Socio-economic influences on income inequality: projections for Germany

Faik, Jürgen

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Jürgen Faik

Socio-Economic Influences on Income Inequality – Projections for Germany

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Tel.: 069/34409710
Fax: 069/34409714
E-Mail: info@fama-nfs.de
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Zusammenfassung*

Das Diskussionspapier korrespondiert mit der Präsentation eines Posters auf der Jahrestagung 2012 der International Association for Research in Income and Wealth (IARIW) in Boston mit dem Titel ***„Measuring and Predicting Individual Well-Being on the Basis of a New Methodical Framework – The Case of Germany 1995-2009“***. Das Papier befasst sich mit sozioökonomischen Einflüssen auf die *künftige* bundesdeutsche personelle Einkommensverteilung. Auf der Grundlage eines neuen Ansatzes (des so genannten „Zerlegungsansatzes“) werden die Effekte einkommensstruktureller und soziodemografischer Veränderungen analysiert. Der Zerlegungsansatz ist hierbei direkt mit Analysen zur sozialen Schichtung gekoppelt. In diesem Zusammenhang bietet die Nutzung zerlegbarer Ungleichheitsindikatoren die Möglichkeit, Shift-share-Analysen durchzuführen. In dem Diskussionspapier kommen derartige Analysen zur Anwendung, um die Relevanz der demografischen Alterung bezüglich der querschnittsbezogenen Einkommensungleichheit aufzuzeigen. Die korrespondierenden Shift-share-Berechnungen werden primär zur Vorhersage der bundesdeutschen Einkommensungleichheit genutzt. Neben der Altersstruktur werden weitere Variablen wie Haushaltsgröße/-struktur ebenso wie altersdifferenzierte Einkommensanteile verschiedener Einkommensarten (Arbeits-, Kapital-, Transfereinkommen) als Erklärungsgrößen verwendet. Des Weiteren werden längsschnittliche Kohorteneffekte als Einflussfaktoren innerhalb der diversen Projektionen berücksichtigt.

Summary*

The discussion paper corresponds with the presentation of a poster at the 2012 annual conference of the International Association for Research in Income and Wealth (IARIW) in Boston with the title ***“Measuring and Predicting Individual Well-Being on the Basis of a New Methodical Framework – The Case of Germany 1995-2009”***. The paper deals with socio-economic influences upon the *future* German personal income distribution. On the basis of a new approach (so-called “decomposition approach”), the effects of income-structural and socio-demographic changes are analysed. Hereby, the decomposition approach is directly linked to analyses of social stratification. In this context, the usage of decomposable inequality indicators offers the possibility to perform shift-share analyses. In the paper such analyses are carried out in order to assess the relevance of demographic ageing concerning cross-sectional income inequality. The corresponding shift-share calculations are primarily used for predicting German income inequality. Besides age structure, further variables like household size/household composition as well as age-differentiated income shares of different kinds of income (labour income, capital gains, transfers) are used as explaining factors. Furthermore, longitudinal cohort effects are considered as influencing variables within the several projections.

* Dr. Jürgen Faik ist Geschäftsführer von FaMa – Neue Frankfurter Sozialforschung. Autoren-Kontakt: faik@fama-nfs.de.

Content

1. Introduction

The discussion paper deals with socio-economic influences upon the *future* German personal income distribution. On the basis of a new approach (so-called "decomposition approach"), the effects of income-structural and socio-demographic changes are analysed. Hereby, the decomposition approach is directly linked to analyses of social stratification. In this context, the usage of decomposable inequality indicators offers the possibility to perform shift-share analyses. In the paper such analyses are carried out in order to assess the relevance of demographic ageing concerning cross-sectional income inequality. The corresponding shift-share calculations are primarily used for predicting German income inequality. Besides age structure, further variables like household size/household composition as well as age-differentiated income shares of different kinds of income (labour income, capital gains, transfers) are used as explaining factors. Furthermore, longitudinal cohort effects are considered as influencing variables within the several projections.

For (socio-)political purposes, the current cross-sectional income inequality is of high importance since possible distributional conflicts immediately arise in such a cross-sectional perspective. The same holds for the future cross-sectional income distribution. In this context, often a "battle between generations" is stated as a consequence of demographic ageing. Thus, it is a demanding task to analyse the underlying socio-economic factors for such possible developments, i. e., to consider the (possible/probable) future income inequality.

The paper is organized as follows: Chapter 2 reveals important theoretical relationships between socio-economic variables and income inequality which is followed by empirical, descriptive considerations for Germany (Chapter 3). These empirical facts are used for projections of German income inequality up to 2020 (Chapter 4). The paper ends with concluding remarks (Chapter 5).

2. Relationships between socio-economy and income inequality[1]

2.1 Preliminary remarks

The analysis of individual welfare either rests upon individual resources (like income, wealth, or consumption[2]) or upon individual circumstances (concerning nutrition, clothing, habitation, health, education, transportation, communication, legal protection, etc.). Ultimately, both approaches represent individual, non-measurable utility. Despite the fact that the latter approach has received a lot of attention in the recent past – particularly because of Sen's much-noticed capability approach[3] –, I will analyse welfare only on the basis of resources (because large data restrictions exist for an analysis of circumstances). In this context, I will concentrate myself on *income* inequality since income is a suitable predictor for other welfare categories.[4]

Typically, income analyses are grounded on household net incomes. The reason for this is that this concept includes transfers and tax payments, and thus it represents individual well-being much better than e. g. gross incomes. In order to compare incomes for different household types, the household net incomes must be divided by "normalizing" values called equivalence scales. The resulting variable is named as equivalent household net income.

[1] Chapter 2 is largely based on the corresponding considerations in Faik 2010a, 2010b, 2010c, 2011b, 2011c, 2011d, and 2012.
[2] For an overview about this subject see, for instance, Faik 1995, pp. 32-36.
[3] See Sen 1999.
[4] This was even recognized by Townsend, an apologist of a multidimensional welfare concept based on circumstances (see Townsend 1979, p. 253 and pp. 256-262).

Since individuals and not households achieve well-being,[5] the equivalent household net incomes are weighted by the number of persons in each household.[6]

Typically, studies of personal income distribution refer to equivalence scales which hold for the entire income spectrum; these scales are called constant equivalence scales and are based on the assumption that equivalence scales and therefore the needs of different household types are independent of a base level of income or utility.[7] They contrast to income-dependent, variable equivalence scales which vary with the income level of the different households. There are good reasons for basing distributional analyses on such flexible equivalence scales, e. g.:[8]

1. In the higher income ranges the underlying consumption levels (e. g., concerning accommodation costs) would be high so that a new household member's appearance (e. g., the "adding" of a child) would increase the corresponding costs only slightly, and this would lead to low relative costs, i. e., flat equivalence scales for larger households in the upper income range compared with the lower incomes.

2. Prices of commodities can differ from each other across income groups such that members of the upper income classes obtain price advantages.

3. Credit constraints for households in the bottom income range may shift the consumption bundles of these households towards lower expenditure shares of durables which are connected with relatively high economies of scale.

I will apply this approach in the following. In this context, I will assume three income regions: a bottom, a mid-, and an upper income region. These income regions will be *separately* generated for each household type so that no *overall* equivalence scale must be specified. My proceeding, which means an orientation of welfare levels only on the behaviour of one's *own* group of households, is based on socio-psychological approaches like Festinger's theory of social comparisons which suggest that people compare themselves with similar people.[9]

This means that people do not have (or do not want to have) complete information on society's entire income situation. Since such welfare comparisons refer to *household* incomes and since households are (very) different with respect to size and composition, it seems to be a Herculean task for each individual to consider all these aspects in the context of his/her well-being rankings. It seems much easier for individuals to compare themselves with household types which are similar to their own type. This implies a kind of bounded rationality.[10] As a consequence and as was already mentioned above, my proceeding is based on an orientation of well-being levels only on the behaviour of one's *own* group of households.[11] A number of empirical findings point towards this direction.[12]

Following the idea of variable equivalence scales, the scale values in the low-income region are highest and those in the upper income region are lowest, i. e.: The income values in the low-income region are divided by higher scale values than the incomes in the middle and in

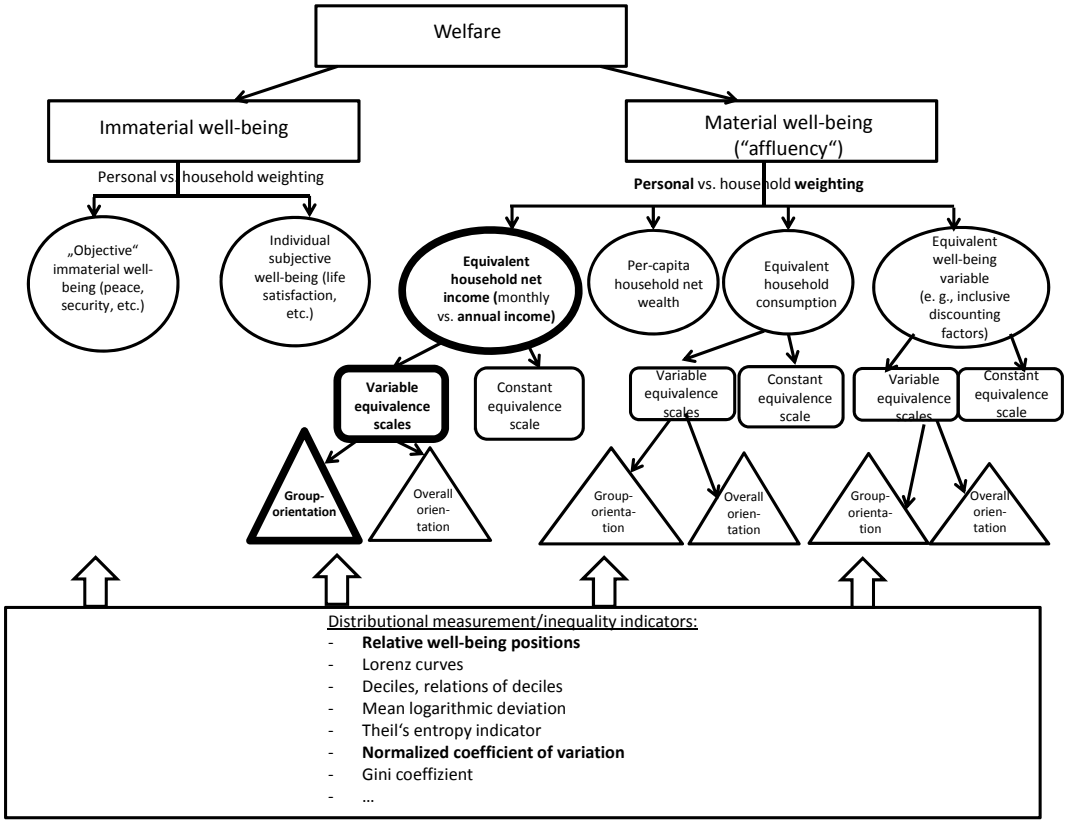
[5] See, e. g., Faik 2008, p. 23.
[6] Bönke and Schröder 2008 applied an alternative weighting, the so-called needs-related weighting, i. e., weighting of equivalent incomes by equivalence scale values. In my eyes, this alternative weighting is intuitively less plausible than the weighting of incomes by the number of persons (concerning the question of well-being receivers).
[7] See, e. g., Lewbel 1989.
[8] See Schröder 2004, p. 42, and Koulovatianos, Schröder, and Schmidt 2005, p. 969.
[9] See Festinger 1954.
[10] Concerning this issue see, e. g., Simon 1957 or Leibenstein 1976.
[11] With respect to the issue of reference groups in distributional analyses see, e. g., Amiel and Cowell 1999, pp. 2-6.
[12] See, e. g., Clark and Oswald 1996, or Frey and Stutzer 2002, pp. 88-90.

the upper income region. According to empirical findings or settings in the literature[13] the following differentiations are made:

- *Low-income region:* for single persons poverty line at 70 percent of their mean net incomes, and for multi-person households[14] calculation of poverty lines on the basis of the (approximated) old OECD scale, i. e.: on the basis of θ = 0.8 (in the Buhmann et al. formula[15]);
- *Middle-income region:* for single persons income from 70 percent to below 200 percent of their mean net incomes, and for multi-person households calculation of middle-income lines on the basis of θ = 0.8 for the lower boundary and of θ = 0.7 for the upper boundary (i. e., "deflating" income within the middle-income region by θ = 0.7);
- *High-income region:* for single persons high-income line at 200 percent of their mean net incomes, and for multi-person households calculation of high-income lines on the basis of θ = 0.7 but "deflating" incomes within the high-income region via (approximated) new OECD scale, i. e., by θ = 0.6.

Figure 1 gives an overview about the paper's methodical setting concerning the measurement of (cross-sectional) income inequality (see the bold-framed fields in Figure 1).

Figure 1: Methodical settings in welfare analyses



Source: Present author's own illustration

[13] See, e. g., Faik 2011a, Grabka et al. 2007, pp. 60-61, Becker and Hauser 2009, p. 223; see also Faik 2011b, pp. 5-10, and Faik 2011c, pp. 8-12.

[14] The calculations of the paper are restricted to single- to six-person households since the number of cases for household sizes with seven and more persons is too low for statistical reasons (see Faik 2011c, p. 24).

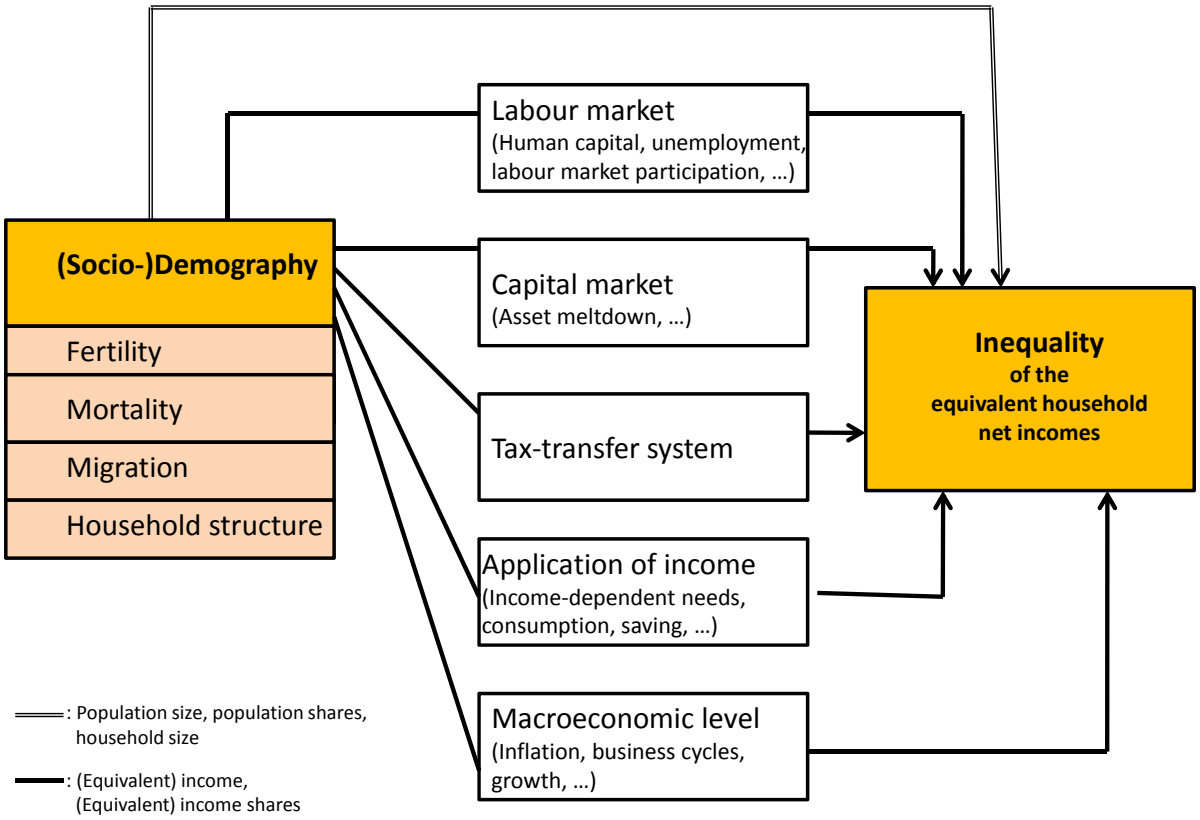
[15] Buhmann et al.'s equivalence scale formula is as follows: $m_h = S^\theta \quad (0 \le \theta \le 1)$; see Buhmann et al. 1988, p. 119 [m_h: equivalence scale value of household type h (with respect to the reference household type, in this case a single-person household), S: household size, θ: elasticity of the equivalence scale with regard to household size (and it therefore also reflects the degree of economies of scale)].

2.2 A small model

With respect to the connections between (socio-)demography and income inequality a differentiation between direct and indirect impacts of (socio-)demography makes sense. Direct demography effects are solely defined by changes in population shares (or by changes in household size) on the supposition of constant economic variables (like mean incomes or dispersions of incomes for the several socio-demographic groups). In contrast, indirect demographic effects aim at economic processes which are relevant for distributional purposes. Examples for such economic processes are individual adjustment reactions (e. g., on the labour market with dependencies on an individual's own age but also on other market participants' age) or fiscal aspects like the compliance of budget restrictions.[16]

Simplified (in a cross-sectional perspective) and referring to the different income sources – labour income, capital income, and (net) transfers –, three main transmission channels for indirect demographic changes exist: the labour market, the capital market, and the tax-transfer system. Additionally, in Figure 2 the channels "application of income" and "macroeconomic level" are depicted.[17] These latter channels are only subordinated influences compared with the first three channels mentioned; partly they depend on the main channels. For reasons of simplicity, such interrelations are not pointed out in Figure 2. Moreover, in Figure 2 feedbacks from personal income distribution towards demography (or towards the other indicated variables) are not marked.

Figure 2: Idealised transmission channels of demography on income inequality



Source: Faik 2010b, p. 18 (weakly modified by present author)

[16] See von Weizsäcker 1994a, pp. 33-34 (principally, in this context see also von Weizsäcker 1994b).
[17] See also in this context Heerink 1994, p. 2.

2.3 A decomposition approach

In order to capture (socio-)demographic impacts on the measured inequality of equivalent incomes, it makes sense to use a decomposable inequality measure. For such purposes, the usage of a general class of inequality indicators is convenient. A very popular class of indicators is the family of Generalized Entropy (GE) measures. Concerning those measures, groups' population shares serve as weighting factors as well as groups' income shares. Hereby, it is possible to investigate within-group and between-group influences of inequality where the assumed groups must be disjoint to each other. The within-group component measures the weighted sum of the analyzed indicator for the different groups. Concerning the between-group component, each member of a group is given the average income of his/her group.[18]

It holds:

(1) $$GE = \frac{1}{(\lambda^2 - \lambda) \cdot n} \cdot \sum_{i=1}^{n} \left[\left(\frac{Y_i}{\mu} \right)^{\lambda} - 1 \right] \qquad \text{for } \lambda \neq 0 \wedge \lambda \neq 1;$$

$$GE = \frac{1}{n} \cdot \sum_{i=1}^{n} \ln\left(\frac{\mu}{Y_i} \right) \qquad \text{for } \lambda = 0;$$

$$GE = \frac{1}{n} \cdot \sum_{i=1}^{n} \left[\frac{Y_i}{\mu} \cdot \ln\left(\frac{Y_i}{\mu} \right) \right] \qquad \text{for } \lambda = 1$$

[GE = Generalized Entropy index, λ = parameter with respect to inequality preferences, n = population size, Y_i = income of person i, μ = mean income].

The parameter λ reflects the social perceptions of inequality. If λ is greater than 0, the upper income region receives a relatively high weight with respect to inequality; the opposite is the case if λ is less 0. For λ = 0 the GE measure represents the mean logarithmic deviation, for λ = 1 Theil's well-known entropy measure is the result, and for λ = 2 the GE measure corresponds with the normalized coefficient of variation (= half the squared coefficient of variation).

GE can be additively decomposed in a within-group and a between-group component of inequality, as mentioned above:

(2) $$GE = \sum_{g=1}^{G} v_g^{\lambda} \cdot w_g^{1-\lambda} \cdot GE_g + GE_B$$

within-group inequality between-group inequality

The weighting factors w_g (= n_g/n) represent the population shares of the several groups of persons g (g = 1, 2, …, G), μ_g is the mean of incomes within group g, v_g (= $w_g \mu_g/\mu$) denotes the group-specific share of the aggregate income, and GE_g symbolizes the within-group GE inequality measure and GE_B the between-group GE inequality indicator.

[18] See, e. g., Rodrigues 1993, p. 6.

At this, GE_B is defined in the following way:

$$(3)\quad GE_B = \frac{1}{(\lambda^2 - \lambda)} \cdot \left\{ \left[\sum_{g=1}^{G} w_g \cdot \left(\frac{\mu_g}{\mu} \right)^{\lambda} \right] - 1 \right\} \quad \text{for } \lambda \neq 0 \wedge \lambda \neq 1;$$

$$GE_B = \sum_{g=1}^{G} w_g \cdot \ln\left(\frac{\mu}{\mu_g} \right) \quad \text{for } \lambda = 0;$$

$$GE_B = \sum_{g=1}^{G} v_g \cdot \ln\left(\frac{\mu_g}{\mu} \right) \quad \text{for } \lambda = 1.^{19}$$

The normalized coefficient of variation as the half-squared coefficient of variation (HSCV) is decomposable as follows:[20]

$$(4)\quad HSCV = \sum_{g=1}^{G} v_g^2 \cdot w_g^{-1} \cdot HSCV_g + \frac{1}{2} \cdot \left\{ \left[\sum_{g=1}^{G} w_g \cdot \left(\frac{\mu_g}{\mu} \right)^2 \right] - 1 \right\}$$

within-group inequality between-group inequality.

Using the squared coefficient of variation (SCV; i. e., twice HSCV)[21], von Weizsäcker has illustrated some impacts of demography on income inequality within the framework of differential analysis. Concretely, he differentiated the squared coefficient of variation with respect to the population share of the gainfully employed persons x (and, thus, implicitly with respect to the quotient between the elderly and the young people). As a total differential, he obtained (under some simplifying assumptions, e. g., by dismissing capital gains):[22]

$$\frac{dSCV_{GG}}{dx} = \frac{\partial SCV}{\partial x} + \frac{\partial SCV}{\partial tx_{GG}} \cdot \frac{dtx_{GG}}{dx} + \frac{\partial SCV}{\partial c_{GG}} \cdot \frac{dc_{GG}}{dx}$$

$$(5)\quad = (1 - tx_{GG}) \cdot (1 - c_{GG}) \cdot \left[2 \cdot \frac{\mu_P}{\mu_A} - x \cdot (1 - tx_{GG}) \cdot (1 - c_{GG}) \right] \cdot \sigma_A^2 - (2 - x) \cdot \sigma_P^2 + (\mu_{Y,GG} - \mu_P) \cdot \left[(3 - 2 \cdot x) \cdot \mu_P - x \cdot \mu_A \right]$$

[with: SCV_{GG} = squared coefficient of variation within economic equilibrium, x = population share of the gainfully employed persons, tx_{GG} = tax rate within economic equilibrium, c_{GG} = contribution rate of the German statutory pension system within economic equilibrium, μ_P = average pension, μ_A = average gross labour income, σ_A^2 = variance of gross labour income,

[19] A more comprehensive consideration of the class of GE measures can be found in Faik 1995, pp. 326-330, which is primarily based on Cowell 1980, Shorrocks 1980, Mookherjee/Shorrocks 1982 and Jenkins 1991.

[20] In this context, see Faik 2010a, pp. 13-14.

[21] Because of this merely ordinal transformation, the results of Equation (5), which are related to SCV, are also valid for HSCV.

[22] See von Weizsäcker 1993, pp. 38-39.

σ_P^2 = variance of pensions, $\mu_{Y,GG}$ = average total gross income within economic equilibrium with total income := labour income plus pensions].

The first term in the first row of Equation (5) reflects the direct influence of population – in the sense of "ageing" – on the squared coefficient of variation; within von Weizsäcker's (equilibrium) model, this effect is negative (since von Weizsäcker assumes a lower inequality level within the group of the elderly compared to the young people). Concerning the second term in the first row of Equation (5), it is assumed that an increase of the quotient between the elderly and the young people leads to a rise of the tax rate, and this causes a diminishment of the measured inequality. The latter is also true for the third term in the first row of Equation (5) where an increasing quotient between the elderly and the young people generates an increase of the contribution rate of the German statutory pension system and, in a next step, a reduction of total inequality. Thus, within von Weizsäcker's model, the terms mentioned indicate that an increase of the quotient "elderly/young people" causes a diminishment of total income inequality.[23] This example illustrates the possible applications for analysing the relationships between demography and economy (or distribution).

In this context, a further issue is important: the role of the different income components since they are of different importance during the individual life-cycle. For instance, labour income plays an outstanding role during the individual working life while it is in front of and after working life (childhood versus old age) of less importance compared with other kinds of income (especially compared with transfers). Amidst the backdrop of demographic changes, shifts concerning the societal importance of different kinds of income are realistic (with corresponding changes with respect to income distribution and income inequality).

Methodically, the inequality of equivalent household net income can be decomposed as follows (for HSCV):[24]

$$(6)\quad HSCV_{Yn} = HSCV_A \cdot v_A^2 + HSCV_{TR} \cdot v_{TR}^2 + HSCV_{KE} \cdot v_{KE}^2 + \frac{1}{2} \cdot \frac{Inter}{\mu_{Yn}^2},$$

where: $v_A = \frac{\mu_A}{\mu_{Yn}}$, $v_{TR} = \frac{\mu_{TR}}{\mu_{Yn}}$, $v_{KE} = \frac{\mu_{KE}}{\mu_{Yn}}$, $Inter = 2 \cdot \mathrm{cov}(A, TR) + 2 \cdot \mathrm{cov}(A + TR, KE)$

[with: HSCV = normalized coefficient of variation, v = share of the corresponding kind of income concerning total income, Y_n = equivalent household net income, A = equivalent household labour income, TR = equivalent household net transfers (i. e., transfers minus taxes), KE = equivalent household capital gains, cov = covariance, μ = arithmetic mean].

3. Empirical income inequality findings for Germany, 1995-2009

3.1 The data base[25]

In the following, data from the German Socio-Economic Panel (SOEP) for the waves 1996 to 2010 is used. The SOEP of the German Institute for Economic Research (DIW Berlin)[26] has been collected since 1984 in annual intervals. The sample sizes (from wave 1996 on) are provided in Table A.1 in the Appendix. The participants of the surveys give detailed infor-

[23] See von Weizsäcker 1993, pp. 38-40.
[24] Equation (6) assumes that transfers and capital gains are not taxed so that all taxes (and payments of contributions) are related to (gross) labour income. By the way, alternatives to Equation (6) – which is obviously based on the ideas of variance analysis – exist, e. g., in the form of Shapley-value decompositions (see, e. g., Sastre and Trannoy 2002).
[25] See Faik 2012, p. 14.
[26] See, e. g., Wagner, Frick, and Schupp 2007.

mation on their incomes, household composition, earnings' and family's biographies, health, life satisfaction, etc.

The following subsamples have been drawn to capture different sub-populations:

- Sample A: German households in the Federal Republic of Germany since 1984,
- Sample B: households of foreigners in the Federal Republic of Germany since 1984,
- Sample C: private households in eastern Germany (German Democratic Republic) since 1990,
- Sample D: households of immigrants in Germany since 1994/1995,
- Sample E: complementary sample of households in Germany since 1998,
- Sample F: complementary sample of households in Germany since 2000,
- Sample G: sample of high-income receivers (households) in Germany since 2002, and
- Sample H: complementary sample of households in Germany since 2006.

For distributional analyses two central income variables exist: Monthly household income of the current year and annual household income of the previous year so that the query for the latter variable is retrospective. In this study, we use – in accordance with the Canberra Group's guidelines[27] – annual household net income which includes household's income obtained from all sources (including imputed rents) over a one year's period.

In the context of the SOEP, the following kinds of income and of income deductions are differentiated from each other:[28]

- Income resulting from self-employment and from gainfully employed work (= labour income),
- Capital gains (including fictive imputed rents),
- Transfers: private pensions, other private transfers, and public transfers (e. g., pensions from the statutory pension system),
- Income deductions: taxes, social security payments of contribution.

The data analysis begins with wave 1996 (with information on annual incomes in 1995) because of the fairly overcoming of great economic distortions in eastern Germany in the mid-1990s. Furthermore, one convention in the context of the SOEP must be considered: Annual incomes of the previous year are linked to the socio-demographic population's structure of the current year since both distributional elements (incomes, socio-demography) are related to the same data wave and, thus, to the same weighting scheme, etc. Hence, in the following analyses, period t corresponds with the SOEP wave in t+1, e. g.: "1995" means that (retrospective) income information stems from 1996 SOEP wave as well as socio-demographic information does. Moreover, for the age-related analyses that follow, nine age groups are differentiated from each other: until 9 years, 10-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, 70-79 years, and 80 years and older.

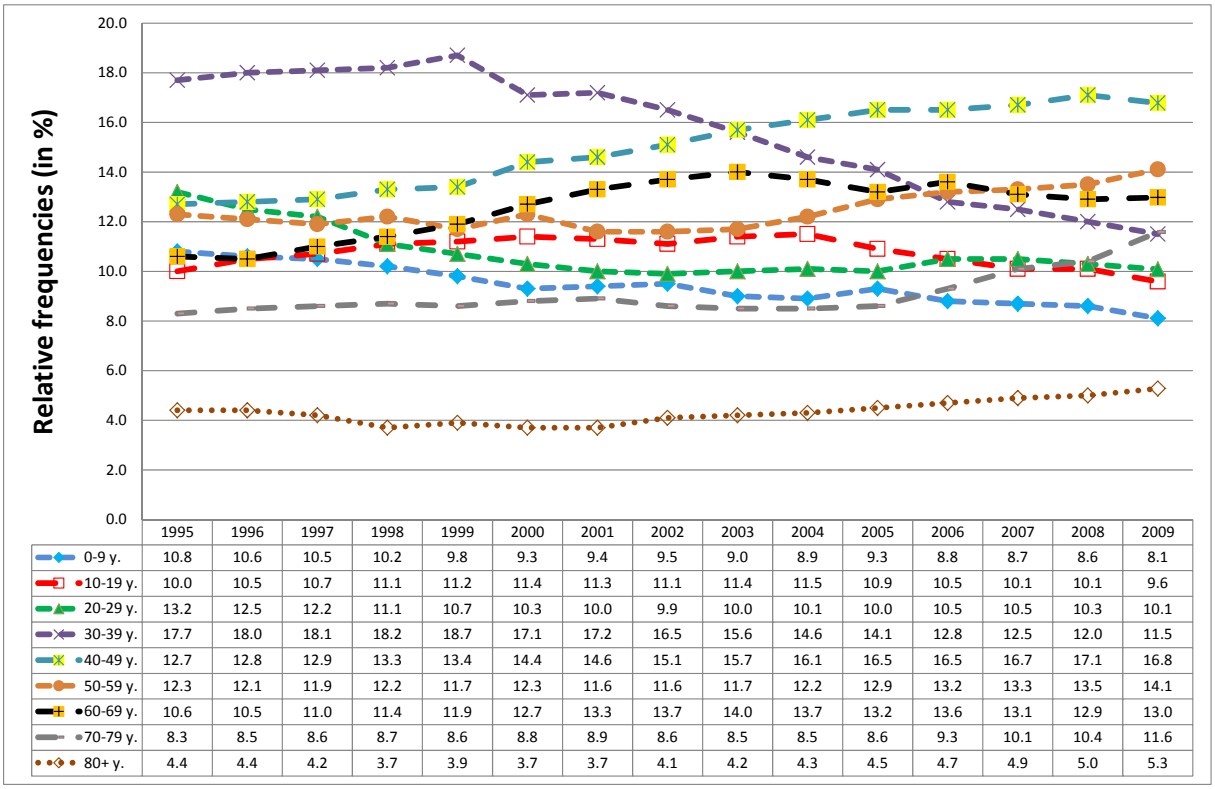
[27] See UN 2011, pp. 26-27.
[28] See, e. g., Peichl, Pestel, and Schneider 2009, pp. 10-11.

3.2 Demographic impacts

3.2.1 Population shares

Concerning the population shares of the different age groups, it becomes obvious that the younger age groups (until 9 years, 10 to 19 years) do have negative trends over time. In the age group 20 to 29 years, the curve in Figure 3 at first reveals a negative trend (until the beginning of the 21st century), and then, up to 2009, it is characterized by a positive trend. While age class 30 to 39 years does have a clearly negative trend concerning population shares, the opposite holds for age classes 40 to 49 years and 50 to 59 years (at least since the beginning of the 21st century). Up to the millennium, the population share of the persons in age category 60 to 69 years increased, and afterwards it decreased slightly. For the oldest persons (70 to 79 years, 80 years and older) a positive trend occurred (at least since the millennium).

Figure 3: Population shares of different age groups in Germany, 1995-2009



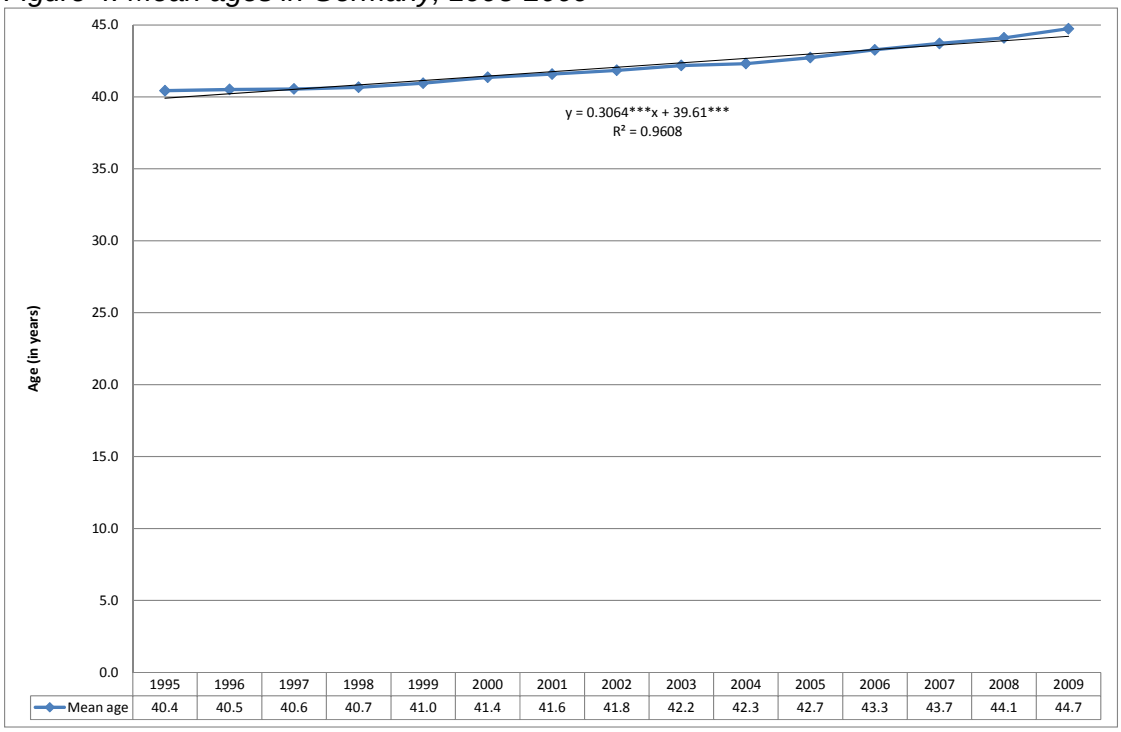
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0-9 y.	10.8	10.6	10.5	10.2	9.8	9.3	9.4	9.5	9.0	8.9	9.3	8.8	8.7	8.6	8.1
10-19 y.	10.0	10.5	10.7	11.1	11.2	11.4	11.3	11.1	11.4	11.5	10.9	10.5	10.1	10.1	9.6
20-29 y.	13.2	12.5	12.2	11.1	10.7	10.3	10.0	9.9	10.0	10.1	10.0	10.5	10.5	10.3	10.1
30-39 y.	17.7	18.0	18.1	18.2	18.7	17.1	17.2	16.5	15.6	14.6	14.1	12.8	12.5	12.0	11.5
40-49 y.	12.7	12.8	12.9	13.3	13.4	14.4	14.6	15.1	15.7	16.1	16.5	16.5	16.7	17.1	16.8
50-59 y.	12.3	12.1	11.9	12.2	11.7	12.3	11.6	11.6	11.7	12.2	12.9	13.2	13.3	13.5	14.1
60-69 y.	10.6	10.5	11.0	11.4	11.9	12.7	13.3	13.7	14.0	13.7	13.2	13.6	13.1	12.9	13.0
70-79 y.	8.3	8.5	8.6	8.7	8.6	8.8	8.9	8.6	8.5	8.5	8.6	9.3	10.1	10.4	11.6
80+ y.	4.4	4.4	4.2	3.7	3.9	3.7	3.7	4.1	4.2	4.3	4.5	4.7	4.9	5.0	5.3

Source: Present author's own calculations (SOEP)

Altogether, the afore-mentioned results point to the fact that the German society is growing "older" in the sense of "demographic ageing". This is also indicated by the development of mean age values (see Figure 4): In 1995 the average age amounted to 40.4 years, and 14 years later (in 2009) this mean value grew up to 44.7 years. That means that "demographic ageing" already exists in Germany.[29]

[29] If a trend function is specified in a figure – like the one in Figure 4 –, the parameters' significance is indicated as follows: *** = statistically significant at the 1-percent level, ** = statistically significant at the 5-percent level, * = statistically significant at the 10-percent level.

Figure 4: Mean ages in Germany, 1995-2009

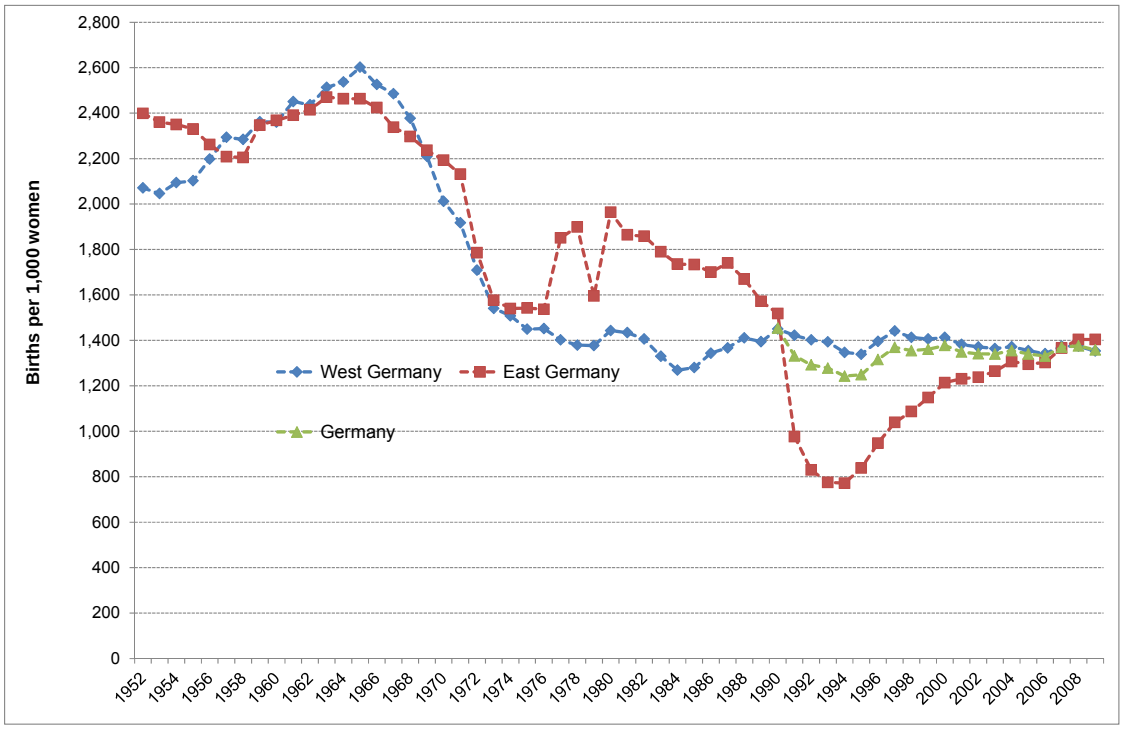


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean age	40.4	40.5	40.6	40.7	41.0	41.4	41.6	41.8	42.2	42.3	42.7	43.3	43.7	44.1	44.7

Source: Present author's own calculations (SOEP)

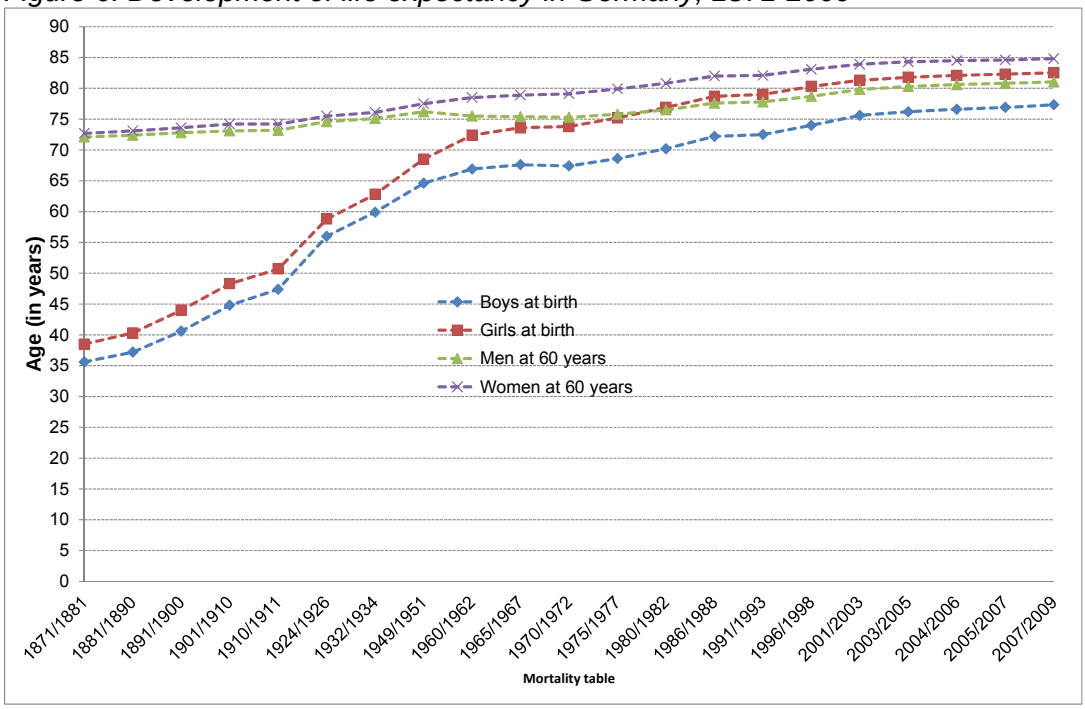
The "ageing" of the German society is the result of relatively low fertility rates and of an increase in life expectancy (see Figures 5 and 6) and, in consequence of this, of negative differences between births and deaths (see Figure 7).

Figure 5: Development of birth rates in Germany, 1952-2009



Source: Present author's own compilation on the basis of Statistisches Bundesamt 2009, p. 28, and www.destatis.de/genesis (access at 2012-06-24)

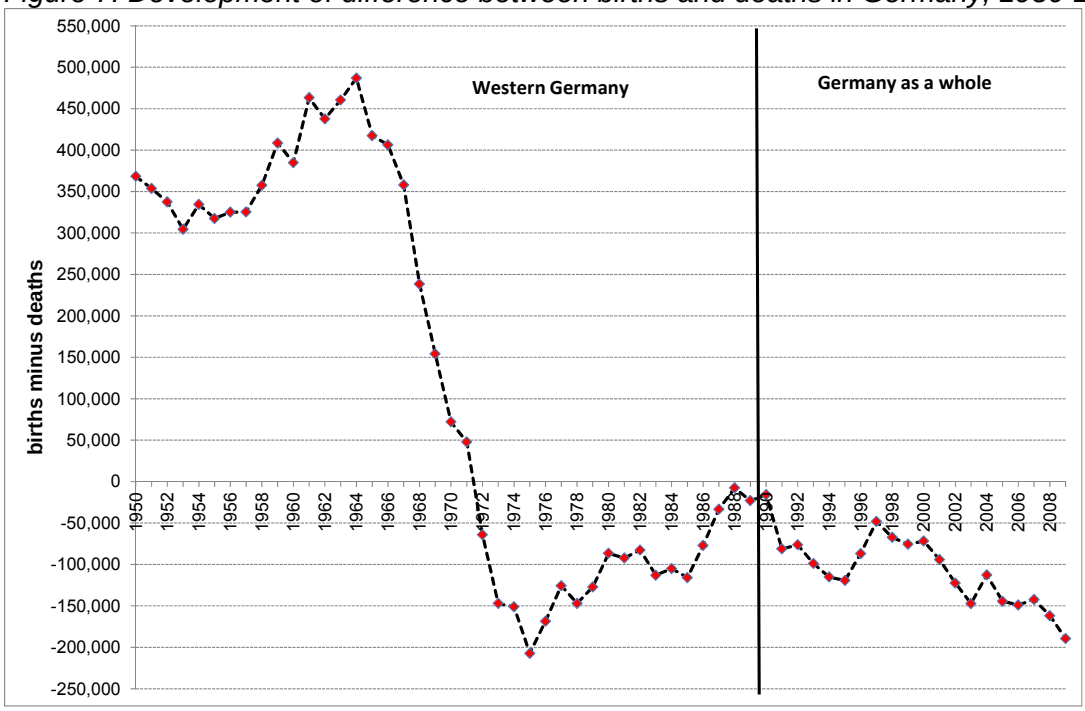
Figure 6: Development of life expectancy in Germany, 1871-2009



1871/1881 to 1932/1934: German Reich, 1949/1951 to 1986/1988: Former Federal Republic of Germany, since 1991/1993: Germany as a whole; abscissa non-equidistant

Source: Present author's own compilation on the basis of Eisenmenger 2005, p. 471, Eisenmenger and Emmerling 2011, p. 235, and www.destatis.de/genesis (access at 2012-06-24)

Figure 7: Development of difference between births and deaths in Germany, 1950-2009

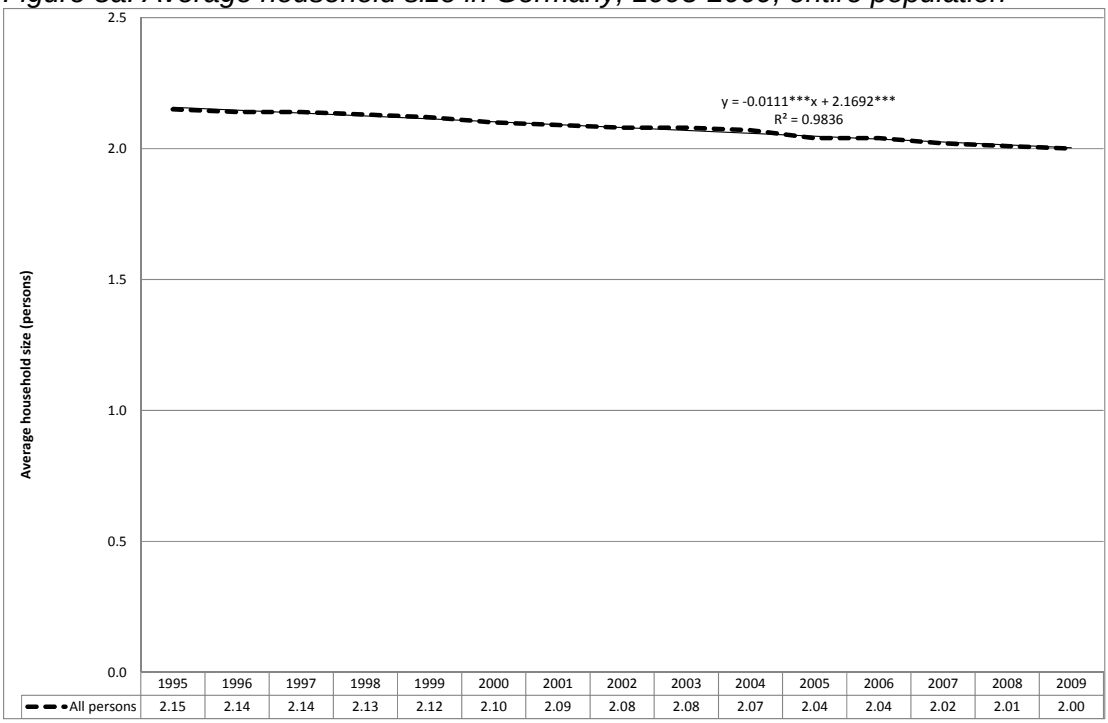


Source: Present author's own compilation on the basis of http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Statistiken/Zeitreihen/LangeReihen/Bevoelkerung/Content100/lrbev04a,templateId=renderPrint.psml and http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Statistiken/Zeitreihen/LangeReihen/Bevoelkerung/Content100/lrbev04fra,templateId=renderPrint.psml (access at 2012-06-24 in both cases)

3.2.2 Household size

Over time, the average household size decreased remarkably in Germany, as can be seen by Figure 8a. Whereas this feature also holds for the age groups until 69 years (with exceptions for the group 20-29 years), the opposite occurred for the older persons (70 years and older; see Figures 8b to 8d).

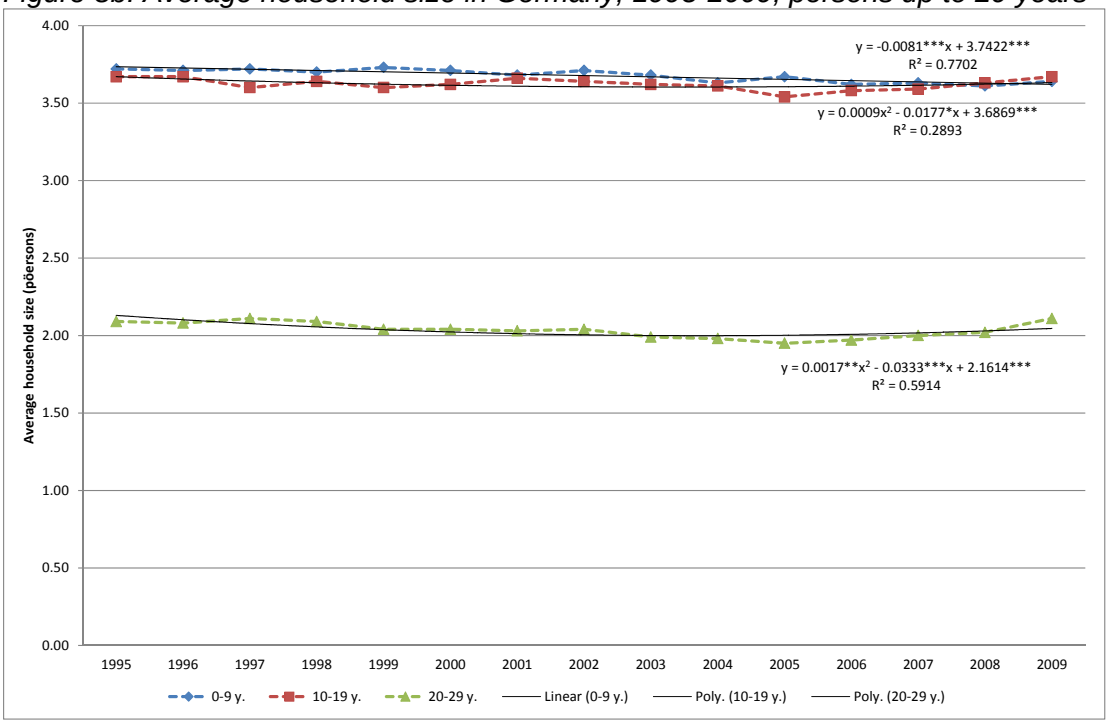
Figure 8a: Average household size in Germany, 1995-2009, entire population



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
All persons	2.15	2.14	2.14	2.13	2.12	2.10	2.09	2.08	2.08	2.07	2.04	2.04	2.02	2.01	2.00

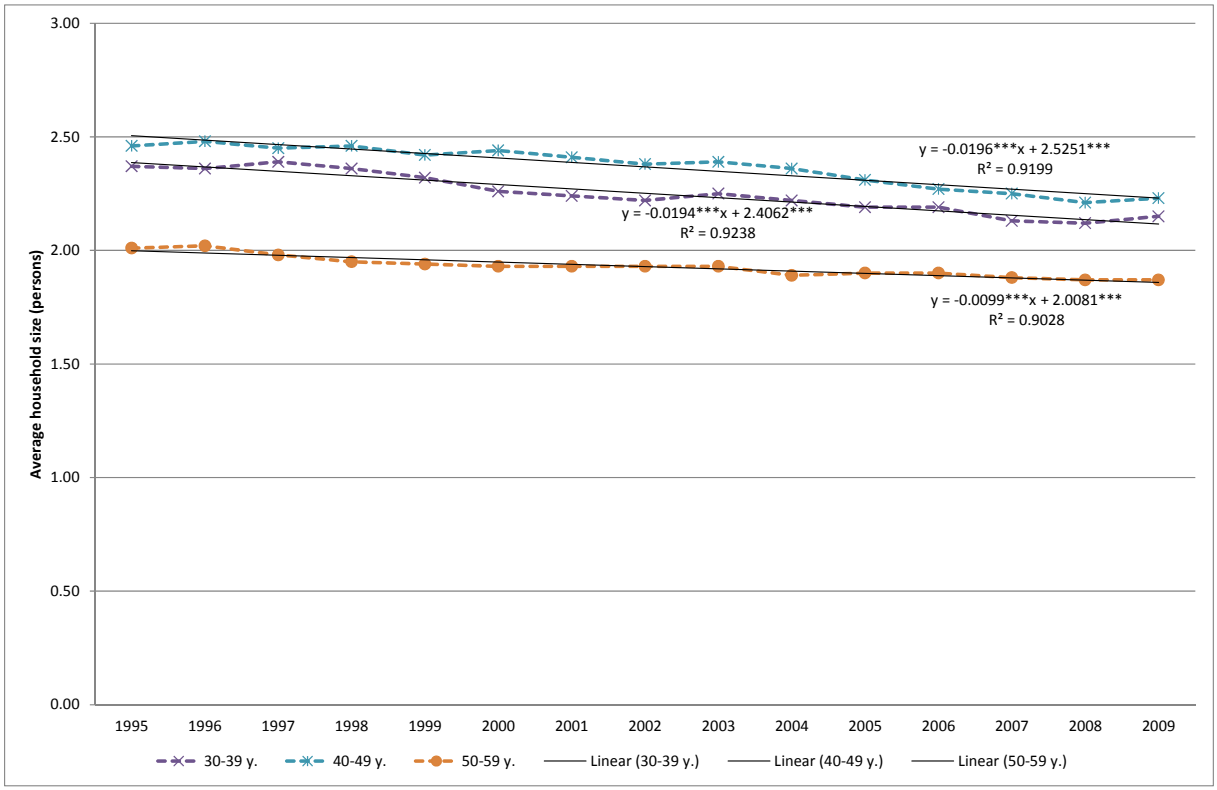
Source: Present author's own calculations (SOEP)

Figure 8b: Average household size in Germany, 1995-2009, persons up to 29 years



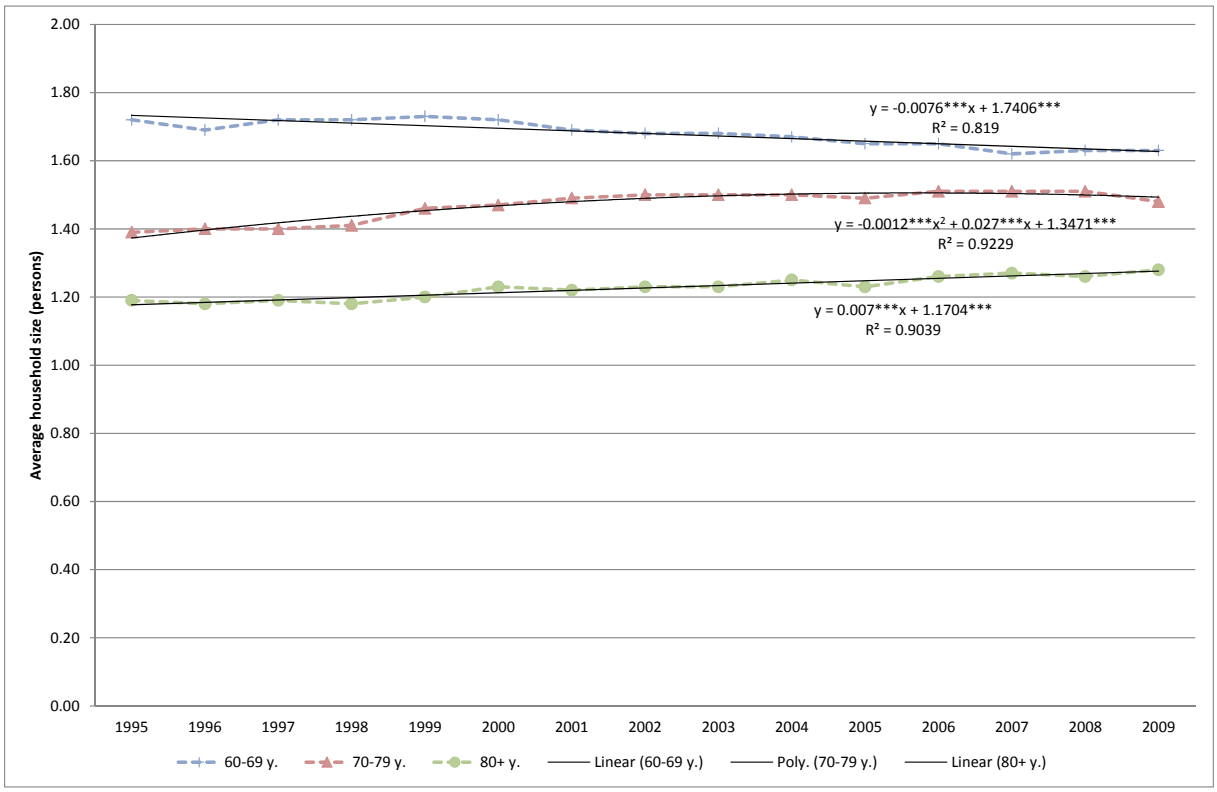
Source: Present author's own calculations (SOEP)

Figure 8c: Average household size in Germany, 1995-2009, persons 30-59 years



Source: Present author's own calculations (SOEP)

Figure 8d: Average household size in Germany, 1995-2009, persons 60 years and older



Source: Present author's own calculations (SOEP)

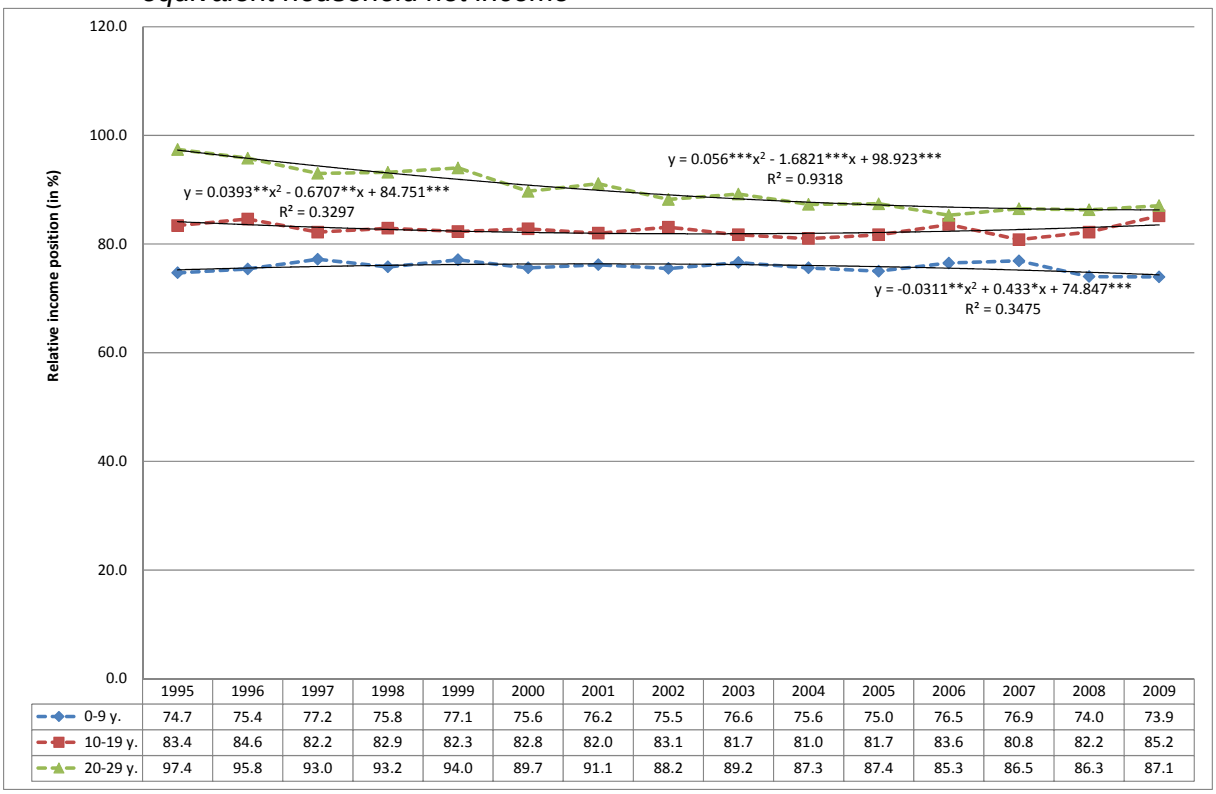
3.3 Inter-generational income inequality

3.3.1 Trends

In Figures 9a to 9c, the relative income positions of different age groups are considered for Germany between 1995 and 2009. The definition of relative income positions is: average equivalent household (net) income of a specific age group divided by general average equivalent household (net) income. For this indicator, the empirical value ranges are: up to 9 years: 73.9 %-77.2 %, 10 to 19 years: 80.8 %-85.2 %, 20 to 29 years: 85.3 %-97.4 %, 30 to 39 years: 94.3 %-98.5 %, 40 to 49 years: 105.1 %-114.5 %, 50 to 59 years: 118.5 %-129.7 %, 60 to 69 years: 103.4 %-116.5 %, 70 to 79 years: 98.2 %-104.5 %, and 80 years and older: 92.3 %-103.3 %. Thus, the relative income positions of the age groups until 39 years are below the average societal income level in all years. Similarly, the relative income positions of the persons in the age of 70 years and older are below or only somewhat above the overall average income level. In contrast to these findings, the relative income positions of the persons between 40 and 69 years are above the overall mean income level in all periods of time. Thereby, persons between 50 and 59 years have been on top in every year.

Over time, negative trends have occurred for the 20-29 years old persons as well as for the persons in the age class 50-59 years and – at least since the millennium – in the age groups 70-79 years and 80 years and older. For the youngest persons (0-9 years), no clear-cut trend can be observed. In the remaining age classes (10-19 years, 30-39 years, 40-49 years, and especially 60-69 years), a more or less positive trend (at least since the beginning of the 21st century) has been calculated.

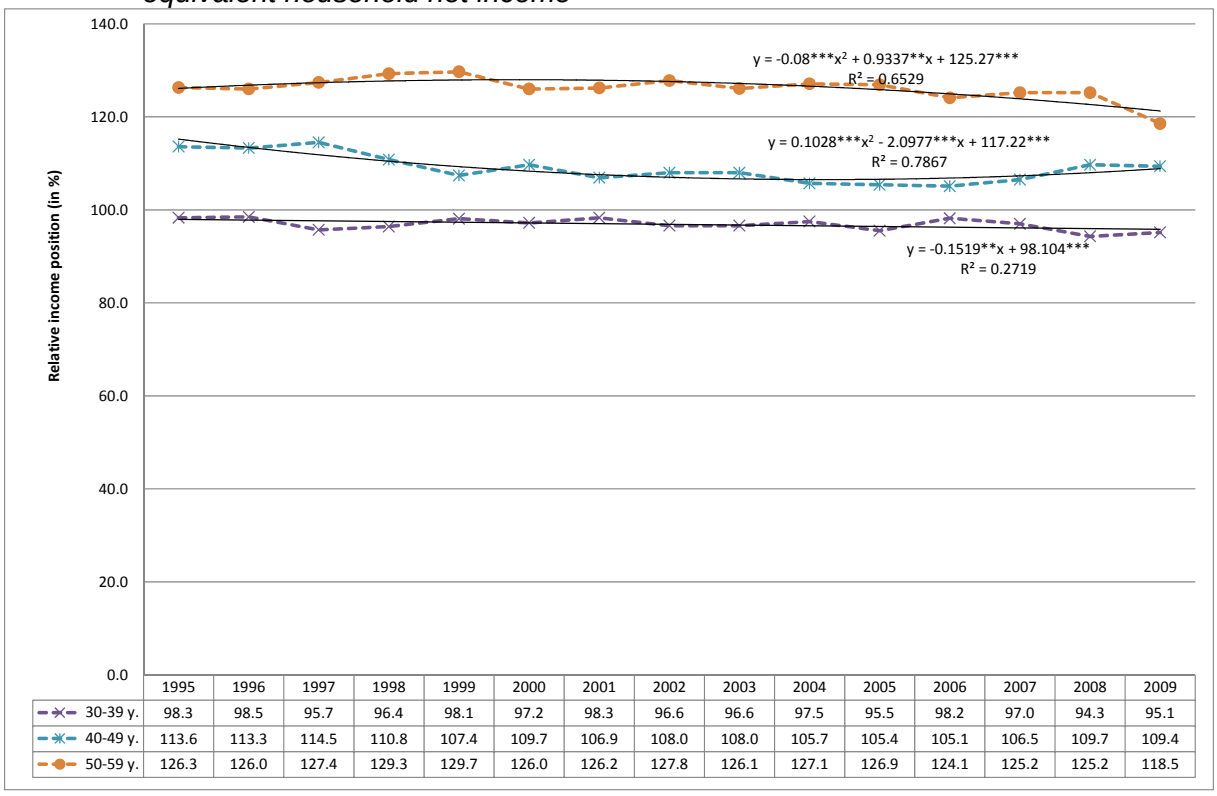
Figure 9a: Relative income positions in Germany, 1995-2009, persons up to 29 years: equivalent household net income



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0-9 y.	74.7	75.4	77.2	75.8	77.1	75.6	76.2	75.5	76.6	75.6	75.0	76.5	76.9	74.0	73.9
10-19 y.	83.4	84.6	82.2	82.9	82.3	82.8	82.0	83.1	81.7	81.0	81.7	83.6	80.8	82.2	85.2
20-29 y.	97.4	95.8	93.0	93.2	94.0	89.7	91.1	88.2	89.2	87.3	87.4	85.3	86.5	86.3	87.1

Source: Present author's own calculations (SOEP)

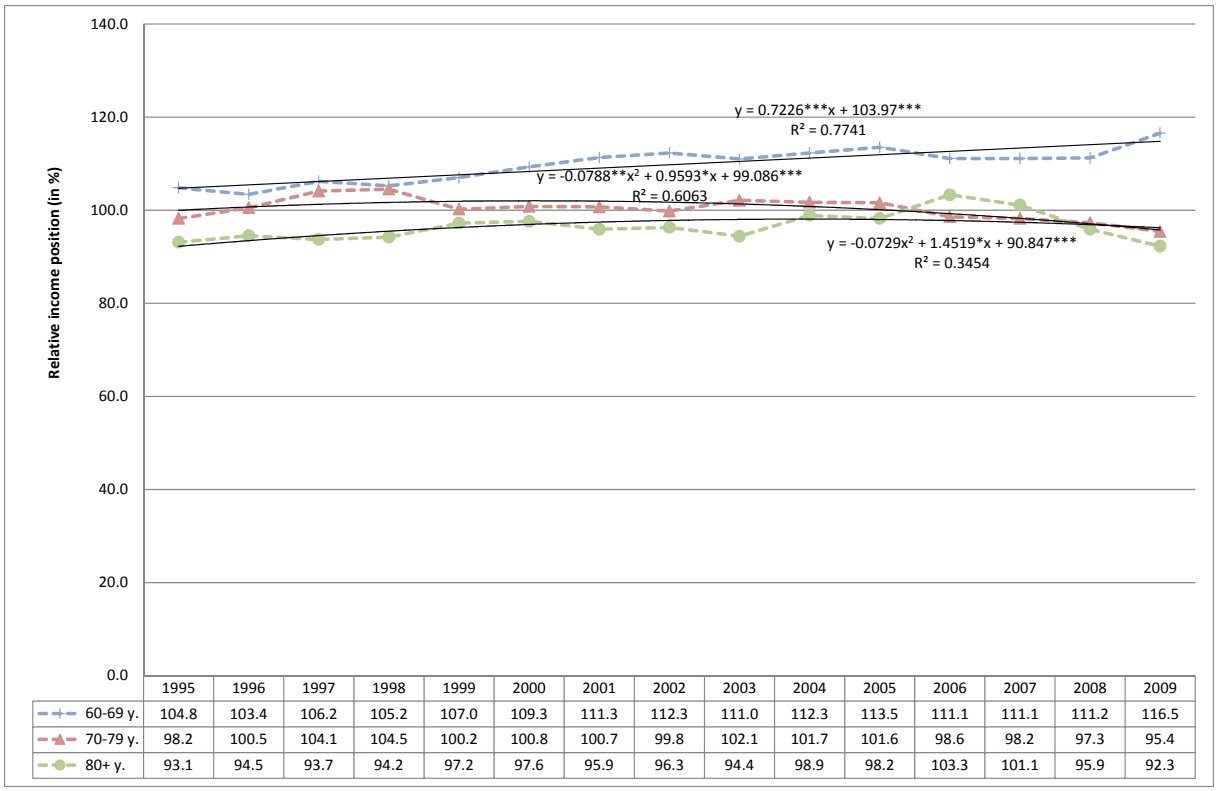
Figure 9b: Relative income positions in Germany, 1995-2009, persons 30-59 years: equivalent household net income



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
30-39 y.	98.3	98.5	95.7	96.4	98.1	97.2	98.3	96.6	96.6	97.5	95.5	98.2	97.0	94.3	95.1
40-49 y.	113.6	113.3	114.5	110.8	107.4	109.7	106.9	108.0	108.0	105.7	105.4	105.1	106.5	109.7	109.4
50-59 y.	126.3	126.0	127.4	129.3	129.7	126.0	126.2	127.8	126.1	127.1	126.9	124.1	125.2	125.2	118.5

Source: Present author's own calculations (SOEP)

Figure 9c: Relative income positions in Germany, 1995-2009, persons 60 years and older: equivalent household net income



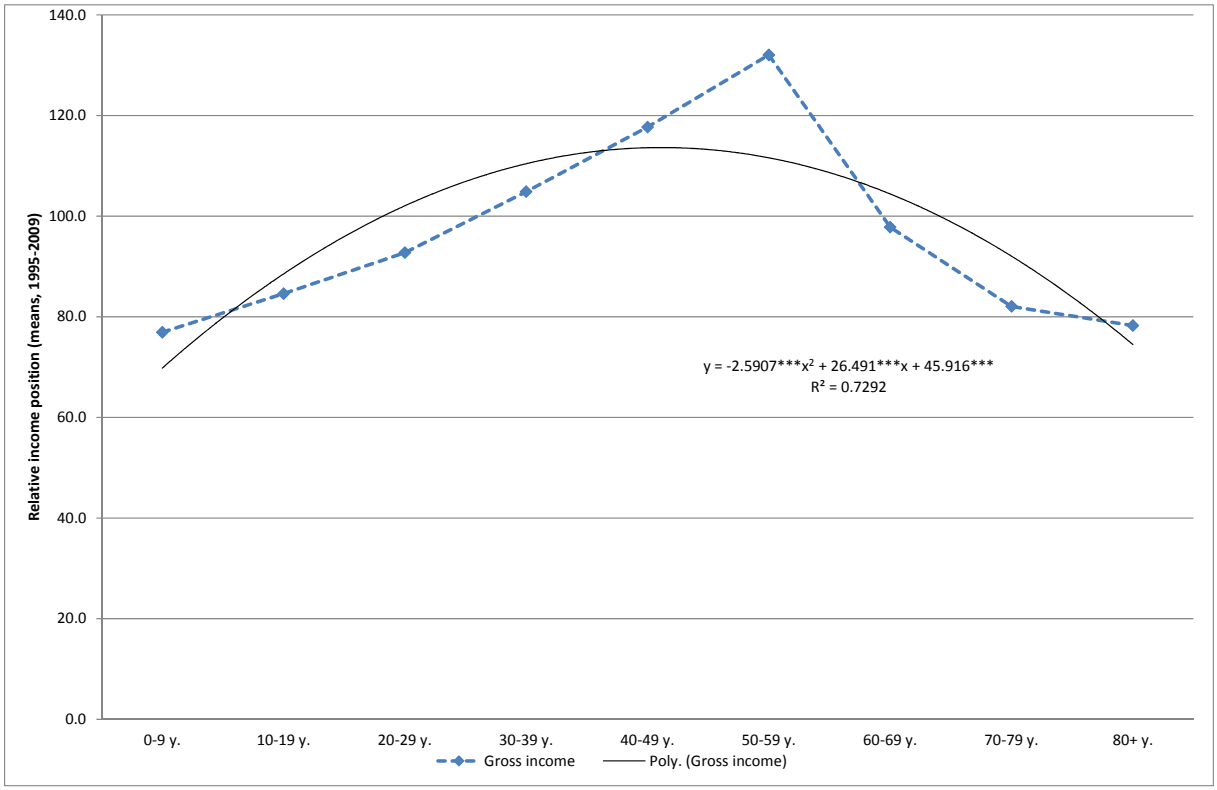
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
60-69 y.	104.8	103.4	106.2	105.2	107.0	109.3	111.3	112.3	111.0	112.3	113.5	111.1	111.1	111.2	116.5
70-79 y.	98.2	100.5	104.1	104.5	100.2	100.8	100.7	99.8	102.1	101.7	101.6	98.6	98.2	97.3	95.4
80+ y.	93.1	94.5	93.7	94.2	97.2	97.6	95.9	96.3	94.4	98.9	98.2	103.3	101.1	95.9	92.3

Source: Present author's own calculations (SOEP)

3.3.2 Age-income profiles

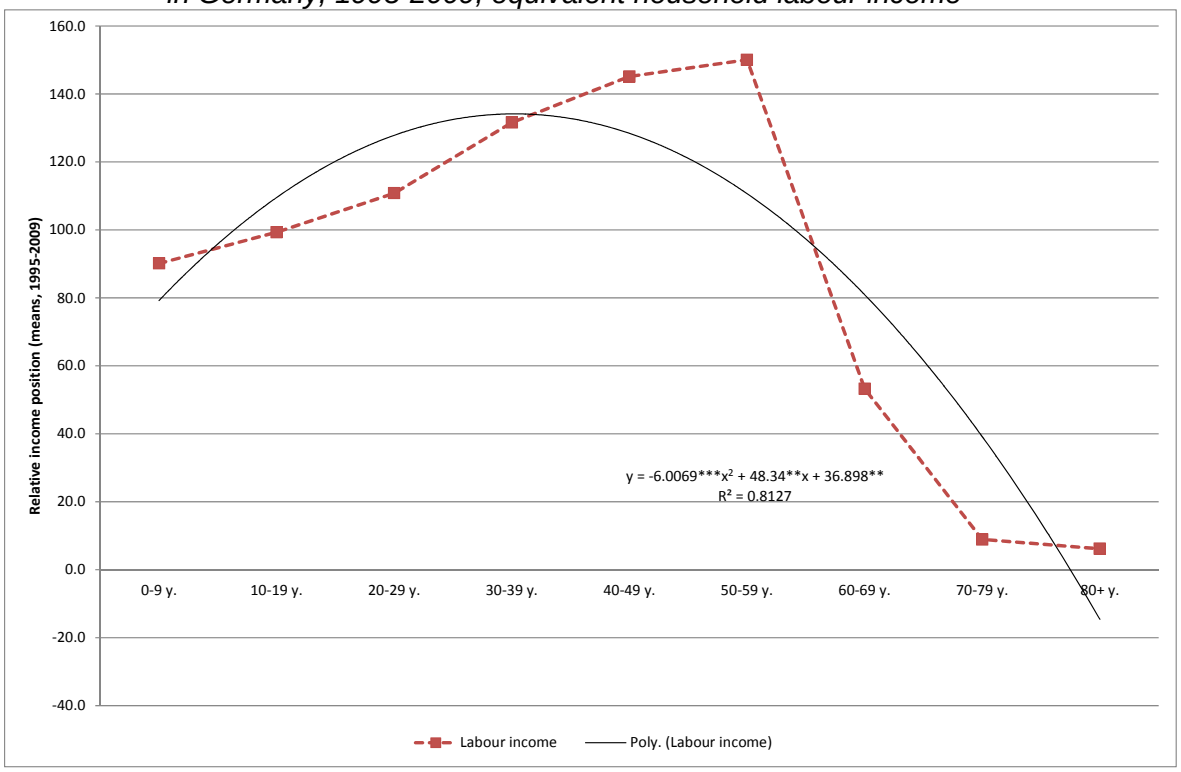
While the afore-mentioned figures are timing diagrams, the following Figures 10a-10e refer to cross-sectional data in the sense that for different income categories and across several age groups means with respect to relative income positions are computed. For gross, labour, and net incomes the income profile is concave, whereas for capital gains and for transfers a positively sloped income profile becomes obvious.

Figure 10a: Cross-sectional mean relative income positions with respect to age in Germany, 1995-2009, equivalent household gross income



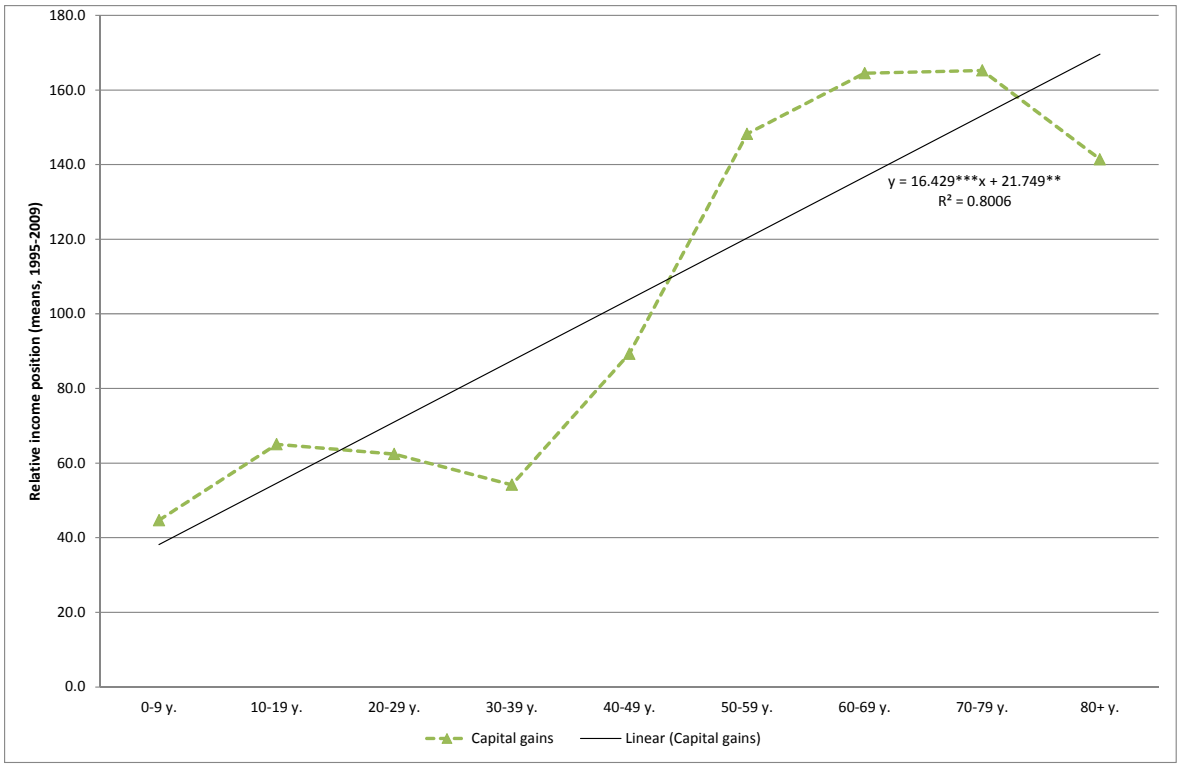
Source: Present author's own calculations (SOEP)

Figure 10b: Cross-sectional mean relative income positions with respect to age in Germany, 1995-2009, equivalent household labour income



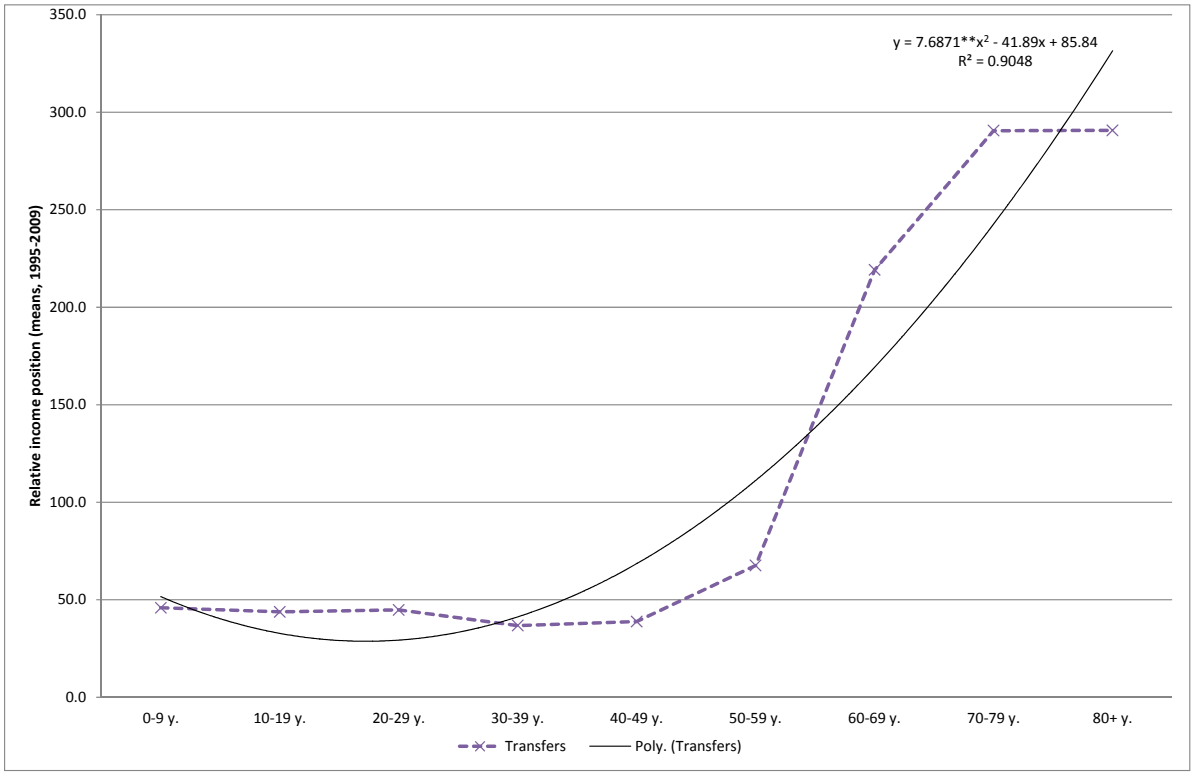
Source: Present author's own calculations (SOEP)

Figure 10c: Cross-sectional mean relative income positions with respect to age in Germany, 1995-2009, equivalent household capital gains



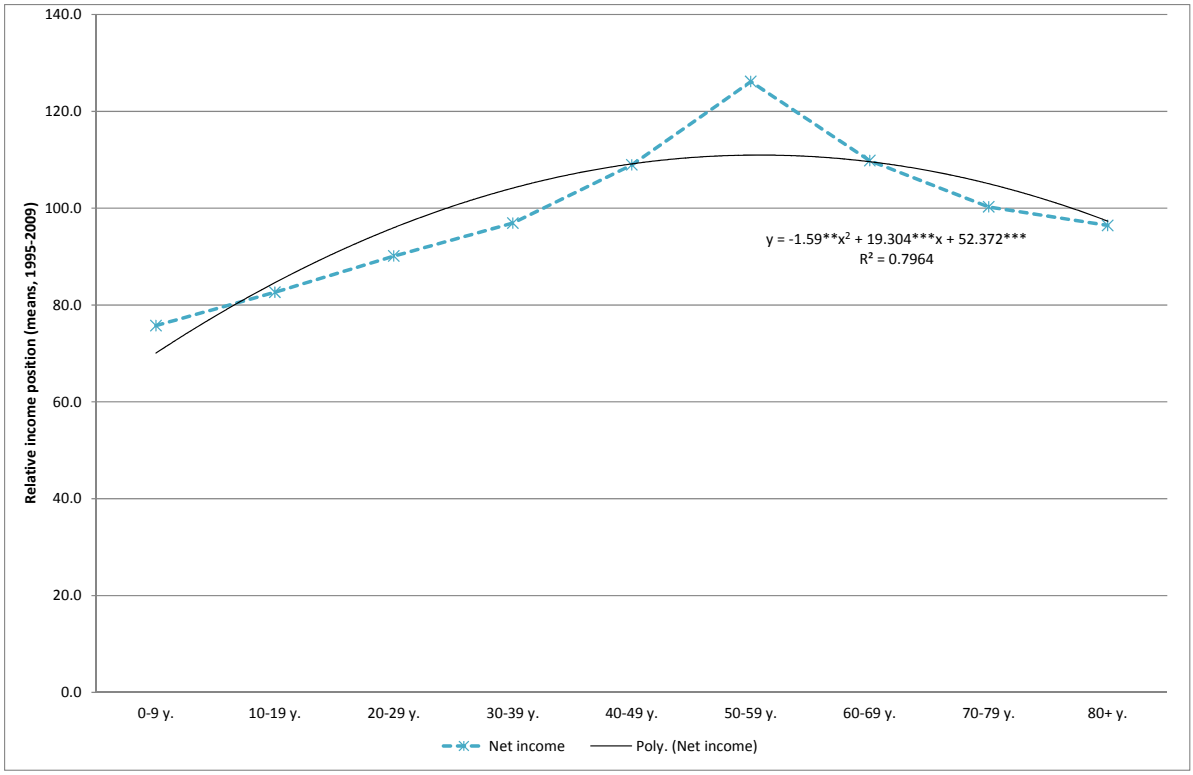
Source: Present author's own calculations (SOEP)

Figure 10d: Cross-sectional mean relative income positions with respect to age in Germany, 1995-2009, equivalent household transfers



Source: Present author's own calculations (SOEP)

Figure 10e: Cross-sectional mean relative income positions with respect to age in Germany, 1995-2009, equivalent household net income



Source: Present author's own calculations (SOEP)

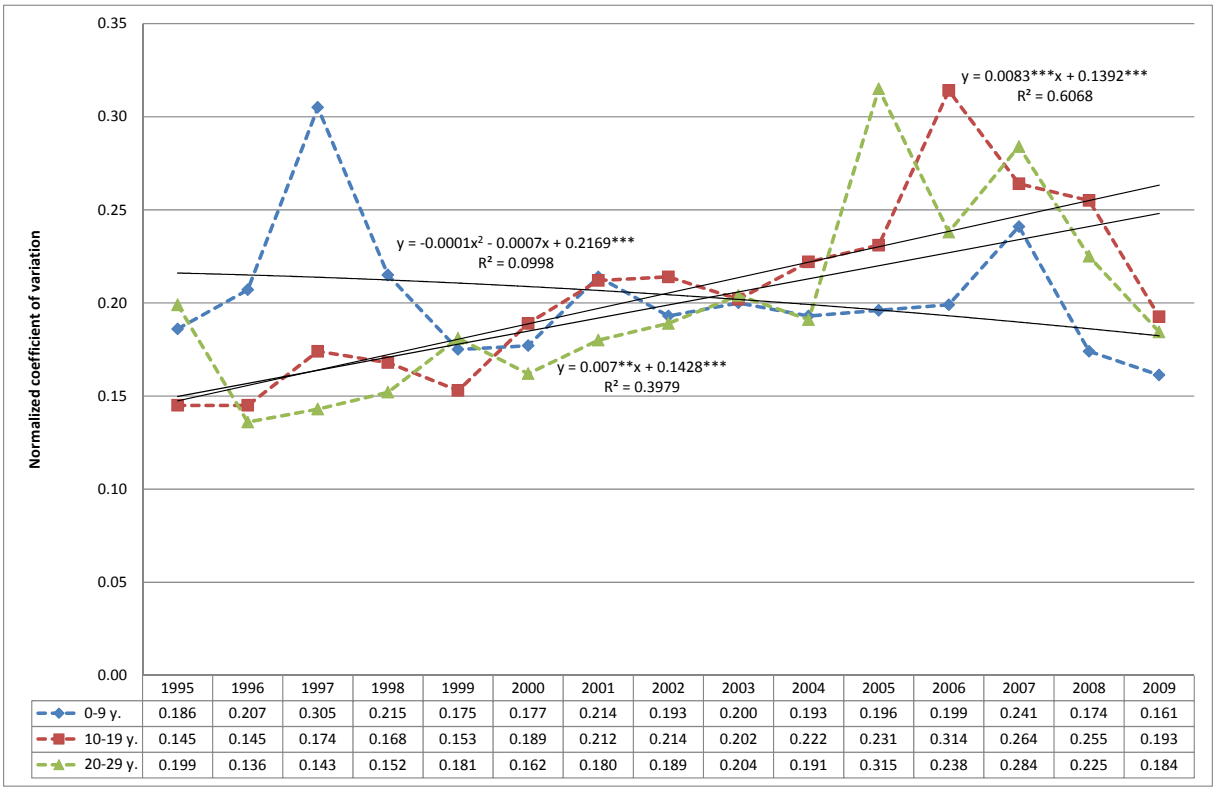
3.4 Intra-generational income inequality

3.4.1 Trends

Concerning within-group inequality, the following value ranges of the normalized coefficient of variation for equivalent household net incomes occurred (see Figures 11a to 11c): up to 9 years: 0.174-0.305, 10 to 19 years: 0.145-0.314, 20 to 29 years: 0.136-0.315, 30 to 39 years: 0.132-0.208, 40 to 49 years: 0.153-0.769, 50 to 59 years: 0.195-0.557, 60 to 69 years: 0.136-0.474, 70 to 79 years: 0.106-0.444, and 80 years and older: 0.103-0.275.

Over time, the corresponding functions are more or less erratic. Despite this finding, some rough trends can be calculated: For instance, in the age class until 9 years, within-group inequality (weakly) decreased by trend, while in the other young age groups (10-19 years, 20-29 years) a positive trend indicates increasing within-group inequality over time. Positive trends also occurred in the middle-age groups (i. e., between 30 and 59 years) where the corresponding function of the persons in the age class 50 to 59 years has a very pronounced positive slope. The latter indicates severely growing within-group inequality within this age group, possibly (at least partly) caused by developments on the German labour market (towards a spreading of wages) which are particularly important for this age class. In the upper age classes, such a positive trend of within-group inequality also becomes evident for the persons in the age of 80 years and older. Contrary to this finding, for the age groups 60-69 years and 70-79 year within-group inequality increased until the beginning of the 21st century, and afterwards it decreased (slightly) by tendency.

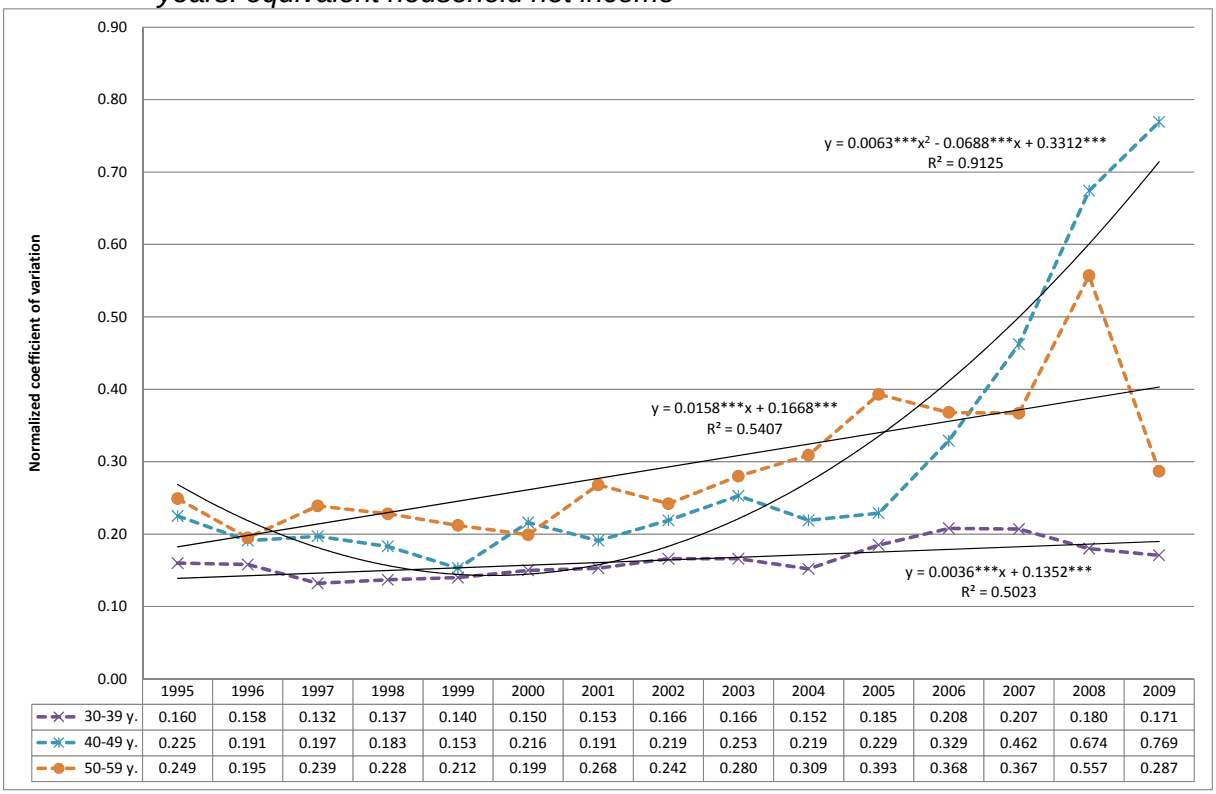
Figure 11a: Normalized coefficients of variation in Germany, 1995-2009, persons up to 29 years: equivalent household net income



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0-9 y.	0.186	0.207	0.305	0.215	0.175	0.177	0.214	0.193	0.200	0.193	0.196	0.199	0.241	0.174	0.161
10-19 y.	0.145	0.145	0.174	0.168	0.153	0.189	0.212	0.214	0.202	0.222	0.231	0.314	0.264	0.255	0.193
20-29 y.	0.199	0.136	0.143	0.152	0.181	0.162	0.180	0.189	0.204	0.191	0.315	0.238	0.284	0.225	0.184

Source: Present author's own calculations (SOEP)

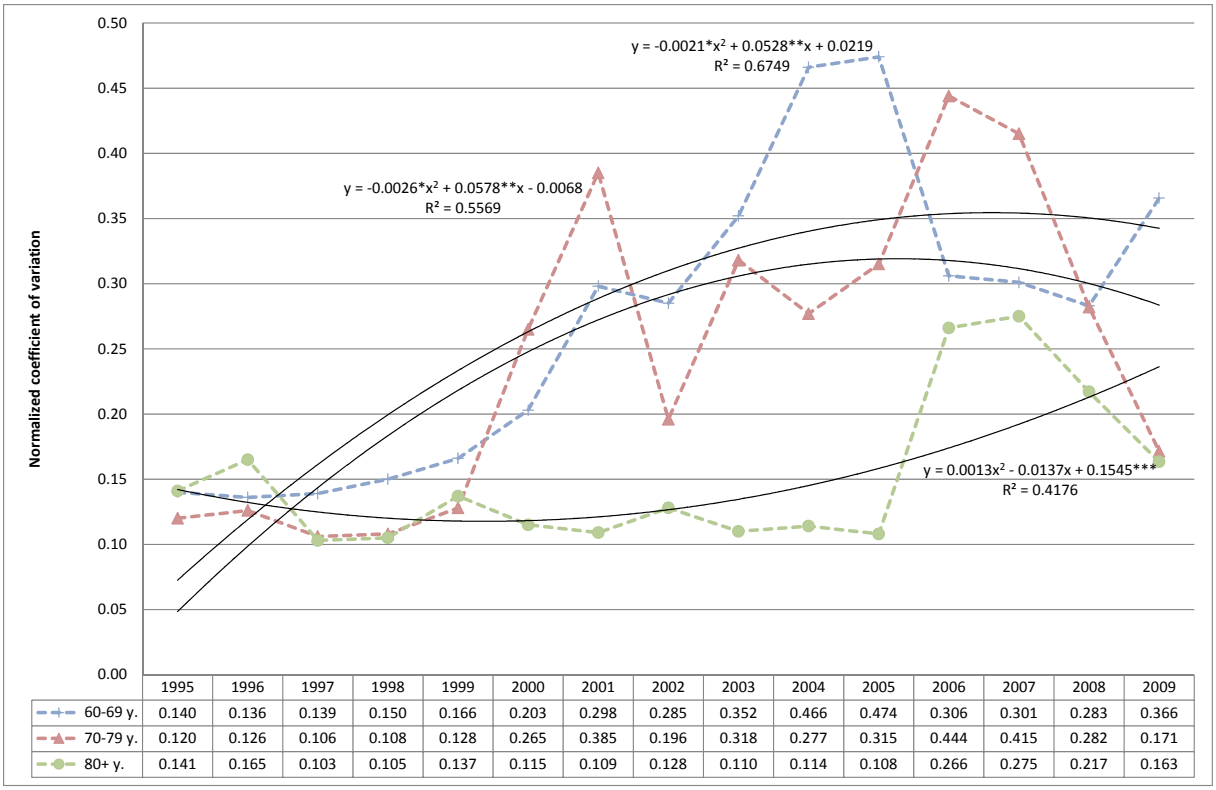
Figure 11b: Normalized coefficients of variation in Germany, 1995-2009, persons 30-59 years: equivalent household net income



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
30-39 y.	0.160	0.158	0.132	0.137	0.140	0.150	0.153	0.166	0.166	0.152	0.185	0.208	0.207	0.180	0.171
40-49 y.	0.225	0.191	0.197	0.183	0.153	0.216	0.191	0.219	0.253	0.219	0.229	0.329	0.462	0.674	0.769
50-59 y.	0.249	0.195	0.239	0.228	0.212	0.199	0.268	0.242	0.280	0.309	0.393	0.368	0.367	0.557	0.287

Source: Present author's own calculations (SOEP)

Figure 11c: Normalized coefficients of variation in Germany, 1995-2009, persons 60 years and older: equivalent household net income



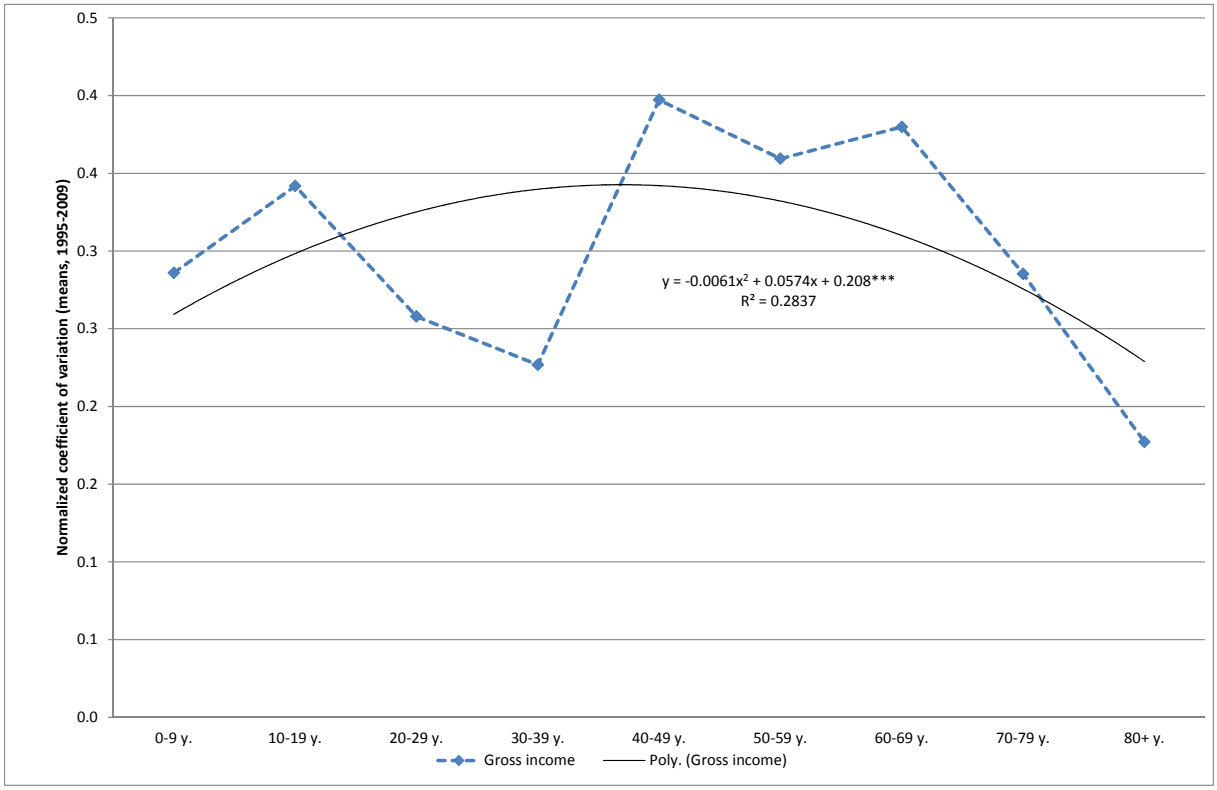
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
60-69 y.	0.140	0.136	0.139	0.150	0.166	0.203	0.298	0.285	0.352	0.466	0.474	0.306	0.301	0.283	0.366
70-79 y.	0.120	0.126	0.106	0.108	0.128	0.265	0.385	0.196	0.318	0.277	0.315	0.444	0.415	0.282	0.171
80+ y.	0.141	0.165	0.103	0.105	0.137	0.115	0.109	0.128	0.110	0.114	0.108	0.266	0.275	0.217	0.163

Source: Present author's own calculations (SOEP)

3.4.2 Age-income profiles

The computation of cross-sectional inequality profiles for different age groups and different income categories reveals concave profiles for gross incomes, capital gains, transfers, and net incomes, while the profile for labour income is convex (see Figures 12a-12e).[30]

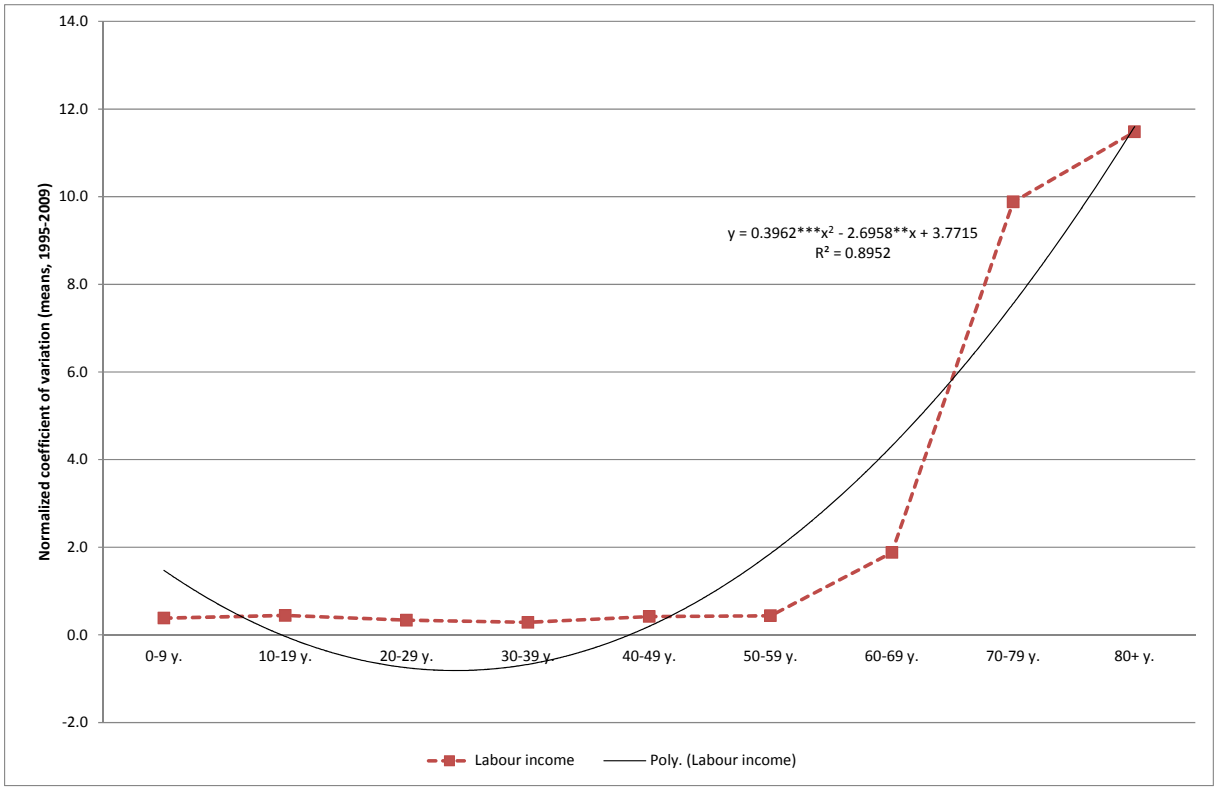
Figure 12a: Cross-sectional mean normalized coefficients of variation with respect to age in Germany, 1995-2009, equivalent household gross income



Source: Present author's own calculations (SOEP)

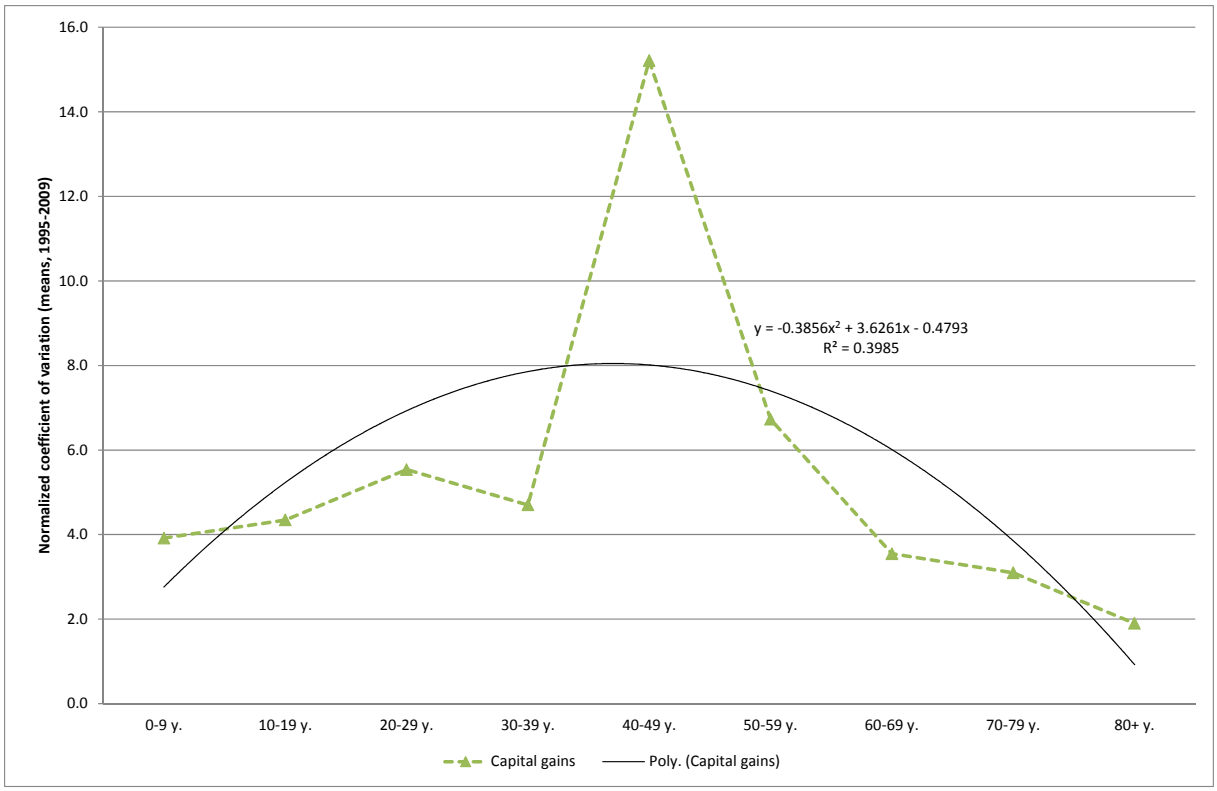
[30] It must be noted that economically some of the trend values do not make sense since they are negative. This relates to the trend values for the age groups 10 to 39 years in Figure 12b and for the persons in the age of 80 years and older in Figure 12d. Thus, for further considerations, the corresponding negative values must be set to zero. Furthermore, as can be seen by Figures 12a-12e, a number of parameters is non-significant.

Figure 12b: Cross-sectional mean normalized coefficients of variation with respect to age in Germany, 1995-2009, equivalent household labour income



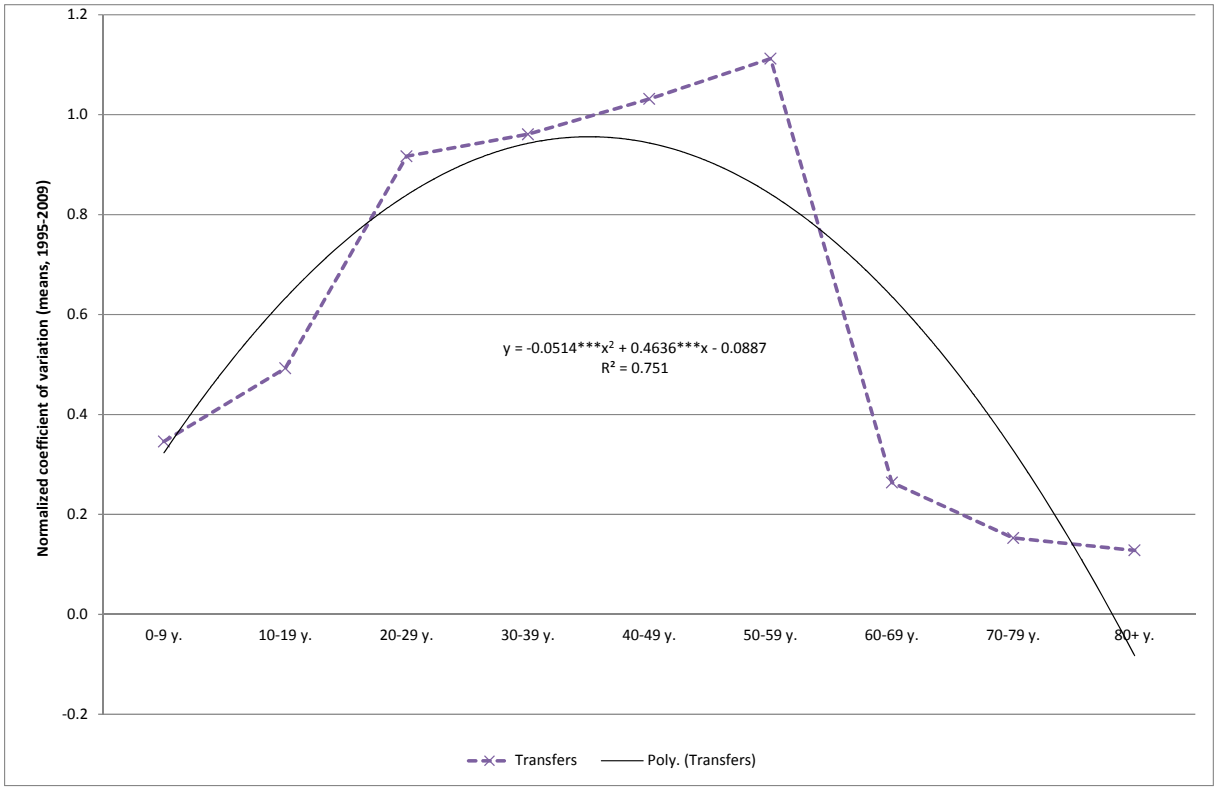
Source: Present author's own calculations (SOEP)

Figure 12c: Cross-sectional mean normalized coefficients of variation with respect to age in Germany, 1995-2009, equivalent household capital gains



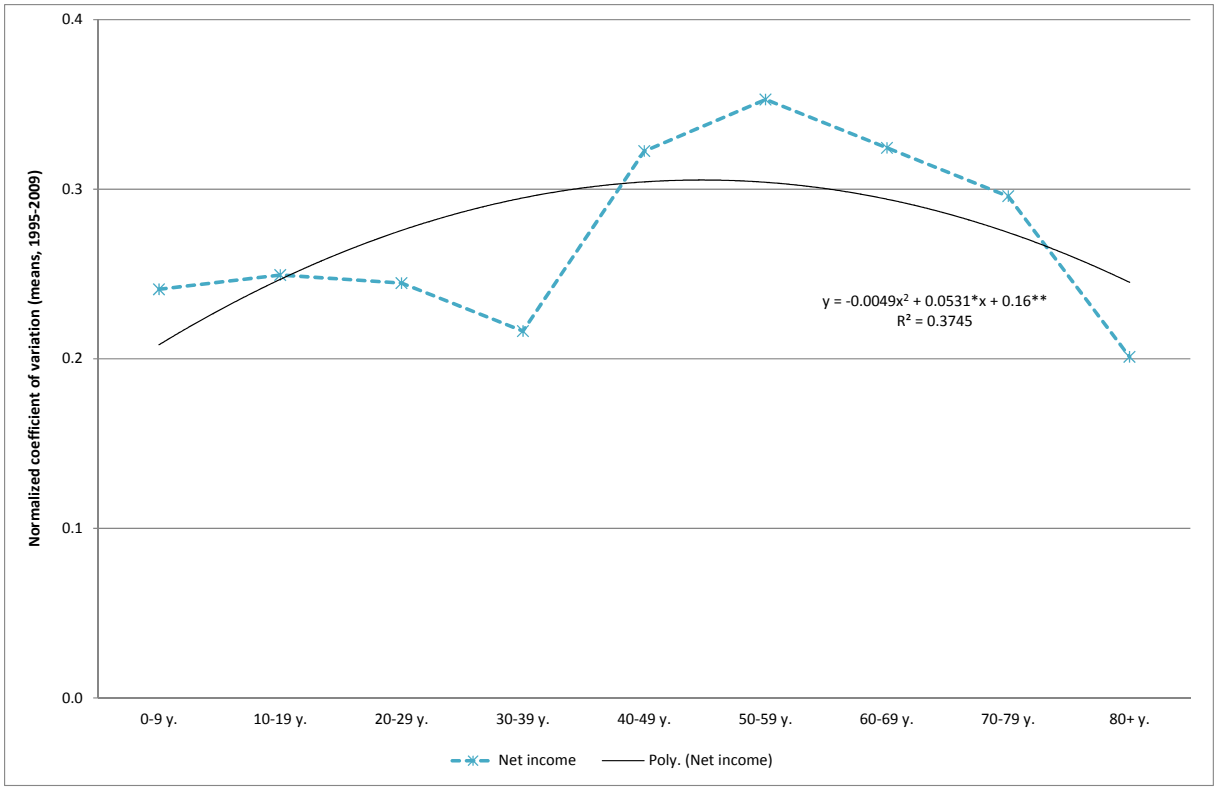
Source: Present author's own calculations (SOEP)

Figure 12d: Cross-sectional mean normalized coefficients of variation with respect to age in Germany, 1995-2009, equivalent household transfers



Source: Present author's own calculations (SOEP)

Figure 12e: Cross-sectional mean normalized coefficients of variation with respect to age in Germany 1995-2009, equivalent household net income

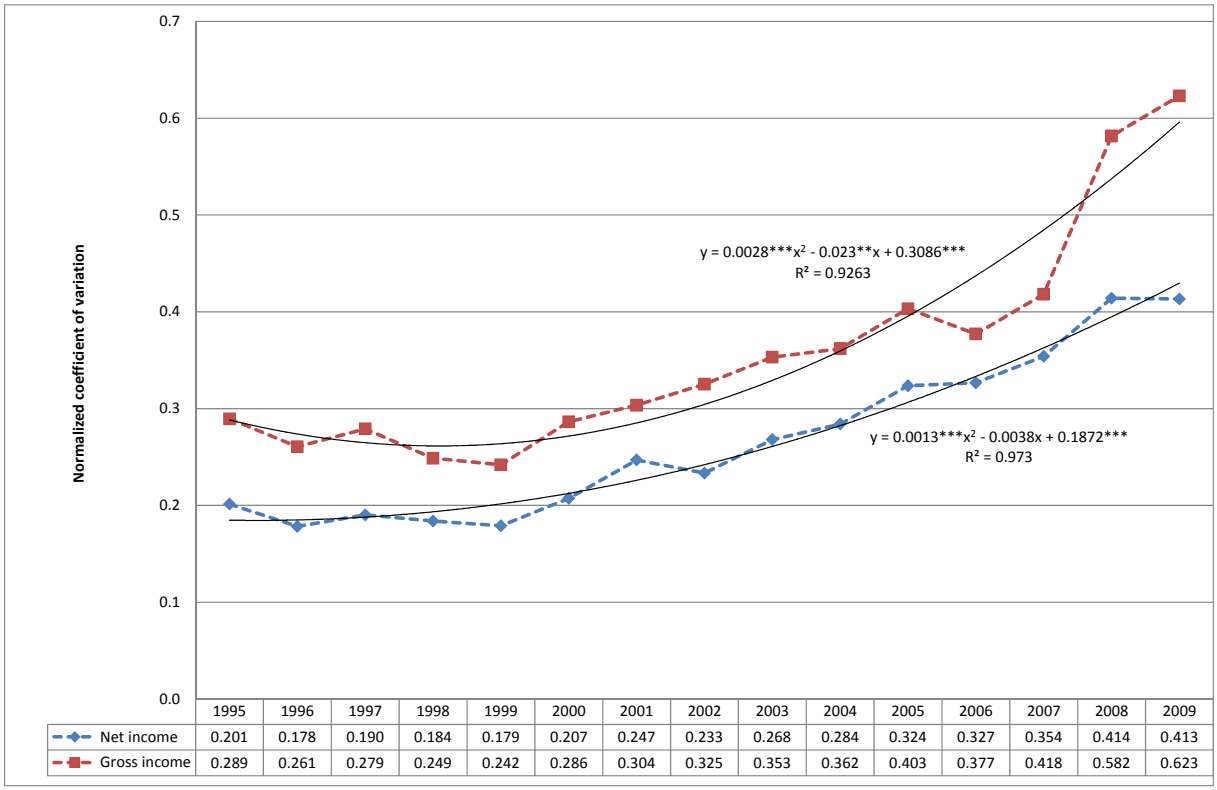


Source: Present author's own calculations (SOEP)

3.5 Overall income inequality

Both overall net income's inequality and overall gross income's inequality show a positive trend over time (see Figure 13a). In this context, the percentage difference between gross and net income's inequality[31] at first has decreased, and afterwards it has increased (see Figure 13b). Hence, at the end of the observation window, this indicates growing levelling effects by the German tax-transfer system (via redistribution).

Figure 13a: Equivalent household income inequality in Germany, 1995-2009: equivalent household gross income versus equivalent household net income

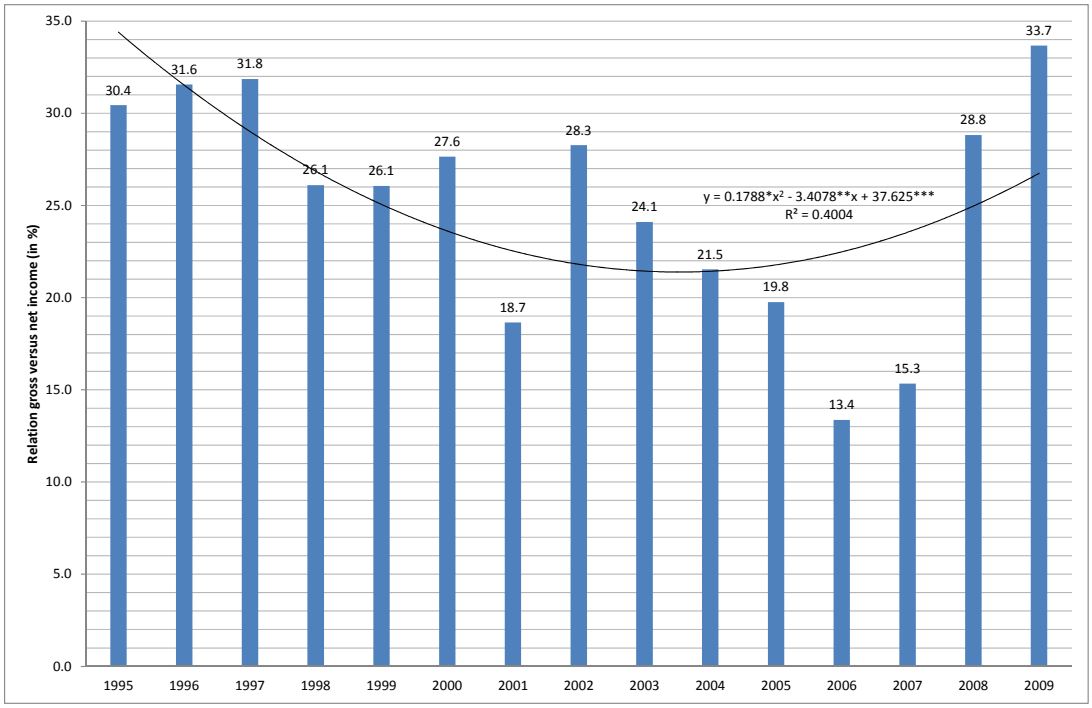


	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Net income	0.201	0.178	0.190	0.184	0.179	0.207	0.247	0.233	0.268	0.284	0.324	0.327	0.354	0.414	0.413
Gross income	0.289	0.261	0.279	0.249	0.242	0.286	0.304	0.325	0.353	0.362	0.403	0.377	0.418	0.582	0.623

Source: Present author's own calculations (SOEP)

[31] Definition: (-100) * (net income inequality – gross net income inequality)/(gross income inequality).

Figure 13b: Equivalent household income inequality in Germany, 1995-2009: relation between gross and net income's inequality



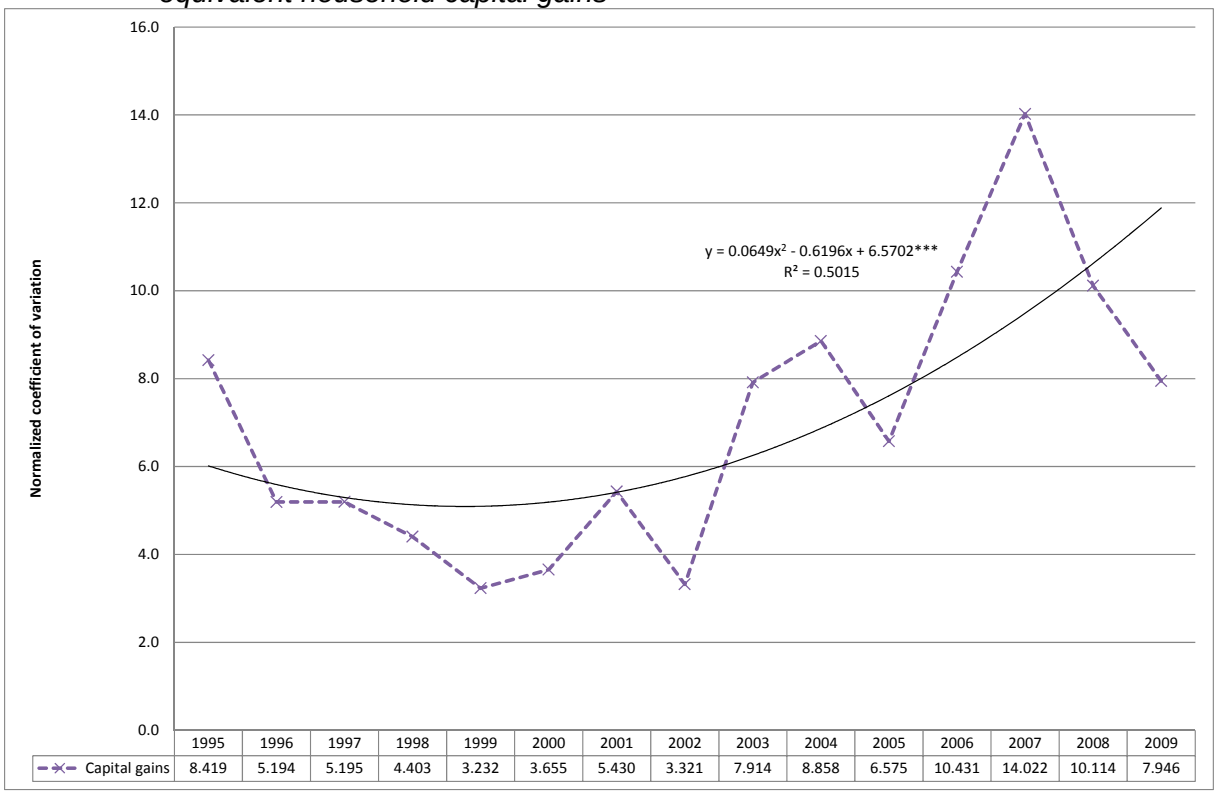
Source: Present author's own calculations (SOEP)

Furthermore, the positive trends of gross and net income's inequality are obviously caused by the inequality tendencies of labour income and capital gains (see Figures 14a and 14b). Compared with this, the trend of transfers' inequality is negative (see Figure 14c).

Figure 14a: Equivalent household income inequality in Germany, 1995-2009: equivalent household labour income

Source: Present author's own calculations (SOEP)

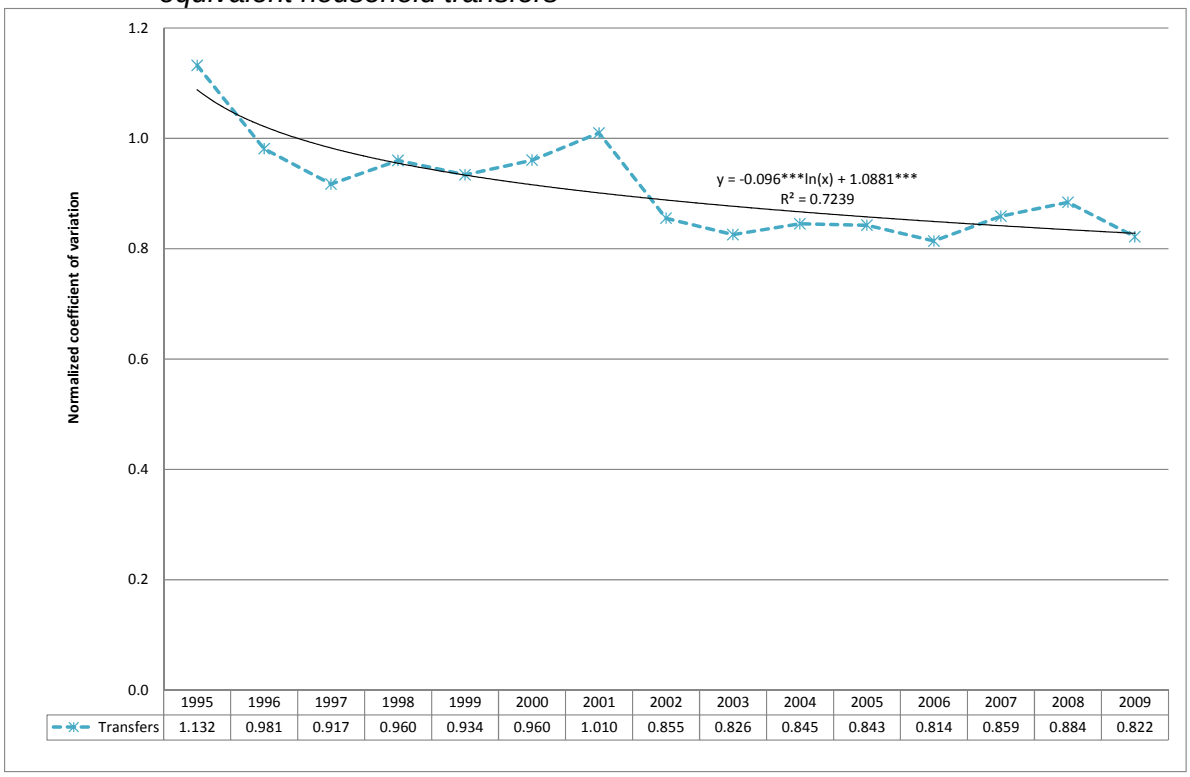
Figure 14b: Equivalent household income inequality in Germany, 1995-2009: equivalent household capital gains



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Capital gains	8.419	5.194	5.195	4.403	3.232	3.655	5.430	3.321	7.914	8.858	6.575	10.431	14.022	10.114	7.946

Source: Present author's own calculations (SOEP)

Figure 14c: Equivalent household income inequality in Germany, 1995-2009: equivalent household transfers



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Transfers	1.132	0.981	0.917	0.960	0.934	0.960	1.010	0.855	0.826	0.845	0.843	0.814	0.859	0.884	0.822

Source: Present author's own calculations (SOEP)

4. Projections of income inequality for Germany

The following projections of income inequality for Germany – typically up to the year 2020 – refer to a number of scenarios in order to illustrate the (partial) impact on inequality of different socio-demographic factors. These scenarios are compiled in Table 1. In this context, it must be noted that the (population's shares-)weighted mean of relative income positions always amounts to one. Thus, constancy of relative income positions in a concrete year requires the division of all positions by a normalization factor to fulfil this restriction.

Table 1: Forecast scenarios in this paper

Scenario	Base year(s) concerning constant values	Population shares	(Average) Household size	Relative income positions	Group-specific HSCV's	Figure
1aa	1995-2009	3-W2	constant	constant	constant	16a
1ab	1995-2009	6-W1	constant	constant	constant	16a
1ba	2009	3-W2	constant	constant	constant	16b
1bb	2009	6-W1	constant	constant	constant	16b
2aa	1995-2009	3-W2	variable	constant	constant	19
2ab	1995-2009	6-W1	variable	constant	constant	19
2ba	2009	3-W2	variable	constant	constant	A.1
2bb	2009	6-W1	variable	constant	constant	A.1
3aa	1995-2009	3-W2	constant	variable	constant	21a
3ba	1995-2009	3-W2	variable	variable	constant	21a
3ab	2009	3-W2	constant	variable	constant	A.3a
3bb	2009	3-W2	variable	variable	constant	A.3a
3ca	1995-2009	6-W1	constant	variable	constant	21b
3da	1995-2009	6-W1	variable	variable	constant	21b
3cb	2009	6-W1	constant	variable	constant	A.3b
3db	2009	6-W1	variable	variable	constant	A.3b
4a	1995-2009	constant	constant	constant	variable	22
4b	2009	constant	constant	constant	variable	A.4
5a	-	3-W2	variable	variable	variable	23
5b	-	6-W1	variable	variable	variable	23

Source: Present author's compilation

4.1 Demography

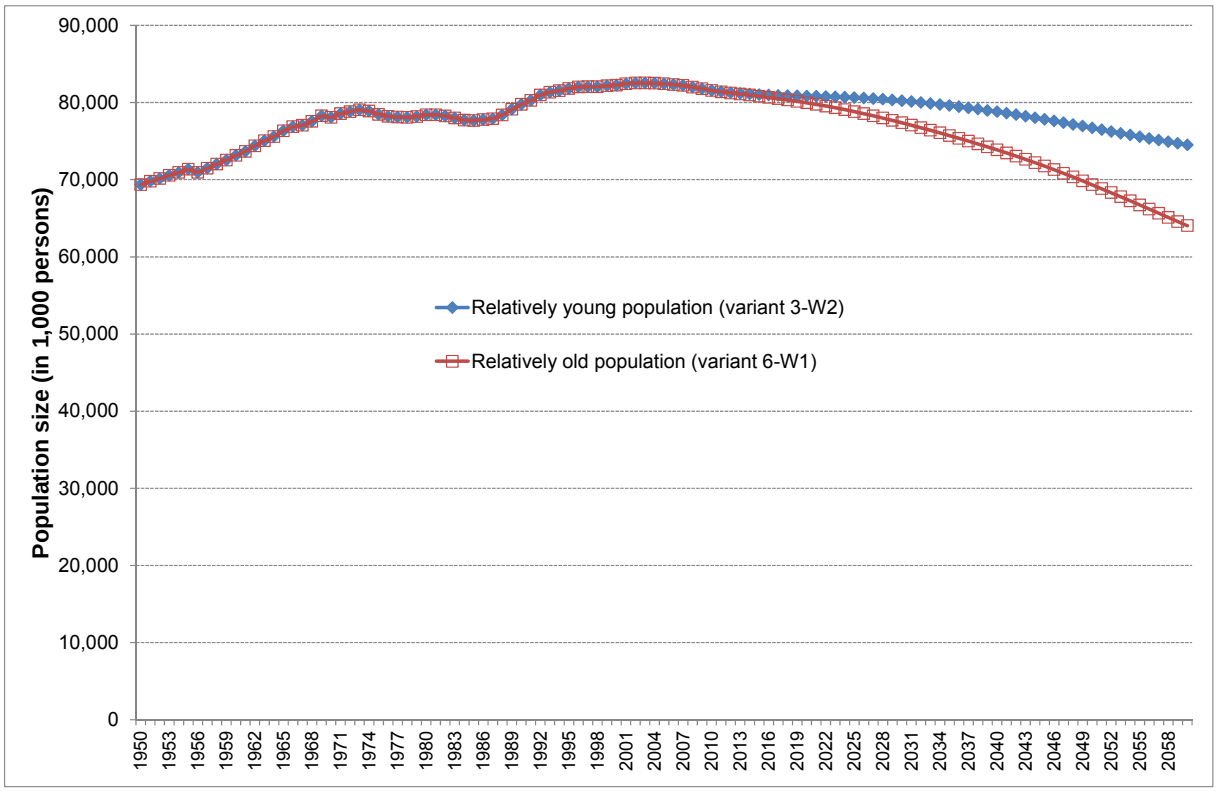
4.1.1 Population shares

The three demographic elements birth frequencies, life expectancy, and (im)migration constitute the starting point for population forecasts concerning Germany. Because of the lassitude of demographic processes, such forecasts are relatively reliable (i. e., since a large part of the population of the next decades is already born). On this basis and with assumptions with respect to fertility and mortality, quite good forecasts about the future population's size and structure are possible. In this context, (im)migration is the most unsteady component.[32] The corresponding statements concerning the future demographic process in Germany coincide at least principally. All forecasts assume a further ageing of the German population.[33]

[32] See Deutsche Bank Research 2002, p. 10.
[33] See, more extensively, Birk 2005, pp. 97-118.

Forecasts of the German Statistical Office (*Statistisches Bundesamt)* on the basis of the 12th coordinated population's forecast, give – in dependence of the chosen variant – evidence to a more or less distinct reduction of the German population size. Figure 15 comprises two main variants: on the one hand a relatively young population up to the year 2060 and on the other hand a relatively old population up to 2060. In the first case, a population's reduction from currently approximately 80 Mio persons to about 75 Mio persons in 2060 is predicted; in the second case, the population size would be reduced to about 65 Mio persons in 2060.

Figure 15: Population forecasts for Germany up to 2060



Assumptions:

1. Relatively young population (variant 3-W2): increasing birth frequency, on average, up to 1.6 children per woman in 2025 and subsequently constancy of this level until 2060; increasing life expectancy at birth to 89.2 years for girls and to 85.0 years for boys in 2060; life expectancy at the age of 60 years: 30.1 further years for women and 26.6 further years for men; migration at balance: +200,000 persons p. a.;

2. Relatively old population (variant 6-W1): decreasing birth frequency, on average, up to 1.2 children in 2060; increasing life expectancy at birth to 91.2 years for girls and to 87.7 years for boys in 2060; life expectancy at the age of 60 years: 32.1 further years for women and 29.2 further years for men; migration at balance: +100,000 persons p. a.

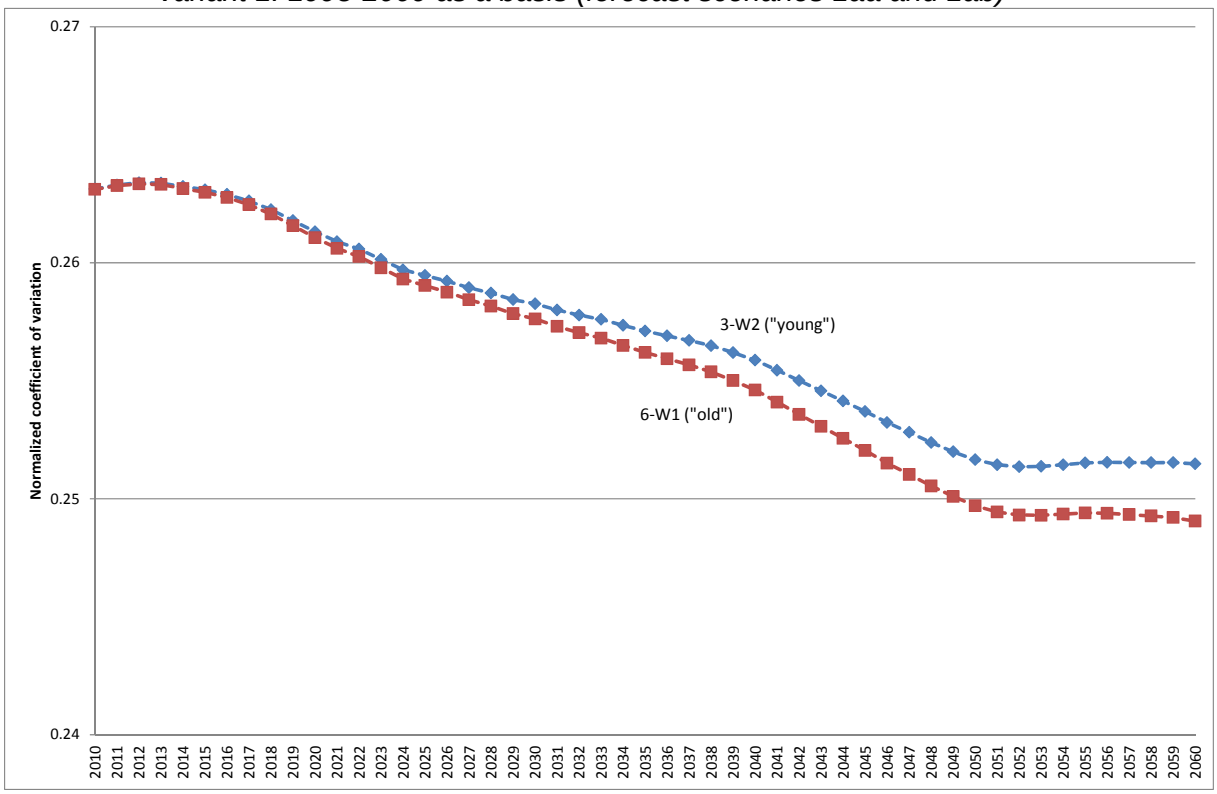
Source: Present author's own illustration on the basis of www.destatis.de/genesis (access at 2012-06-19) and following Statistisches Bundesamt 2009, p. 32.

Using the estimates of the 12th German coordinated population's forecast for the nine age classes considered in the paper and keeping within- and between-group inequality levels constant for each age class during the forecast period (2010[34]-2060), the future entire income inequality in Germany is calculated.

In this context, I have chosen two variants concerning within- and between-group inequality: In the first variant, I used mean values for the inequality components due to the whole period of observation (1995-2009), and in the second variant, I set the corresponding parameters to the values in the last year of observation (2009). The first variant's effects on entire inequality are shown in Figure 16a, the other variant's impact upon inequality is stated in Figure 16b. Both variants reveal at least a tendency towards decreasing inequality in the future until 2060 which is caused by tendentially lower within-group inequality levels in the older age groups than in the younger age classes and – concerning between-group inequality – by relative income positions near the average value for the elderly.

In the variant with 2009 as a basis, the within-group inequality pattern does not appear as straightforward as in the other variant, and the predicted inequality levels in the variant with 2009 as a basis are higher than in the other variant. Furthermore, in both variants the inequality levels in the sub-variant "old" are, typically, lower than in the sub-variant "young" which follows from the tendentially lower within-group inequality levels of old (especially of very old) persons compared with younger persons.[35]

Figure 16a: Normalized coefficients of variations of equivalent household net income in Germany, 2010-2060 (forecasts), in two demographic scenarios; variant 1: 1995-2009 as a basis (forecast scenarios 1aa and 1ab)

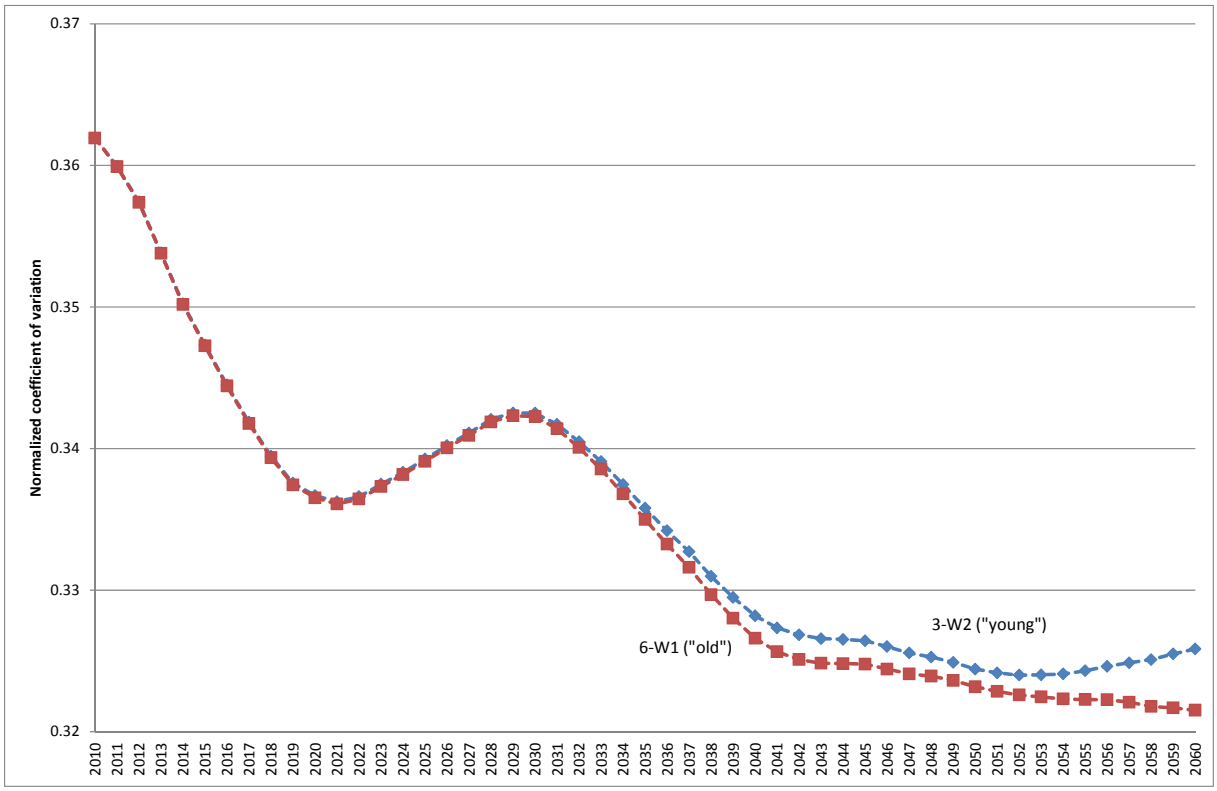


Source: Present author's own calculations

[34] "2010" is the first year in the forecasts since currently available information on annual incomes within the SOEP ends with the year 2009.

[35] It is important to note that both in Figure 16a and in Figure 16b (and in some of the following figures) the ordinate is truncated – only for reasons of clarity.

Figure 16b: Normalized coefficients of variations of equivalent household net income in Germany, 2010-2060 (forecasts), in two demographic scenarios; variant 2: 2009 as a basis (forecast scenarios 1ba and 1bb)



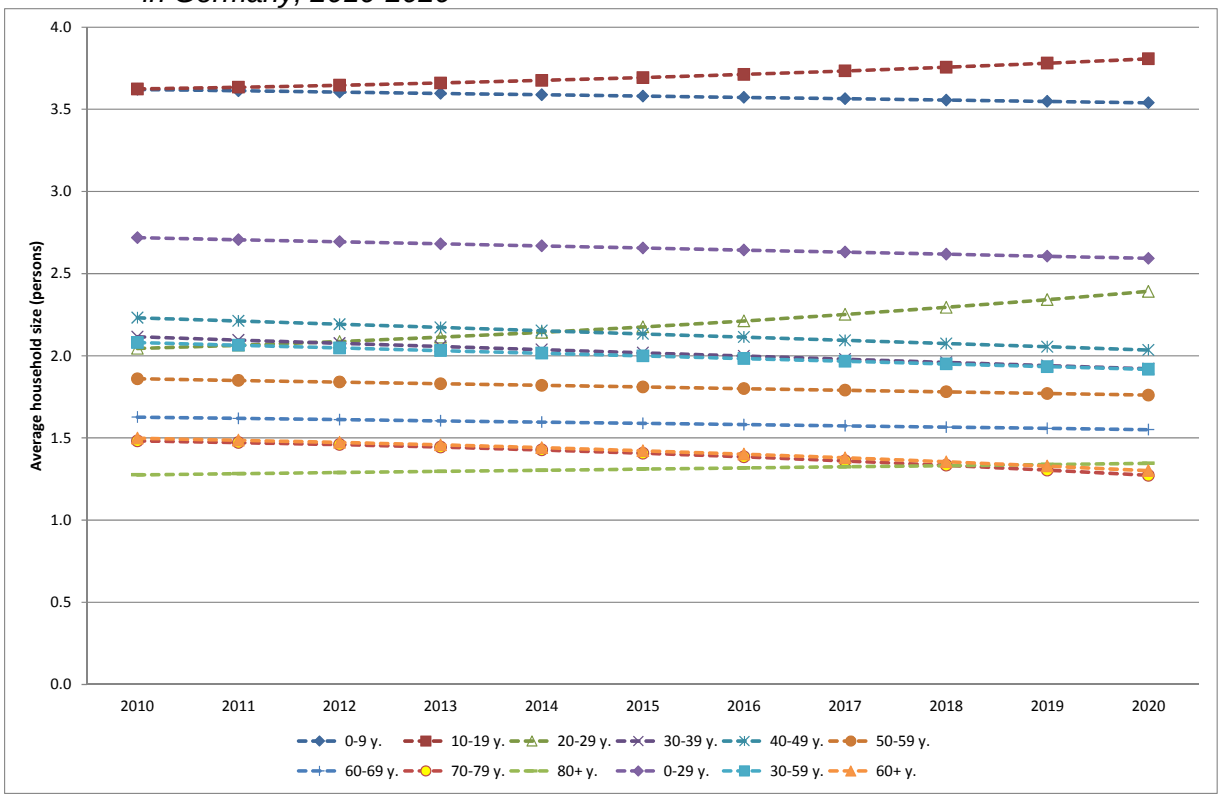
Source: Present author's own calculations

4.1.2 Household size

As was shown above, in Germany overall average household size and concerning most of group-specific average household sizes within the different age groups have diminished their values over time. On this statistical basis, time trends have been (OLS) estimated (see former Figures 8b-8d) and were used for forecasts until 2020[36] (see Figure 17).

[36] Contrary to Figures 16a and 16b, which refer to 2060 as the last forecast period, in the following, forecasts are restricted to 2020 since, compared with pure population shares, other socio-economic developments are much more unsure; thus, a shorter forecast period makes sense in my eyes.

Figure 17: Forecasts for the development of average household sizes in Germany, 2010-2020



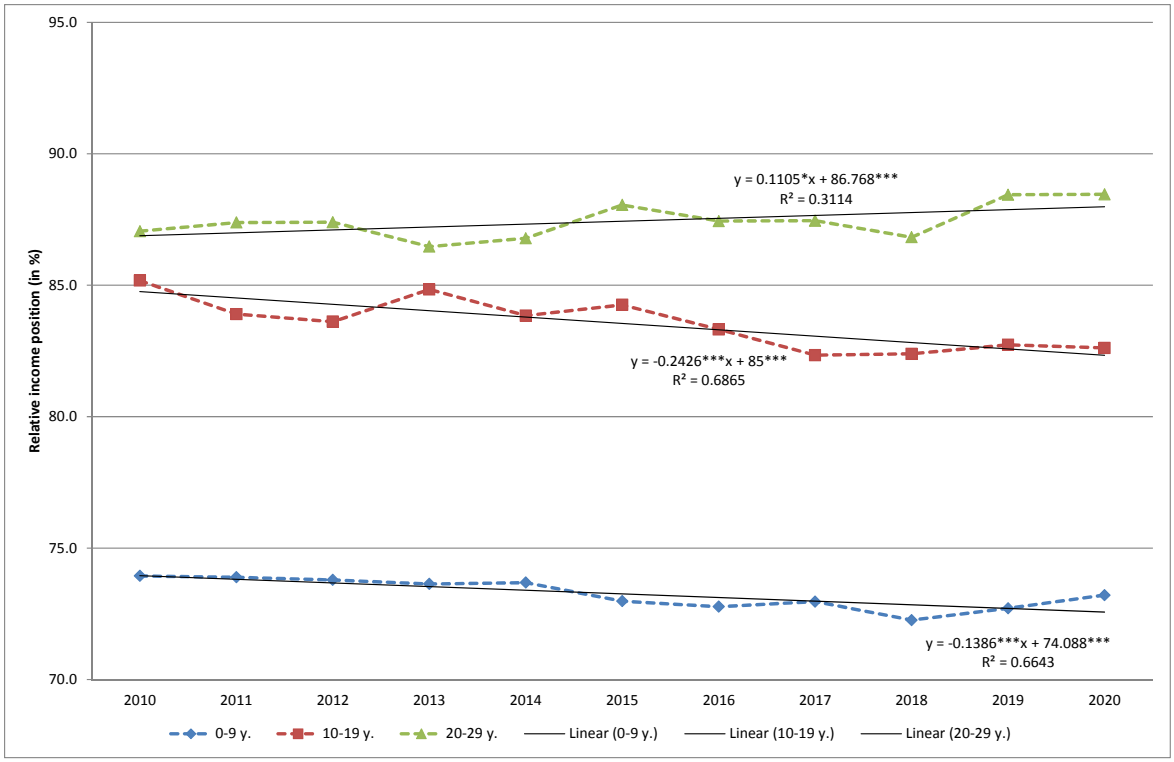
Source: Present author's own calculations (on the basis of the trend functions in Figures 8b-8d)

In the context of income inequality, I have operationalized the inequality effects of household size by normalization constants of the average equivalent household net income as well as of the standard deviations of the same variable. Concretely, the "growth factors" concerning the changing average household sizes, as stated in Figure 17, are used as such normalization constants. Since HSCV is multiplicatively invariant, the sketched construction does not generate any effect with respect to within-group inequality but only concerning between-group inequality in terms of relative income positions, and by this overall inequality is affected.

Figures 18a to 18c show the corresponding impacts of changing average household sizes on the relative income positions for the several age groups. On this basis, negative trends for within-group inequality can be observed for the age classes until 19 years and for the persons in the age groups from 70 years upwards. In contrast, the corresponding trend functions for the age classes 20 to 49 years do have positive slopes. The trend function for age class 50-59 years is concave while the trend function for age class 60-69 years is convex.[37]

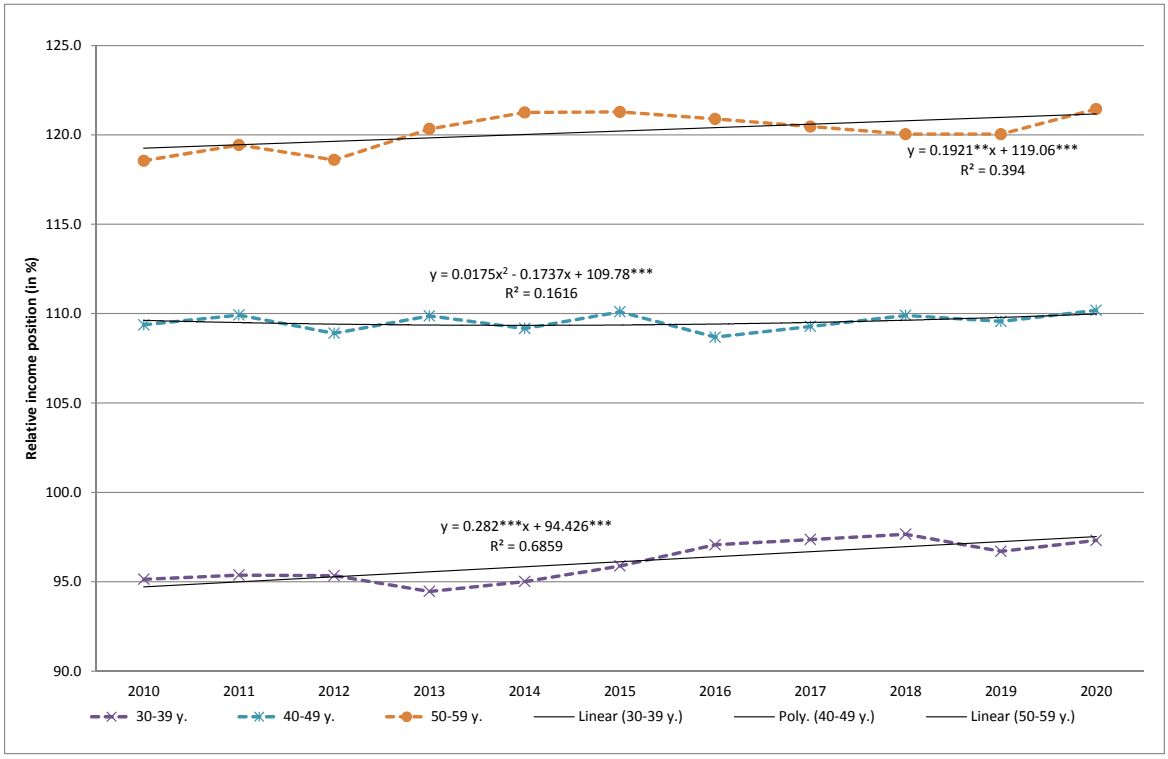
[37] Because of typically relatively low variation in relative income positions between 1995 and 2009 (see Figures 9a-9c) it appears justifiable to only use 2009 figures as the basis for the predictions in Figures 18a-18c. The corresponding differences are (2009 as a base year versus 1995-2009 as base years; in percentage points): up to 9 years: -1.8, 10 to 19 years: +2.5, 20 to 29 years: -3.0, 30 to 39 years: -1.8, 40 to 49 years: +0.4, 50 to 59 years: -7.6, 60 to 69 years: +6.8, 70 to 79 years: -4.8, 80 years and older: -4.2. My calculations of relative income positions use average equivalent household net incomes of the several age classes in 2009 as starting points and update these averages via the predicted changes in average household size for the different age groups.

Figure 18a: Forecasts for the development of relative net income positions with respect to predicted average household sizes in Germany, 2010-2020, persons up to 29 years (basis: 2009): equivalent household net income



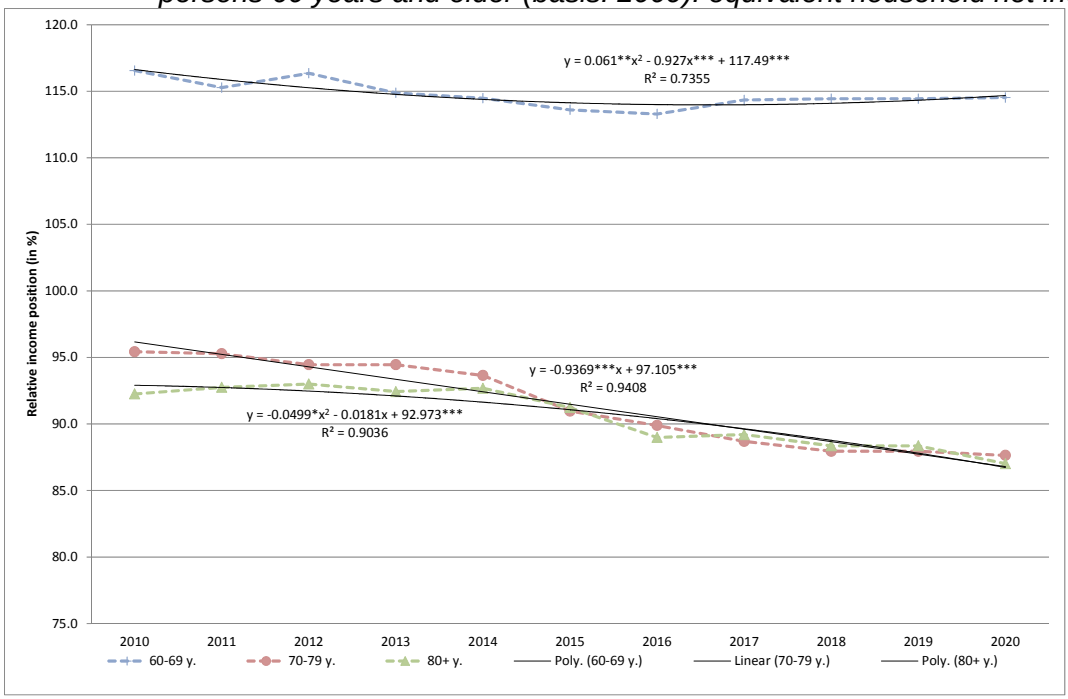
Source: Present author's own calculations

Figure 18b: Forecasts for the development of relative net income positions with respect to predicted average household sizes in Germany, 2010-2020, persons 30-59 years (basis: 2009): equivalent household net income



Source: Present author's own calculations

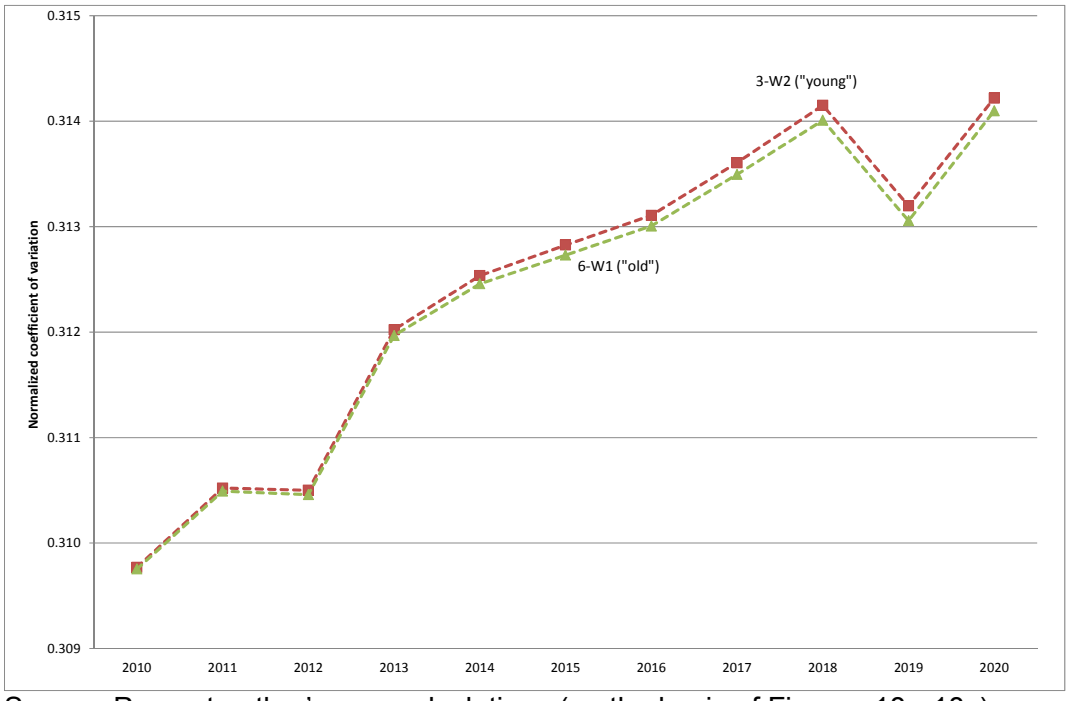
Figure 18c: Forecasts for the development of relative net income positions with respect to predicted average household sizes in Germany, 2010-2020, persons 60 years and older (basis: 2009): equivalent household net income



Source: Present author's own calculations

The consequences of the afore-mentioned developments on entire income inequality are revealed in Figure 19. Obviously, in both presented variants with an ageing society (3-W2 versus 6-W1) the estimated inequality is, by tendency, increasing until 2020.

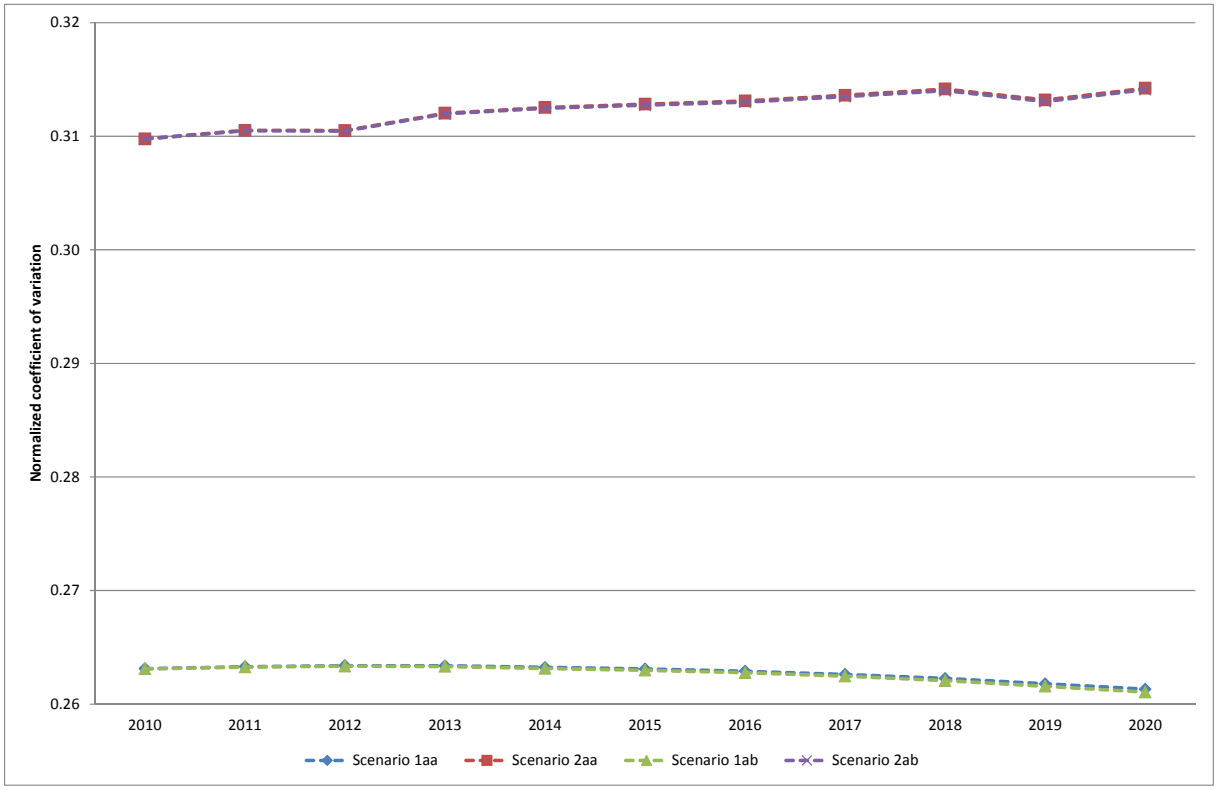
Figure 19: Forecasts for the development of entire equivalent household net income inequality with respect to predicted average household sizes in Germany, 2010-2020 (1995-2009 as a basis; forecast scenarios 2aa and 2ab)



Source: Present author's own calculations (on the basis of Figures 18a-18c)

Figure 20 reveals the difference between scenarios 1aa and 1ab (according to Figure 16a) on one hand and scenarios 2aa and 2ab (according to Figure 19) on the other hand. The additional consideration of household size effects obviously alters the predicted inequality pattern for the period 2010-2020 towards an increasing inequality trend compared with the concave pattern generated by the effects merely based on changes in population shares. This difference is caused by the different trends of the several age groups with respect to relative income positions (concerning this see former Figures 18a to 18c).

Figure 20: Comparison of forecast scenarios 1aa and 1ab with 2aa and 2ab for Germany, 2010-2020: equivalent household net income's inequality (base years: 1995-2009)



Source: Present author's own compilation (on the basis of Figures 16a and 19)

4.2 Inter-generational effects

In this section, trends for different income components are estimated which are reported in Table A.2 in the Appendix. On this basis, relative income positions for several age groups are estimated, partly plus the effects of (average) household size effects (see Table 2).

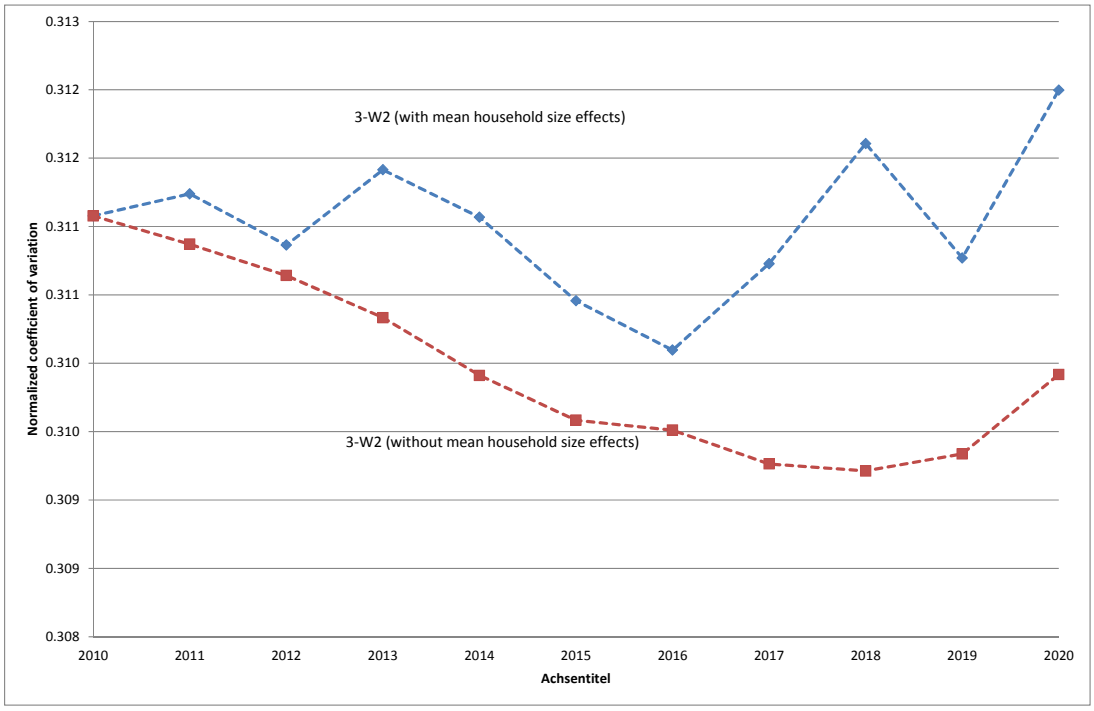
Table 2: Relative income positions of different age groups for Germany, 2010-2020, due to several incomes' trends estimations and, additionally, due to (average) household size effects: equivalent household net incomes

Only trends' effects:									
Period	**0-9 years**	**10-19 years**	**20-29 years**	**30-39 years**	**40-49 years**	**50-59 years**	**60-69 years**	**70-79 years**	**80+ years**
2010	75.2	83.5	84.0	97.6	107.8	121.4	120.0	103.4	103.7
2011	74.8	84.0	83.6	97.9	108.4	119.7	120.9	102.4	103.4
2012	74.5	84.6	83.2	98.2	109.1	117.9	121.7	101.4	103.0
2013	74.1	85.2	83.0	98.6	109.9	116.0	122.5	100.3	102.6
2014	73.8	86.0	82.8	99.0	110.8	114.0	123.4	99.2	102.2
2015	73.4	86.9	82.6	99.5	111.7	111.8	124.1	98.0	101.6
2016	73.0	87.7	82.4	99.5	112.8	109.4	124.8	96.7	100.9
2017	72.6	88.7	82.3	100.5	113.9	107.0	125.6	95.3	100.2
2018	72.2	89.8	82.3	101.1	115.2	104.4	126.4	93.9	99.4
2019	72.1	91.3	82.6	102.1	116.9	102.1	127.6	92.7	98.9
2020	71.4	92.2	82.4	102.5	118.0	99.0	127.9	90.8	97.7
Trends' effects plus (average) household size effects:									
Period	**0-9 years**	**10-19 years**	**20-29 years**	**30-39 years**	**40-49 years**	**50-59 years**	**60-69 years**	**70-79 years**	**80+ years**
2010	75.2	83.5	84.0	97.6	107.8	121.4	120.0	103.4	103.7
2011	74.8	82.7	83.9	98.1	108.9	120.6	119.5	102.3	104.0
2012	74.3	83.0	83.6	98.4	108.6	118.0	121.5	100.4	103.9
2013	73.8	84.9	82.4	97.9	110.3	117.8	120.7	99.3	102.8
2014	73.5	84.7	82.5	98.9	110.6	116.6	121.2	97.4	102.6
2015	72.4	85.9	83.5	100.3	112.5	114.4	121.0	93.4	100.4
2016	71.8	85.8	82.8	102.0	112.0	111.6	121.3	91.0	97.3
2017	71.6	85.8	82.7	102.9	113.8	108.7	123.2	88.6	96.8
2018	70.6	86.9	82.1	103.8	115.7	105.8	124.1	86.5	95.2
2019	70.9	88.7	84.0	103.8	117.1	103.4	125.3	85.4	94.8
2020	70.7	89.4	83.8	104.8	118.8	101.4	125.7	83.4	92.2

Source: Present author's own calculations (on the basis of Table A.2 in the Appendix)

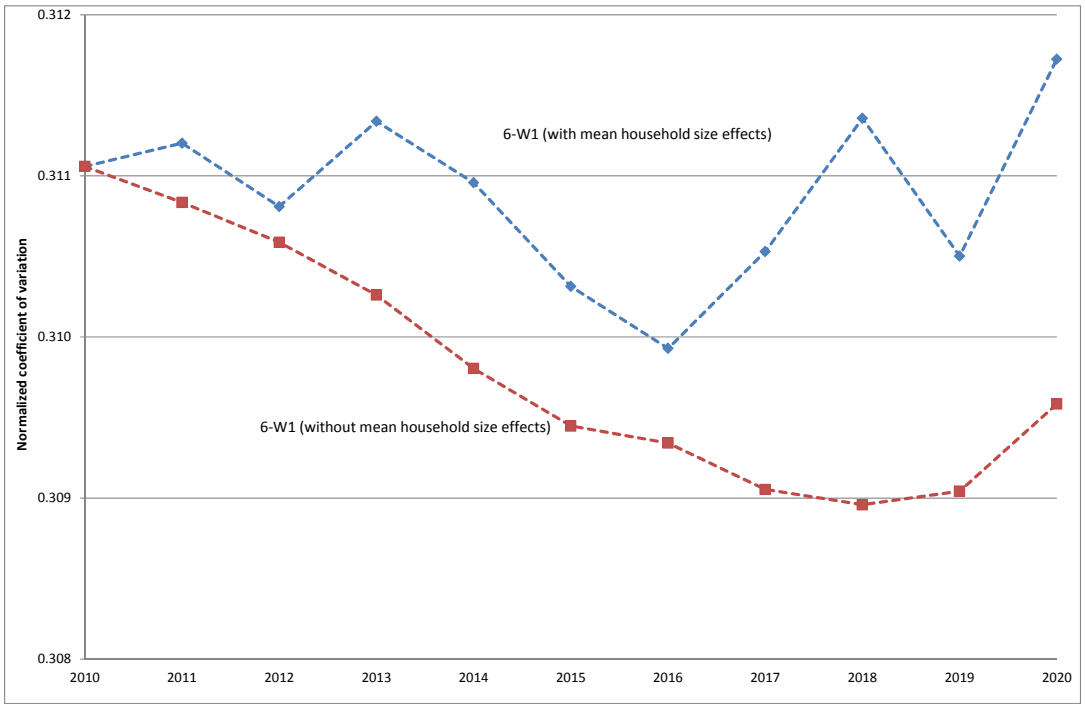
The relative income positions stated in Table 2 generate the inequality curves which are revealed in Figures 21a and 21b (for two alternative population's variants which, obviously, only marginally differ from each other).

Figure 21a: Forecasts for the development of entire equivalent household net income inequality with respect to incomes' trends and predicted average household sizes in Germany, 2010-2020 (population's variant 3-W2; base years: 1995-2009; forecast scenarios 3aa and 3ba)



Source: Present author's own calculations (on the basis of Table 2)

Figure 21b: Forecasts for the development of entire equivalent household net income inequality with respect to incomes' trends and predicted average household sizes in Germany, 2010-2020 (population's variant 6-W1; base years: 1995-2009; forecast scenarios 3ca and 3da)

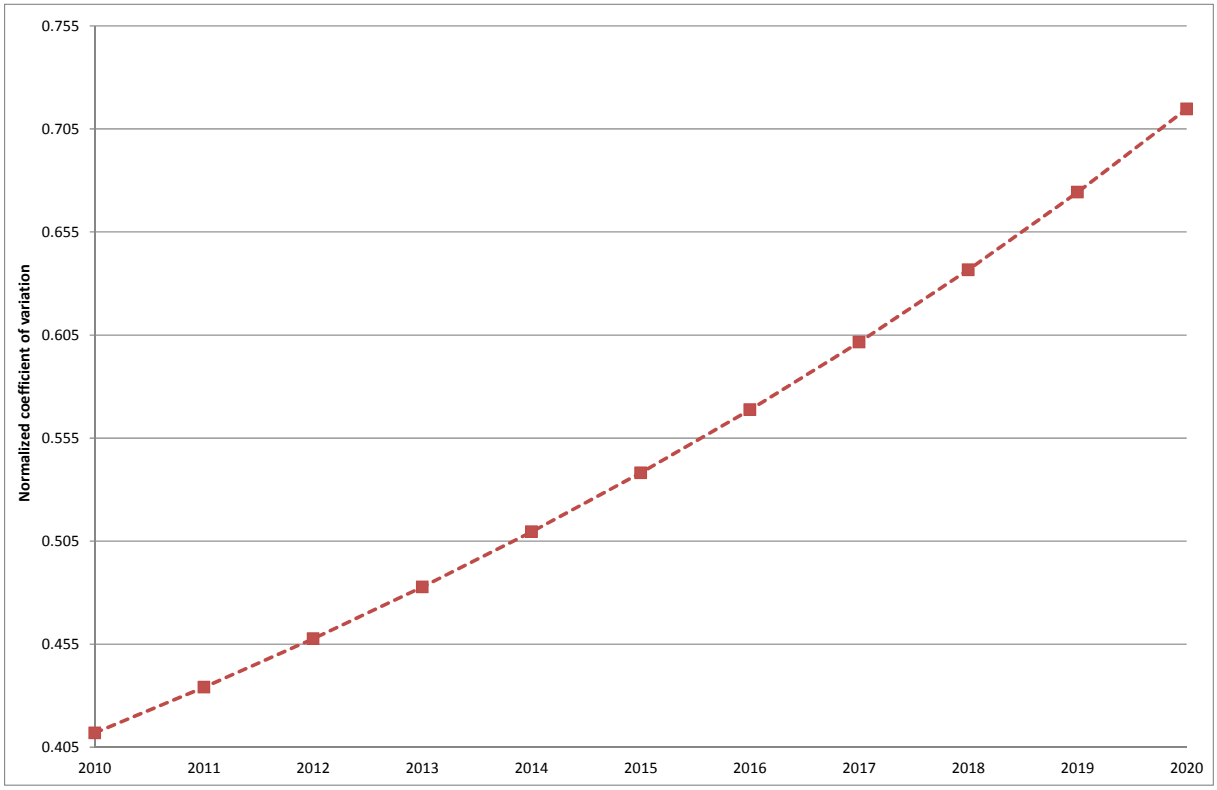


Source: Present author's own calculations (on the basis of Table 2)

4.3 Intra-generational effects

On the basis of the predicted time trends for the standard deviations of equivalent household net incomes (see Table A.3 in the Appendix) and the predicted mean values of equivalent household net incomes (in this context see Table A.2 in the Appendix), group-specific HSCV values are computed. Furthermore, assuming constant population shares (alternatively for 1995 to 2009, see Figure 22, or for 2009, see Figure A.3; i. e., assuming no ageing process at all), constant average household sizes, and constant relative income positions over time (basis in each of the latter cases: mean values from 1995 to 2009 or mean values in 2009), Figure 22 reveals the consequences of intra-generational impacts on the entire net income inequality. Obviously, increasing group-specific inequality does not change the pattern of increasing general income inequality revealed by the figures in the preceding sections. This "causality" is not very surprising since it is a well-known fact that between-group inequality affects entire inequality at a high rate.

Figure 22: Forecasts for the development of entire equivalent household net income inequality with respect to HSCV trends in Germany, 2010-2020 (constant population values, constant average household sizes, constant relative income positions, on the basis of the corresponding mean values during 1995-2009, respectively; forecast scenario 4a)

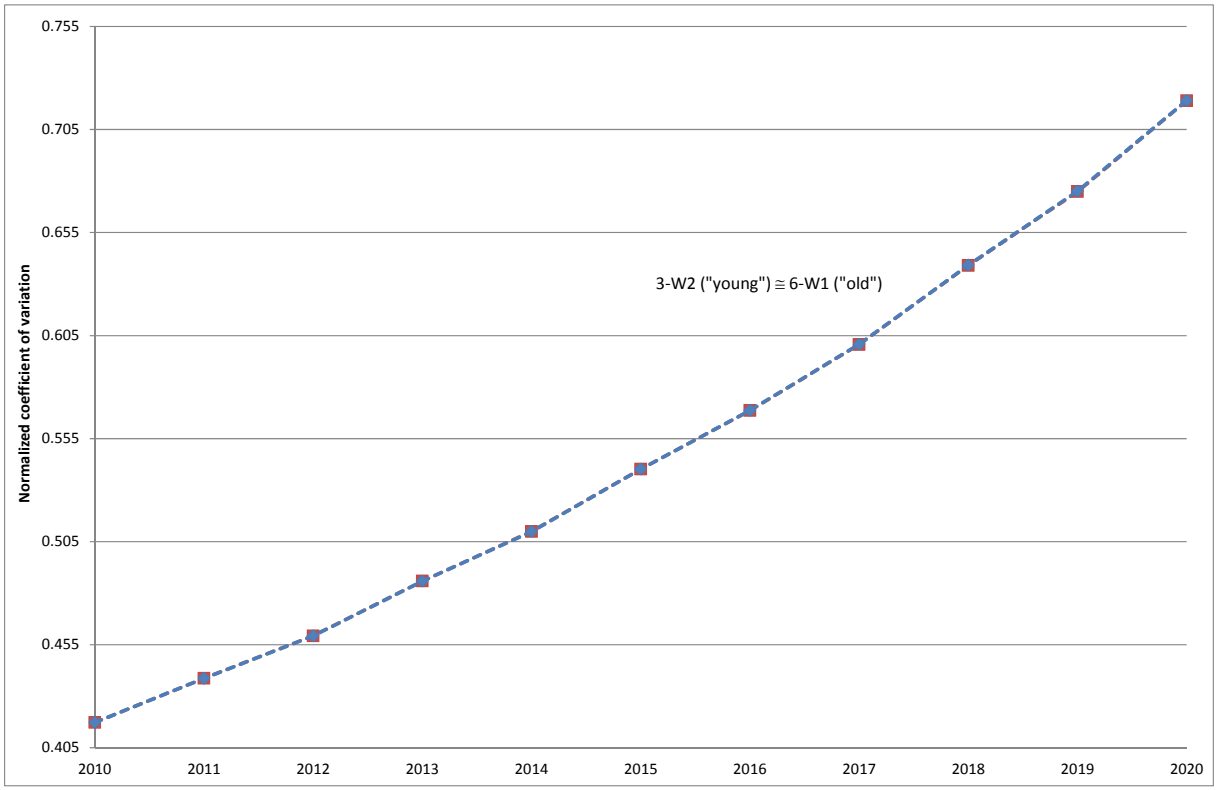


Source: Present author's own calculations (on the basis of Tables A.2 and A.3 in the Appendix)

4.4. Total-analytical findings for income inequality

Altogether, variable population shares, variable relative income positions, variable average household sizes, and variable group-specific HSCV values lead to expected increasing net income inequality levels for Germany in the future (see Figure 23 where the deviations between the two population's variants 3-W2 and 6-W1 are marginal). Thus, the concave "inequality pattern" generated by population shares' effects changes into a clearly increasing "inequality curve" when considering household size effects and the impacts of between-group and within-group inequality.

Figure 23: Forecasts for the development of entire equivalent household net income inequality in Germany, 2010-2020 (variable group-specific HSCV values, variable population values, variable average household sizes, variable relative income position; forecast scenarios 5a and 5b)

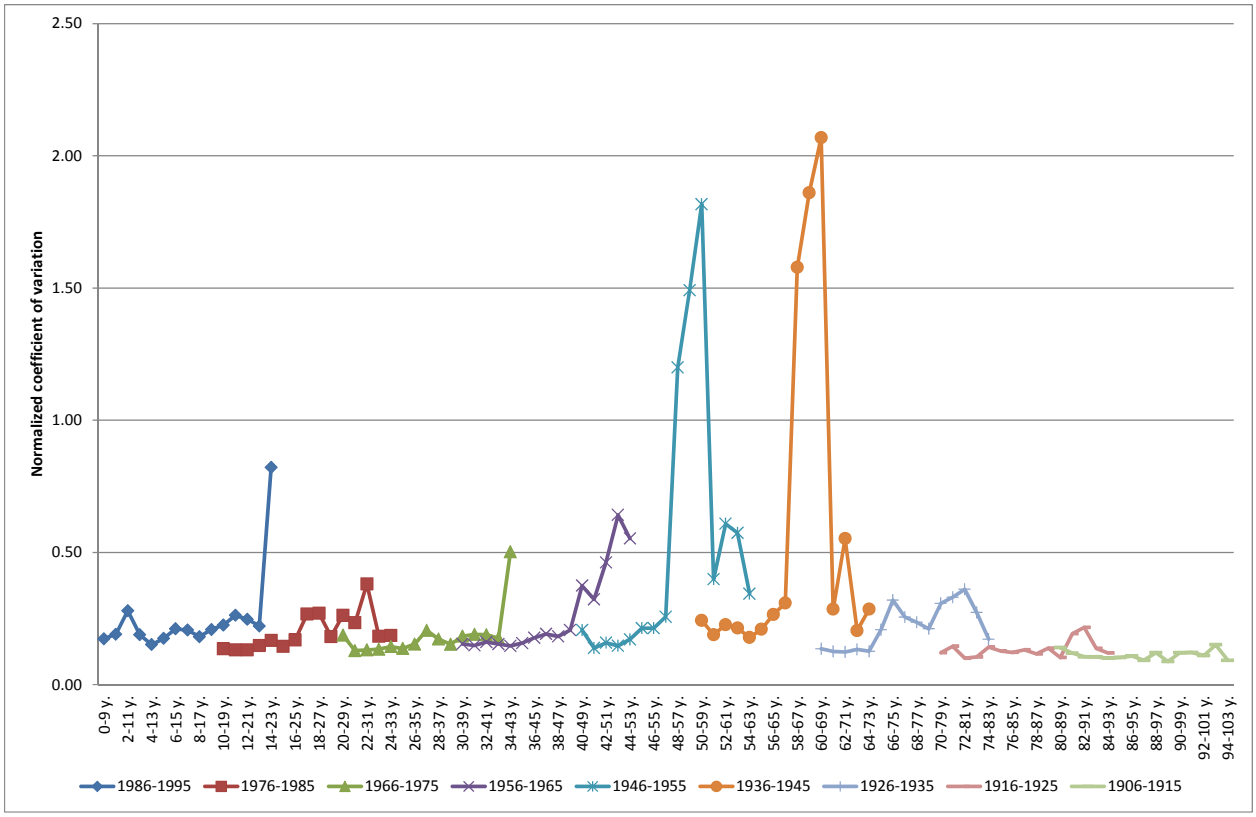


Source: Present author's own calculations

However, de facto there are more explaining factors for future German income inequality than were sketched in Figure 23. For instance, cohort effects should be considered that tend to increase future cross-sectional income inequality, as is sketched in the following.

In this context, Figures 24a (original values) and 24b (trend values[38]) show that, typically, the older cohorts do have lower inequality levels than the younger cohorts. This means that within-group inequality has grown by birth year. That finding for itself will cause inequality increases until 2020.

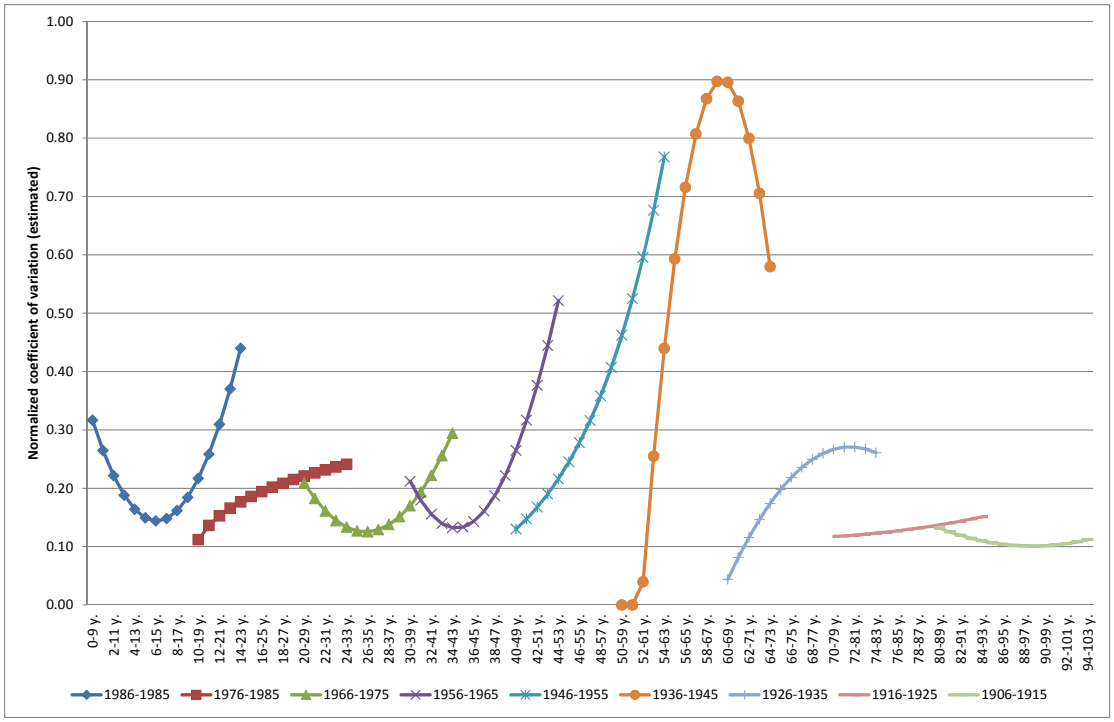
Figure 24a: Longitudinal normalized coefficients of variation with respect to age in Germany, 1995-2009, equivalent household net incomes – original values



Source: Present author's own calculations (SOEP)

[38] The parameter values in Figures 24b and 25b are available by request from present author.

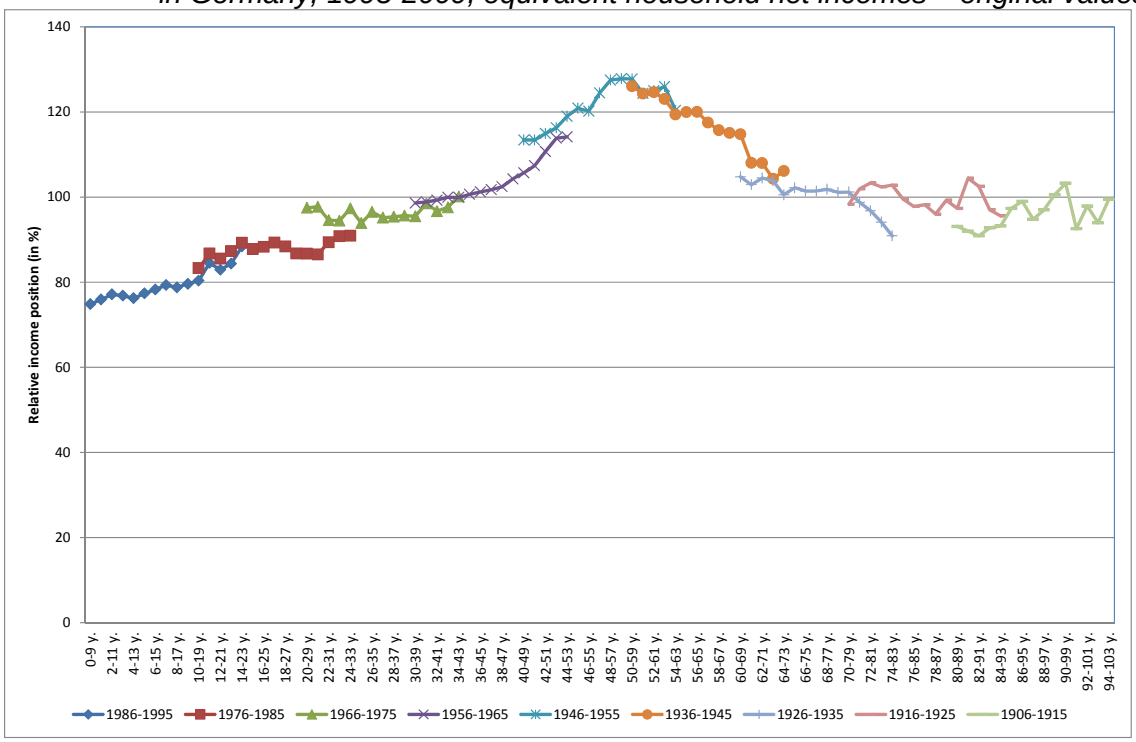
Figure 24b: Longitudinal normalized coefficients of variation with respect to age in Germany, 1995-2009, equivalent household net incomes – trends



Source: Present author's own calculations (SOEP)

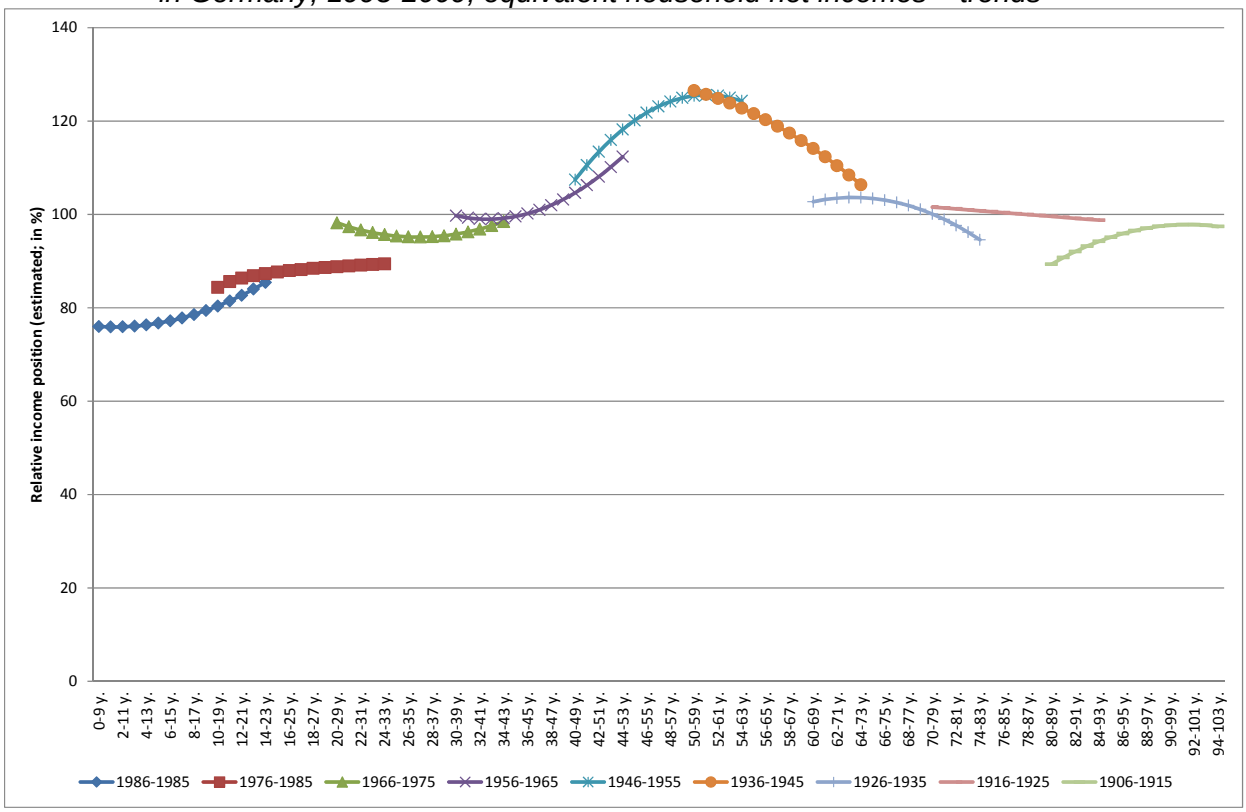
According to the further longitudinal curves presented in Figures 25a and 25b, the relative net income positions rise up to a "medium" age and then decline (by tendency). Furthermore, pairwise compared, the relative net income positions are typically higher in the older cohorts up to cohort 1946-1955.

Figure 25a: Longitudinal relative income positions with respect to age in Germany, 1995-2009, equivalent household net incomes – original values



Source: Present author's own calculations (SOEP)

Figure 25b: Longitudinal relative income positions with respect to age in Germany, 1995-2009, equivalent household net incomes – trends



Source: Present author's own calculations (SOEP)

5. Concluding remarks

In this paper, the impact of different socio-economic influences on cross-sectional income inequality *in the future* is considered for Germany. This was done by applying a "decomposition approach" which included a decomposable inequality measure, the normalized coefficient of variation. This inequality measure can be decomposed in demographic effects as well as in within- and between-group income inequality. For nine age groups, SOEP data for 1995 to 2009 was used in order to identify future inequality tendencies.

The following Table 3 summarizes the predicted impacts of the different socio-economic factors on future German income inequality. Altogether, an increase of future German income inequality appears plausible. This is, in total, strongly valid for the influencing factors considered explicitly in the paper and will be strengthened by the longitudinal effects above sketched.

Further inequality-increasing effects are homogamy and heritages. At a high rate, (income and education) homogamy means that rich (poor) persons marry other rich (poor) persons so that there are lower inequality-compensating effects at the household level than otherwise. Assuming that the degree of homogamy will increase in Germany[39] causes an increase of inequality. A similar effect probably emerges from growing heritages because typically the receivers of heritages are located in a mid-age group for which relative income positions are high. Thus, heritages in such an age region will create still higher (capital) incomes for these groups.

[39] See, in this context Schröder 2011.

Another influencing factor concerning income inequality is the development of unemployment. Amidst the backdrop of demographic ageing, labour supply will presumably become scarce in future – followed by higher incomes for former unemployed groups so that inequality will decrease but it is contestable whether this effect will be strong.

Two other factors do have rather unclear effects upon future inequality (in my eyes): The probably increasing significance of transfers and capital gains as well as the redistribution in old age by the tax system (the latter caused by an increasing taxing of pensions due to new regulations concerning the German pensions system in the recent past). With respect to those factors the above Equation (6) should be considered more detailed (optimally on an empirical basis) than has been done in this paper.

Altogether, it became evident that socio-economic developments tend to increase future income inequality in Germany.

Table 3: Socio-economic developments and their supposed impacts on German income inequality until 2020 (under the assumption of demographic ageing)

Socio-economic development	**Supposed inequality increase (ceteris paribus)**	**Supposed inequality reduction (ceteris paribus)**	**Impact on inequality (ceteris paribus) not clear**
Explicitly analyzed in the paper:			
Demographic ageing (population shares)			X
Forward projection of current relative income positions		X	
Forward projection of current within-group inequalities	X		
Reduction of average household size	X		
Not explicitly analyzed in the paper:			
Development of unemployment (assumption: reduction of unemployment)		X	
Longitudinal change of relative income positions of the (future) elderly	X		
Longitudinal tendency towards higher inequality within the younger cohorts	X		
Increase of cohort-specific homogamy	X		
Heritages	X		
Prospective increased significance of transfers and capital gains			X
Redistribution in old age via tax system			X

Source: Present author's own compilation

Appendix

*Table A.1: Unweighted number of households in Germany, 1995-2009, due to household size**

Wave	1 person	2 persons	3 persons	4 persons	5 persons	6 persons	7 persons	8 persons and more	Sum
1995	1,513	2,195	1,416	1,233	380	101	36	17	6,891
1996	1,488	2,240	1,367	1,205	373	87	33	17	6,810
1997	1,794	2,568	1,500	1,296	359	101	34	13	7,665
1998	1,730	2,536	1,405	1,227	353	95	31	11	7,388
1999	3,399	4,590	2,314	2,074	651	156	39	19	13,242
2000	3,047	4,161	2,073	1,873	601	133	43	14	11,945
2001	3,077	4,592	2,200	1,999	624	144	37	14	12,687
2002	3,026	4,398	2,048	1,839	583	128	34	15	12,071
2003	2,977	4,377	1,978	1,763	545	117	28	13	11,798
2004	3,009	4,253	1,886	1,645	513	107	29	8	11,450
2005	3,391	4,780	2,014	1,690	501	107	23	13	12,519
2006	3,212	4,445	1,902	1,554	463	88	22	10	11,696
2007	3,099	4,270	1,762	1,414	406	88	18	9	11,066
2008	3,357	4,654	1,835	1,503	424	97	22	7	11,899
2009	3,112	4,323	1,591	1,369	347	87	23	5	10,857

* Only households with positive net incomes considered

Source: Present author's own calculations (SOEP)

Table A.2: Estimated equations (OLS) in the context of well-being relations and mean share of net income on gross income for Germany, 1995-2009

Dependent variable	**Until 9 years**	**10-19 years**	**20-29 years**
Labour income	-1.6877 t^2 + 249.91*** t + 12,944*** (R^2=0.9167)	11.601 t^2 + 72.386 t + 14,796*** (R^2=0.8525)	11.676t^2 – 92.271 t + 17,611*** (R^2=0.4849)
Capital income	-3.1302** t^2 + 64.152*** t + 624.71*** (R^2=0.5935)	941.99*** $t^{0.1469***}$ (R^2=0.7971)	-4.9923** t^2 + 96.25** t + 808.99*** (R^2=0.4894)
Transfer income	1361.1*** $t^{0.2824***}$ (R^2=0.9596)	1355.4*** $t^{0.2620***}$ (R^2=0.9564)	-3.7604 t^2 + 149.01*** t + 1,419.6*** (R^2=0.8954)
Net income share (mean)	0.73	0.72	0.72
Dependent variable	**30-39 9 years**	**40-49 years**	**50-59 years**
Labour income	6.109 t^2 + 303.28*** t + 18,386*** (R^2=0.9557)	18.555* t^2 + 79.681 t + 21,503*** (R^2=0.8855)	-20.568* t^2 + 838.62*** t + 19,784*** (R^2=0.9231)
Capital income	-2.0029* t^2 + 58.04*** t + 723.1*** (R^2=0.7804)	1.244 t^2 + 9.9862 t + 1,543.8*** (R^2=0.6494)	-13.316*** t^2 + 246.12*** t + 1,995.9*** (R^2=0.5645)
Transfer income	361.73*** ln(t) (R^2=0.9548)	-7.2024*** t^2 + 171.46*** t + 1,176.3*** (R^2=0.8961)	0.4931 t^2 + 11.285 t + 31,725*** (R^2=0.2868)
Net income share (mean)	0.69	0.68	0.70
Dependent variable	**60-69 years**	**70-79 years**	**80 years and older**
Labour income	15.179 t^2 + 161.48 t + 6,189.6*** (R^2=0.873)	0.7441 t^2 + 14.804 t + 1,188.3*** (R^2=0.4484)	-5.8922*** t^2 + 99.433*** t + 466.73*** (R^2=0.4802)
Capital income	-8.2648** t^2 + 256.49*** t + 1,808.2*** (R^2=0.9107)	-13.39*** t^2 + 305.51*** t + 1,822.3*** (R^2=0.8798)	2.0892 t^2 + 144.02** t + 1,475.8*** (R^2=0.9291)
Transfer income	-10.593*** t^2 + 321.07*** t + 9,334.3*** (R^2=0.9581)	-2.3411 t^2 + 282.51 t*** + 12,575*** (R^2=0.9532)	-8.7165* t^2 + 412.91*** t + 12,139*** (R^2=0.9636)
Net income share (mean)	0.85	0.95	0.96

t = time period – 1995; R^2 = determination coefficient; all incomes are equivalent incomes; gross income:= labour income + capital income + transfer income; net income:= net income's share (estimated) multiplied by gross income (calculated); *** = statistically significant at the 1-percent level; ** = statistically significant at the 5-percent level; * = statistically significant at the 10-percent level

Source: Present author's own calculations (SOEP)

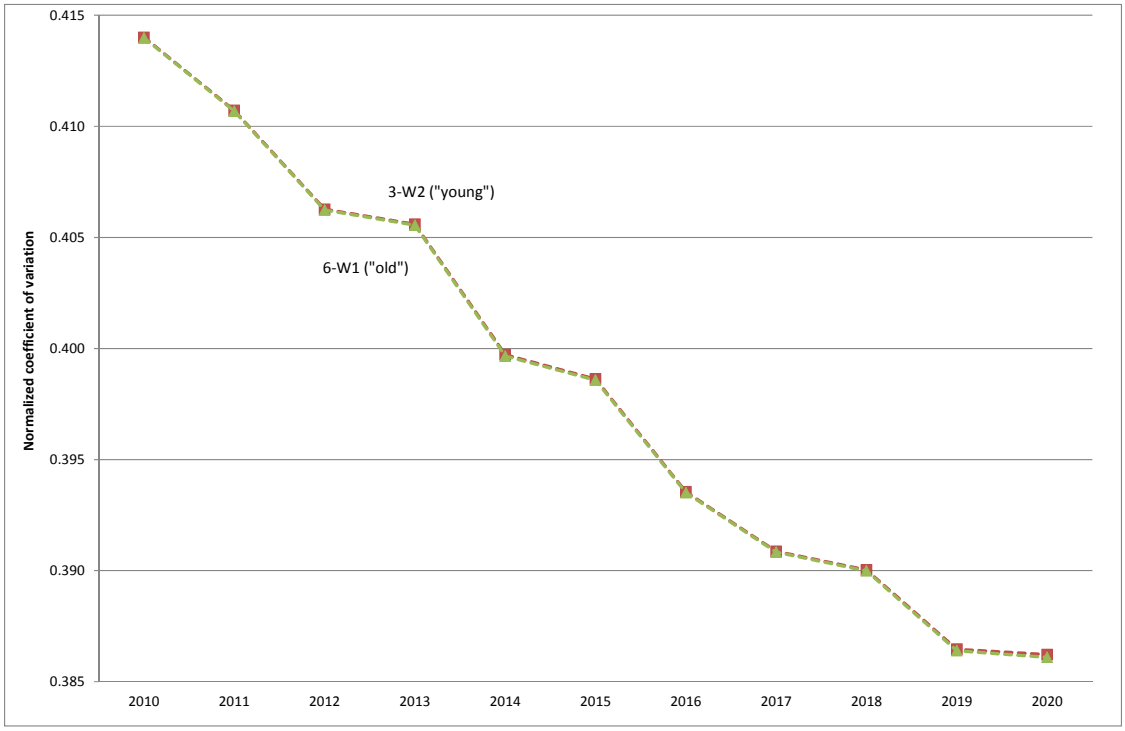
Table A.3: Estimated equations (OLS) for standard deviations of equivalent household net income for Germany, 1995-2009

Age Group	Equation	R^2
0-9 years	$6{,}539^{***}\ t^{0.1161^{***}}$	0.7430
10-19 years	$78.564^{*}\ t^2 - 575.35\ t + 7{,}937.5^{***}$	0.6895
20-29 years	$-20.852\ t^2 - 538.29\ t + 7{,}117.5^{***}$	0.3501
30-39 years	$31.38\ t^2 - 23.064\ t + 7{,}656.7^{***}$	0.6129
40-49 years	$12.436\ t^2 + 871.11\ t + 7{,}722.3^{**}$	0.5909
50-59 years	$9{,}293.4^{***}\ t^{0.3469^{***}}$	0.4984
60-69 years	$6{,}348.9^{***}\ t^{0.4189^{***}}$	0.6559
70-79 years	$-47.151^{**}\ t^2 + 1{,}230.8\ t^{***} + 5{,}046.7^{***}$	0.8272
80+ years	$26.265\ t^2 + 22.938\ t + 6{,}919.1^{***}$	0.7278

t = time period – 1995; R^2 = determination coefficient; all incomes are equivalent incomes; gross income:= labour income + capital income + transfer income; net income:= gross income minus (taxes and contributions); *** = statistically significant at the 1-percent level; ** = statistically significant at the 5-percent level; * = statistically significant at the 10-percent level

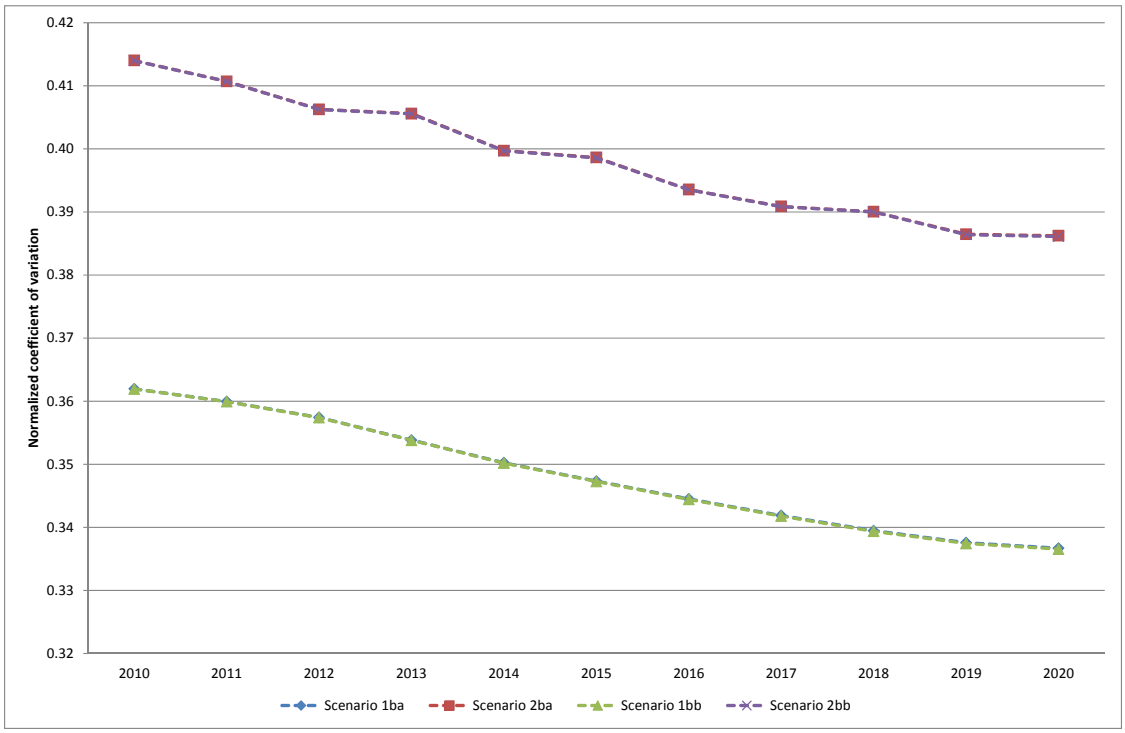
Source: Present author's own calculations (SOEP)

Figure A.1: Forecasts for the development of entire equivalent household net income inequality with respect to predicted average household sizes in Germany, 2010-2020 (2009 as a basis; forecast scenarios 2ba and 2bb)



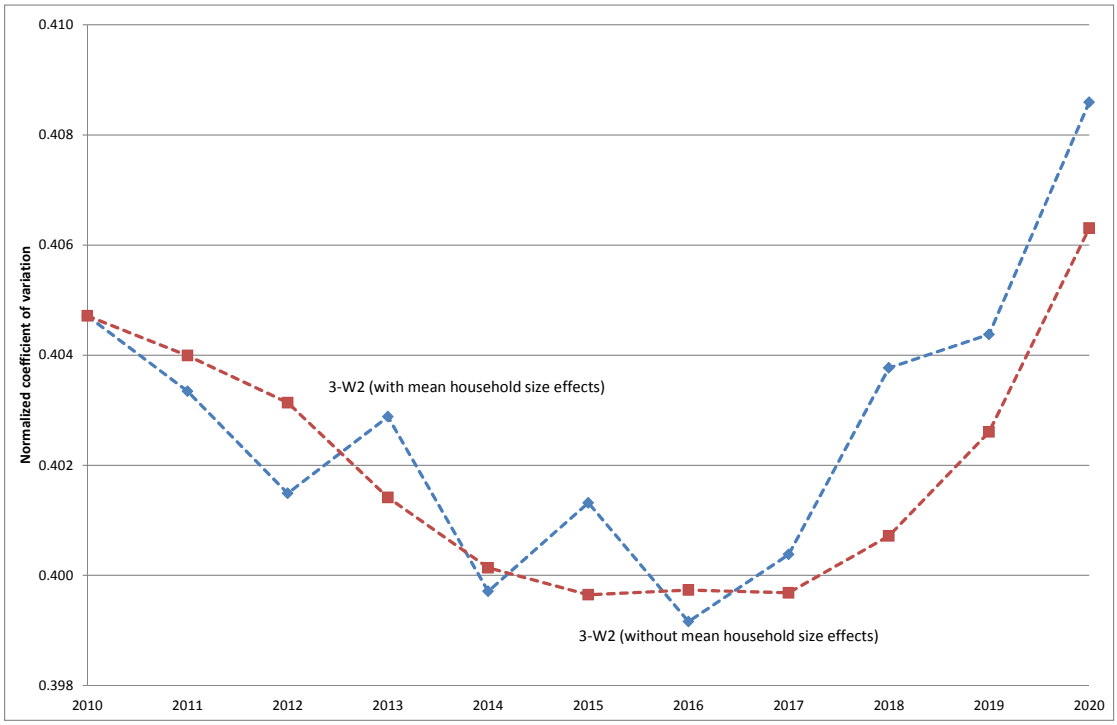
Source: Present author's own calculations (on the basis of Figures 18a-18c)

Figure A.2: Comparison of forecast scenarios 1ba and 1bb with 2ba and 2bb for Germany, 2010-2020: equivalent household net income's inequality (base year: 2009)



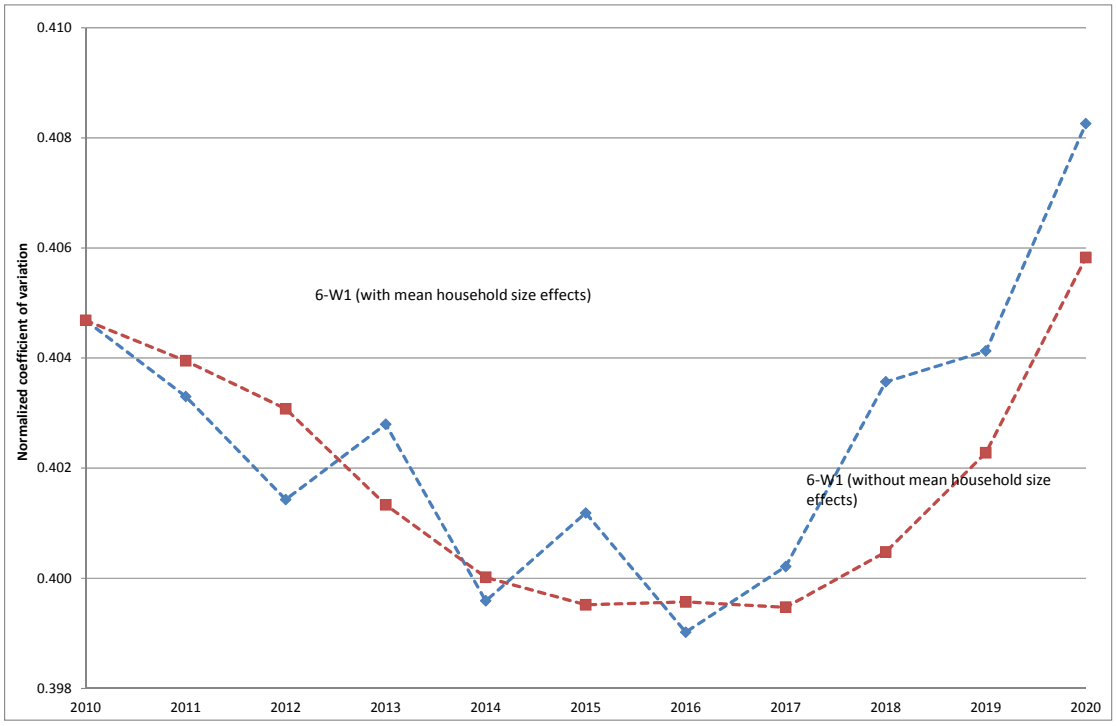
Source: Present author's own compilation (on the basis of Figures 16b and A.1)

Figure A.3a: Forecasts for the development of entire equivalent household net income inequality with respect to incomes' trends and predicted average household sizes in Germany, 2010-2020 (population's variant 3-W2; base year: 2009; forecast scenarios 3ab and 3bb)



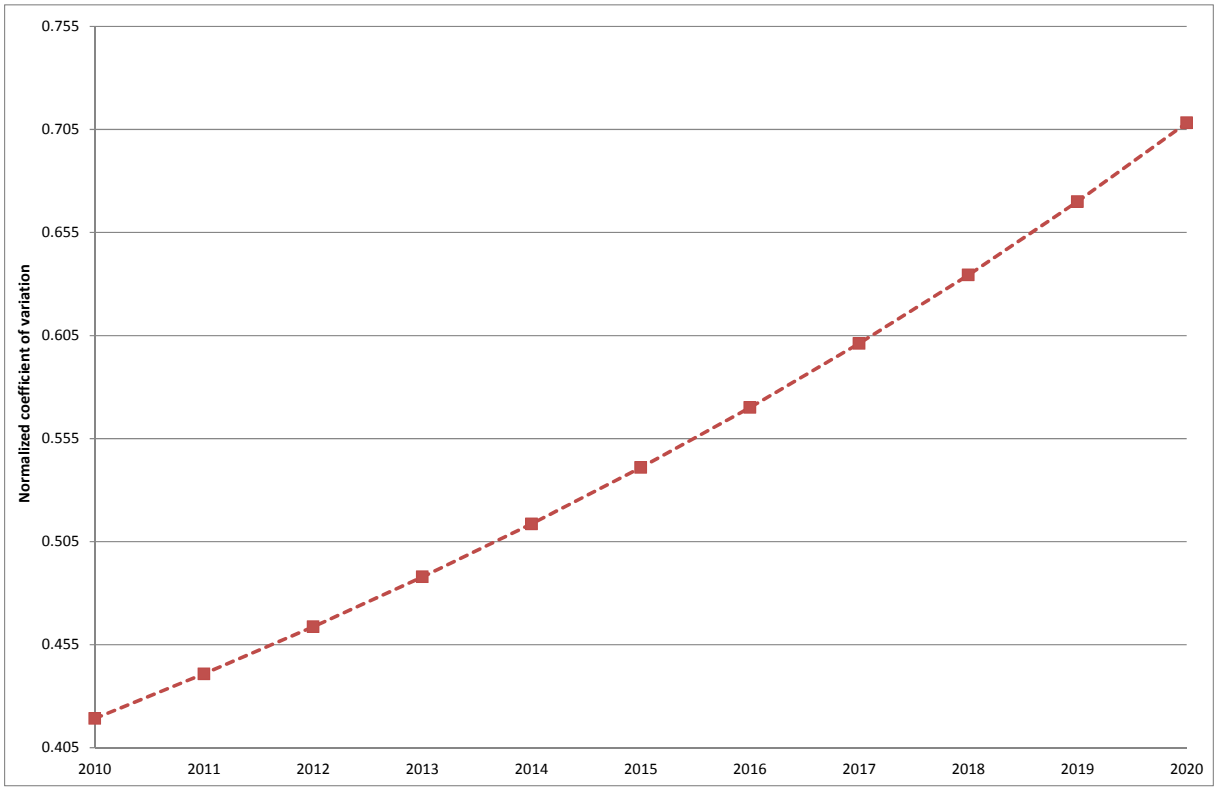
Source: Present author's own calculations (on the basis of Table 2)

Figure A.3b: Forecasts for the development of entire equivalent household net income inequality with respect to incomes' trends and predicted average household sizes in Germany, 2010-2020 (population's variant 6-W1; base year: 2009; forecast scenarios 3cb and 3db)



Source: Present author's own calculations (on the basis of Table 2)

Figure A.4: Forecasts for the development of entire equivalent household net income inequality with respect to HSCV trends in Germany, 2010-2020 (constant population values, constant average household sizes, constant relative income positions, on the basis of the corresponding mean values 2009, respectively; forecast scenario 4b)



Source: Present author's own calculations (on the basis of Tables A.2 and A.3 in the Appendix)

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Jürgen Faik . Hans-Christian Mager | GbR

Nikolausstraße 10
D-65936 Frankfurt/Main
http://www.fama-nfs.de
info@fama-nfs.de
Tel. +49(0)69-34409710
Fax: +49(0)69-34409714