta),$$

where GEW is within-group inequality, and GEB is between-group inequality. Within-group inequality is defined as

[10] In the technical description we assume that ties in the country ranking do not exist.

$$(4a) \quad GEW(a) = \sum_{k=1}^{K} q_k^t \cdot \left(\frac{\mu_k^t}{\mu^t} \right)^a \cdot GE_k(a), \quad a \neq 0, 1$$

$$(4b) \quad GEW(1) = \sum_{k=1}^{K} q_k^t \cdot \frac{\mu_k^t}{\mu^t} \cdot GE_k(1)$$

$$(4c) \quad GEW(0) = \sum_{k=1}^{K} q_k^t \cdot GE_k(0)$$

The first expression in equations (4a) to (4c), q_k^t, denotes the population share living in household type k. Depending on the chosen weighting procedure, the population share of type-k households equals

$$(5a) \qquad q_k^S = \frac{\sum_{i_k=1}^{I_K} w_{i_k}^S}{\sum_{k=1}^{K} \sum_{i_k=1}^{I_K} w_{i_k}^S}$$

$$(5b) \quad q_k^N(\theta) = \frac{\sum_{i_k=1}^{I_K} w_{i_k}^N(\theta)}{\sum_{k=1}^{K} \sum_{i_k=1}^{I_K} w_{i_k}^N(\theta)},$$

where I_k denotes the (non-weighted) number of household observations of type k. S-weighted population shares are constant and do not depend on household-size economies θ. On the opposite, N-weighted population shares are dependent on θ: The higher is θ, the lower is the population share of the larger households relative to the smaller.

The second expression in (4a) and (4b), μ_k^t / μ^t is the ratio of average equivalent income of type k households relative to the population-wide mean with

$$(6a) \quad \mu_k^S = \mu_k^N = \frac{\sum_{i_k=1}^{I_K} f_{i_k} \cdot y_{i_k}\left(y_{i_k}^d, n_{i_k}, \theta\right)}{\sum_{i_k=1}^{I_K} f_{i_k}}$$

$$(6b) \qquad \mu^t = \sum_{k=1}^{K} q_k^t \cdot \mu_k^t.$$

Average equivalent income of type k households is the same for both weighting schemes, whereas average equivalent income across households depends on the weighting scheme via the population shares.

The last expression in (4a) to (4c), $GE_k(a)$ describes inequality in subgroup k. It is calculated as if the subgroup k were a separate population. Due to the fact that all households

of a particular subgroup are homogeneous with respect to size, $GE_k(a)$ is the same for both types of weighting.

The between-group inequality component, $GEB(a)$, is defined as

$$(7a) \quad GEB(a) = \frac{1}{a \cdot (a-1)} \cdot \left[\sum_{k=1}^{K} q_k^t \cdot \left(\left(\frac{\mu_k}{\mu^t} \right)^a - 1 \right) \right], \quad a \neq 0, 1$$

$$(7b) \quad GEB(1) = \sum_{k=1}^{K} q_k^t \cdot \left(\frac{\mu_k}{\mu^t} \right) \cdot \ln \left(\frac{\mu_k}{\mu^t} \right)$$

$$(7c) \quad GEB(0) = \sum_{k=1}^{K} q_k^t \cdot \ln \left(\frac{\mu^t}{\mu_k} \right).$$

The between-group inequality from the size weighted distribution differs from the needs weighted as a result of differences in weighted average equivalent incomes, μ^S and μ^N, and household type-specific population weights q_k^t. In the empirical part of the paper, the results from the decomposition will serve as a vehicle for explaining the sensitivity of bilateral country inequality rankings to weighting procedure.

3.3. Bootstrap inference

To test for statistical significance of our results, we have implemented a bootstrap approach following the theoretical framework outlined in Biewen (2002). In a first step, we create a pooled database from the selected set of 20 countries. From the pooled database, we draw with replacement, $B = 100$ random bootstrap samples, using countries as strata.[11] For each country, each bootstrap sample has as many sampling units as the country-specific LIS database, and each sampling unit has the same probability of being selected.[12]

Particularly, for each country we compute from each bootstrap sample b a particular measure, M^b, say the Theil index. Confidence intervals are computed following Hall (1994). Hall's confidence interval at the 95 percent level is defined as $\Pr\left(2\hat{M}^c - M^b_{0.975} \leq M \leq 2\hat{M}^c - \hat{M}^b_{0.025}\right) = (100 - 2\alpha)/100$, where $\hat{M}^c$ denotes the bootstrap bias corrected statistic, $M^b_{0.975}$ and $M^b_{0.025}$ the 2.5$^{\text{th}}$ upper and lower percentile in the bootstrap index distribution, and M the index's true value. The bootstrap bias-corrected index is

[11] Our analysis requires a bootstrapping over 20 countries, 20 equivalence scales and two weighting schemes. At the same time the LIS computers' working space is limited. Although the LIS team provided us with extra computer capacity for our analyses, we had to confine ourselves to 100 bootstrap repetitions.

[12] While LIS frequency weights and households' needs/size weights are not accounted for in the bootstrap, they are always included when inequality indices (and related statistics) are derived. For technically equivalent empirical applications see Athanasopoulos and Vahid (2003) or Bönke et al. (forthcoming).

$\hat{M}^c = \hat{M} - Bias$, where $\hat{M}$ is the index derived from the sampling distribution and $Bias = \frac{1}{B} \cdot \sum_{b=1}^{B} M^b - \hat{M}$. The bias-corrected confidence interval has advantages compared to standard confidence intervals when the underlying distribution, as it is the case for income distributions, is skewed (Hall, 1994).

To investigate whether the bilateral ranking of any two countries l and m is significantly affected by the weighting procedure, we rely on the confidence intervals' upper and lower limits. The weighting procedure has a significant effect on the bilateral ranking if

$$(8a) \quad \left[\left(2\hat{M}^c - M^b_{0.975}\right)^S_m - \left(2\hat{M}^c - M^b_{0.025}\right)^S_l\right] \cdot \left[\left(2\hat{M}^c - M^b_{0.975}\right)^N_m - \left(2\hat{M}^c - M^b_{0.025}\right)^N_l\right] < 0$$

and/or if

$$(8b) \quad \left[\left(2\hat{M}^c - M^b_{0.025}\right)^S_m - \left(2\hat{M}^c - M^b_{0.975}\right)^S_l\right] \cdot \left[\left(2\hat{M}^c - M^b_{0.025}\right)^N_m - \left(2\hat{M}^c - M^b_{0.975}\right)^N_l\right] < 0 .$$

For example, let the confidence interval for a given measure M and significance level be $[0.20;0.30]^S_l$ and $[0.26;0.34]^N_l$ for country l, respectively $[0.35;0.40]^S_m$ and $[0.31;0.37]^N_m$ for m. From (8a) and (8b), we obtain $(0.40-0.20)\cdot(0.37-0.26)>0$, and $(0.35-0.30)\cdot(0.31-0.34)<0$. As (8b) is negative, weighting has a significant effect on the bilateral ranking. More precisely, the size-weighted distribution in m is more unequal than in l, while needs weighted distributions statistically exhibit the same level of inequality (confidence intervals overlap).

Taking a broader multinational perspective, we also take inequality indices to draw conclusions concerning the differences in size- and needs weighted cross-country rankings. More precisely, the procedure outlined in (8a) and (8b) is carried out on any pair of countries. If condition (8a) or (8b) is satisfied (both are rejected), a re-ranking occurs and the respective pair of countries is denoted discordant (concordant). Having identified the number of concordant pairs, $P(a;\theta)$, and discordant pairs $Q(a;\theta)$, Kendell's tau, $\tau(a;\theta)$ is derived from (2).

4. Sensitivity of country inequality rankings to weighting schemes

The sensitivity of country inequality rankings to weighting schemes is scrutinized from a bilateral and a multinational perspective. The bilateral perspective is concerned with the question whether two countries l and m are consistently ranked according to the criteria defined in equations (8a) and (8b) or not. The multinational perspective is concerned with the

correlation of size and needs weighted cross-country inequality rankings as indicated by Kendall's tau. Both types of sensitivity analysis are carried out for all three entropy inequality indices at two levels of the equivalence-scale elasticity, $\theta = 0.5$ and $\theta = 0.25$. For $\theta = 0.5$, we have the 'square-root scale' extensively used in empirical inequality analyses. A household-size elasticity of 0.25 indicates substantial household-size economies.

Table 1a. Size and needs weighted inequality estimates; equivalence-scale elasticity of 0.5

Country	GE(0)		GE(1)		GE(2)	
Code	S	N	S	N	S	N
AT	10.11 *(9.39;10.68)*	10.32 *(9.65;10.81)*	9.76 *(9.13;10.32)*	10.01 *(9.36;10.55)*	10.53 *(9.72;11.31)*	10.85 *(9.97;11.63)*
BE	10.44 *(9.77;11.18)*	10.78 *(10.00;11.49)*	10.27 *(9.53;11.03)*	10.81 *(9.89;11.55)*	11.26 *(10.23;12.20)*	12.15 *(10.85;13.19)*
EE	18.37 *(17.57;19.18)*	18.69 *(17.97;19.46)*	18.24 *(17.27;19.02)*	18.86 *(17.87;19.68)*	21.34 *(20.12;22.42)*	22.49 *(21.14;23.72)*
FR	10.84 *(10.54;11.16)*	11.30 *(10.98;11.60)*	10.80 *(10.50;11.10)*	11.30 *(10.95;11.66)*	11.95 *(11.54;12.28)*	12.59 *(12.10;13.02)*
FI	8.19 *(7.91;8.47)*	8.83 *(8.53;9.13)*	8.08 *(7.78;8.35)*	8.76 *(8.46;9.07)*	8.65 *(8.28;8.96)*	9.47 *(9.07;9.86)*
DE	11.25 *(10.73;11.69)*	11.82 *(11.21;12.20)*	10.85 *(10.25;11.26)*	11.46 *(10.82;11.82)*	11.81 *(11.00;12.30)*	12.60 *(11.66;13.08)*
GR	17.53 *(16.52;18.54)*	18.17 *(17.10;19.10)*	16.29 *(15.35;17.26)*	16.92 *(15.96;17.78)*	17.62 *(16.47;18.79)*	18.41 *(17.23;19.50)*
HU	11.64 *(10.69;12.73)*	12.02 *(11.02;13.15)*	12.12 *(10.99;13.28)*	12.69 *(11.50;13.85)*	14.33 *(12.70;15.67)*	15.32 *(13.61;17.00)*
IE	15.13 *(13.57;16.38)*	16.08 *(14.46;17.11)*	14.70 *(13.02;16.07)*	15.74 *(14.13;17.01)*	16.44 *(14.23;18.17)*	17.76 *(15.51;19.39)*
IT	15.84 *(14.81;16.82)*	15.83 *(14.93;16.74)*	15.32 *(14.41;16.17)*	15.45 *(14.51;16.25)*	17.40 *(16.14;18.50)*	17.72 *(16.38;18.88)*
LU	9.88 *(9.27;10.54)*	10.01 *(9.41;10.71)*	9.99 *(9.34;10.66)*	10.20 *(9.46;10.98)*	11.08 *(10.14;11.99)*	11.46 *(10.31;12.51)*
NO	8.09 *(7.86;8.39)*	8.92 *(8.67;9.24)*	7.71 *(7.50;8.00)*	8.49 *(8.25;8.80)*	8.11 *(7.84;8.48)*	8.99 *(8.62;9.39)*
PL	11.28 *(11.07;11.54)*	11.21 *(11.01;11.44)*	11.17 *(10.94;11.44)*	11.19 *(10.95;11.45)*	12.42 *(12.09;12.77)*	12.54 *(12.20;12.88)*
RU	29.73 *(27.48;31.34)*	29.37 *(27.46;30.92)*	28.31 *(25.79;29.93)*	28.68 *(26.54;30.24)*	35.49 *(31.43;38.35)*	36.93 *(33.13;39.73)*
ES	17.17 *(16.12;17.85)*	17.52 *(16.47;18.23)*	16.76 *(15.77;17.49)*	17.30 *(16.25;18.00)*	19.10 *(17.66;20.13)*	20.03 *(18.14;21.24)*
SI	10.35 *(9.70;11.11)*	10.91 *(10.20;11.67)*	9.71 *(9.14;10.34)*	10.24 *(9.67;10.86)*	10.17 *(9.57;10.88)*	10.78 *(10.12;11.58)*
SE	9.04 *(8.80;9.31)*	9.84 *(9.55;10.11)*	8.52 *(8.30;8.76)*	9.27 *(9.04;9.53)*	8.89 *(8.65;9.17)*	9.74 *(9.49;10.05)*
CH	10.82 *(10.26;11.41)*	11.02 *(10.44;11.58)*	10.63 *(10.09;11.21)*	10.86 *(10.21;11.39)*	11.71 *(10.86;12.47)*	12.02 *(11.11;12.73)*
UK	16.54 *(16.23;16.84)*	16.97 *(16.66;17.28)*	16.29 *(15.97;16.60)*	16.82 *(16.45;17.12)*	18.52 *(18.04;18.92)*	19.31 *(18.78;19.70)*
US	20.22 *(19.87;20.60)*	20.88 *(20.53;21.28)*	19.03 *(18.60;19.44)*	19.69 *(19.26;20.14)*	22.18 *(21.44;22.73)*	23.11 *(22.38;23.79)*

Note. S indicates size weighting, N needs weighting. GE(0) is mean logarithmic deviation; GE(1) is Theil index; GE(2) is half the square of the coefficient of variation. Point estimates and, in parentheses and italics, 95 percent bootstrap confidence intervals. All indices multiplied with 100. See Table A1 in the Appendix for definition of country codes. Own calculations based on LIS 2000 data.

Table 1b. Size and needs weighted inequality estimates; equivalence-scale elasticity of 0.25

Country	GE(0)		GE(1)		GE(2)	
Code	S	N	S	N	S	N
AT	10.72 *(10.05;11.22)*	11.56 *(10.95;12.02)*	10.17 *(9.55;10.69)*	11.08 *(10.48;11.59)*	10.78 *(10.04;11.45)*	11.89 *(11.14;12.61)*
BE	12.33 *(11.64;13.08)*	13.23 *(12.31;13.97)*	11.78 *(11.12;12.61)*	13.09 *(12.22;13.84)*	12.52 *(11.58;13.56)*	14.50 *(13.44;15.57)*
EE	20.02 *(19.07;20.79)*	21.08 *(20.27;21.85)*	19.53 *(18.67;20.32)*	21.00 *(20.04;21.89)*	22.50 *(21.30;23.64)*	24.89 *(23.50;26.15)*
FR	11.42 *(11.14;11.79)*	12.57 *(12.24;12.90)*	11.08 *(10.79;11.38)*	12.26 *(11.93;12.52)*	11.94 *(11.59;12.32)*	13.39 *(12.94;13.76)*
FI	9.81 *(9.49;10.15)*	11.38 *(11.00;11.76)*	9.25 *(8.95;9.55)*	10.93 *(10.58;11.29)*	9.54 *(9.20;9.88)*	11.56 *(11.16;12.00)*
DE	12.36 *(11.80;12.77)*	13.64 *(12.96;14.06)*	11.59 *(11.02;11.93)*	12.95 *(12.19;13.33)*	12.27 *(11.51;12.72)*	14.00 *(12.98;14.42)*
GR	18.91 *(17.83;19.88)*	20.42 *(19.17;21.37)*	17.31 *(16.25;18.31)*	18.76 *(17.62;19.71)*	18.63 *(17.24;19.89)*	20.44 *(18.80;21.66)*
HU	12.80 *(11.91;13.93)*	14.00 *(12.96;15.09)*	12.93 *(11.87;14.08)*	14.38 *(13.13;15.44)*	14.80 *(13.29;16.22)*	16.90 *(15.11;18.35)*
IE	16.67 *(15.00;18.04)*	18.81 *(17.04;19.99)*	15.66 *(13.92;17.24)*	17.89 *(15.95;19.15)*	17.05 *(14.72;18.93)*	19.88 *(16.97;21.87)*
IT	16.16 *(15.04;17.00)*	16.71 *(15.79;17.49)*	15.53 *(14.64;16.32)*	16.24 *(15.32;17.00)*	17.45 *(16.19;18.47)*	18.50 *(17.00;19.57)*
LU	9.95 *(9.38;10.63)*	10.48 *(9.89;11.23)*	9.91 *(9.29;10.55)*	10.56 *(9.92;11.38)*	10.73 *(9.97;11.46)*	11.64 *(10.71;12.68)*
NO	9.98 *(9.73;10.30)*	11.82 *(11.46;12.13)*	9.10 *(8.86;9.39)*	10.93 *(10.60;11.29)*	9.25 *(8.97;9.61)*	11.36 *(10.94;11.81)*
PL	11.45 *(11.21;11.69)*	11.90 *(11.69;12.15)*	11.28 *(11.04;11.53)*	11.81 *(11.59;12.06)*	12.43 *(12.10;12.74)*	13.14 *(12.83;13.43)*
RU	31.42 *(29.22;33.08)*	31.48 *(29.41;32.95)*	29.79 *(27.40;31.40)*	30.87 *(28.65;32.50)*	37.13 *(33.18;39.70)*	39.84 *(36.01;42.50)*
ES	17.90 *(16.88;18.65)*	18.88 *(17.93;19.65)*	17.23 *(16.26;17.93)*	18.38 *(17.37;19.13)*	19.32 *(17.95;20.29)*	20.95 *(19.34;22.12)*
SI	11.38 *(10.72;12.26)*	12.89 *(12.27;13.85)*	10.41 *(9.87;11.18)*	11.83 *(11.22;12.61)*	10.72 *(10.15;11.55)*	12.28 *(11.56;13.20)*
SE	10.91 *(10.60;11.18)*	12.64 *(12.27;12.98)*	9.89 *(9.61;10.12)*	11.66 *(11.35;11.92)*	10.01 *(9.73;10.27)*	12.11 *(11.81;12.42)*
CH	10.64 *(10.12;11.22)*	11.41 *(10.84;11.96)*	10.27 *(9.71;10.84)*	11.09 *(10.47;11.61)*	11.04 *(10.42;11.76)*	12.04 *(11.26;12.75)*
UK	17.38 *(17.13;17.68)*	18.61 *(18.33;18.93)*	16.79 *(16.47;17.09)*	18.15 *(17.84;18.46)*	18.75 *(18.28;19.14)*	20.63 *(20.14;21.03)*
US	20.63 *(20.30;20.99)*	22.21 *(21.82;22.61)*	19.07 *(18.66;19.39)*	20.56 *(20.16;21.01)*	21.81 *(21.08;22.31)*	23.76 *(23.03;24.35)*

Note. S indicates size weighting, N needs weighting. GE(0) is mean logarithmic deviation; GE(1) is Theil index; GE(2) is half the square of the coefficient of variation. Point estimates and, in parentheses and italics, 95 percent bootstrap confidence intervals. All indices multiplied with 100. See Table A1 in the Appendix for definition of country codes. Own calculations based on LIS 2000 data.

For our set of twenty countries, Table 1a and Table 1b provide the three inequality indices (point estimates) together with the respective bootstrap confidence intervals underneath. Statistics in Table 1a relate to the $\theta = 0.5$ and in Table 1b to the $\theta = 0.25$ scenario. The first number in each cell is the observed inequality index in percent. Take Poland (PL) and Slovenia (SI) when $\theta = 0.25$ as an example. Point estimates of mean logarithmic deviations, $GE(0)$, from size-weighted distributions indicate more inequality in Poland compared to Slovenia, i.e. 11.45 percent versus 11.38 percent. Overlapping confidence

intervals, however, indicate that the difference is insignificant. The needs weighted distributions lead to a different conclusion, i.e. significantly more inequality in Slovenia compared with Poland.

Table 2a. Sensitivity of bilateral inequality rankings, equivalence scale elasticity of 0.5

	AT	BE	EE	FR	FI	DE	GR	HU	IE	IT	LU	NO	PL	RU	ES	SI	SE	CH	UK
BE	.																		
EE	.	.																	
FR	100	.	.																
FI	.	.	.	.															
DE	011	.	.	.	.														
GR	.	.	.	.	.	.													
HU	.	.	.	.	.	.	.												
IE	.	.	.	.	.	.	100	010											
IT	.	.	.	.	.	.	100	001	.										
LU	.	.	.	100	.	.	.	.	.	.									
NO	.	.	.	.	.	.	.	.	.	.	.								
PL	.	.	.	.	.	.	.	011	.	.	011	.							
RU	.	.	.	.	.	.	.	.	.	.	.	.	.						
ES	.	.	.	.	.	.	.	.	.	010	.	.	.	.					
SI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.				
SE	111	100	.	.	.	.	.	.	.	.	010	.	.	.	.	.			
CH	.	.	.	.	.	.	.	010	.	.	.	.	.	.	.	.	.		
UK	.	.	.	.	.	.	.	.	.	010	.	.	.	.	.	.	.	.	
US	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Note. "1" ("0") denotes that bilateral ranking is sensitive (insensitive) to weighting procedure. "." indicates that size and needs weighting give consistent results for all three indices. First entry in numerical sequences refers to GE(0), second to GE(1), and third to GE(2). All indices multiplied with 100. See Table A1 in the Appendix for definition of country codes. Own calculations based on LIS 2000 data.

Table 2b. Sensitivity of bilateral inequality rankings, equivalence scale elasticity of 0.25

	AT	BE	EE	FR	FI	DE	GR	HU	IE	IT	LU	NO	PL	RU	ES	SI	SE	CH	UK
BE	.																		
EE	.	.																	
FR	100	.	.																
FI	011	.	.	.															
DE	.	.	.	.	.														
GR	.	.	.	.	.	.													
HU	.	.	.	.	.	.	.												
IE	.	.	.	.	.	.	.	010											
IT	.	.	.	.	.	.	010	010	.										
LU	.	.	.	.	001	.	.	.	.	.									
NO	011	.	.	.	.	.	.	.	.	.	101								
PL	010	111	.	100	100	010	.	.	.	.	.	100							
RU	.	.	.	.	.	.	.	.	.	.	.	.	.						
ES	.	.	.	.	.	.	.	.	.	110	.	.	.	.					
SI	100	.	.	001	011	.	.	.	.	.	.	011	101	.	.				
SE	100	100	.	.	.	100	.	100	.	.	100	001	110	.		.			
CH	.	001	.	111	011	001	.	.	.	.	.	011	010	.	.	100	101		
UK	.	.	.	.	.	.	.	.	.	001	.	.	.	.	.	.	.	.	
US	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Note. "1" ("0") denotes that bilateral ranking is sensitive (insensitive) to weighting procedure. "." indicates that size and needs weighting give consistent results for all three indices. First entry in numerical sequences refers to GE(0), second to GE(1), and third to GE(2). All indices multiplied with 100. See Table A1 in the Appendix for definition of country codes. Own calculations based on LIS 2000 data.

Tables 2a and 2b summarize all inconsistent bilateral rankings from the two types of weighting. Table 2a refers to the $\theta = 0.5$ scenario, while Table 2b refers to $\theta = 0.25$. For each pair of countries, the symbol "." indicates that bilateral rankings are immune to weighting for all three indices; else a three digit numerical sequence is provided. The first digit relates to a country ranking by means of the logarithmic deviation; the second to a ranking by the Theil coefficient, and the third to the half the square of the coefficient of variation. In the sequence, a "1" ("0") indicates, accordingly to the criteria (8a) and (8b), that bilateral rankings from size and needs weighted distributions are inconsistent (consistent).

For example, take the sequence "011" for Germany and Austria when $\theta = 0.5$. According to $GE(0)$, both types of weighting lead to the same conclusion, namely that there is significantly more inequality in Germany compared to Austria. According to $GE(1)$ and $GE(2)$, however, conclusions are weighting dependent. While size weighting suggests no significant difference in inequality levels in Germany and Austria, estimates from the needs weighted distributions indicate significantly more inequality in Germany.

We find a non trivial number of inconsistencies in bilateral rankings derived from size and needs weighted distributions. If we consider all the pair-wise comparisons of the 20 countries for $\theta = 0.5$, then we have six discordant pairs in case of the logarithmic deviation, nine in case of the Theil index, and five in case of half the square of the coefficient of variation. Accordingly, 3.51 percent of the comparisons yield conflicting rankings. For $\theta = 0.25$ the number of discordant pairs more than doubles. Now we have 51 discordant pairs. Correspondingly, 8.95 percent of all the bilateral rankings are sensitive to the weighting procedure. Yet, not only has the mere number of discordances risen. It is also interesting to note that some bilateral comparisons are sensitive to weighting when $\theta = 0.5$ while this is not the case when $\theta = 0.25$. Examples include Austria and Germany as well as France and Luxembourg.

The bilateral comparisons clearly indicate discrepancies that arise when switching from one weighting scheme to another. Indeed, various point estimates suggest outright reversals of country ranks when switching from one weighting scheme to another. As example consider point estimates for $GE(0)$ at $\theta = 0.5$ from Table 1a. Outright reversals concern Belgium and Slovenia, France and Poland, Finland and Norway, Germany and Poland, as well as Ireland and Italy. At $\theta = 0.25$ (Table 1b) outright reversals concern the bilateral positions of Austria and Norway, France and Slovenia, France and Sweden, Finland and Luxembourg, Ireland and United Kingdom, Norway and Switzerland, Poland and Slovenia, as well as Poland and Sweden. Confidence intervals do not support the presence of

outright reversals. Rather they indicate significant differences in inequality levels for one weighting scheme and insignificant differences for the other.

Table 3. Kendall's tau and number of discordant pairs

	$\theta = 0.50$			$\theta = 0.25$		
	GE(0)	GE(1)	GE(2)	GE(0)	GE(1)	GE(2)
Kendall's τ (bootstrapped)	93.68	90.53	94.74	81.05	83.16	81.05
Kendall's τ (point estimate)	94.74	94.74	94.74	90.53	91.58	92.63
Significantly discordant pairs (bootstrapped)	6	9	5	18	16	18

Note. GE(0) is mean logarithmic deviation; GE(1) is Theil index; GE(2) is half the square of the coefficient of variation. θ denotes the equivalence-scale elasticity. Kendall's tau multiplied with 100. Own calculations based on LIS 2000 data.

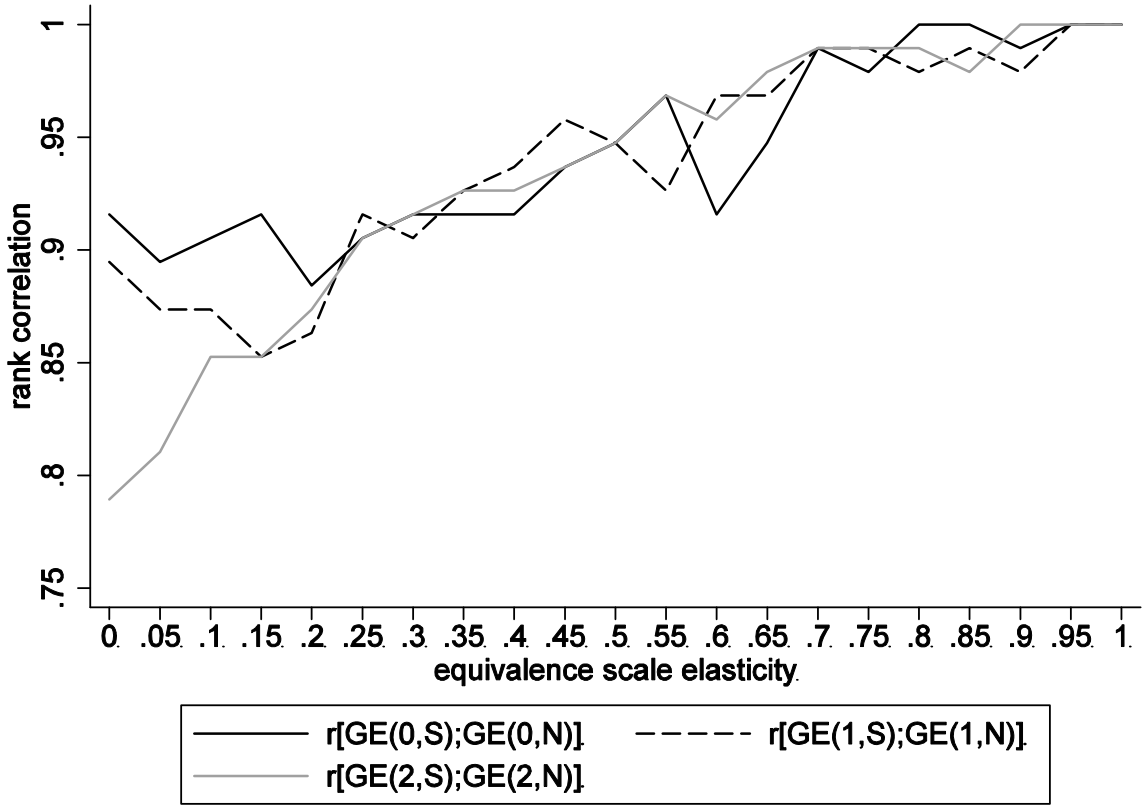
We next turn to the multinational perspective. Numbers of discordant pairs (significant) together with rank correlation coefficients (point estimates and bootstrapped values) are provided in Table 3. As mentioned above, Kendall's tau gives the correlation of size and needs weighted cross-country inequality rankings. For all three entropy indices, the number of discordant pairs and Kendall's tau indicate a strong correlation of country inequality rankings derived from size and needs weighted distributions. At the same time, the correlation is weaker when household size economies are high (when θ is small). This impression is reconfirmed by Figure 1. In the graph, three lines are provided. Each line connects Kendall's rank correlation coefficients derived for different levels of household-size economies when countries are ranked according to a particular entropy index.[13] Take, for example Kendall's rank correlation coefficient derived from Theil index based country rankings. We have a correlation of 1.0 for $\theta \geq 0.95$, 0.989 for $\theta = 0.75$, 0.947 for $\theta = 0.5$, 0.916 for $\theta = 0.25$, and 0.895 for $\theta = 0.00$.

Kinks in the lines indicate that the relationship between τ and θ is not monotonous. This non- monotonicity is consistent with the results from the bilateral comparisons: It is not ruled out that ranks of countries are sensitive to weighting when θ is high and insensitive when θ is low.

We want to point out that the sensitivity of country rankings is not a phenomenon restricted to the generalized entropy class of inequality indices. We have also experimented with several other popular measures such as the Gini and the Atkinson index. The results are congruent with abovementioned conclusions.[14]

[13] Due to hardware restrictions, we have derived the rank correlations from the observed inequality indices rather than from a bootstrap-based ranking.
[14] Results can be provided by the authors upon request.

Figure 1. Kendall's tau



Note. Kendall's tau rank correlations of country rankings derived from size- and needs weighted distributions. Black solid line refers to mean logarithmic deviation; black dashed line to Theil index; grey solid line to half the square of the coefficient of variation Own calculations based on LIS 2000 data.

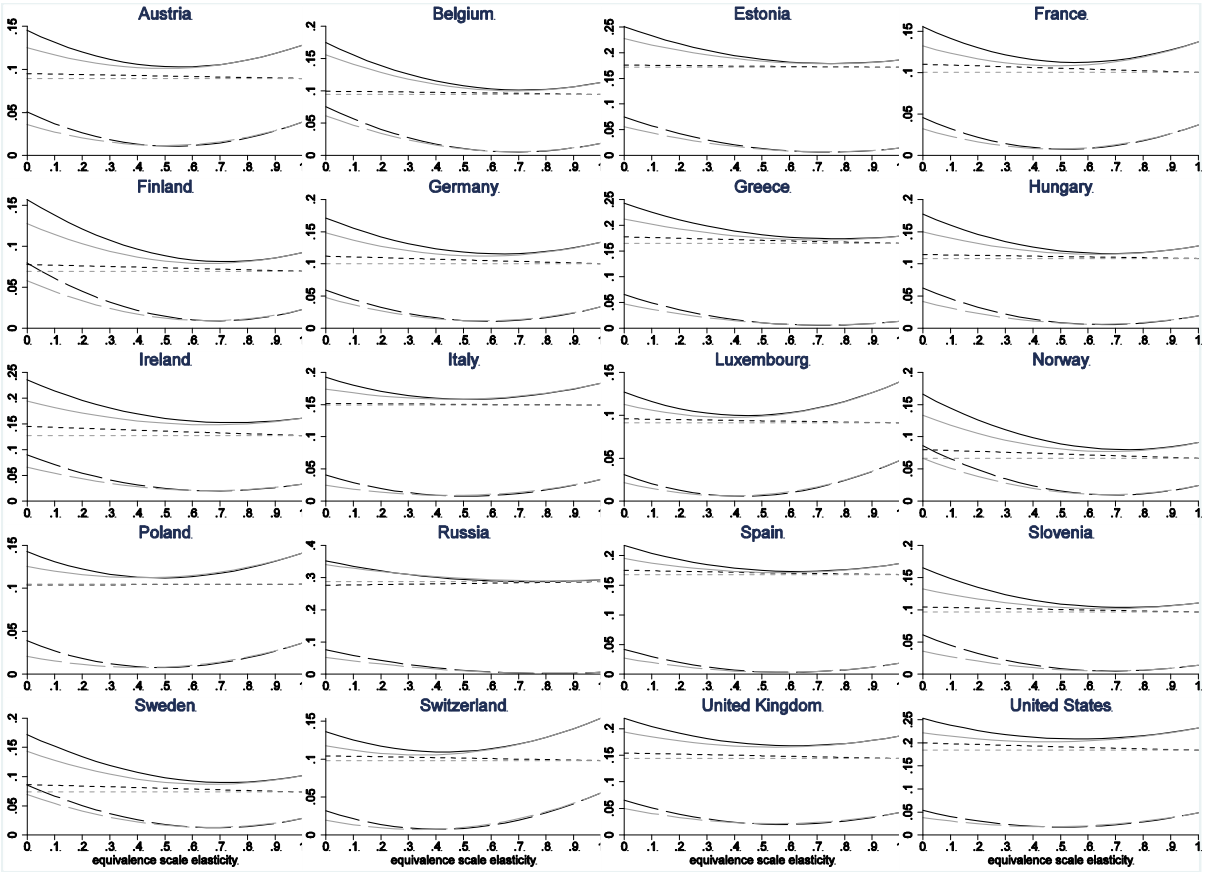
5. Decomposition analysis

This section starts with a general overview of the country-specific estimates from the inequality decomposition for both weighting schemes. Afterwards, we proceed with a detailed two-country case study. It seeks to carve out the country specifics of distributions of income and household types leading to weighting-dependent country rankings.

For admissible values of household-size economies, Figures 2a-2c provide the size and needs weighted levels of inequality, inequality within and inequality between for our three inequality indices. Grey lines refer to size weighting, black lines to needs weighting. Long dashed lines depict the inequality between component, short dashed lines the inequality within component, and solid lines refer to the sum of both, i.e. to the overall inequality index. Figures 2a-2c depict how variations of three ingredients - the functional form of the index (via variation of a), household-size economies (via variation of θ) and the type of weighting (by size versus needs) – affect the level of measured inequality in each of the twenty countries. The figures are provided for visualizing the role of weighting procedures for (bilateral) country inequality rankings. The figures are *not* intended to mislead the reader into inequality

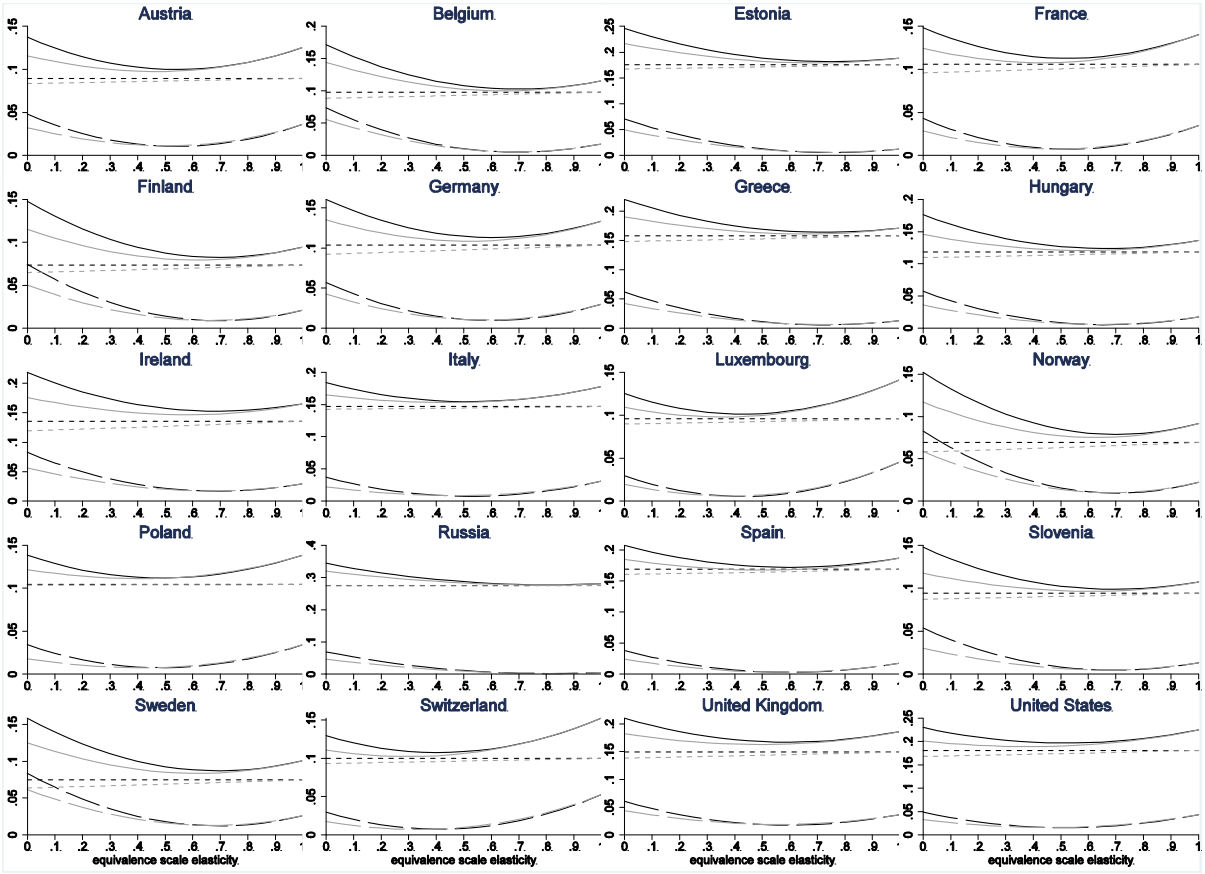
comparisons for a particular country along the dimension of one of the three ingredients. Such comparisons are meaningless as, whenever one of the ingredients is changed, we obtain a new measure.

Figure 2a. Decomposition of mean logarithmic deviation



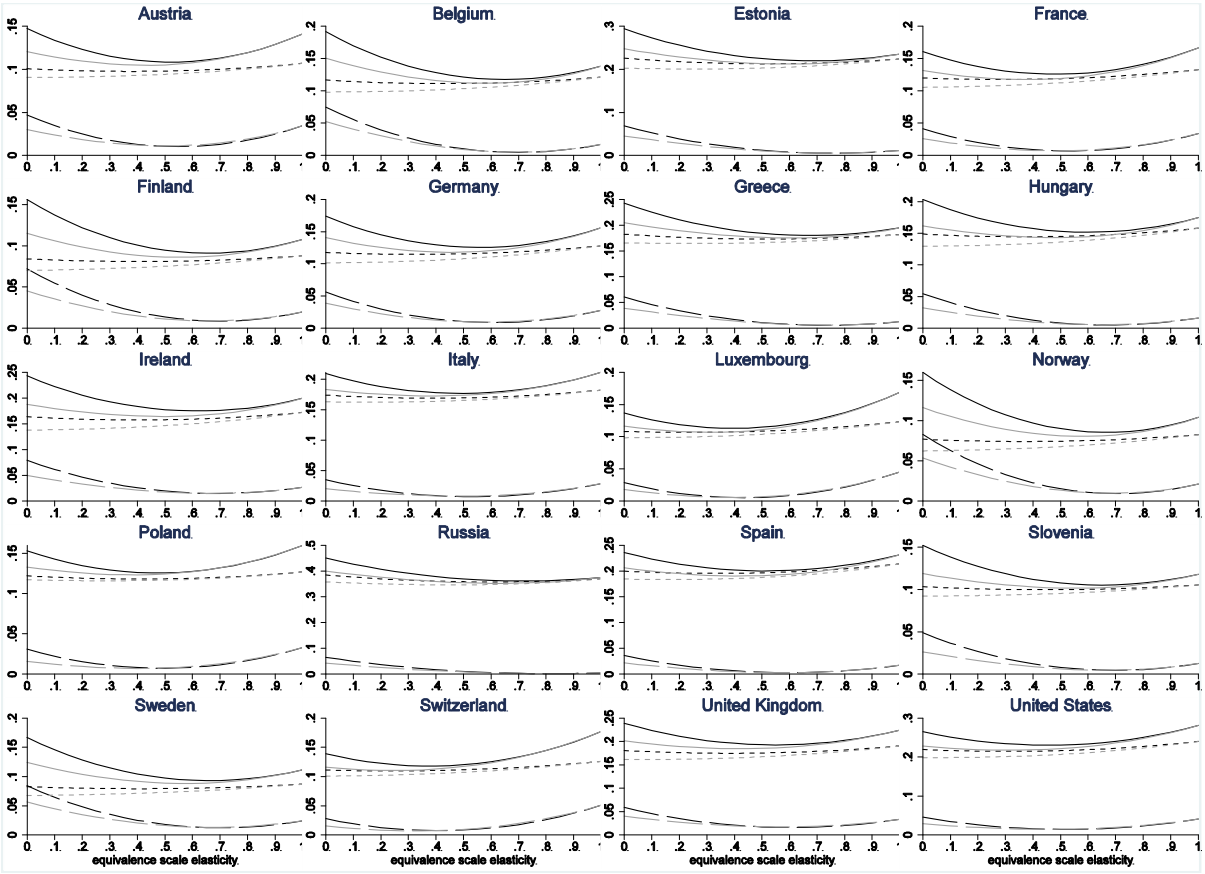
Note. Grey lines refer to size weighting, black lines to needs weighting. Solid lines indicate mean logarithmic deviation; short dashed lines the within-group inequality component; long dashed lines the between-group inequality component. Own calculations based on LIS 2000 data.

Figure 2b. Decomposition of Theil index



Note. Grey lines refer to size weighting, black lines to needs weighting. Solid lines indicate Theil index; short dashed lines the within-group inequality component; long dashed lines the between-group inequality component. Own calculations based on LIS 2000 data.

Figure 2c. Decomposition of half the square of the coefficient of variation



Note. Grey lines refer to size weighting, black lines to needs weighting. Solid lines indicate half the square of the coefficient of variation; short dashed lines the within-group inequality component; long dashed lines the between-group inequality component. Own calculations based on LIS 2000 data.

For matters of space, we shall confine ourselves to one bilateral case study. Our case study involves a comparison of France and Sweden for $GE(0)$. Readers who want to perform analogous bilateral country comparisons may consult the decomposition results summarized in Tables A2 together with Tables A3a-A3c in the Appendix. For France and Sweden, Table 4 conveys point estimates of mean logarithmic deviation, the inequality between- and within-group component at two levels of household size economies, i.e. $\theta = 0.5$ and $\theta = 0.25$. For $\theta = 0.5$ point estimates from both weighting schemes indicate more inequality in France. The result, however, reverts for $\theta = 0.25$. At the same time, the between (within) component explains a larger fraction of total inequality in Sweden (France). In case of size (needs) weighting and $\theta = 0.5$, it makes up 18.49 percent (18.57 percent) of overall inequality in Sweden as opposed to 7.20 percent (6.73 percent) in France. For $\theta = 0.25$, the between-group component in Sweden explains 32.47 percent (34.11 percent) of total inequality for size (needs) weighting while the respective number for France is 11.93 percent (14.17).

These patterns in combination with the further disaggregated statistics in Table 5 make the effects of weighting schemes on country rankings intelligible. Particularly, Table 5 provides the determinants of the mean logarithmic deviation and its within and between component decomposed by the nine household types.

Table 4. Inequality indices for France and Sweden

	State	$\theta = 0.50$		$\theta = 0.25$	
		S	N	S	N
GE(0)	FR	10.84	11.30	11.42	12.57
	SE	9.04	9.84	10.91	12.64
GEB(0)	FR	0.78	0.76	1.36	1.78
		(7.20)	(6.73)	(11.93)	(14.17)
	SE	1.67	1.83	3.54	4.31
		(18.49)	(18.57)	(32.47)	(34.11)
GEW(0)	FR	10.06	10.54	10.06	10.79
		(92.80)	93.27)	(88.07)	(85.83)
	SE	7.37	(8.01	7.37	8.33
		(81.51)	(81.43)	(67.53)	(65.89)

Note. GE(0) is mean logarithmic deviation; GEB(0) is between group inequality; GEW(0) is within group inequality. θ denotes the equivalence-scale elasticity. In parentheses: Contribution in percent to total inequality. All indices multiplied with 100. Own calculations based on LIS 2000 data.

Altogether, Table 5 consists of three panels. The first panel contains household-type specific measures that are invariable to equivalence scale elasticity, i.e. household sizes, size-weighted population shares and household types' mean logarithmic deviations. Comparing the two countries, there are two obvious dissimilarities. First, in Sweden the population share of childless single adults is particularly high (25.68 percent in Sweden vs. 14.21 percent in France). Second, household-type specific mean logarithmic deviations are always higher in France compared to Sweden, while the quantitative variation in subgroup indices is more pronounced for Sweden. Again, Swedish childless single adults again stick out with a subgroup index far above the other household types' indices.

The second (third) panel of Table 5 gives household-type specific equivalence scales, needs weighted population shares and mean equivalent incomes relative to the population-wide means when $\theta = 0.5$ ($\theta = 0.25$). The latter statistic reveals another remarkable difference between France and Sweden. It concerns the economic situation of childless single adults: Average equivalent income of childless single adults falls far below the Swedish average. For France, the gap is substantially smaller. Both effects combined it is not surprising that, compared with size weighting, a higher population share of childless single adults in case of needs weighting (particularly at high levels of household-size economies) has

other implications for the within- and between-group component in Sweden compared to France: In Sweden, both effects have a quantitatively stronger positive effect on measured inequality when switching from size to needs weighting. As a result, size and needs weighting lead to (in)consistent findings when household-size economies are low (high).

Table 5. Detailed decomposition results for France and Sweden

	State	1 adult, childless	1 adults, 1 child	1adult, 2 children	1 adult, 3 children	2 adults, childless	2 adults, 1 child	2 adults, 2 children	2 adults, 3 children	3 adults, childless
						Scale-independent statistics				
n		1	2	3	4	2	3	4	5	3
q_k^S	FR	14.21	2.10	1.85	0.64	30.26	13.32	19.39	9.25	8.98
	SE	25.68	3.11	2.95	1.13	27.59	9.62	17.49	7.32	5.10
$GE_k(0)$	FR	13.08	11.16	9.22	9.23	11.71	8.84	8.25	6.80	8.72
	SE	10.67	6.94	4.59	3.81	8.15	5.97	4.86	4.19	4.85
						$\theta = 0.5$				
$n^{0.5}$		1.41	1.73	2.00	1.41	1.73	2.00	2.24	1.73	1.41
q_k^N	FR	21.81	2.28	1.64	0.49	32.83	11.80	14.87	6.34	7.95
	SE	36.59	3.13	2.43	0.80	27.80	7.92	12.46	4.67	4.20
μ_k^S / μ^S	FR	86.56	68.32	59.90	59.33	108.87	102.46	96.73	92.84	120.72
	SE	75.14	72.35	70.03	66.06	115.96	108.79	109.36	98.89	133.50
μ_k^N / μ^N	FR	87.09	68.73	60.26	59.69	109.52	103.08	97.31	93.40	121.45
	SE	77.71	74.83	72.43	68.32	119.93	112.52	113.11	102.28	138.08
						$\theta = 0.25$				
$n^{0.25}$		1.19	1.32	1.41	1.19	1.32	1.41	1.50	1.32	1.19
q_k^N	FR	26.37	2.31	1.50	0.42	33.39	10.84	12.72	5.13	7.31
	SE	42.47	3.06	2.14	0.66	27.13	6.98	10.23	3.62	3.70
μ_k^S / μ^S	FR	68.28	64.09	62.18	66.18	102.12	106.37	107.91	109.51	125.33
	SE	44.99	51.52	55.18	55.94	82.57	85.73	92.60	88.54	105.20
μ_k^N / μ^N	FR	72.00	67.58	65.57	69.79	107.68	112.16	113.78	115.47	132.15
	SE	66.95	76.67	82.12	83.24	122.88	127.58	137.81	131.77	156.56

Note. n denotes household size; q_k^t is the fraction of the population living in type k households according to weighting scheme t. μ_k^t is mean equivalent income of type k household according to weighting scheme t; μ^t is mean equivalent income according to t. $GE_k(0)$ is mean logarithmic deviation in subgroup k. θ denotes the equivalence-scale elasticity; In parentheses and in italics: Fraction of total inequality. All indices multiplied with 100. Own calculations based on LIS 2000 data.

6. Conclusion

There is broad consensus regarding the adjustment of household incomes via equivalence scales in order to control for household economies when research involves the distribution of income and living standards in a society. On the contrary, the modus operandi concerning the weighting of household units is open to debate. When a population of differently-sized

households is transformed into an artificial equivalent population, two alternative conversion schemes have been advocated: a weighting by household size and by needs.

We have provided cross-country personal-income inequality rankings derived from size- and needs-weighted distributions. Our examination revealed that cross-country inequality rankings are sensitive to weighting for reasonable levels of within-household size economies. For example, when the square-root equivalence scale is applied, Kendall's rank correlation of size and needs weighted country rankings based on the Theil index is 0.905. Performing a two-country inequality decomposition case study we isolated the channels that lead to differences in size and needs weighted country inequality rankings. The identification of these channels turned out to be a complex yet doable task.

Finally, we want to point out that beyond cross-country inequality rankings it may well be that also country welfare (mean equivalent income) or poverty rankings, as well as the assessment of the distributional effects of tax-transfer systems, are sensitive to the choice between the two weighting-types we have studied here.

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Appendix

Table A1. Country-specific sample characteristics

State Code	State	*Average income*	*N*	*Coverage*
AT	Austria	34,159	1,792	79.20
BE	Belgium	105,818	1,937	87.39
EE	Estonia	5,710	4,880	78.09
FR	France	15,411	9,338	83.63
FI	Finland	13,908	9,406	88.78
DE	Germany	4,880	10,037	87.00
GR	Greece	430,244	2,977	69.80
HU	Hungary	84,873	1,570	73.13
IE	Ireland	2,001	1,851	68.43
IT	Italy	3,576	6,334	71.30
LU	Luxembourg	157,838	2,174	81.62
NO	Norway	29,093	11,279	87.57
PL	Poland	1,728	24,039	63.61
RU	Russia	3,235	2,465	66.15
ES	Spain	283,709	3,627	65.23
SI	Slovenia	195,632	2,565	61.01
SE	Sweden	21,846	13,449	90.16
CH	Switzerland	6,456	3,358	86.37
UK	United Kingdom	1,764	23,210	83.66
US	United States	3,984	43,711	78.63

Note. Average income is monthly disposable household income per individual denoted in local currency. *N* gives the non-weighted size of the country-specific working samples. Coverage gives the weighted fraction of the initial LIS dataset living in the considered nine household types. Own calculations based on LIS 2000 data.

Table A2. Country-specific sample characteristics by household type

State		1 adult, childless	1 adults, 1 child	1adult, 2 children	1 adult, 3 children	2 adults, childless	2 adults, 1 child	2 adults, 2 children	2 adults, 3 children	3 adults, childless
	N	502	42	23	2	608	153	213	60	189
AT	*Pop. share*	16.46	2.78	1.61	0.17	29.15	14.24	19.64	4.97	10.97
	Av. income	18,508	20,240	23,505	21,138	34,039	38,043	39,169	40,593	46,325
	N	603	35	25	7	636	174	265	96	96
BE	*Pop. share*	17.46	2.05	1.80	0.88	29.53	10.45	22.39	9.22	6.22
	Av. income	48,121	56,425	69,231	68,810	104,914	120,736	129,154	145,420	136,386
	N	1,102	166	69	21	1,650	610	523	139	600
EE	*Pop. share*	14.74	3.59	1.50	0.57	28.94	17.72	16.27	4.16	12.52
	Av. income	2,526	3,599	3,559	3,011	5,087	6,911	7,789	7,577	6,857
	N	2,640	219	125	35	3,278	879	1,086	417	659
FR	*Pop. share*	14.21	2.10	1.85	0.64	30.26	13.32	19.39	9.25	8.98
	Av. income	8198	9,150	9,825	11,237	14,581	16,807	18,322	19,660	19,803
	N	2,047	157	89	26	3,523	1,032	1,219	531	782
FI	*Pop. share*	19.84	2.45	1.80	0.77	32.45	11.16	16.12	8.43	6.98
	Av. income	6,456	8,905	10,280	11,969	13,710	16,379	18,293	19,124	18,527
	N	3,016	220	104	21	3,573	1,029	1,082	304	688
DE	*Pop. share*	22.52	2.29	1.32	0.28	33.01	12.36	15.18	4.82	8.22
	Av. income	2,653	2,553	2,489	3,050	5,097	5,667	6,315	6,252	6,560
	N	595	16	14	1	1,063	290	441	70	487
GR	*Pop. share*	10.29	0.51	0.65	0.04	27.58	11.26	25.55	4.32	19.80
	Av. income	201,218	289,840	280,318	931,000	315,507	521,603	547,652	462,454	506,243

Table continues

Table continued

	N	393	22	7	2	556	154	176	40	220
HU	*Pop. share*	14.22	1.23	0.44	0.19	29.80	12.67	18.01	4.79	18.66
	Av. income	41,458	43,222	70,985	45,458	73,925	105,998	106,929	101,826	98,928
	N	480	37	25	8	565	156	242	163	175
IE	*Pop. share*	12.69	3.26	2.37	1.52	22.65	11.33	22.11	14.53	9.54
	Av. income	947	835	945	872	1,693	2,278	2,428	2,826	2,401
	N	1,454	53	19	6	2,157	667	759	141	1,078
IT	*Pop. share*	10.82	0.80	0.38	0.26	28.60	14.96	19.64	4.63	19.91
	Av. income	1,892	2,658	2,477	2,333	3,310	3,842	3,761	3,703	4,536
	N	583	30	13	2	735	270	255	96	190
LU	*Pop. share*	13.84	1.07	0.88	0.09	30.05	14.83	19.90	9.21	10.13
	Av. income	95,810	95,666	98,877	55,288	151,196	160,864	180,182	182,251	204,341
	N	2,811	299	128	32	3,670	1,114	1,514	703	1,008
NO	*Pop. share*	21.93	3.66	2.40	0.70	26.65	10.23	17.88	9.67	6.87
	Av. income	13,224	19,286	20,611	23,185	28,476	34,217	38,221	41,831	41,592
	N	4,311	547	300	114	7,267	3,441	3,754	1,370	2,935
PL	*Pop. share*	7.11	1.73	1.35	0.69	23.72	16.65	23.82	10.68	14.24
	Av. income	850	1,196	1,240	1,212	1,567	1,856	1,935	1,817	2,005
	N	611	122	29	2	775	417	235	30	244
RU	*Pop. share*	10.65	4.25	1.52	0.16	27.01	21.80	19.31	2.54	12.76
	Av. income	1,291	2,491	2,166	1,128	2,741	3,914	4,010	5,795	3,462
	N	716	22	11	3	1,337	462	474	80	522
ES	*Pop. share*	8.94	0.46	0.47	0.16	30.30	15.66	21.29	4.62	18.12
	Av. income	133,700	156,883	179,362	268,475	242,902	303,652	336,284	371,434	330,616
	N	365	29	11	0	844	304	389	57	566
SI	*Pop. share*	8.59	1.17	0.69	0.00	24.55	14.37	25.45	4.16	21.02
	Av. income	81,139	116,026	127,828	0	158,345	207,803	233,124	218,648	234,378
	N	4,694	237	150	43	4,772	978	1,332	446	797
SE	*Pop. share*	25.68	3.11	2.95	1.13	27.59	9.62	17.49	7.32	5.10
	Av. income	10,444	14,222	16,859	18,363	22,794	26,192	30,401	30,736	32,141
	N	895	45	40	9	1,192	307	509	172	189
CH	*Pop. share*	15.67	0.89	1.23	0.31	33.35	10.66	20.86	8.19	8.85
	Av. income	4,013	4,290	4,684	4,477	6,776	6,762	6,938	7,267	7,852
	N	7,179	805	659	268	8,036	1,853	2,354	802	1,254
UK	*Pop. share*	14.41	2.70	3.23	1.79	33.18	10.20	17.06	7.29	10.14
	Av. income	897	882	952	966	1,719	1,965	2,279	2,146	2,434
	N	12,442	1,337	914	348	14,902	4,231	4,758	1,929	2,850
US	*Pop. share*	12.95	2.77	2.86	1.43	30.40	12.97	19.06	9.09	8.49
	Av. income	2,029	2,117	2,266	1,886	3,995	4,511	4,870	4,672	4,935

Note. *N* denotes non weighted number of observation. "Pop. share" is the fraction of working sample living in a household type (weighted by LIS frequency weights; in percent). "Av. income" denotes mean disposable income (weighted by LIS frequency weights). See Table A1 for country code definitions. Own calculations based on LIS 2000 data.

Table A3a. Subgroup specific mean logarithmic deviations

State	1 adult, childless	1 adults, 1 child	1adult, 2 children	1 adult, 3 children	2 adults, childless	2 adults, 1 child	2 adults, 2 children	2 adults, 3 children	3 adults, childless
AT	10.23 *(9.11;11.22)*	5.95 *(3.03;7.56)*	9.12 *(1.96;12.72)*	2.10 *(0.58;3.02)*	11.01 *(9.96;11.87)*	6.73 *(5.63;8.05)*	7.49 *(5.70;9.00)*	7.98 *(4.33;10.64)*	8.36 *(6.92;9.48)*
BE	9.83 *(7.19;11.79)*	5.24 *(2.08;7.61)*	9.31 *(3.25;14.72)*	4.29 *(-2.73;8.70)*	12.48 *(11.11;13.77)*	7.13 *(4.82;9.08)*	9.04 *(6.97;11.18)*	5.85 *(3.10;7.64)*	6.71 *(3.95;8.42)*
EE	19.34 *(16.12;22.50)*	18.32 *(9.65;23.57)*	11.00 *(6.08;14.79)*	10.49 *(3.57;16.48)*	16.84 *(15.50;18.42)*	16.74 *(14.63;18.41)*	18.02 *(15.08;19.92)*	15.09 *(11.51;18.35)*	16.21 *(14.11;18.28)*
FR	13.08 *(12.09;13.88)*	11.16 *(9.04;13.07)*	9.22 *(6.59;12.34)*	9.23 *(4.66;13.51)*	11.71 *(11.20;12.22)*	8.84 *(7.94;9.86)*	8.25 *(7.48;8.95)*	6.80 *(5.46;7.67)*	8.72 *(7.67;9.73)*
FI	9.07 *(8.30;9.76)*	6.44 *(4.48;7.91)*	4.51 *(3.10;5.81)*	3.95 *(0.95;6.20)*	8.22 *(7.72;8.49)*	6.04 *(5.27;6.79)*	4.80 *(4.27;5.29)*	4.53 *(3.85;5.15)*	5.59 *(4.36;6.41)*
DE	13.54 *(12.12;14.67)*	8.95 *(6.41;10.85)*	14.75 *(9.10;19.10)*	2.93 *(1.42;4.22)*	10.58 *(9.97;11.17)*	8.49 *(7.40;9.42)*	7.27 *(5.79;8.43)*	7.75 *(6.17;9.41)*	6.91 *(4.62;8.16)*
GR	22.01 *(19.58;24.72)*	26.00 *(7.27;41.24)*	23.30 *(12.13;32.54)*	0.00 *(0.00;0.00)*	18.65 *(16.76;20.18)*	16.09 *(13.53;20.29)*	15.01 *(12.06;17.96)*	12.09 *(8.38;17.00)*	13.53 *(10.13;16.95)*
HU	13.04 *(9.67;16.22)*	12.95 *(4.23;19.93)*	4.61 *(0.99;7.40)*	4.56 *(-1.77;2.80)*	11.38 *(10.04;13.14)*	14.21 *(9.56;16.12)*	10.28 *(6.37;13.44)*	5.51 *(1.74;9.36)*	8.12 *(5.05;11.05)*
IE	18.27 *(14.67;20.57)*	7.17 *(3.95;9.49)*	6.30 *(2.62;8.47)*	4.83 *(-1.41;7.76)*	17.76 *(14.69;19.72)*	11.14 *(8.04;14.56)*	8.92 *(6.45;11.13)*	10.78 *(7.39;13.28)*	12.36 *(6.70;16.21)*
IT	16.27 *(14.32;18.15)*	11.42 *(4.94;16.40)*	14.41 *(3.69;21.13)*	12.88 *(-4.21;21.16)*	15.30 *(14.00;16.43)*	13.90 *(11.66;15.88)*	14.59 *(12.66;16.75)*	16.51 *(9.22;21.00)*	14.60 *(12.77;16.17)*
LU	10.39 *(8.21;11.93)*	7.33 *(3.68;8.83)*	10.73 *(2.80;16.23)*	2.28 *(-0.51;1.76)*	10.46 *(9.56;11.23)*	8.37 *(6.59;10.41)*	8.15 *(6.71;9.26)*	8.06 *(6.15;9.49)*	7.55 *(5.63;8.87)*
NO	10.51 *(9.86;11.19)*	7.13 *(4.84;8.74)*	5.89 *(2.42;8.79)*	3.00 *(0.71;4.91)*	7.41 *(6.97;7.84)*	4.81 *(4.15;5.36)*	4.54 *(4.09;4.94)*	3.91 *(3.04;4.52)*	4.25 *(3.73;4.73)*
PL	10.60 *(10.07;11.25)*	12.80 *(10.86;14.47)*	10.18 *(8.40;11.90)*	9.76 *(4.63;13.52)*	9.71 *(9.38;10.06)*	11.54 *(10.97;12.15)*	10.54 *(10.02;10.96)*	10.96 *(10.15;11.76)*	9.72 *(9.14;10.30)*
RU	26.17 *(20.15;30.92)*	38.58 *(29.11;46.10)*	36.70 *(13.62;53.97)*	0.00 *(0.00;0.00)*	22.88 *(19.18;25.60)*	34.58 *(26.71;43.62)*	32.98 *(27.64;38.87)*	39.42 *(16.93;52.29)*	20.88 *(4.27;28.64)*
ES	21.64 *(18.33;24.63)*	13.77 *(5.51;21.64)*	23.39 *(7.91;31.99)*	23.93 *(-5.09;22.65)*	17.79 *(16.59;19.14)*	13.70 *(9.26;16.02)*	17.32 *(15.04;20.04)*	19.17 *(13.98;23.47)*	14.06 *(9.41;16.18)*
SI	11.83 *(9.88;13.43)*	7.31 *(2.33;9.98)*	14.48 *(-0.57;22.47)*	0.00 *(0.00;0.00)*	12.69 *(11.03;13.82)*	8.81 *(7.01;10.36)*	7.05 *(5.29;8.40)*	7.29 *(3.07;9.79)*	9.48 *(7.73;10.89)*
SE	10.67 *(10.15;11.19)*	6.94 *(4.87;8.64)*	4.59 *(2.87;6.32)*	3.81 *(0.32;6.86)*	8.15 *(7.81;8.52)*	5.97 *(5.23;6.53)*	4.86 *(4.25;5.27)*	4.19 *(3.56;4.86)*	4.85 *(4.07;5.35)*
CH	11.41 *(9.78;12.56)*	5.51 *(3.53;7.30)*	10.26 *(6.22;13.65)*	5.15 *(1.40;7.48)*	11.32 *(10.37;12.16)*	7.01 *(5.88;8.05)*	6.95 *(6.02;8.03)*	10.29 *(6.52;13.07)*	11.59 *(8.65;13.83)*
UK	17.62 *(16.90;18.27)*	10.15 *(8.86;11.33)*	9.08 *(7.48;10.15)*	6.04 *(4.29;7.36)*	16.75 *(16.29;17.16)*	13.41 *(12.58;14.40)*	12.49 *(11.76;13.14)*	12.13 *(11.08;13.10)*	12.14 *(11.23;13.02)*
US	24.87 *(24.06;25.82)*	18.59 *(17.27;20.39)*	21.83 *(18.33;25.24)*	21.12 *(16.98;26.11)*	19.67 *(19.00;20.19)*	16.64 *(15.75;17.57)*	15.06 *(14.19;15.68)*	15.69 *(14.54;16.89)*	15.41 *(14.48;16.26)*

Note. Point estimates and, in parentheses and italics, 95 percent bootstrap confidence intervals. All indices multiplied with 100. See Table A1 in the Appendix for definition of country codes. Own calculations based on LIS 2000 data.

Table A3b. Subgroup specific Theil indices

State	1 adult, childless	1 adults, 1 child	1adult, 2 children	1 adult, 3 children	2 adults, childless	2 adults, 1 child	2 adults, 2 children	2 adults, 3 children	3 adults, childless
AT	10.49	5.52	8.30	2.21	10.29	6.41	7.12	6.77	8.08
	(9.25;11.59)	*(2.64;7.07)*	*(1.81;11.14)*	*(0.69;3.14)*	*(9.38;11.13)*	*(5.35;7.55)*	*(5.71;8.20)*	*(4.09;8.85)*	*(6.64;9.11)*
BE	11.14	5.58	9.54	3.47	12.75	6.56	8.14	5.50	6.61
	(7.56;13.95)	*(2.30;8.14)*	*(2.42;15.00)*	*(-3.12;7.30)*	*(11.10;14.24)*	*(4.73;7.97)*	*(6.14;9.87)*	*(2.79;6.95)*	*(4.16;8.29)*
EE	22.32	19.46	11.46	9.68	17.99	15.34	16.45	14.61	15.32
	(17.92;25.74)	*(8.04;26.39)*	*(5.99;15.44)*	*(3.83;15.06)*	*(16.47;19.89)*	*(13.38;16.80)*	*(14.45;18.33)*	*(10.72;17.57)*	*(13.13;17.02)*
FR	13.83	11.62	9.91	10.10	11.62	8.58	8.16	6.76	8.20
	(12.71;14.80)	*(8.97;13.72)*	*(6.44;13.88)*	*(4.32;14.88)*	*(11.02;12.15)*	*(7.75;9.64)*	*(7.41;8.82)*	*(5.76;7.60)*	*(7.30;9.13)*
FI	9.79	6.30	4.50	4.38	8.25	5.66	4.61	4.41	5.27
	(8.98;10.75)	*(4.55;7.70)*	*(2.91;5.74)*	*(1.61;6.78)*	*(7.77;8.55)*	*(5.02;6.28)*	*(4.13;5.02)*	*(3.70;4.96)*	*(4.34;5.94)*
DE	13.96	8.55	13.92	2.70	10.22	8.30	7.13	7.29	6.51
	(12.02;15.40)	*(6.19;10.56)*	*(8.35;17.83)*	*(1.45;3.88)*	*(9.61;10.77)*	*(7.29;9.19)*	*(5.71;8.23)*	*(6.10;8.79)*	*(4.78;7.55)*
GR	21.08	22.11	21.28	0.00	18.38	14.96	13.82	11.64	12.26
	(18.79;24.04)	*(5.16;34.18)*	*(10.10;30.65)*	*(0.00;0.00)*	*(16.54;19.91)*	*(12.02;19.29)*	*(11.39;16.65)*	*(8.07;16.24)*	*(9.35;15.32)*
HU	16.08	14.16	4.72	4.51	12.33	14.27	9.83	5.49	8.10
	(12.04;20.67)	*(5.42;21.73)*	*(1.03;7.52)*	*(-1.74;2.77)*	*(10.89;14.38)*	*(9.70;16.05)*	*(6.04;13.20)*	*(2.03;9.19)*	*(5.16;10.99)*
IE	18.97	6.91	6.35	4.95	18.14	10.11	8.56	10.30	12.31
	(15.17;22.00)	*(3.63;9.16)*	*(2.32;8.64)*	*(-1.38;8.02)*	*(14.59;20.59)*	*(7.32;13.42)*	*(6.07;10.69)*	*(7.17;12.71)*	*(6.96;16.52)*
IT	17.27	11.85	14.68	11.64	15.45	13.08	13.78	16.11	13.29
	(14.86;19.53)	*(4.07;17.23)*	*(3.57;21.64)*	*(-5.30;18.23)*	*(13.80;16.77)*	*(10.82;14.97)*	*(12.05;15.42)*	*(10.40;20.03)*	*(11.46;14.69)*
LU	11.52	7.07	11.31	2.22	10.45	7.94	8.24	7.86	7.56
	(8.48;13.52)	*(4.12;8.58)*	*(2.73;16.61)*	*(-0.54;1.73)*	*(9.42;11.22)*	*(5.85;10.20)*	*(6.55;9.29)*	*(6.19;9.30)*	*(5.69;8.86)*
NO	10.48	7.03	5.19	2.68	7.30	4.67	4.46	3.82	4.10
	(9.53;11.36)	*(4.54;8.65)*	*(2.39;7.21)*	*(0.97;4.26)*	*(6.87;7.71)*	*(3.96;5.21)*	*(4.00;4.88)*	*(3.15;4.39)*	*(3.66;4.61)*
PL	12.05	13.46	10.23	11.13	9.80	11.18	10.30	10.83	9.38
	(11.33;12.90)	*(11.10;15.54)*	*(8.10;12.25)*	*(4.18;16.45)*	*(9.44;10.15)*	*(10.62;11.73)*	*(9.76;10.70)*	*(10.03;11.57)*	*(8.76;9.92)*
RU	33.75	36.98	32.76	0.00	23.84	30.53	28.68	34.18	18.23
	(25.60;39.92)	*(28.24;44.39)*	*(14.40;49.51)*	*(0.00;0.00)*	*(20.22;27.00)*	*(24.73;36.10)*	*(24.54;33.91)*	*(16.58;46.33)*	*(4.57;24.91)*
ES	24.99	14.69	22.06	20.92	17.78	13.05	16.45	18.93	13.13
	(20.11;28.69)	*(6.83;23.11)*	*(7.94;30.37)*	*(-6.29;21.74)*	*(16.42;19.23)*	*(7.60;15.14)*	*(14.28;19.38)*	*(14.58;22.37)*	*(7.93;15.11)*
SI	12.00	7.27	13.76	0.00	12.05	8.18	6.71	7.15	8.59
	(10.05;13.72)	*(2.73;9.83)*	*(-1.37;21.11)*	*(0.00;0.00)*	*(10.44;13.21)*	*(6.60;9.54)*	*(5.31;7.90)*	*(3.13;9.53)*	*(7.40;9.65)*
SE	10.38	6.77	4.55	4.28	7.79	5.52	4.56	4.11	4.41
	(9.75;10.90)	*(4.57;8.47)*	*(2.73;6.36)*	*(0.00;7.91)*	*(7.51;8.08)*	*(4.96;6.04)*	*(4.03;4.91)*	*(3.49;4.65)*	*(3.95;4.79)*
CH	11.82	5.59	10.20	4.97	10.73	6.93	6.83	9.40	10.55
	(10.13;13.34)	*(3.59;7.39)*	*(5.69;13.86)*	*(1.23;7.19)*	*(10.05;11.69)*	*(5.83;7.91)*	*(6.03;7.83)*	*(6.57;11.70)*	*(7.93;12.70)*
UK	19.07	11.29	10.30	6.60	16.39	12.58	11.96	12.10	11.43
	(18.19;19.87)	*(9.61;12.98)*	*(8.02;11.60)*	*(4.74;8.24)*	*(15.96;16.80)*	*(11.78;13.39)*	*(11.32;12.54)*	*(11.00;12.99)*	*(10.54;12.10)*
US	25.00	17.34	21.58	22.28	18.35	15.61	14.63	15.26	13.91
	(24.03;26.21)	*(15.87;18.83)*	*(17.89;25.36)*	*(16.75;28.26)*	*(17.70;18.96)*	*(14.73;16.56)*	*(13.69;15.31)*	*(14.03;16.61)*	*(12.96;14.49)*

Note. Point estimates and, in parentheses and italics, 95 percent bootstrap confidence intervals. All indices multiplied with 100. See Table A1 in the Appendix for definition of country codes. Own calculations based on LIS 2000 data.

Table A3c. Subgroup specific half the square of the coefficient of variation

State	1 adult, childless	1 adults, 1 child	1adult, 2 children	1 adult, 3 children	2 adults, childless	2 adults, 1 child	2 adults, 2 children	2 adults, 3 children	3 adults, childless
AT	12.04 *(10.09;13.57)*	5.52 *(2.70;7.33)*	8.79 *(1.72;12.44)*	2.35 *(0.81;3.31)*	10.81 *(9.86;11.91)*	6.52 *(5.40;7.70)*	7.40 *(6.00;8.36)*	6.42 *(4.19;8.25)*	8.49 *(6.83;9.71)*
BE	14.92 *(7.99;20.07)*	6.26 *(2.31;9.11)*	10.97 *(1.45;17.42)*	2.98 *(-3.06;6.49)*	14.55 *(12.26;16.63)*	6.62 *(4.83;8.07)*	8.13 *(6.37;9.80)*	5.53 *(2.59;7.19)*	6.95 *(4.04;9.10)*
EE	31.51 *(23.18;36.84)*	26.84 *(7.56;39.29)*	13.42 *(5.93;18.60)*	9.68 *(4.00;14.79)*	22.56 *(20.37;25.13)*	16.36 *(14.00;18.27)*	17.46 *(15.09;19.83)*	16.35 *(11.29;19.86)*	16.72 *(13.79;18.72)*
FR	16.77 *(15.07;18.27)*	13.62 *(9.25;16.48)*	11.89 *(7.32;17.86)*	12.18 *(4.34;18.50)*	12.82 *(11.95;13.48)*	9.08 *(8.19;10.32)*	8.73 *(7.73;9.44)*	7.19 *(5.98;8.08)*	8.37 *(7.46;9.35)*
FI	11.83 *(10.55;13.38)*	6.66 *(4.62;8.18)*	4.75 *(2.83;6.05)*	5.04 *(1.67;7.71)*	8.93 *(8.32;9.31)*	5.67 *(5.10;6.22)*	4.67 *(4.17;5.12)*	4.49 *(3.70;5.03)*	5.32 *(4.52;5.85)*
DE	16.94 *(13.84;19.39)*	8.99 *(5.81;11.47)*	14.87 *(7.69;19.64)*	2.54 *(1.46;3.64)*	10.94 *(10.16;11.54)*	8.79 *(7.50;9.85)*	7.63 *(5.95;8.82)*	7.50 *(5.93;9.04)*	6.70 *(5.28;7.79)*
GR	24.21 *(19.86;28.75)*	24.98 *(-3.18;40.18)*	21.53 *(7.17;32.89)*	0.00 *(0.00;0.00)*	21.25 *(18.71;23.48)*	15.93 *(11.14;21.61)*	14.61 *(12.15;17.88)*	12.52 *(8.49;18.27)*	12.71 *(9.16;16.14)*
HU	24.37 *(17.07;32.91)*	17.26 *(5.88;27.38)*	4.95 *(0.91;7.84)*	4.52 *(-1.86;2.79)*	15.18 *(12.74;18.09)*	16.13 *(10.81;19.09)*	10.35 *(5.45;14.59)*	5.75 *(1.61;9.62)*	8.79 *(5.48;12.10)*
IE	22.44 *(17.39;25.96)*	6.99 *(3.19;9.37)*	6.76 *(2.20;9.33)*	5.24 *(-1.57;8.57)*	21.32 *(16.52;24.95)*	10.17 *(7.01;13.56)*	9.14 *(6.11;11.84)*	11.04 *(7.31;14.10)*	13.86 *(7.85;18.86)*
IT	21.89 *(17.87;25.99)*	14.25 *(2.46;21.61)*	16.81 *(0.67;25.75)*	11.55 *(-5.31;17.54)*	18.29 *(15.56;20.42)*	14.25 *(10.60;16.56)*	15.15 *(12.95;17.36)*	18.29 *(11.76;22.81)*	13.97 *(11.09;15.47)*
LU	14.61 *(10.19;17.83)*	7.12 *(3.69;8.77)*	12.68 *(2.60;18.28)*	2.19 *(-0.63;1.72)*	11.32 *(10.27;12.25)*	8.07 *(5.47;10.80)*	8.87 *(6.93;10.09)*	8.17 *(6.58;9.99)*	8.04 *(6.00;9.37)*
NO	12.00 *(10.29;13.41)*	8.03 *(4.65;10.54)*	5.20 *(2.49;7.17)*	2.57 *(1.03;4.01)*	7.82 *(7.24;8.26)*	4.84 *(4.02;5.44)*	4.69 *(4.16;5.12)*	3.96 *(3.25;4.55)*	4.15 *(3.66;4.72)*
PL	15.82 *(14.37;17.38)*	16.43 *(12.08;19.82)*	11.64 *(8.19;14.92)*	15.06 *(2.99;23.60)*	11.02 *(10.49;11.47)*	12.09 *(11.41;12.82)*	11.13 *(10.49;11.64)*	11.97 *(11.08;12.92)*	10.01 *(9.27;10.66)*
RU	61.02 *(39.25;73.95)*	48.35 *(33.61;59.82)*	41.42 *(13.76;65.52)*	0.00 *(0.00;0.00)*	32.21 *(25.29;37.95)*	36.27 *(29.35;42.42)*	32.64 *(26.20;39.72)*	39.53 *(17.89;55.89)*	19.74 *(3.39;28.59)*
ES	35.96 *(25.07;43.66)*	17.75 *(7.81;28.58)*	23.54 *(7.32;33.46)*	19.93 *(-9.18;23.27)*	20.69 *(18.71;22.95)*	14.26 *(7.11;16.83)*	18.18 *(15.04;21.58)*	21.18 *(16.19;24.46)*	14.01 *(7.65;16.74)*
SI	13.65 *(11.28;16.18)*	7.81 *(2.77;10.96)*	14.55 *(0.51;22.37)*	0.00 *(0.00;0.00)*	13.10 *(11.03;14.57)*	8.34 *(6.63;9.85)*	7.02 *(5.56;8.34)*	7.48 *(3.24;10.06)*	8.62 *(7.49;9.66)*
SE	11.54 *(10.56;12.30)*	7.46 *(4.84;9.74)*	4.95 *(2.53;7.18)*	5.26 *(-0.46;9.97)*	8.10 *(7.79;8.43)*	5.59 *(5.04;6.17)*	4.58 *(4.12;4.94)*	4.26 *(3.62;4.74)*	4.30 *(3.88;4.72)*
CH	14.09 *(11.30;16.52)*	5.92 *(3.93;7.92)*	11.07 *(5.17;15.57)*	4.92 *(1.25;7.12)*	11.29 *(10.54;12.53)*	7.33 *(6.12;8.44)*	7.32 *(6.23;8.35)*	9.68 *(6.84;12.48)*	10.65 *(8.13;12.80)*
UK	24.69 *(23.07;26.44)*	14.30 *(11.31;16.95)*	13.37 *(9.03;16.08)*	7.90 *(5.05;10.11)*	18.47 *(17.89;19.04)*	13.49 *(12.50;14.52)*	12.94 *(12.16;13.68)*	13.48 *(12.07;14.69)*	12.06 *(11.13;12.92)*
US	32.97 *(30.68;35.42)*	19.75 *(17.17;22.45)*	28.47 *(19.74;36.46)*	31.55 *(18.70;44.20)*	20.93 *(19.95;21.82)*	17.75 *(16.39;19.29)*	16.91 *(15.59;18.04)*	17.72 *(16.01;19.76)*	14.81 *(13.44;15.58)*

Note. Point estimates and, in parentheses and italics, 95 percent bootstrap confidence intervals. All indices multiplied with 100. See Table A1 in the Appendix for definition of country codes. Own calculations based on LIS 2000 data.

Zusammenfassung

Die vorliegende kumulative Dissertation besteht aus vier Beiträgen. Der erste Beitrag *Incomes and Inequality in the Long Run: The Case of German Elderly* ist eine Gemeinschaftsarbeit mit Carsten Schröder und Katharina Schulte, wobei jeder Autor einen eigenen Beitrag von 33% geleistet hat. Darüber hinaus wurde das Papier zur Veröffentlichung im *German Economic Review* akzeptiert. In dem Beitrag werden sechs Wellen der Einkommens- und Verbrauchsstichprobe (EVS) benutzt um die Einkommensverteilung der älteren Bevölkerung über den Zeitraum von 1978 bis 2003 zu untersuchen. Die ältere Bevölkerung, definiert als Individuen, die mindestens das 55te Lebensjahr erreicht haben, wird nach neuen und alten Bundesländern zerlegt. Weiterhin wird zwischen Personen mit Renten- und/ oder Pensionsbezug und solchen ohne diese Bezüge unterschieden. Ungleichheitsmaße werden darüber hinaus nach Einkommenskomponenten zerlegt und die Bootstrapmethode wird angewandt, um die statistische Signifikanz der Ergebnisse zu überprüfen.

Der zweite Beitrag *Poverty in Germany – Statistical Inference and Decomposition* ist wiederum ein gemeinsames Werk mit Carsten Schröder. Sein Anteil liegt in diesem Fall bei 50% und der Artikel ist angenommen zur Publikation im *Journal of Economics and Statistics (Jahrbücher für Nationalökonomie und Statistik)*. Inhaltlich setzt sich der Beitrag mit der Armutsentwicklung in Deutschland über den Zeitraum von 1978 bis 2003 auseinander. Wie schon dem ersten Beitrag liegen diesem Artikel sechs Wellen der EVS zugrunde und die Signifikanz von Resultaten wird mit der Bootstrapmethode überprüft. Weiterhin werden Armutsrisiko und Armutsintensität nach Haushaltstypen und Regionen zerlegt. Ein Vergleich der Haushaltstypen zeigt, dass insbesondere Alleinerziehende ein hohes Armutsrisiko tragen ,und eine Zerlegung nach Regionen offenbart, dass das Armutsriko besonders in den neuen Bundesländern sehr ausgeprägt ist. Welche Rolle die unterschiedliche Verteilung der Haushaltscharakteristika zwischen den beiden Regionen auf das unterschiedliche Armutsrisiko hat, wird mittels einer nichtlinearen Oaxaca-Blinder-Zerlegung quantifiziert.

Der dritte Beitrag *Cohort Earnings Inequality and Mobility: Evidence from German Social Security Records* ist ein alleiniges Projekt und nutzt Längsschnittdaten der Sozialversicherung um auf Basis individueller Erwerbsbiographien die langfristige Entwicklung von Lohnungleichheit und Lohnmobilität in Deutschland zu untersuchen. Der Untersuchungszeitraum erstreckt sich über 40 Jahre von 1967 bis 2007. Kategorisiert nach vier Alterskohorten werden die Jahreseinkommen aus sozialversicherungspflichtiger Beschäftigung westdeutscher Männer untersucht. Jede Alterskohorte umfasst 10 Jahre. Es

wird gezeigt, dass die Lohnungleichheit in der jüngsten und ältesten Alterskohorte höher als für die mittleren Kohorten ist und insgesamt über den untersuchten Zeitraum für alle Alterskohorten zunimmt. Demgegenüber ist sowohl die kurzfristige als auch langfristige Lohnmobilität unverändert geblieben. Eine Zerlegung der Ungleichheit in eine permanente und eine transitorische Komponente hat zum Ergebnis, dass die Zunahme der Ungleichheit fast ausschließlich auf einen Anstieg in der permanenten Ungleichheit zurückzuführen ist.

Der vierte Teil *Country Inequality Rankings and Conversion Schemes* leistet einen Beitrag zum konzeptionellen Verständnis von Einkommensverteilungen und ist wiederum ein gemeinsames Projekt mit Carsten Schröder. Sein Anteil beträgt auch hier 50%. In dem Papier wird untersucht, welchen Einfluss zwei unterschiedliche Gewichtungsstrategien von äquivalenten Haushaltseinkommen auf die gemessene Ungleichheit von individuellen Lebensstandards haben. Entweder wird das äquivalente Haushaltseinkommen mit der Anzahl der Mitglieder des Ursprungshaushalts oder ihrer Bedürfnisse gewichtet. Wir zeigen mit Querschnittdaten der Luxembourg Income Study (LIS) wie sensitiv auf Ungleichheitsmaßen basierende Länderrankings auf eine Änderung der Gewichtungsmethode reagieren und erklären die Ergebnisse mit einer Dekompositionsanalyse. Um die statistische Signifikanz der Ergebnisse zu überprüfen wird wiederum das Bootstrapverfahren verwendet.

Curriculum Vitae

Wissenschaftlicher Werdegang

11/2005 – 9/2010	*Freie Universität Berlin*, Promotionsstudium der Volkswirtschaftslehre *Betreuer:* Professor Giacomo Corneo
10/2005	Diplom der Volkswirtschaftslehre, Titel: "Alternativszenarien zur rot-grünen Steuerreform: eine mikrodaten-basierte Analyse".
06/2001 - 10/2005	*Freie Universität Berlin*, Studium der Volkswirtschaftlehre

Publikationen

a) in begutachteten Fachzeitschriften:

Poverty in Germany - statistical inference and decomposition (mit C. Schröder), *Journal of Economics and Statistics - Jahrbücher für Nationalökonomie und Statistik* (im Erscheinen).

Horizontal equity in the German tax-benefit system: A simulation approach for employees (mit S. Eichfelder), *FinanzArchiv - Public Finance Analysis* (im Erscheinen).

Incomes and inequality in the long run: the case of German elderly (mit C. Schröder und K. Schulte), *German Economic Review* (im Erscheinen).

Bestimmung ökonomischer Einkommen und effektiver Einkommensteuerbelastungen mit der Faktisch Anonymisierten Lohn- und Einkommensteuerstatistik (mit F. Neher und C. Schröder), *Schmollers Jahrbuch - Journal of Applied Social Science Studies* 127 (2007), 585-623.

Was hätte man sonst machen können? Alternativszenarien zur Rot-Grünen Steuerreform (mit G. Corneo), *Schmollers Jahrbuch - Journal of Applied Social Science Studies* 126 (2006), 489-519.

b) in editierten Sammelbänden:

Die funktionsweise des bundesdeutschen Finanzausgleichs und seine ökonomischen Anreizeffekte auf Länderebene (mit B. Joachimsen und C. Schröder), in Universität Kiel (Hrsg.): *Christiana Albertina* Band 70/2010, S. 6-17.

Gekappte Einkommen in prozessgenerierten Daten der Deutschen Rentenversicherung - Ein paretobasierter Imputationsansatz, in Deutsche Rentenversicherung Bund (Hrsg.): *DRV-Schriften* Band 55/2009, S. 214 - 230.

Gutachertätigkeit

German Economic Review; Journal of Applied Social Science Studies (Schmollers Jahrbuch - Zeitschrift für Wirtschafts- und Sozialwissenschaften); Journal of Economics and Statistics (Jahrbücher für Nationalökonomie und Statistik); Journal of Income Distribution

Präsentationen

08/2010 66th Congress of the Internationl Institue of Public Finance (IIPF), *Poverty in Germany – statistical inference and decomposition*, Uppsala.

09/2009 Annual Meeting of the German Economic Association (Verein für Socialpolitk) 2009, *Horizontal equity in the German tax-benefit system: A simulation approach for employees*, Magdeburg.

07/2009 3rd Meeting of the ECINEQ Society, *The German spatial poverty divide: poorly endowed or bad luck?*, Buenos Aires.

07/2009 6. Workshop des FDZ-RV, *Untersuchung von Einkommensungleicheit in Deutschland: Wie geeignet sind prozessproduzierte Daten der Sozialversicherung?*, Bensheim.

05/2009 Annual Meeting of the Austrian Economic Association 2009, *Poverty in Germany before and after Reunification*, Linz.

05/2009 Wifo Extern, Präsentation: *Untersuchung von Einkommensungleicheit in Deutschland: Wie geeignet sind prozessproduzierte Daten der Sozialversicherung?*, Wien.

04/2009 Annual Meeting of the European Public Choice Society 2009, *Horizontal equity in the German tax-benefit system: A simulation approach for employees*, Athen.

09/2008 JID Conference on Income distribution and the family, *Poverty risks of children in Germany*, Kiel.

08/2008 64th Congress of the Internationl Institue of Public Finance (IIPF), *Incomes and inequality in the long run: the case of German elderly*, Maastricht.

07/2007 2nd Meeting of the ECINEQ Society, *Inequality and welfare estimates for two different weighting schemes*, German Institut for Economic Research, Berlin.

Durchgeführte Lehrveranstaltungen

a) Vorlesungen:

Ökonomie des Wohlfahrtstaates (Master/Hauptstudium), Staat und Allokation (Bachelor/Hauptstudium)

b) Übungen:

Regulierung öffentlicher Unternehmen (Master/Hauptstudium), Ökonomie des Wohlfahrtstaates (Master/Hauptstudium)

c) Seminare:

Empirische finanzwissenschaftliche Seminare (Master/Hauptstudium), Theoretische finanzwissenschaftliche Seminare (Master/Hauptstudium), Finanzwissenschaftliches Colloquium (Bachelor/Master/Haupstudium)