THE JOINT DISTRIBUTION OF NET WORTH AND PENSION WEALTH IN GERMANY

BY TIMM BÖNKE

Free University Berlin

MARKUS M. GRABKA

SOEP at DIW Berlin

CARSTEN SCHRÖDER

Free University Berlin, SOEP at DIW Berlin

EDWARD N WOLFF*

New York University

AND

LENNARD ZYSKA

Catholic University of Eichstaett-Ingolstadt.

The research on wealth inequality has generally focused on real and financial assets, while giving little attention to pension wealth: the present value of future pension entitlements from public and company pension schemes. This is surprising given the important role pension plans play in guaranteeing material security and well-being for a majority of the population, and suggests that they should be accounted for in peoples' wealth portfolios. Using novel data from the Socio-Economic Panel (SOEP), we study the incidence, relevance, and distribution of individual pension wealth, net worth, and augmented wealth (the sum of the two) in Germany. Further, we investigate age-wealth profiles and differences between East and West Germany.

1. INTRODUCTION

In economics and neighboring disciplines, the rising inequalities in many societies are regarded as one of the most crucial problems facing the world today (Atkinson, 2015; IMF, 2015; OECD, 2015a; Stiglitz, 2012). A broad empirical

literature has emerged investigating inequalities in incomes, but empirical studies on wealth inequalities – another crucial dimension of economic inequalities—are considerably rarer. This is surprising given that wealth is a powerful indicator of opportunities for social participation. It reflects the total material resources available to a household to achieve a given standard of living, permits consumption-smoothing in the presence of income volatilities, enables the inter-generational transmission of social status, and, in general, provides financial security and income. Additionally, high wealth can be used to influence political decision-making processes.

Research on the distribution of private wealth requires high-quality microdata. Initiatives undertaken by the European Central Bank (ECB) and the Cross National Data Center in Luxembourg (LIS) are important steps in this direction. The ECB's Eurosystem Household Finance and Consumption Survey (HFCS)[1] provides detailed information on real and financial assets for the euro area. Likewise, LIS's Luxembourg Wealth Study (LWS)[2] contains harmonized wealth microdata from high- and middle-income countries around the world. Neither of these two scientific surveys, however, collects information on entitlements in statutory and company pension schemes, at least for the non-retired population. Such entitlements are the basis for determining pension wealth, the present value of the expected stream of future pensions (see OECD, 2013a). Administrative microdata from statutory pension institutions, conversely, lack information on company pensions, financial and real assets.

Reasons to consider pension wealth in wealth analysis are manifold. Most importantly, entitlements from statutory and company pension insurance plans play an important role for material security and well-being for the insured population. Further, if pension entitlements are a substitute for private savings schemes, differences in pension institutions (generosity, subsidization of pension plans, coverage, etc.) might jeopardize the comparability of standard wealth aggregates across countries. Similarly, a pension system may undermine the comparability of standard wealth aggregates between non-covered and covered individuals or households within a country. A vast literature examines the interplay among pension wealth, household savings, and wealth accumulation (i.e. Bottazzi et al., 2006; Dicks-Mireaux, 1984; Gustman and Steinmeier, 1999). Further, subsidization schemes for private retirement savings might affect peoples' savings decisions with regard to both savings levels and the composition of portfolios. Case studies for Germany include Coppola and Reil-Held (2009), Corneo et al. (2009), Corneo et al. (2010) and Pfarr and Schneider (2011); see Engen et al. (1996) for the US, and Chetty et al. (2013) for Denmark.

There are also aspects that make the interpretation of augmented wealth difficult. This is because net worth and pension wealth are not perfect substitutes: they differ in terms of possibilities for market liquidation and disposability, inheritance bequest, legal amendments, usability as collateral, and dependency on policies.

In its 2013 wave, the Socio-Economic Panel (SOEP) collected in-depth information on individual pension entitlements in Germany both for the retired and non-retired population. For the first time, the non-retired population was asked to report current entitlements based on the official annual information provided by

---

[1]https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_hfcn.en.html

[2] https://www.lisdatacenter.org/our-data/lws-database/

insurers. For the retired and non-retired population, we define pension entitlements following the "accrual method" (see Wolff, 2015)[3] as the expected capitalized value of entitlements. For the retired population, we define entitlements by the pension stream from the "present day" (defined as 2012) up to death. For the non-retired, we define entitlements by the pension stream from retirement age to death based on accumulated remuneration points up to the "present day" (again 2012). With individual pension wealth for the entire population at hand, we extend previous wealth inequality analyses for Germany further by computing an augmented wealth aggregate; by measuring and decomposing wealth inequalities; and by studying wealth accumulation processes of residents of East and West Germany over the life course.

Augmented wealth is defined here as the sum of two broad wealth components: individual net worth and pension wealth. Net worth includes real and financial assets (net of debt) plus current values of private-pension plans (including so-called Riester and Rürup pensions).[4] Pension wealth is the sum of present values of statutory pension, civil servant, and company pension entitlements.

For the interpretation of the level and distribution of augmented wealth, four points should be noted. First, financial wealth in the form of standard monetary holdings is not subject to taxes or social security contributions in Germany. However, when converting assets or real wealth into cash, taxes may arise. The tax burden then depends on many unobserved tax-relevant characteristics (i.e. acquisition value, speculation, and holding periods). Second, the current and liquidation values of an insurance contract (e.g. for life-risk insurance or a private pension) may differ. This may be due, for instance, to insurance fees or repayment of tax relief or allowances (e.g. in the case of Riester and Rürup pensions). Third, if a wealth aggregate is determined by the present value of a future income stream (e.g. statutory or company pension), the future incomes are subject to social security contributions and/or taxes. We refrain from approximating present values net of taxes and contributions, given that this would require us to make numerous assumptions about the future income composition, future family status, and so on. Augmented wealth is therefore comprised of wealth components that differ with respect to tax and social security burdens.[5] This implies that, de facto, the convertibility of the different components is limited, an issue which is common in wealth analysis and, for the aforementioned reasons, is not reflected in the subsequent analysis. Fourth, mainly due to data restrictions, our augmented wealth measure does not comprise widow(er) pensions in the main analyses.

The papers that may be closest to ours because they deal with the German case and also use SOEP data are two by Frick and Grabka (2010, 2013). They statistically link (SOEP) survey data and administrative data—employment histories provided by the German statutory pension insurance—to assess pension wealth

---

[3] An alternative approach is the "ongoing concern" treatment. It derives pension wealth under the assumption that employees continue to work at their place of employment until expected date of retirement. We abstain from implementing this approach as it requires strong assumptions about employees' future employment biographies and retirement decisions.

[4] We have included private pension plans in net worth as these plans are difficult to distinguish from other types of private savings.

[5] Further examples are private pensions (Riester and Rürup pensions) that are subject to deferred taxation. In case of real estate and assets, the time of sale determines the tax burden of a divestiture of real estate (e.g., via the market value of assets and the income tax on resulting gains).

and its role for households' overall wealth. The present paper differs from Frick and Grabka (2010, 2013) in several ways:

1. *Definition of wealth aggregate*. As in Frick and Grabka (2010, 2013), our wealth aggregate includes occupational pensions of both the retired and non-retired population. In contrast to Frick and Grabka (2010, 2013), our wealth aggregates are pre- rather than post-taxes.

2. *Comprehensiveness of the analysis*. While Frick and Grabka (2010, 2013) focus on the level effect of the inclusion of pension wealth in a broader wealth concept, we provide a decomposition of wealth inequality by factors. Further, we assess the variability of our estimators by means of a bootstrap procedure.

3. *Consistency of data*. Our analysis relies on a single dataset, in which both net worth and pension entitlements were surveyed directly. Because of data limitations, Frick and Grabka (2010, 2013) use two distinct microdata sets and link them by means of statistical matching. Their statistical matching procedure relies on age trajectories of key variables. For late birth cohorts, the trajectories are short and contain little information. For early birth cohorts, there is significant item non-response, requiring considerable data imputation. Such and other issues have unknown implications for the accuracy of their analysis.

4. *Period of analysis*. Whereas Frick and Grabka (2010, 2013) analyze data from 2007, we use more recent data from 2012 and 2013.

The results of our analysis can be summarized as follows. From a survey methodological perspective, we provide affirmative evidence that the pension entitlements reported by SOEP respondents are credible by cross-checking SOEP averages with official numbers from Germany's statutory pension insurance (external validity). Further, we contribute to the empirical research on wealth inequality by taking an individual-level perspective. First, we show that individual pension wealth is a crucial component of individual wealth in Germany: In 2012, average pension wealth was 91,440 euros, compared with 85,348 euros net worth. Second, a sizeable reduction of about 25 percent in wealth inequality (measured by the Gini coefficient) occurs if pension wealth is incorporated into individual net worth results: For 2012, it is 0.785 for individual net worth without pension wealth, but 0.594 for augmented wealth. Third, we find a sizeable regional divide in wealth levels. For example, at age 40, East Germans hold 65% of the average augmented wealth of their West German counterparts.

The paper is structured as follows: Section 2 provides an overview of the pension system in Germany. A literature review of estimates of pension wealth in Germany follows in Section 3. Section 4 explains the data and the accounting framework for the derivation of pension wealth and the empirical implementation. Section 5 provides an empirical analysis of the German wealth distribution with and without consideration of individual pension wealth. In Section 6 we undertake an effort to consider widow(er) pensions in augmented wealth. Section 7 discusses potential data limitations, and Section 8 concludes.

2. Institutional Setting and Pension Levels in Germany

2.1. *Institutional Setting*

The German pension system has three pillars. The first pillar is the statutory pension insurance, i.e. statutory PAYG, civil servant, and liberal profession pensions, while the second pillar consists of company pension plans. In both pillars, the insured acquire pension entitlements throughout their working careers. Following the principle of equivalence, pension entitlements from the first and second pillars are proportionate to overall lifecycle earnings during the active phase of working life. The third pillar covers private voluntary insurance plans.

2.1.1. Entitlements from the Mandatory Public-Pension Scheme for Employees

In 2014, about 78 percent (or 36.1 million) of the German working-age population (20-65 years) was insured through the statutory pension insurance (Gesetzliche Rentenversicherung, GRV) (Deutsche Rentenversicherung Bund, 2015). The legal framework of Germany's statutory pension system is defined in Book 6 of the Social Security Code (SSC VI). Following the equivalence principle, there is a close relationship between the sum of earnings subject to compulsory insurance from contribution periods and monthly pension entitlement after retirement: If earnings in a given year coincide with average earnings of all employed workers in the same year (50 percent of the national average), 1.0 (0.5) remuneration points are credited. In addition, pension entitlements can be gained during non-contribution periods. For example, when a mother withdraws from the labor market after the birth of a child, pension contributions (and corresponding entitlements) are credited for a limited period. Credit for non-contribution periods may be granted for the following reasons: (i) sickness, rehabilitation, studies or higher education, and others (Anrechnungszeiten); (ii) military service or detention due to political reasons (Ersatzzeiten); and (iii) child-raising or care for family members (Beruecksichtigungszeiten).

Several types of statutory pensions are granted, with regular old-age pensions and pensions for very long-term insured people being the most frequent types.[6] In addition, there are reduced earnings capacity pensions, pensions for the long-term unemployed, disability pensions, and special pensions for women, to name a few. Pension entitlements are defined by a pension formula. According to SSC VI, section 64, the annual pension entitlement from the statutory PAYG pension scheme is:

$$pension^{stat} = 12 \times A \times E \times R$$

The multiplier A denotes the actual pension value, a monetary amount that links the pension entitlement with several macro variables including the wage sum, the nationwide sum of pension contributions, and the demographic structure of

---

[6] The regular retirement age was raised stepwise from age 65 to 67. The phase-in started with individuals born in 1947, increased by one month per birth cohort, and reached 67 for individuals born after 1963. Very long-term insured individuals are currently eligible for a full pension at a minimum age of 63 after having worked for at least 45 years.

the population, etc. In 2012, the current pension level in the West (East) German Federal States was 28.07 euros (24.92 euros). The multiplier E is the number of personal remuneration points a beneficiary has accrued over his/her lifetime. Finally, R is a pension-type-specific factor; in case of an old-age pension this is set to 1.[7] According to §§ 50-53 SSC VI, an individual is vested in their pension plan after having contributed for five years or 60 months.[8]

2.1.2. Entitlements from the civil servant pension scheme

In the spirit of the equivalence principle, civil servant pensions primarily depend on the overall tenure and average salaries in the last position a civil servant held for at least two years. For each year of full-time service, a civil servant collects 0.0179375 replacement points. The regular maximum replacement rate is limited to 0.7175. The annual pension entitlement for civil servants is calculated according to equation (2),

$$pension^{civil} = salary \times r$$

with *salary* denoting average annual salaries, as defined above, and r denoting the rate of replacement. It is possible for individuals to receive a civil servant pension in addition to a statutory pension. In this case, particular deduction rules apply.[9]

2.1.3. Entitlements from Compulsory Pension Schemes of Liberal Profession Associations

The liberal professions are not insured under the standard statutory pension insurance system but under separate compulsory pension schemes according to laws of the Laender. The pension schemes of the liberal professions comprise a compulsory system providing benefits for members of particular professional associations (Berufskammern): architects, chartered accountants, dentists, lawyers, notaries, pharmacists, physicians, and psychotherapists. In total, there are 85 pension schemes serving the liberal professions, providing old age pensions, disability benefits, and survivors' benefits. Consequently, entitlements cannot be determined by simple rules, but rather are highly individual.[10]

2.1.4. Entitlements from Occupational Pension Schemes

Occupational pension schemes (betriebliche Altersvorsorge) are part of the second pillar and are granted by a company to its employees. In Germany, these pension schemes date back to the 1974 Company Pensions Law

---

[7] For other pensions, such as pensions for reduced earning capacity, the respective factor is 0.5.

[8] Several separate, specific pension plans covering the members of specific occupational groups fall under the GRV, including the miners' association (Knappschaft), seamen's insurance association (Seekasse), and the agriculture pension scheme (Landwirtschaftliche Alterskasse).

[9] In 2011, roughly 2.9 million persons had entitlements from the civil servant pension scheme (BMAS, 2012a).

[10] In 2014, about 1.4 million persons had entitlements from the liberal professions pension scheme (Arbeits gemeinschaft Berufsständischer Versorgungseinrichtungen, 2016).

TABLE 1
PENSION BY PENSION SCHEME (RETIRED 65 YEARS AND OLDER) IN 2011

Pension scheme	Mean gross pension (euros / month)	Share of recipients* (in %)
Statutory pension	890	90
Civil servant	2,714	5
Liberal professions	2,140	1
Company (private sector)	491	15
Company (public sector (VBL))	315	10

Note: *Relative to all retired individuals living in Germany 65 years and older.
Source: BMAS (2012a: 82). Shares sum up to more than 100 percen because individuals may receive multiple pensions.

(Betriebsrentengesetz) and comprise defined benefits (Leistungszusagen), defined contributions (beitragsorientierte Leistungszusagen), and also contributions with minimum benefit.[11] About 56 percent of the compulsorily insured employees aged between 25 and 65 in 2011[12] are covered by these programs.

2.2. *Pension Levels at a Glance*

For the retired population, aged 65 or older, average monthly pensions vary markedly. By far the most important scheme is the statutory pension insurance, which covers 90 percent of the retired population and provided, on average, a gross monthly pension payment of 890 euros in 2011 (Table 1). In contrast, only 5 percent are entitled to civil servant pensions, with a mean value of about 2,700 euros. One key reason for the higher average pension levels of civil servants is their normally fairly continuous occupational career, without periods of unemployment as well as their normally higher levels of education. Additionally, the replacement rates in the civil servant pension scheme are more generous than in the statutory pension scheme. Retirees who are covered by one of the liberal profession schemes also enjoy a relatively high monthly pension of about 2,100 euros on average.

Company pensions are often voluntary and complementary to the statutory pensions. They are therefore substantially smaller than pensions in the other schemes on average. One can distinguish between company pensions in the private and public sector. In the private sector, the mean pension amounts to about 500 euros, and 15 percent of the retired population are entitled to such pensions. In the public sector, the respective share is 10 percent and the monthly pension amounts to about 300 euros. This difference is partly driven by a higher share of female earners in the public sector (Federal Statistical Office, 2015a). Lower public

[11] There exist at least five different company pension plans in Germany, including direct benefit plans, support funds (Unterstuetzungskasse), direct insurance (Direktversicherung), staff pension funds (Pensionskasse), and pension funds (Pensionsfonds), each with slightly different financing rules and benefit levels. As is the case in many OECD countries, there is also a general trend from DB to DC pension plans in Germany. However, with the available SOEP data, we are not able to differentiate the different types of company pension plans.

[12] According to BMAS (2012b), around 14.1 out of 25 million compulsorily insured employees aged 25 to 65 have entitlements to a company pension. According to the SOEP, this figure is 13.1 million. Hence, coverage is reflected quite accurately.

company pensions also originate from the lower average wages of female compared to male employees. Compared to their overall population share, women are overrepresented in several branches of the public sector. Further, women interrupt their careers and reduce their working time for family reasons more frequently and for longer periods than men (BMFSFJ, 2009).

3. Previous Studies on Pension Wealth in Germany

Most empirical wealth analyses for Germany do not consider pension wealth, probably due to a lack of adequate microdata: direct information on actual pension entitlements, at least for the non-retired part of the population, is not contained in the Income and Expenditure Survey (EVS), the SAVE study, or the German part of the Household Finance and Consumption Survey.[13,14] Only the 2013 wave of the Socio-Economic Panel (SOEP) study provides this information. Hence, few studies analyze pension wealth in Germany and even fewer consider pension wealth to obtain a comprehensive wealth measure, namely augmented wealth.

One strand of this research deals with the role of pension wealth in retirement decisions (see, for example, Börsch-Supan, 2000, or Berkel and Börsch-Supan, 2004). Another strand examines the role of pension wealth in saving decisions (see, for example, Alessie et al., 2013). A third strand aims at deriving pension wealth and is directly linked to the present paper.

This third strand of research can further be subdivided into two categories of papers, one dealing with pension wealth but not augmented wealth, and another dealing with pension wealth in an augmented wealth context. Beckers et al. (2012), using the number of accumulated remuneration points in Germany's statutory pension insurance scheme as a proxy for social security wealth, falls into the first category. They restrict their attention to the 1939–1953 and 1978–2003 birth cohorts and find markedly lower inequality in their social security wealth measure than for other types of wealth. For example, in 2003 for the 1949–1953 birth cohort, the Gini coefficient for gross financial wealth is 0.675 and for the number of cumulated remuneration points it is 0.442. They do not derive present values of pension entitlements, however. Braakmann and Haug (2007) approximate pension wealth at the macro level for various socio-economic groups. Their estimate for the aggregate pension wealth of the statutory pension insurance—using a discount rate of 5

[13] For our purposes, one shortcoming of the German part of the HFCS—the PHF survey—is that information on pension entitlements from the statutory pension system is collected for future expected pensions only. These are approximated on the assumption of an ongoing earnings history mirroring the previous five years up to the official retirement age instead of the actual accumulated entitlements used in this study. Additionally, there is not sufficient information on company pension entitlements or the employment histories of civil servants; thus entitlements of civil servants cannot be derived. Finally, information about net worth is collected at the household level, which does not facilitate the analyses of augmented wealth at the individual level.

[14] A fourth German survey exists, the German SHARE, where a subset of observations is directly linked with information from the German pension register. However, the linked number is 1,100 individuals per wave. SHARE is not representative for the total population as only persons aged 55 or older are surveyed and information about company pensions is not available.

percent—amounts to 5.3 trillion euros in 2005, which is 2.3 times GDP. However, pension entitlements for civil servants as well as entitlements from company pensions are not considered in their measure. In addition, combinations with standard net worth are not the topic of the paper.

The OECD (2013b) provides estimates of pension wealth, defined as the lifetime discounted value of the flow of retirement benefits in mandatory pension schemes at the age of retirement. They rely on prototypical hypothetical insurant profiles and projections on future earnings growth and real discount rates. According to their calculations, the gross pension value of a typical male earner with an average income in 2012 is about 367,360 euros.[15] The distribution of pension wealth is not an issue.

Frick and Headey (2009) provide a cross-country comparison of German and Australian retirees (aged 65 and over) before and after considering pension entitlements in the measure of net worth. Concerning levels of extended wealth, the authors find similar results for both countries. For standard net worth, the level is markedly higher in Australia. Furthermore, while net worth is much less equally distributed in Germany than in Australia, taking public pension wealth into consideration in the extended wealth measure brings inequality down to similar levels in the two countries.

The only two studies—at least to our knowledge—deriving a broad wealth measure for the total population are those of Frick and Grabka (2010, 2013). As explained in the Introduction, the two studies are subject to uncertainties regarding the accuracy of the matching process, and only consider information on company pensions for the retired.

4. Data and Framework

4.1. *Wealth data in the Socio-Economic Panel*

The database used in the present study is the German Socio-Economic Panel (SOEP). Here we use the SOEP version SOEPv30, https://doi.org/10.5684/soep.v30. SOEP is an ongoing longitudinal survey of approximately 21,000 adult respondents, conducted annually since 1984 (see Wagner et al., 2007). In version v30 (survey year 2013), SOEP consists of ten sub-samples, with seven pure random samples drawn in different years. In addition, special samples are drawn to better represent particular population subgroups, for example, high-income households.

A wide spectrum of topics, including household composition, employment, income, and so forth, is covered by SOEP. Information about private wealth was surveyed four times: in 1988, 2002, 2007, and 2012.

The SOEP surveys the following individual wealth components (see Grabka and Westermeier, 2015a, for further details):

---

[15] The applied method yields somewhat different results when another base year is assumed. For 2014 (OECD, 2015b), the respective gross pension value amounts to 666,304 euros instead of 367,360 euros in 2012: an increase of more than 81 percent.

1. Owner-occupied property wealth
2. Other property wealth
3. Building loan contracts
4. Financial assets (in forms such as savings accounts, bonds, shares or investments). Note that assets in checking accounts and cash money are not explicitly retrieved.
5. Private insurance policies (in the form of life insurance policies or private retirement plans including Riester or Rürup pensions, etc.)
6. Collectables (in the form of gold, jewelry, coins, or valuable collections, etc.)
7. Net business assets (gross business assets minus debts)
8. Mortgages on owner-occupied housing
9. Other mortgages
10. Consumer credits and loans (from banks, other institutions, or individuals)

In contrast to other wealth surveys, the SOEP asks each adult respondent to provide information about her/his individual assets and debts.[16] If a wealth component is owned by several members, they are asked to report their individual share value in percent. In case of item non-response, the single wealth components are multiply imputed. In the survey year 2012, the component-specific shares of item non-response for requested amounts vary between about five percent for owner-occupied property wealth and about 24.7 percent for building loan contracts.

Net worth is the sum of assets (components 1 to 7) minus total debt (components 8 to 10). All its components are in market values of the day of the interview. Notice that SOEP does not explicitly survey cash holdings or money in checking accounts. It also does not survey wealth in the form of durable commodities such as vehicles or furniture or the value of patents.

Our unit of analysis is the individual. Focusing on individuals has several advantages over a household-level concept, particularly in the context of augmented wealth. Most importantly, current and future pension entitlements in Germany are individual, and it is not guaranteed that household units are stable up to and during the payout phase. In case of instability, a household-level analysis would give a biased assessment of the household members' actual access to material resources. Technically speaking, an analysis at the individual level requires no assumptions about intra-household sharing rules or bargaining power, equivalence scales, present and future conceivable legal claims, etc. The same reasoning applies for pension wealth resulting from the death of a partner or parent, i.e., widow(er) or orphan's pension. To ensure a consistency of the individual approach, we exclude them in the main analysis. In general, household-level analyses of wealth would show a more equal distribution than individual-level analysis.

Our computations are based on SOEP respondents living in private households who participated in the 2012 and 2013 waves and were 18 or older in 2013. The need for the participation restriction arises because standard wealth variables

[16] A potential benefit of surveying wealth information at the individual level is the higher accuracy of the data compared to those from surveys that rely exclusively on the answers of the reference person. This is particularly true for multi-person households. A potential drawback of the individual approach is the higher probability of non-response.

are collected every five years, most recently in the 2012 wave (with asset values at the interview month). The current pension entitlements of the non-retired were only collected in 2013 (retrospectively for the previous year). Thus all information refers to 2012. We exclude observations lacking valid information. In particular, we exclude Sample M (the migration sample) and Sample K, as no information on wealth was collected for these respondents in 2012. We also exclude all observations with individual weighting factors of zero. An appropriate weighting scheme is available in SOEP to account for these exclusions. This leaves a sample of 16,285 observations, representing a total weighted number of about 68.9 million individuals.

4.2. *Pension entitlements in the Socio-Economic Panel*

Deriving pension wealth requires information on the expected stream of future pensions, both for the retired and the non-retired population. These pensions may be based on an individual's own contributions during working life, or transferred rights, i.e. widow(er) pensions for married couples. In our main analyses, we will focus on pension wealth built on pensions from individuals' own contributions. This is for conceptual and data-driven reasons. Conceptually, widow(er) pensions are more a transfer payment than an individual asset, which is paid only under certain conditions, i.e. dependent on the economic situation of the non-deceased partner. From a data point of view, if the partner is still alive, estimating the expected stream of future widow(er) pensions requires strong working assumptions (mortality of the partner, own income situation, risk of divorce, etc.). Despite these difficulties, Section 6 will make an effort to include widow(er) pensions in the analysis.

4.2.1. Retired Population

For the retired population, the data is directly provided in SOEP, as it regularly asks respondents to state their monthly gross income from the following eight types of pensions: the statutory German pension insurance (GRV, including Knappschaft), civil servant pensions, company pensions from the public (supplementary insurance for public sector employees (VBL)) and private sectors (occupational pensions), private pensions (e.g. life insurance or Riester pension), accident insurance pensions, compensation and assistance for war victims pensions (Kriegsopferversorgung), and other pensions (in particular those from abroad). The validity of this information is documented in Grabka (2007).

The SOEP's panel structure and information on earnings and family biographies, combined with the pension law, allows for a validity assessment of the reported statutory pension entitlements for the retired population.[17] In particular, if the stated statutory pension exceeded the maximum pension in 2012 (about 2,500 euros per month), we assume that the respondents included their company pensions in the stated

---

[17] For all other types of pensions, SOEP data do not contain sufficient information to assess the validity of stated entitlements by means of internal or external consistency checks. In case of company pensions, we recoded 9 observations having exceptionally high entitlements compared with the earnings biography.

statutory pension.[18] We then replace the stated pension with the 2012 maximum, shifting the remainder to the stated company pensions. This was true for 17 observations.

4.2.2. Non-retired population

For the non-retired population, SOEP collects information on two types of pension entitlements: statutory pensions, and public and private company pensions.[19] Respondents are asked to report the exact information from the (public or private) pension provider's obligatory annual statement to the insured. The statement includes such information as the current value of accumulated entitlements (see Figure A1 for the design of the questionnaire). Since these data were collected for the first time in the SOEP data under examination here, two aspects are important for assessing the quality of the new data on pension entitlements: item-non response (INR) and validity of responses.

In general, INR for the newly included pension-related questions is small. For example, INR is 1.3 percent for the introductory filter variable on having statutory pension entitlements. Among those with an entitlement, only 0.3 percent did not provide the actual level of the entitlement in the follow-up questions. Thus, unwillingness to respond should not be a major obstacle for our analysis (see Grabka and Westermeier, 2015a).

To ensure the validity of responses on current entitlements of the non-retired, it is essential that respondents followed the instructions in the questionnaire precisely: They were asked to consult their annual official pension information letters. If respondents did not report the information directly from the letter and instead guessed, they are unlikely to have provided accurate figures for their entitlements due to the complexity of statutory German pension law. Fortunately, the data enable a distinction between types of respondents,[20] with 41 percent of the sample reporting the exact amount according to the official information.[21]

Just as it had been done for the retired, we also assessed the validity of the reported statutory pension entitlements for the non-retired population. For this group, we use biographical information to determine whether a pension entitlement exists. If the biography indicates an entitlement but the respondent does not report one, the entitlement is imputed (see details in the Appendix). If the biography indicates no statutory pension entitlement but the person reports one, the entitlement is set to zero (a typical example is a person who has always worked as a civil servant). Third, we compute an upper bound of the individual statutory pension entitlements. It is determined by the individual employment biography,

---

[18] In 2013, among those receiving a statutory pension, 24 percent also enjoy payments from a company pension.

[19] Due to the diversity of the liberal professions scheme, entitlements are not surveyed for the non-retired population. Further, the questionnaire does not differentiate the various pension schemes subsumed under the statutory pension insurance, namely entitlements from the miners' association (Knappschaft), seamen's insurance association (Seekasse), pension insurance for artists (Kuenstlersozialversicherung), and agriculture pension scheme (Landwirtschaftliche Alterskasse).

[20] Respondents were asked to indicate if the reported entitlement was exact or an estimate (see Figure A1).

[21] The respective share of INR for company pensions is 1.1 percent for the filter question and 2.5 percent for the amount. Overall, 66% provided only a rough estimate of their pension level, while 34 percent provided the exact amount.

valuing employment periods with the maximum possible remuneration points for insured people in East and West Germany, considering periods of military and civilian service as well as parental leave. If the difference between the stated entitlement and the upper bound is "small",[22] we rely on the stated entitlements. Otherwise, we replace the stated entitlement with an imputed value.

When we run a linear regression of the difference between upper bound and reported entitlement on a dummy of approximate answer, the level of entitlement and the interaction of dummy and level of entitlement, the results indicate that approximated values are larger than the exact values (coefficient of dummy: 204 euros), showing an upward bias in responses. Further, the difference is not random but decreases slightly in the reported entitlement. Hence, we treat approximated statutory pension entitlement as INR. For the same reasons, we also treat approximated company pensions as INR.

For the non-retired population who gave an approximation of their entitlement and those with INR on the respective question, we implement a predictive mean matching using multiple imputation (Rubin, 1987; Schenker and Taylor, 1996). The imputation is performed with the Stata package "mi impute chained pmm". INR on pension information for the retired population is already imputed by SOEP data providers. The respective share of INR is less than 2 percent. Our matching relies on the following set of variables: individual employment histories (number of years working full- or part-time or unemployed), earnings histories for the last 10 years, industry sector, firm size, age, sex, number of children, region of residence (East/West), immigration year, marital status, and education level.[23]

We assess the quality of the imputed entitlements by means of trace plots (Figures A2 and A3) that show the stability of the imputation over iterations (here $i = 100$), and QQ-plots of observed and imputed values (Figures A4 to A7). The trace plots show no apparent trends in the summaries of the imputed values, suggesting that the number of burn-in iterations is adequate.[24] The QQ-plots were performed for pension entitlements from the statutory pensions and company pensions as well as for those cases with exact and approximated answers. For the exact answers, the plots indicate no systematic deviations. For the approximated answers, consistent with the aforementioned upward bias, the imputed values are smaller than the reported entitlements, thus reinforcing our assumption to impute these cases.

Figure 1 provides age-entitlement profiles for the non-retired population from the SOEP data after imputation and register data from the statutory pension insurance. Both profiles show a hump-shaped accumulation process. The highest

---

[22] The difference is assumed to be "small" if the absolute difference is below 300 euros per month and the relative difference is also below 30 percent. A correction has been applied to only 28 observations.

[23] In addition, for the imputation of entitlements to company pensions, information about the financing scheme, number of jobs, and occupational status is used.

[24] To check convergence and stability of the matching algorithm, we also look at several chains, each obtained from a different set of initial values. The chains show no apparent trends and oscillate around the mean, suggesting convergence of the algorithm.

Figure 1. Age profiles for gross statutory pensions, SOEP and register data (in euros/month).
[Colour figure can be viewed at wileyonlinelibrary.com]

Notes: All active insured with GRV pension entitlements; 95 percent CI based on 200 bootstrap replication weights.
Source: German Statutory Pension Insurance (2016)—Versichertenstatistik (Table: 015.30), SOEPv30, respondents of the 2012 and 2013 waves, own calculations.

average monthly gross pensions are reached at the age of 60. For older age groups, the respective figure declines. This is the result of (early) retirement by members of the various sub-groups in the statutory pension insurance, including the miners' association, pensioners with reduced earning capacity, disability pensioners and the long-term unemployed, which are eligible to enter retirement before the official retirement age of 65. The remaining active insured consist largely of individuals with low labor market integration such as housewives or self-employed people with short periods of dependent employment in their working career. Members of this population typically hold lower pension entitlements on average, and if eligible tend to opt out of regular dependent employment earlier. Most importantly, the 95% confidence band for the SOEP entitlements reveals no significant differences.

Figure 2 provides SOEP-based age profiles for company pensions and civil servant pensions, again for the non-retired population only. Unfortunately, due to the lack of data (at least to our knowledge), we cannot provide register-data-based profiles to check the plausibility of the SOEP-based findings. However, for civil servants, the general picture is as expected. Due to the rather strict pension formula for civil servants, there is a strong correlation between age (which highly matched to tenure) and pension level. The spike at the age of 52 seems to be the result of German reunification, given that civil servants in East Germany—at least during the 1990s—had lower salaries than their West German counterparts (see also Figure 5).
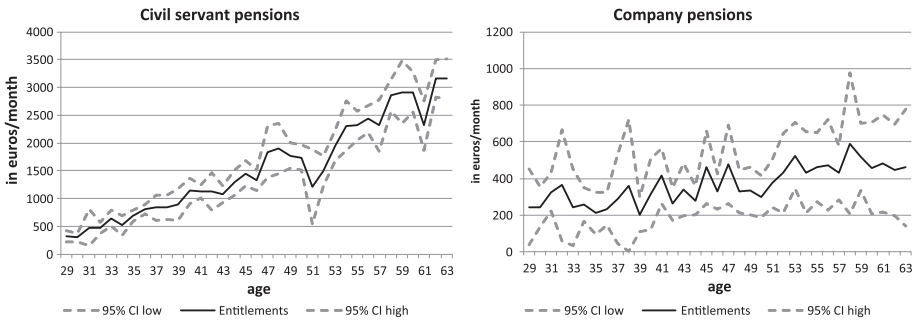
Figure 2. Age profiles for gross civil servant and company pensions (in euros/month).

Notes: Results based on first imputation. 95 percent CIs obtained via bootstrapping with 200 runs.

Source: SOEPv30, respondents of the 2012 and 2013 waves, own calculations.

For company pensions, the confidence bands reflect not only the greater uncertainty due to smaller numbers of eligible persons but also the diversity of forms this pension type takes.

4.3. *Derivation of Present values*

We compute gross present values of pension entitlements accumulated until 2012 from the first and second pillar in real terms (present value or *PV* from now and on). *Gross* means that pension entitlements are considered before taxes and social security contributions. The value of expected capitalized pensions from a particular pension scheme $p = stat, civil, comp$ is the current pension entitlement adjusted for real interest rates and average survival probabilities. The present value of entitlements from a pension scheme $pension^p$ in 2012 is,

$$PV_p = \sum_{t=0}^{T-a} s_{a,t} \times \frac{1}{(1+i)^t} \times pension_t^p,$$

with $S_{a,t}$ denoting the probability of a person of age a in year 2012 surviving until year t; $T - a$, indicating the remaining maximum lifespan differentiated by sex and birth cohort;[25] i a constant discount rate (here a rate of 3%); and $pension_t^p$ the pension entitlement from pension scheme p. A retired person (including those with pensions for reduced earning capacity)[26] receives the pension from period $t = 0$ (year 2012) onward. A non-retired person receives the pension starting in a future period $t > 0$, defined by the person's age and the official retirement age.

[26] Pensions for reduced earnings capacity are considered for actual recipients only. This is because assessing the expected present value of such a pension for individuals who are not currently receiving it requires untestable ad hoc assumptions. For retired individuals, earnings capacity pensions and old-age pensions are contained in a single SOEP variable. For reasons of comparability, it would be advised to curtail the total pension by earnings capacity pensions, but we see no sensible way to do so.

[25] Figures provided by Federal Statistical Office (2015b). Previous studies also point to differences in life expectancy between social groups (Shkolnikov et al., 2008). However, official statistics are not sufficiently detailed.

We have chosen an interest rate of 3% as a compromise between the long standing interest rate for German government bonds and low short-term interest rates today. Further, an interest rate of 3 percent is common in the international literature (see, for example, Alessie et al., 2011, Attanasio and Rohwedder, 2001; Hurd et al., 2012 and McGarry and Davenport, 1998). Table A1 provides results for alternative discount rates between zero and five percent. Compared to the results outlined below, increasing the discount rate lowers the estimated level of pension wealth and its distributive effect.

The above generation of present values for today's entitlements follows the so-called "accrual method" (Wolff, 2015). For the interpretation of the present values, two aspects should be mentioned. First, entitlements from the liberal professions scheme are not comprised in present values for the non-retired population but only for the retired.[27] The same holds for pension entitlements from abroad. Second, for the reasons explained above, we refrain from considering any entitlements from survivor pensions in the main analyses.

5. Results

5.1. *Wealth Composition and Prevalence of Ownership: the Broad Picture*

In the following, we present our estimates of individual net worth, total pension wealth, augmented wealth, and of the three sub-components of total pension wealth. All computations rely on a bootstrap procedure using multiply-imputed wealth components (five imputed values) following Rubin (1987).

Table 2 shows the medians and means of the wealth aggregates along with the fractions of the adult population with positive wealth holdings.[28] The median is always derived from the specific wealth distribution under consideration. Median individual net worth is about 18,000 euros. The respective mean is about 85,000 euros, about five times higher. About 73 percent of the adult population holds positive net worth.[29]

The most important component of net worth in quantitative terms is housing wealth, with a mean value of 70,000 euros. Financial assets and other assets play a minor role at 13,500 euros and 18,000 euros, respectively. About 47 percent of

[27] As mentioned above, pension entitlements of liberal professions can only be considered for the retired population. Employees in the liberal professions, on average, earn higher income than the population in general. Hence, we expect that the inclusion of such schemes for the non-retired would increase augmented wealth inequality, at least among the non-retired population. It is difficult, however, to assess the effect size. We would like to thank an anonymous reviewer for sensitizing us to this matter.

[28] All bootstrapped estimates rely on 200 bootstrap runs using the first implicate. The four other implicates do not differ with respect to a 95 percent confidence interval.

[29] Aggregating personal net worth at the household level allows a comparison with alternative German data sources. Here we find a value of about 148,000 euros. According to the German Income and Expenditure Survey (EVS) conducted by the Federal Statistical Office, mean household net worth in 2013 is about 123,000 euros (Federal Statistical Office, 2014). According to the German part of HFCS, household net worth in 2010 was about 195,200 euros (ECB, 2013). Note that the definitions of net worth are not exactly the same across datasets. For example, the wealth aggregate from EVS, as opposed to SOEP, does not consider business assets, while the aggregate from ECB includes the value of vehicles, checking accounts and cash money which are not included in SOEP's questionnaire.

the population holds financial assets and 54 percent other assets. Mean total debts amount to 16,400 euros; about a third of the adult population is indebted.

According to Table 2, less than 50 percent of the adult population holds positive financial assets. At face value, this result is counterintuitive and inconsistent with other wealth reports. For example, according to Household Survey of Consumer Finances data from 2014, participation of households in financial assets is 99.4 percent (ECB, 2016, p. 92). However, the HFCS definition of financial assets is broader than in SOEP: in particular, it also includes checking accounts and cash holdings. To get an approximate idea of the underestimation problem in SOEP, it is interesting to contrast mean financial wealth in SOEP with its HFCS counterpart: about 13,500 euros vs. 53,800 euros (ECB, 2016, p. 121). Note however, that the former value is individual while the latter value is at the household level. At the household level, average financial assets in SOEP amount to 39,754 euros.[30]

Total pension wealth turns out to be an important component of individual economic resources. Its median is about 59,000 euros, thus three times the level of median net worth. It is also far more prevalent: about 89 percent of the adult population possesses pension wealth. Thus, statutory pension entitlements are by far the most important source of pension wealth: the median (mean) over all individuals amounts to about 44,000 euros (68,000 euros). Median entitlements from civil servant or company pensions amount to zero, due to the relative small population share of beneficiaries: about 6 percent of the adult population holds entitlements from civil servant pensions and about 24 percent from company pensions. For the same reason, the unconditional means are small: about 14,000 euros for entitlements from civil servant pensions and 10,000 euros for entitlements from company pensions. The conditional means, however, are sizeable: about 211,000 euros for civil servant and 42,000 euros for company pensions.

The last row of Table 2 gives key figures for augmented wealth. Its median is about 107,000 euros and thus about six times greater than median net worth. Its mean is about 177,000 euros, about twice as large as mean net worth. For about six percent of the adult population, augmented wealth is negative or zero; these are predominantly young adults who have not yet contributed for the necessary number of years that the statutory pension insurance requires for pension entitlements to be granted.

To gain an initial impression of wealth inequalities, Table 3 provides the decile-specific means of six wealth aggregates. Deciles are wealth-concept-specific: individuals are sorted in increasing order of the particular wealth concept under consideration.

In the bottom two deciles, average net worth is negative or zero. One potential explanation for the large fraction of individuals with negative or zero net worth is that the aggregate does not comprise cash holdings or durable commodities (e.g. vehicles or furniture). In the 5th decile, the value is still moderate at about 11,000

---

[30] Another possible explanation for the high incidence of zeros in financial wealth is that in married couples, only one spouse reports financial assets in joint possession. However, communal ownership of assets acquired prior to marriage is the exemption rather than the rule in Germany. The default rule is the community of accrued gains (Zugewinngemeinschaft): spouses do not share wealth acquired prior to the marriage but only that acquired during the marriage.

TABLE 2
MEDIAN AND MEAN WEALTH BY WEALTH AGGREGATE

Wealth aggregate	Median (in euros)	Mean (in euros)	Cond. Mean (in euros)	Fraction (in %)
	Total population		Individuals with positive wealth in respective component	
Net worth	18,000	85,348	119,449	72.58
		(2,082)	(2,791)	(0.42)
- Housing wealth	0	69,875	167,645	41.68
		(1,660)	(3,611)	(0.45)
- Financial assets	0	13,527	28,683	47.16
		(563)	(1,189)	(0.43)
- Other assets	1,000	18,346	33,806	54.27
		(1,153)	(2,128)	(0.44)
- Total debt	0	16,400	50,342	32.58
		(624)	(1,795)	(0.46)
Pension wealth				
- Total	58,990	91,440	102,766	88.98
		(1,133)	(1,200)	(0.37)
- Statutory	43,617	67,500	81,348	82.98
		(745)	(807)	(0.41)
- Civil servant	0	13,740	210,993	6.51
		(576)	(7,164)	(0.21)
- Company	0	10,200	42,191	24.18
		(506)	(1,980)	(0.40)
Augmented wealth	107,392	176,789	188,959	93.85
		(2,370)	(2,429)	(0.30)

Note: Medians based on first imputation (for robustness over imputations, see Table A2). For all other statistics, results based on multiple imputed data and 200 bootstrap replicate weights; standard deviation in parentheses.
Source: SOEPv30, persons living in private households age 18 and above in 2013 and respondents of the 2012 and 2013 waves.

euros. From the 6th to the 10th decile, we find a pronounced increase from about 29,000 euros in the 6th to nearly 500,000 euros in the 10th decile. In other words, the 10th decile possesses about 60 percent of total net worth in Germany. This confirms previous SOEP-based studies on net worth in Germany (i.e. Grabka and Westermeier, 2014). For pension entitlements, the distribution is flatter. Further, in the bottom 9 deciles, average total pension wealth is always higher than net worth, which underscores the relevance of pension wealth in Germany. As an example, for the 5th decile, the average is about 48,000 euros, thus about four times the level of net worth. This ratio decreases over the deciles, but only in the highest decile does the average value of net worth exceed the average of total pension wealth. For the three sub-components of pension wealth, we find that entitlements from statutory pensions are, by far, the most equally distributed component. Their mean is zero in the bottom decile, about 35,000 euros in the 5th decile, 146,000 euros in the 9th and 228,000 euros in the top decile. Because of the low incidence of eligible persons, civil servant pensions and company pensions are exclusively clustered in the top and top three deciles, respectively.

Decile-specific means of augmented wealth are always markedly higher than means of net worth. Further, augmented wealth is more equally distributed than net worth. In the third (5th, 10th) decile, the average of the former is about 29,000 euros (90,000 euros, 723,000 euros), thus about 240 (8, 1.5) times higher than the latter.

While Table 3 provides information on the decile-specific means for the wealth-type specific distributions, we next turn to the composition of augmented wealth. It is depicted in Figure 3 in the form of two graphs. The left graph gives the composition of augmented wealth along the deciles of the net worth distribution. The right graph gives the decile-specific amounts of the wealth aggregates along the augmented wealth distribution. The upper part of Table 4 complements the left graph in Figure 3 by providing wealth aggregate means by decile and the relative share by net worth deciles. For the bottom decile, net worth is negative and thus the relative share amounts to -30 percent. In contrast, statutory pensions contribute the major share to augmented wealth. This share systematically decreases over the net worth deciles: from 93 percent in the 2nd to 70% in the 5th and 14 percent in the 10th decile. Running almost parallel to the decline of the share of statutory pension entitlements is the rise in the share of net worth: from 0 percent in the 2nd and 3rd to 14 percent in the 5th and 75 percent in the 10th decile. The shares of entitlements from civil servant pensions and company pensions show opposing trends: whereas for civil servant pensions, the relative share is higher for upper net worth deciles (up to 11 percent in the 9th decile), company pensions have a somewhat higher relative importance in the middle and at the bottom of the net worth distribution (9 percent and 12 percent, respectively).

The right panel of Figure 3 and the lower part of Table 4 give the composition of augmented wealth along the deciles of augmented wealth, thus also shedding light on its correlation with net worth (0.937). Again—as is the case when ordering the data by net worth deciles—the relative importance of net worth increases over deciles while statutory pension wealth decreases.

The most noticeable difference between the two ordering concepts concerns the decile-specific shares of entitlements from civil servant pensions. Comparing the top decile of the augmented wealth distribution with the top decile of the net worth distribution (Table 4) reveals that civil servant pensions make up a markedly higher share in the former ordering (14 percent vs. 6 percent of total wealth).

Another common pattern of both graphs in Figure 3 is that the relative importance of statutory pension wealth is significantly smaller for the top two deciles. This result is mainly driven by the upper contribution ceiling in the statutory pension insurance in Germany, which caps the entitlements to this upper bound.

5.2. *Wealth Inequalities*

Further insight into wealth inequality is provided by Lorenz and concentration curves (Figure 4). The left-hand graph shows the Lorenz curve of augmented wealth and the concentration curves for net worth and total pension wealth. The right-hand graph gives the concentration curves for each of the three pension wealth subcomponents separately.

The Lorenz curve of augmented wealth presents the cumulated proportion of total augmented wealth, with individuals being sorted in increasing order of augmented wealth. The concentration curves give the cumulative share of a particular wealth aggregate but the ordering criterion is always augmented wealth. Accordingly, in contrast to the Lorenz curve, which cannot lie above the line of perfect equality (45° line), concentration curves can lie either above or below the

TABLE 3
MEANS OF WEALTH AGGREGATES BY RESPECTIVE DECILES (IN EUROS)

Decile*	Net worth	Pension wealth				Augmented wealth
		Total	Statutory	Civil servant	Company	
1	−13,378	0	0	0	0	−4,314
	(1,939)	(0)	(0)	(0)	(0)	(1,837)
2	0	6,028	1,094	0	0	11,653
	(0)	(0,446)	(239)	(0)	(0)	(572)
3	121	17,044	10,460	0	0	29,522
	(38)	(551)	(472)	(0)	(0)	(1,068)
4	3,439	30,091	21,096	0	0	56,393
	(241)	(768)	(600)	(0)	(0)	(1,567)
5	11,218	48,102	35,041	0	0	89,828
	(530)	(996)	(789)	(0)	(0)	(1,605)
6	28,502	69,622	54,342	0	0	128,811
	(966)	(970)	(1,014)	(0)	(0)	(1,824)
7	59,256	95,982	76,630	0	0	174,367
	(1,570)	(1,245)	(976)	(0)	(0)	(2,058)
8	101,139	130,485	105,767	0	1,228	231,957
	(1,754)	(1,434)	(1,205)	(0)	(225)	(2,476)
9	165,046	183,610	145,863	0	16,459	329,425
	(2,590)	(2,065)	(1,431)	(0)	(691)	(3,787)
10	495,184	339,996	227,892	137,385	87,117	722,945
	(16,553)	(4,698)	(2,341)	(5,750)	(2,961)	(16,701)

Note: *Decile of respective wealth aggregate. All results based on multiple imputed data and 200 bootstrap replicate weights; standard deviation in parentheses.

Source: SOEPv30, persons living in private households aged 18 and above in 2013, and respondents in the 2012 and 2013 waves.
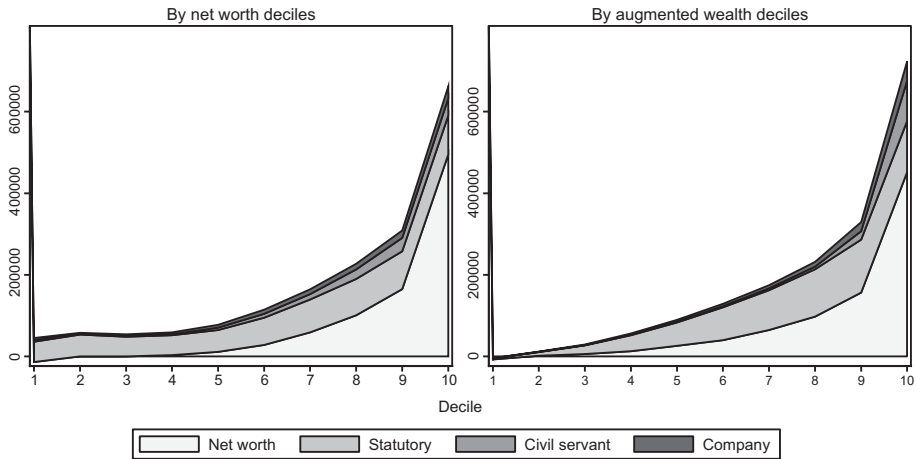
Figure 3. Composition of augmented wealth/ joint distributions (in euros).

Note: Deciles of respective wealth aggregate. Results based on multiple imputed data.

Source: SOEPv30, persons living in private households age 18 and above in 2013 and respondents of the 2012 and 2013 waves.

45° line. If a concentration curve lies above the 45° line, then individuals with low augmented wealth hold a disproportionally high share of the underlying component of augmented wealth.

As can be seen from the left graph in Figure 4, the Lorenz curve of augmented wealth (pattern: solid) falls far below the equal distribution line, suggesting sizeable wealth inequalities. The concentration curve for net worth suggests even higher inequalities, while the opposite is true for total pension wealth. Concerning pension wealth, the right graph further provides the subcomponent-specific concentration curves. Closest to the equal-distribution line is the concentration curve for statutory pensions, followed by company pensions and civil servant pensions.

Actual figures on wealth inequalities, as measured by the Gini coefficient and the Coefficient of Variation (CV), are presented in Table 5. The Gini coefficient is quite insensitive to changes at the top of the distribution, whereas the opposite holds for the coefficient of variation. The inclusion of negative values means that the Gini index is no longer bounded between 0 and 1. We provide both unconditional indices for the full sample (left column) and conditional indices based on individuals holding a strictly positive amount of the wealth component under investigation (right column).

Consistent with previous studies for Germany, the distribution of net worth is very unequal. Here the Gini coefficient is 0.785 (CV: 3.378). The inclusion of pension wealth leads to a marked reduction of the Gini coefficient of roughly 25 percent to 0.594 for augmented wealth (CV: 1.832). Total pension wealth itself has a Gini coefficient of 0.566, indicating a substantially lower level of inequality than for net worth. For the subcomponents of pension wealth, Gini indices are 0.560 for statutory pensions (CV: 1.077), 0.967 for civil servant pensions (CV: 5.195), and 0.905 for company pensions (CV: 3.920). High inequalities in the distributions of entitlements from civil servant or company pension wealth are primarily the result

TABLE 4

COMPOSITION OF AUGMENTED WEALTH ALONG THE DISTRIBUTIONS OF NET WORTH AND AUGMENTED WEALTH, RESPECTIVELY

| | Mean (in euros) | | | | | | Share of augmented wealth (in %) | | | | |
| | | | Pension wealth | | | | | | Pension wealth | | |
Decile*	Net worth	Total	Statutory	Civil-servant	Company	Augmented wealth	Net worth	Total	Statutory	Civil-servant	Company
By net worth deciles											
1	−13,378	58,576	49,390	3,678	5,508	45,198	−29.60	129.60	109.27	8.14	12.19
2	0	58,027	53,992	1,461	2,574	58,027	0.00	100.00	93.05	2.52	4.44
3	121	53,912	48,366	2,664	2,882	54,033	0.22	99.78	89.51	4.93	5.33
4	3,439	55,703	48,786	2,213	4,704	59,142	5.81	94.19	82.49	3.74	7.95
5	11,218	66,244	53,473	6,163	6,608	77,462	14.48	85.52	69.03	7.96	8.53
6	28,502	86,063	66,775	9,154	10,134	114,565	24.88	75.12	58.29	7.99	8.85
7	59,256	105,350	80,100	13,298	11,951	164,606	36.00	64.00	48.66	8.08	7.26
8	101,139	125,739	89,040	22,911	13,788	226,879	44.58	55.42	39.25	10.10	6.08
9	165,046	143,837	92,702	33,195	17,939	308,882	53.43	46.57	30.01	10.75	5.81
10	495,184	166,675	95,429	42,566	28,680	661,859	74.82	25.18	14.42	6.43	4.33
Overall	85,348	91,440	67,500	13,740	10,200	176,789	48.28	51.72	38.18	7.77	5.77
By augmented wealth deciles											
1	−7,089	2,776	2,540	82	153	−4,314	164.35	−64.35	−58.89	−1.91	−3.55
2	1,961	9,692	8,947	159	586	11,653	16.83	83.17	76.78	1.36	5.03
3	6,133	23,389	20,910	665	1,814	29,522	20.78	79.22	70.83	2.25	6.14
4	12,703	43,691	39,536	1,339	2,815	56,393	22.53	77.47	70.11	2.38	4.99
5	26,063	63,765	57,322	1,590	4,853	89,828	29.01	70.99	63.81	1.77	5.40
6	39,994	88,816	80,380	2,688	5,748	128,811	31.05	68.95	62.40	2.09	4.46
7	64,994	109,373	97,266	4,940	7,168	174,367	37.27	62.73	55.78	2.83	4.11
8	97,612	134,345	116,344	6,213	11,787	231,957	42.08	57.92	50.16	2.68	5.08
9	156,788	172,636	129,741	20,771	22,125	329,425	47.59	52.41	39.38	6.31	6.72
10	451,183	271,762	125,167	98,868	47,727	722,945	62.41	37.59	17.31	13.68	6.60
Overall	85,348	91,440	67,500	13,740	10,200	176,789	48.28	51.72	38.18	7.77	5.77

Note: *Decile of respective wealth aggregate. All results based on multiple imputed data. Overall is the average over the whole distribution.
Source: SOEPv30, persons living in private households age 18 and above in 2013 and respondents of the 2012 and 2013 waves.
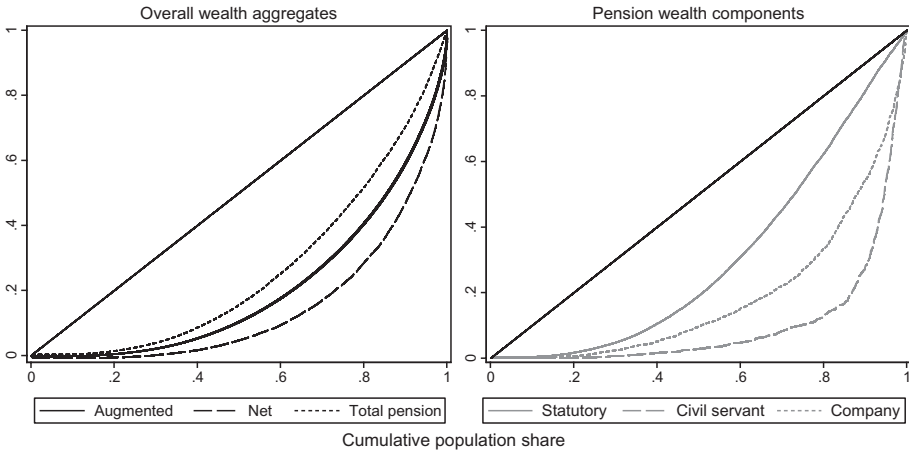
Figure 4. Lorenz and concentration curves.

Note: Results based on first imputation. Ordering is calculated on the basis of augmented wealth.

Source: SOEPv30, persons living in private households 18 years and older, respondents of the 2012 and 2013 waves.

of their low prevalence in the total population (Table 2). For the same reason, the conditional indices are markedly lower than the unconditional ones. The effect is most pronounced for entitlements from civil servant pensions and company pensions. The conditional Gini coefficient for the former is only 0.496, whereas it is 0.605 for company pensions. Conditional and unconditional Gini coefficients for augmented wealth differ little because of the high prevalence of ownership.

We complete the inequality analysis with a factor decomposition of augmented wealth. Here we follow Shorrocks (1982) for the coefficient of variation and Lerman and Yitzhaki (1985) for the Gini. Define inequality of total wealth, W, into inequality contributions from each of the factor components of total wealth, $W^1, \ldots, W^F$. The coefficient of variation can be decomposed as,

$$CV = \sum_{f=1}^{F} cor\left(W^f, W\right) S_f CV_f,$$

where $cor\left(W^f, W\right)$ is the correlation between wealth component f and total wealth, S_f is the share of f in total wealth (Table 4), and CV_f is the coefficient of variation for component f (Table 5). Similarly, the Gini coefficient can be written as,

$$G = \sum_{f=1}^{F} R_f G_f S_f,$$

where R_f is the Gini correlation between wealth component f and total wealth, and G_f is the relative Gini of component f (Table 5). The products in the sum,

TABLE 5

INEQUALITY OF WEALTH AGGREGATES

Wealth aggregate	Total population		Population with positive wealth component	
	Gini		Conditional Gini	
Net worth	0.785	(0.007)	0.666	(0.007)
Pension wealth				
- Total	0.566	(0.004)	0.512	(0.004)
- statutory	0.560	(0.004)	0.470	(0.004)
- civil servant	0.967	(0.001)	0.496	(0.012)
- company	0.905	(0.004)	0.605	(0.014)
Augmented wealth	0.594	(0.006)	0.562	(0.006)
	CV		Conditional CV	
Net worth	3.378	(0.454)	2.763	(0.392)
Pension wealth				
- Total	1.186	(0.014)	1.069	(0.013)
- statutory	1.077	(0.011)	0.890	(0.011)
- civil servant	5.195	(0.098)	0.907	(0.027)
- company	3.920	(0.133)	1.719	(0.070)
Augmented wealth	1.832	(0.205)	1.743	(0.201)

Note: All results based on multiple imputed data and 200 bootstrap replicate weights; standard deviation in parentheses.
Source: SOEPv30, persons living in private households age 18 and above in 2013 and respondents of the 2012 and 2013 waves.

the absolute contributions to inequality, $cor\left(W^f, W\right) S_f CV_f$, and $R_f G_f S_f$, respectively, are presented in the first column of Table 6, while the second column shows the relative contributions, $cor\left(W^f, W\right) S_f CV_f / CV$ and $R_f G_f S_f / G$. Further, Table 6 displays two decompositions for each measure. The first approach decomposes total inequality of augmented wealth into two components: net worth and total pension wealth. The second approach further breaks pension wealth into its three subcomponents.

Both indices show that net worth plays a key role in explaining augmented wealth inequality. In case of the coefficient of variation, the relative contribution to overall net worth inequality is 84 percent, and 58 percent in case of the Gini index. Both civil servant and company pensions, despite high factor-specific inequalities, contribute little to total inequality due to their relatively small share in total wealth. This is different for statutory pension wealth: its contribution to overall inequality is about 25 percent for the Gini and about 7 percent for the coefficient of variation, a relatively small share compared to its 38 percent share in augmented wealth.

5.3. *Age-Wealth Profiles*

Many empirical studies suggest that age trajectories of wealth increase up to retirement age and decrease smoothly thereafter, implying a hump-shaped profile. Estimation of the profile requires that one differentiate age, period, and cohort effects. This is not possible with a single cross-section, as is the case with

© 2018 International Association for Research in Income and Wealth

TABLE 6
FACTOR DECOMPOSITION OF AUGMENTED WEALTH INEQUALITY

Wealth aggregate	Absolute contribution		Relative contribution (in %)	
		Gini		
Net worth	0.345	(0.060)	58.15	(1.25)
Total pension wealth	0.248	(0.042)	41.85	(1.25)
Total inequality	0.594		100	
Net worth	0.345	(0.060)	58.15	(1.25)
Pension wealth				
- Statutory	0.150	(0.025)	25.22	(0.86)
- Civil servant	0.062	(0.011)	10.46	(0.70)
- Company	0.037	(0.007)	6.17	(0.48)
Total inequality	0.594		100	
		CV		
Net worth	1.539	(0.239)	83.95	(3.69)
Total pension wealth	0.293	(0.036)	16.05	(3.69)
Total inequality	1.832		100	
Net worth	1.539	(0.239)	83.95	(3.69)
Pension wealth				
- Statutory	0.127	(0.016)	6.93	(1.62)
- Civil servant	0.101	(0.013)	5.52	(1.30)
- Company	0.066	(0.010)	3.59	(0.89)
Total inequality	1.832		100	

Note: All results based on multiple imputed data and 200 bootstrap replicate weights; standard deviation in parentheses.
Source: SOEPv30, persons living in private households age 18 and above in 2013 and respondents of the 2012 and 2013 waves.

the present data. Thus, we simply provide estimates of the profiles using variation over age in the 2012 cross-section.

We estimate age-wealth profiles for adult residents of West and East German states separately. German reunification was a major economic shock for East Germans, and had substantial implications for labor force participation, income, savings, social security entitlements, and presumably both wealth levels and wealth profiles (see, for example, Fuchs-Schündeln and Schündeln, 2005).

Profiles are derived for each of the six wealth aggregates. Further, we estimate unconditional and conditional profiles. Unconditional profiles consider all valid cases, while conditional profiles exclusively consider persons with a strictly positive wealth level for the particular aggregate. Predictions of wealth-age profiles rely on OLS regressions for multiply imputed data. Suppressing an index for wealth aggregate, the specification is,

$$W_i^f = \alpha + \beta \times age_i + \gamma \times \left(age_i\right)^2 + \delta \times \left(age_i\right)^3 + \varepsilon_i$$

with W_i^f denoting the wealth aggregate owned by individual i of wealth aggregate f (net worth, statutory pension wealth, ...), age_i age in years, and ε_i the error term. Age is considered with a quadratic term that considers the typical dissaving effect after retirement, while the polynomial of the third order is used for robustness purposes.
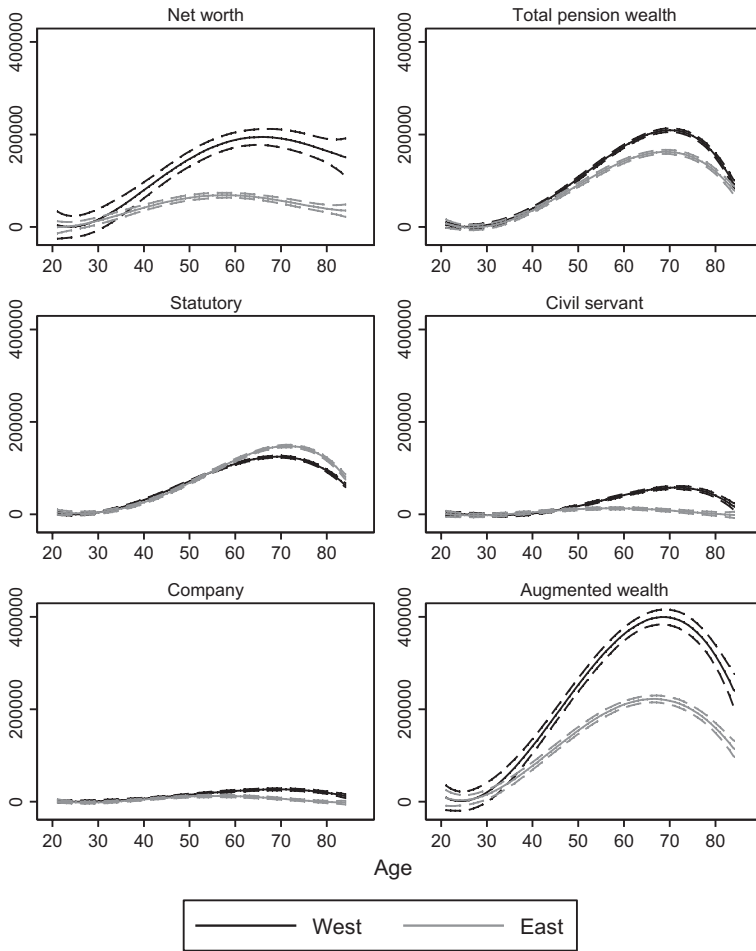
Figure 5. Age-wealth profiles by region 2012 (in euros).

Note: Results based on multiply imputed data and 200 bootstrap replicate weights. Region is region of residence in 2012.

Source: SOEPv30, persons living in private households 18 years and older, respondents of the 2012 and 2013 waves.

Unconditional profiles are presented in Figure 5. We find hump-shaped age profiles for all wealth aggregates. The typical profile shows that whereas individuals have little wealth at younger ages (around zero), they start accumulating sizeable amounts at around age 30–35. Their wealth peaks around age 60–65 and declines thereafter. It is also apparent that, except for entitlements from statutory pensions, wealth profiles are steeper and peak at higher levels for West German residents.

Among residents in the western part of the country, the unconditional value of average net worth at age 40 / 50 / 60 is about 80,000 euros / 147,000 euros / 186,000 euros. Among those living in the East, the corresponding values are about 42,000 euros / 63,000 euros / 68,000 euros, which reflects the historically different conditions for wealth accumulation in the two parts of Germany before the Wall

came down. It is also interesting to note that the East-West divide, the ratio of average net worth owned by residents in the respective region declines in age: East German residents at age 40 / 50 / 60 / 70 / 80 only possess approximately 52 percent / 43 percent / 36 percent / 29 percent / 24 percent of the net worth held by residents in the West. The decline suggests that, in particular, the earlier birth cohorts of East German residents have not managed to accumulate sizeable stocks of net worth. For augmented wealth, we also find a widening gap over age, with a maximum difference amounting to almost 181,000 euros around age 71. The East-West ratio, however, is larger: East German residents of age 40 / 60 / 80, on average, hold approximately 65 percent / 58 percent / 51 percent of augmented wealth owned by West German residents. The narrowing of the regional divide for younger cohorts is basically driven by statutory pension entitlements: here the age-wealth profiles are rather similar for residents of East and West, and significantly higher for residents of the East at later ages after retirement. The latter finding is driven by a higher share of the population entitled to statutory pensions among residents in the East, as can be seen from the conditional age profiles in Figure 6. One important reason is the higher labor market participation of females in East Germany. Another reason is that unemployment was low in the East German Democratic Republic prior to unification. After unification, the basic features of West German pension legislation were transferred to East Germany, and East German employment biographies were translated into West German ones.

Conditional profiles—based on the respective wealth aggregates—are provided in Figure 6. For net worth and augmented wealth, the profiles are similar to the unconditional profiles. This is because of the high incidence of positive values in the population. The conditional profiles for the three pension wealth measures are noticeably different from their unconditional counterparts. For West Germany, the conditional predicted value for total pension wealth at age 70 amounts to 211,000 euros and 162,000 euros in the East. At the same age, the conditional average of net present value of statutory pensions entitlements in West (East) Germany is about 141,000 euros (150,000 euros), of civil servant pensions 435,000 euros (306,000 euros), and of company pensions 95,000 euros (35,000 euros). The generally higher age-wealth profiles in West Germany mirror the still existing earnings gap between the two regions.

6. CONSIDERING WIDOW(ER) PENSIONS

For data-driven and conceptual reasons, in our main analyses we do not consider present values of future widow(er) pensions. However, in particular for elderly married women without a noteworthy labor history, widow(er) pension entitlements are an important source of pension wealth.

In the German system, widow(er) pensions are granted to married couples only. Their level is a function of the pension of the deceased partner, the duration of the marriage and the eventual occurrence of a divorce in the future, the economic situation of the widow(er) today and in the future, etc. The uncertainty about all these arguments for future periods makes the computation of expected values of future widow(er) pensions for married couples a challenge, particularly
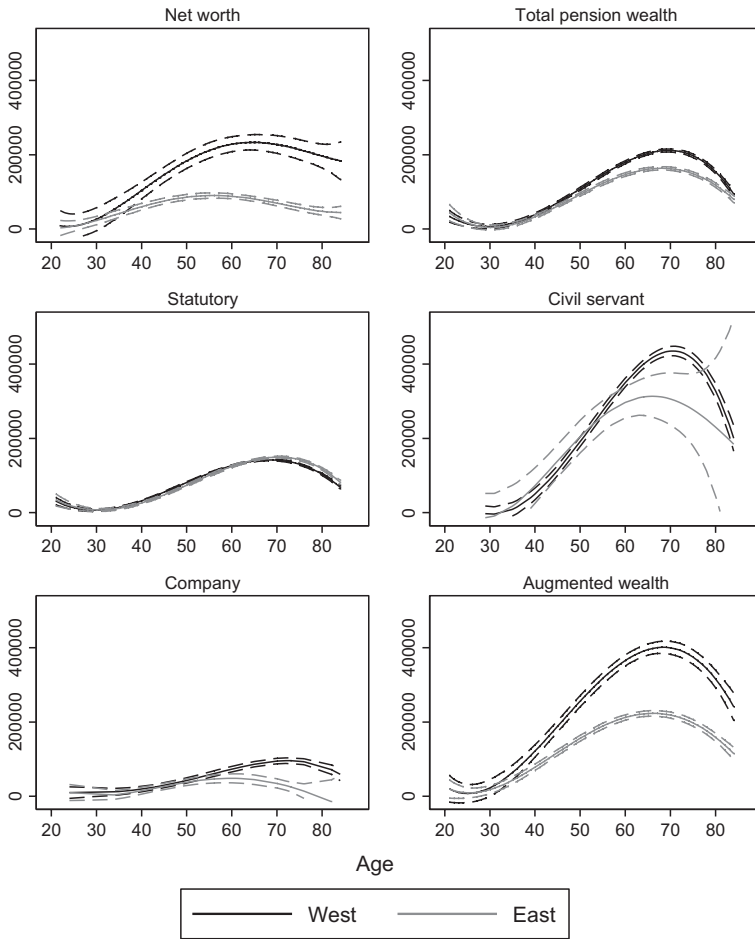
Figure 6. Conditional age-wealth profiles by region 2012 (in euros).

Note: Results based on multiply imputed data and 200 bootstrap replicate weights. Region is region of residence in 2012.

Source: SOEPv30, persons living in private households 18 years and older, respondents of the 2012 and 2013 waves.

if both partners are still alive. Nevertheless, here we undertake an effort to provide estimates of the role of widow(er) pensions in augmented wealth positions.

6.1. *Determination of Widow(er) Pensions*

In the statutory system, the level of a widow(er) pension depends on the actual pension of the deceased partner as well as the financial situation of the widow(er). In the occupational and in the mandatory pension scheme for civil servants, basic regulations for survivor pensions are similar to those in the statutory pension system. Widow(er) pensions are also granted in the liberal profession scheme.

To compute the present values, two situations must be distinguished. If the married partner is deceased, widow(er) pensions of the eight aforementioned pension types are directly recorded in SOEP. These reported numbers allow a direct estimation of the present value of all the future entitlements. If the married partner is still alive, the expected present value must be simulated. It depends on two components: the joint probability that a person is still alive while her or his married partner is deceased (see Section 6.2); the actual level of the widow(er) pension.

For the statutory and company widow(er) pensions, our simulation builds on the following basic rules:

1. The marriage must have lasted for at least 12 months.
2. A widow(er) pension is granted if the deceased partner was insured for at least five years.
3. A "large" widow(er) pension is granted if the widow(er) is of age 45 or above, has a reduced earnings capacity, or if children below age 18 are living in the household. A "small" widow(er) pension is a temporary transfer for a widow(er) of working age. We assume that the surviving partner is entitled to a "large" widow(er) pension. We refrain from considering a "small" widow(er) pension because its present value is small due to a limited payment period of two years.
4. The widow(er) pension is reduced if the surviving partner has his or her own income. If her/his net income exceeds a monthly basic allowance of 741.05 euros in Germany's "old" (former West German) and 657.89 euros in its "new" (former East German) states in 2012, the survivor pension is reduced by 40% of the difference between the net income of the surviving partner and the allowance.

For civil servant widow(er) pensions, the entitlement for the bereaved partner of a civil servant is determined based on the following basic rules:

1. The marriage must have lasted for at least 12 months for marriages after Dec. 31, 2001; otherwise for three months. If the civil servant was above age 65 at the beginning of the marriage and the marriage was childless, no survivor pension is granted.
2. A widow(er) pension is granted if the deceased partner was a civil servant for at least five years.
3. The widow(er) pension amounts to 60 percent (55 percent) of the pension of the deceased partner for survivors born before (after) Dec. 31, 1961.
4. The level of the widow(er) pension depends on the income situation of the widow(er) with particular deduction rules applying.[31]

---

[31]Two cases must be distinguished: Case 1: widow(er) is retired and receives a statutory PAYG pension: According to § 55 (3) 2 of Germany's Civil Service Benefits Act (Beamtenversorgungsgesetz, BeamtVG), the full widow(er) pension is granted. Case 2: widow(er) is retired and receives a civil servant pension: According to § 55 (2) 2 the complete widow(er) pension is granted, but the widow(er)'s own civil servant pension is reduced. The deduction of the own pension is the sum of the widow(er)'s own pension plus her widower pension minus the maximum pension entitlement of the deceased person. The maximum entitlement of the deceased person is 0.75 times her pay grade.

6.2. *Present Values of Widow(er) Pensions*

For computing the present value of widow(er) pensions, we distinguish the following states for married couples:

1. Both partners are alive in t. Then each partner receives his/her own individual pension. The probability is the joint survival probability of the male (m) and female partner (f).
2. The male partner is deceased but the female partner is alive. Then the male partner's pension entitlements are zero and the female partner receives her own pensions plus a widow pension (if eligible). The probability is the product of survival of the female and non-survival of the male partner.
3. The female partner is deceased but the male partner is alive. Then the female partner's pension entitlements are zero and the male partner receives his own pensions plus a widower pension (if eligible). The probability is the product of survival of the male and non-survival of the female partner.

As the level of the widow(er) pension depends on the entitlements of the married partner, a present value of a widow(er) pension can only be calculated when this information is available in SOEP. However, it is not available in the case of partial unit-non response, and if one partner is not living in the same household. Thus, in the following, the level and incidence of widow(er) pensions is slightly underestimated.

6.3. *Wealth Statistics Considering Widow(er) Pensions*

Table 7 complements key statistics from our main analyses (upper panel) with our estimates for widow(er) pensions (lower panel). Compared to the incidence of expected pension wealth from own contributions (around 90 percent), the incidence for expected widow(er) pension wealth (around 20 percent) is markedly lower. Widow(er) pensions from the statutory pension scheme therefore make up by far the largest share.

Because of the low incidence, the unconditional mean of widow(er) pension wealth is minor: while pension wealth from own entitlements add more than 90,000 euros to augmented wealth, widow(er) pensions add about 10,000 euros only. Their conditional mean, however, is non-negligible. For persons with an entitlement, it amounts to about 50,600 euros. For those entitled to a widow(er) pension, the mean is about 88,000 euros, while the value for statutory widow(er) pensions wealth is 43,000 euros, and 24,000 euros for company widow(er) pensions.

To get a first impression of how the inclusion of widow(er) pension wealth reshapes the augmented wealth distribution, Figure 7 plots the decile-specific average widow(er) pension wealth across the deciles of the net worth and augmented wealth distributions. The sum of the three types of pension wealth increases over the net worth deciles from about 5,000 euros in the bottom to about 16,000 euros in the top decile. Sorted by augmented wealth, we find an increase from the bottom to the eighth decile, and a decrease thereafter.

Because of the low incidence of widow(er) pensions and their minor share in augmented wealth, we expect to find a small effect of their inclusion on overall inequality. Table 8 confirms this. For the total population, the Gini coefficient of

TABLE 7

MEDIAN AND MEAN WEALTH BY WEALTH AGGREGATE

Wealth aggregate	Median (in euros)	Mean (in euros)	Cond. Mean (in euros)	Fraction (in %)
	Total population		Individuals with positive wealth in respective component	
Augmented wealth from	107,392	176,789	188,959	93.85
own entitlements		(2,370)	(2,429)	(0.30)
Widow(er)-Pension wealth				
- Total	0	9,910	50,616	19.58
		(298)	(1,167)	(0.36)
- Statutory	0	7,792	42,979	18.13
		(248)	(1,025)	(0.35)
- Civil servant	0	1,418	87,725	1.62
		(147)	(6,497)	(0.10)
- Company	0	700	23,878	2.93
		(48)	(1,396)	(0.14)
Augmented wealth including	120,219	186,698	199,185	94.00
widow(er)-pension wealth		(2,389)	(2,448)	(0.30)

Note: Medians based on first imputation (for robustness over imputations, see Table A2). For all other statistics, results based on multiple imputed data and 200 bootstrap replicate weights; standard deviation in parentheses.

Source: SOEPv30, persons living in private households age 18 and above in 2013 and respondents of the 2012 and 2013 waves.
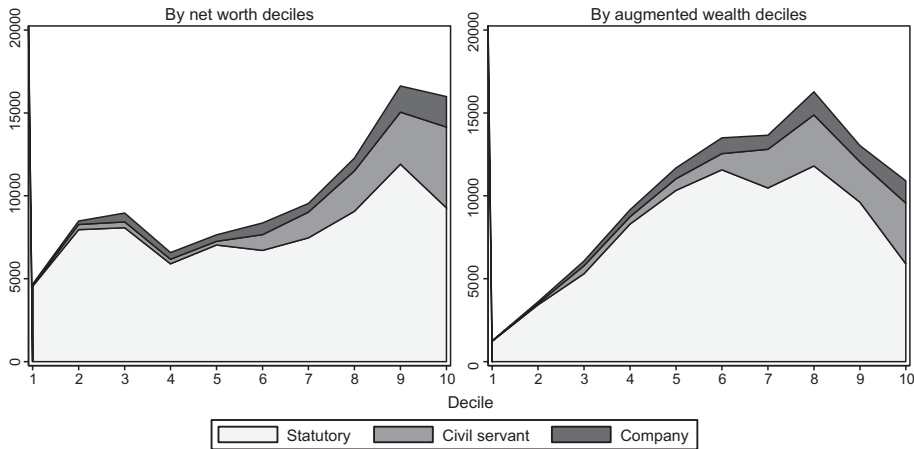
Figure 7. Widow(er) pensions wealth along the wealth distribution (in euros).

Note: Deciles of respective wealth aggregate without widow(er) pension wealth. Results based on multiple imputed data.

Source: SOEPv30, persons living in private households age 18 and above in 2013 and respondents of the 2012 and 2013 waves.

augmented wealth declines slightly from 0.594 to 0.582 due to the consideration of widow(er) pension wealth, indicating that widow(er) pension wealth contributes to mitigating wealth inequalities when looking at individual distributions. Because of the low incidence, all types of widow(er) pensions are highly unequally distributed, with Gini coefficients exceeding 0.9. However, for the eligible persons, the distribution of each widow(er) pension wealth component resembles the respective one from own entitlements.

7. LIMITATIONS OF OUR ANALYSIS

Our analysis builds on survey data. For wealth analyses, such data suffer from two potential limitations. One is the non-inclusion of wealth components: net worth in SOEP includes collectables such as jewelry, classic cars, art, and antiques, but neither durable commodities nor cash. Another potential limitation is the under-coverage of the very top of the distribution, an intensely debated topic, especially in the context of the literature on the top 1 or 0.1 percent. Influential studies from this literature include Alvaredo et al. (2013); Atkinson et al. (2011); Piketty et al. (2006), Piketty and Saez (2006) and Piketty and Zucman (2014). Because of the under-coverage problem, this literature usually relies on administrative income tax records. Under-coverage of the very wealthy is also an issue in SOEP. Although SOEP explicitly aims to cover the top of the distribution by means of the "high-income sub-sample," sample G, the wealthiest person in our sample has a net worth of about 60 million euros in 2012 alone.

Both the non-inclusion problem and the under-coverage problem imply an underestimation of the actual level of net worth in Germany. For net worth inequalities, the non-inclusion of some wealth aggregates has ambiguous effects, with the

TABLE 8
INEQUALITY OF WEALTH AGGREGATES

Wealth aggregate	Total population		Population with positive wealth component	
Widow(er)-Pension wealth	Gini		Conditional Gini	
- Total	0.909	(0.002)	0.535	(0.008)
- Statutory	0.914	(0.002)	0.523	(0.008)
- Civil servant	0.992	(0.001)	0.490	(0.022)
- Company	0.989	(0.001)	0.639	(0.014)
Augmented wealth including widow(er) pension wealth	0.582	(0.006)	0.551	(0.005)

Note: All results based on multiple imputed data and 200 bootstrap replicate weights; standard deviation in parentheses.
Source: SOEPv30, persons living in private households age 18 and above in 2013 and respondents of the 2012 and 2013 waves.

direction and size of the effect depending on the correlation between non-included and included wealth components. The focal point of our analysis, however, is the inclusion of pension wealth in wealth analysis. For pension wealth, both problems should play a negligible role, at least in Germany. This is because pension entitlements are closely connected to earnings, but an assessment ceiling limits the maximum pension entitlement. Hence, neither problem should have severe effects on our estimates of pension wealth. Indeed, we have shown in the above analyses that average pension entitlements according to SOEP and according to official statistics from administrative pension data do not differ statistically.

For the reasons above, we are confident that the general conclusions of the paper are correct: pension wealth is an important component of households' material resources and the incorporation of pension wealth into a broader wealth concept implies a sizeable reduction in measured wealth inequalities. Nevertheless, it is worthwhile to get a more precise idea of the potential biases in net worth.

One possible means of quantitatively assessing the underestimation of wealth in survey data is to compare the derived wealth distribution with the distribution from alternative datasets such as administrative microdata that should not suffer from under-coverage at the top. Administrative data have other limitations. As an example, coverage and valuation of the assets may be affected by tax avoidance, particular valuation rules in the tax law, and tax evasion. Regarding potential biases from valuation rules, Bönke et al. (2007), for example, show that for Germany, the ranking of household units by taxable income differs from a ranking based on total household income. As another example, tax-exempted parts of the population—e.g. those with low wealth or income—are not included, implying incomplete coverage at the bottom. Nevertheless, administrative wealth microdata are not available in Germany. Indeed, the availability of such data has further declined since the suspension of the wealth tax in Germany 1997 and the introduction of a flat withholding tax on capital income in 2009. Before that, capital incomes of the rich were part of the income tax base, and the underlying level of wealth could be approximated under assumptions about the interest rate, for instance. As a result,

in Germany, administrative micro or register data on individual net worth of the rich (or capital incomes) are not available.

Another option for assessing the underestimation problem is to compare aggregate net worth from SOEP with aggregates from the National Accounts. Grabka and Westermeier (2015b) find net worth in SOEP is about 36 percent lower than in National Accounts. However, it is difficult to compare the two derived aggregate figures for several reasons (Grabka and Westermeier, 2015b). First, while SOEP surveys private households only, the National Accounts figures cover both private households and non-profit organizations (e.g. churches, unions, foundations, etc.). Second, the value of real estate and other wealth components in SOEP is reported in current market values as opposed to the replacement costs used in the National Accounts. Grabka and Westermeier (2015b) show that inter-temporal changes in property wealth according to SOEP closely track property price indices from the Federal Statistical Office. It is unclear how much of the 36 percent gap is due to non-comparability or actual underestimation problems in SOEP.

A third option is to compare net worth from SOEP with data from other micro surveys. The German part of the Eurosystem's Household Finance and Consumption Survey (HFCS), the German Panel on Household Finances (PHF), appears to be a most suitable candidate, as it aims at oversampling wealthy households. A comparison reveals that SOEP- and PHF-based net-worth distributions are very similar, except in the top percentile (Westermeier and Grabka, 2015).

A fourth option is to impute the top percentiles of the SOEP wealth distribution. For example, Westermeier and Grabka (2015) assume that the upper tail of the net worth distribution follows the Pareto law, and use the Forbes World's Billionaires List for Germany to estimate the Pareto coefficient. Then they impute the upper tail in SOEP. They show that the Gini coefficient from actual household net worth in SOEP is about 0.75 and about 0.8 after the imputation. To be valid, this procedure requires several assumptions: 1) the Forbes list must be complete and the reported numbers must be valid, which may be disputed as the list is derived from publicly available data assembled by journalists; 2) the lower bound for the Pareto distribution must be determined (usually on an ad hoc basis); 3) the size of the missing population is unknown and must be determined by the researcher (in particular, it is unclear to what extent the missing population overlaps with the Forbes list). The measurement error arising from the missing information and required working assumptions is unknown.

In general, underestimation of wealth among the very rich is an issue in surveys like SOEP. At the same time, we believe that this should not discourage researchers from investigating what happens among the "bottom 99 percent"—particularly as long as no superior alternative datasets are available, at least in Germany.

8. Conclusion

To our knowledge, this is the first analysis of wealth inequalities in Germany that considers the pension wealth of the entire retired and non-retired German population. Our results show that the consideration of pension wealth has important implications for the distribution and level of wealth. In Germany, augmented

wealth inequality, as measured by the Gini coefficient, is about one quarter lower than that of net worth. Further, median augmented wealth is about six times larger than median net worth, whereas the mean is only twice as high due to the high concentration of pension wealth in the lower half of the net worth distribution: up to the 4th decile, pension wealth accounts for more than 90 percent of augmented wealth. Finally, our findings confirm the typical pattern of wealth accumulation processes over the working career, with the highest wealth levels being reached around retirement age. Thereafter, augmented wealth decreases slightly on average. This life-cycle pattern can be observed in both East and West Germany, although at a much higher level in the latter region.

When interpreting these results, the data-related issues discussed in Section 7 should be kept in mind. Further, one should not forget that pension entitlements cannot be easily traded or used as collateral. Further, there is no standard market interest rate (such as interest and dividends from capital) and there are limits to bequeathing (which goes beyond survivors' pensions). This means that pension wealth might not be a perfect substitute for financial or real wealth. At the same time, numerous previous works demonstrate a negative relationship between the generosity of public pension schemes and private savings (and wealth accumulation). Thus, comparisons of standard wealth measures across countries with pensions systems with different levels of generosity might fail to appropriately capture individual overall material resources.

While the OECD abstains from considering pension wealth in their wealth analyses, primarily for practical reasons (OECD, 2013a, p. 71), our analysis should encourage data providers to include measures of pension wealth in their databases. In light of the significant recent pension reforms that have taken place in nearly all OECD countries, typically increasing the relevance of private provision and shifting from defined benefits to defined contributions, this will be important in allowing for rigorous cross-country comparisons of wealth levels.

References

Alessie, R., Angelini, V. and van Santen, P., "Pension Wealth and Household Savings in Europe: Evidence from Sharelife," *Sveriges Riksbank Working Paper Series*, 265, 2013.

Alessie, R., Angelini, V. and van Santen, P., "Pension Wealth and Household Saving in Europe. Evidence from SHARELIFE," NETSPAR discussion papers, 10/2011-088, 2011.

Alvaredo, F., Atkinson, A.B., Piketty, T. and Saez, E., "The Top 1 Percent in International and Historical Perspective," *Journal of Economic Perspectives*, 27, 3–20, 2013.

Arbeitsgemeinschaft berufsständischer Versorgungseinrichtungen e.V. (ABV), *Daten und Fakten*, https://www.abv.de/verlaessliche-struktur.html, 2016

Atkinson, A.B., *Inequality—What Can be Done?* Harvard University Press, Harvard, MA, 2015.

Atkinson, A.B., Piketty, T. and Saez, E., "Top Incomes in the Long Run of History," *Journal of Economic Literature*, 49, 3–71, 2011.

Attanasio, O. and Rohwedder, S., "Pension Wealth and Household Saving: Evidence from Pension Reforms in the UK," *Institute for Fiscal Studies*, WP01/21, 2001.

Beckers, B., Himmelreicher, R.K. and Schröder, C., "The Evolution of Tangibles, Financial and Social Security Wealth over the Lifecycle: Estimates for Germany," *Historical Social Research*, 37, 165–184, 2012.

Berkel, B. and Börsch-Supan, A.B., "Pension Reform in Germany: The Impact on Retirement Decisions," *Public Finance Analysis*, 60, 393–421, 2004.

BMAS (Bundesministerium für Arbeit und Soziales), Ergänzender Bericht der Bundesregierung zum Rentenversicherungsbericht 2012 gemäß § 154 Abs. 2 SGB VI (Alterssicherungsbericht 2012), 2012a.

———, *Verbreitung der Altersversorge 2011. Endbericht*, 2012b.

BMFSFJ (Bundesministerium fuer Familie, Senioren, Frauen und Jugend), *Pay Inequality between Woman and Men in Germany*. Germany, 2009.

Bönke, T., Neher, F. and Schröder, C., "Bestimmung ökonomischer Einkommen und effektiver Einkommensteuerbelastungen mit der Faktisch Anonymisierten Lohn- und Einkommensteuerstatistik," *Journal of Applied Social Science Studies*, 127, 585–623, 2007.

Börsch-Supan, A.B., "Incentive Effects of Social Security on Labor Force Participation: Evidence in Germany and Across Europe," *Journal of Public Economics*, 78, 25–49, 2000.

Bottazzi, R., Jappelli, T. and Padula, M., "Retirement Expectations, Pension Reforms, and their Impact on Private Wealth Accumulation," *Journal of Public Economics*, 90, 2187–212, 2006.

Braakmann, A. and Haug, T., "Das Renten- und Pensionsvermögen in den Volkswirtschaftlichen Gesamtrechnungen," *Wirtschaft und Statistik*, 12, 1167–79, 2007.

Chetty, R., Friedman, J.N., Leth-Petersen, S., Nielsen, T.H. and Olsen, T., "Subsidies vs. Nudges: Which Policies Increase Saving the Most?,"Tech. Rep Center for Retirement Research, 2013.

Coppola, M. and Reil-Held, A., "Dynamik der Riester-Rente: Ergebnisse aus SAVE 2003 bis 2008," Mannheim Research Institute for the Economics of Aging, 2009.

Corneo, G., Keese, M. and Schröder, C., "The Effect of Saving Subsidies on Household Saving-Evidence from Germany," *Ruhr Economic Paper*, 170, 2010.

———, "The Riester Scheme and Private Savings: An Empirical Analysis based on the German SOEP," *Schmollers Jahrbuch: Journal of Applied Social Science Studies/Zeitschrift für Wirtschafts-und Sozialwissenschaften*, 129, 321–32, 2009.

Deutsche Rentenversicherung Bund, *Rentenversicherung in Zahlen 2015,* 2015.

Dicks-Mireaux, L., "Pension Wealth and Household Savings: Tests of Robustness," *Journal of Public Economics*, 23, 115–39, 1984.

ECB, "The Household Finance and Consumption Survey: Results from the Second Wave, Household Finance and Consumption Network," *Statistics Paper Series*, 18, 2016.

———, The Eurosystem Household Finance and Consumption Survey: Statistical Tables, 2013.

Engen, E.M., Gale, W.G. and Scholz, J.K., "The Illusory Effects of Saving Incentives on Saving," *The Journal of Economic Perspectives*, 113–38, 1996.

Federal Statistical Office, Wirtschaftsrechnungen. Einkommens- und Verbrauchsstichprobe. Geld- und Immobilienvermögen sowie Schulden privater Haushalte. *Fachserie*, 15, 2, 2014.

———, "Finanzen und Steuern. Personal des öffentlichen Dienstes," *Fachserie*, 14, 6, 2015a.

———, *Allgemeine Sterbetafeln für Deutschland, 2010/12*, 2015b.

Frick, J.R. and Grabka, M.M., "Old-Age Pension Entitlements Mitigate Inequality—but Concentration of Wealth Remains High," *DIW Berlin Weekly Report*, 8, 55–64, 2010.

Frick, J.R. and Grabka, M.M., "Public, Pension Entitlements and the Distribution of Wealth," in J.C. Gornick and M. Jäntti, eds, *Income Inequality: Economic Disparities and the Middle Class in Affluent Countries*. Stanford University Press, Stanford, CA, 362–88, 2013.

Frick, J.R. and Headey, B., "Living Standards in Retirement: Accepted International Comparisons are Misleading," *Schmollers Jahrbuch: Journal of Applied Social Science Studies/Zeitschrift für Wirtschafts-und Sozialwissenschaften*, 129, 309–19, 2009.

Fuchs-Schündeln, N. and Schündeln, M., "Precautionary Savings and Self-Selection: Evidence from the German Reunification Experiment," *Quarterly Journal of Economics*, 120, 1085–120, 2005.

German Statutory Pension Insurance, *Versichertenstatistik (Table: Tabelle: 015.30)*, 2016.

Grabka, M.M., *Zwischen Bürgerversicherung und Pauschalprämie. Die künftige Finanzierung der Krankenversicherung in Deutschland,* VDM Verlag Dr. Müller, 2007.

Grabka, M.M. and Westermeier, C., "Editing and Multiple Imputation of Item Non-response in the Wealth Module of the German Socio-Economic Panel," SOEP Survey Papers Series C-Data Documentation, 272, 2015a.

———, "Reale Nettovermögen der Privathaushalte in Deutschland sind von 2003 bis 2013 geschrumpft," *DIW Wochenbericht*, 34/2015, 727–38, 2015b.

———, "Persistently High Wealth Inequality in Germany," *DIW Economic Bulletin*, 6, 3–16, 2014.

Gustman, L.A. and Steinmeier, T.L., "Effects of Pensions on Savings: Analysis with Data from the Health and Retirement Study," *Carnegie-Rochester Conference Series on Public Policy*, 50, 271–324, 1999.

Hurd, M., Michaud, P.-C. and Rohwedder, S., "The Displacement Effect of Public Pensions on the Accumulation of Financial Assets," *Fiscal Studies*, 33, 107–28, 2012.

IMF, "Causes and Consequences of Income Inequality: A Global Perspective (prepared by Era Dabla-Norris, Kalpana Kochhar, Frantisek Ricka, Nujin Suphaphiphat, and Evridiki Tsounta)," *International Monetary Fund, Staff Discussion Notes*, 15(13), 2015.

Lerman, R.I. and Yitzhaki, S., "Income Inequality Effects by Income," *The Review of Economics and Statistics*, 67, 151–6, 1985.

McGarry, K.M. and Davenport, A., "Pensions and the Distribution of Wealth," in D.A.Wise ed., *Frontiers in the Economics of Aging*, University of Chicago Press, Chicago, CA, 463–86, 1998.

OECD, *In it Together, Why Less Inequality Benefits All*, Paris, 2015a.

———, *Pension at a Glance*. Paris, 2015b.

———, *OECD Guidelines for Micro Statistics on Household Wealth*, OECD Publishing, 2013a.

———, *Pension at a Glance*. Paris, 2013b.

Pfarr, C. and Schneider, U., "Anreizeffekte und Angebotsinduzierung im Rahmen der Riester-Rente: Eine empirische Analyse geschlechts-und sozialisationsbedingter Unterschiede," *Perspektiven der Wirtschaftspolitik*, 12, 27–46, 2011.

Piketty, T., Postel-Vinay, G. and Rosenthal, J.-L., "Wealth Concentration in a Developing Economy: Paris and France, 1807–1994," *American Economic Review*, 96, 236–56, 2006.

Piketty, T. and Saez, E., "The Evolution of Top Incomes: A Historical and International Perspective," *American Economic Review*, 96, 200–5, 2006.

Piketty, T. and Zucman, G., "Capital is Back: Wealth-Income Ratios in Rich Countries 1700–2010," *The Quarterly Journal of Economics*, 129, 1255–310, 2014.

Rubin, D.B., *Multiple Imputation for Nonresponse in Surveys*, New York, Wiley, 1987.

Schenker, N. and Taylor, J.M.G., "Partially Parametric Techniques for Multiple Imputation," *Computational Statistics & Data Analysis*, 22, 425–46, 1996.

Shkolnikov, V.M., Scholz, R., Jdanov, D.A., Stegmann, M. and von Gaudecker, H.-M., "Length of Life and the Pensions of Five Million Retired German Men," *European Journal of Public Health*, 18, 264–69, 2008.

Shorrocks, A.F., "Inequality Decomposition by Factor Components," *Econometrica*, 50, 193–212, 1982.

Stiglitz, J., *The Price of Inequality*, W. W. Norton & Company, 2012.

Wagner, G.G., Frick, J.R. and Schupp, J., "The German Socio-Economic Panel Study (SOEP) – Scope, Evolution and Enhancements," *Journal of Applied Social Science Studies*, 127, 139–69, 2007.

Westermeier, C. and Grabka, M., "Große statistische Unsicherheit beim Anteil der Top-Vermögenden in Deutschland," *DIW Wochenbericht*, 82, 123–33, 2015.

Wolff, E.N., "U.S. Pensions in the 2000s: The Lost Decade?," *Review of Income and Wealth*, 61, 599–629, 2015.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publishers web-site:

Appendix:

Figure A1: Questionnaire --pension claims survey year 2013

Figure A2: Trace plots for predictive mean matching imputation, statutory pension entitlements, Source: SOEPv30.

Figure A3: Trace plots for predictive mean matching imputation, company pension entitlements, Source: SOEPv30.

Figure A4: QQ plots for exact vs. imputed values for statutory pension entitlements, Source: SOEPv30.

Figure A5: QQ plots for approximated vs. imputed values for statutory pension entitlements, Source: SOEPv30.

Figure A6: QQ plots for exact vs. imputed values for company pensions, Source: SOEPv30.

Figure A7: QQ plots for approximated vs. imputed values for company pensions, Source: SOEPv30.

Table A1: Wealth levels and inequality using alternative interest rates (total population)

Table A2: Robustness of median over imputations