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Beiträge zur Jahrestagung des Vereins für Socialpolitik 2018: Digitale Wirtschaft - Session: Public Economics I, No. C20-V3

Provided in Cooperation with:
Verein für Socialpolitik / German Economic Association

Suggested Citation: Klos, Jonas; Krieger, Tim; Stöwhase, Sven (2018) : A New Measure of Intra-generational Redistribution within PAYG Pension Schemes and its Application to German Micro-data, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2018: Digitale Wirtschaft - Session: Public Economics I, No. C20-V3, ZBW - Leibniz-Informationszentrum Wirtschaft, Kiel, Hamburg

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A New Measure of Intra-generational Redistribution within PAYG Pension Schemes and its Application to German Micro-data

Jonas Klos[1], Tim Krieger[2] & Sven Stöwhase[3]

Preliminary version – February 2018

Abstract:

This paper proposes a new Index for measuring intra-generational redistribution in PAYG pension schemes. This index solely requires information on contributions and pension benefits of retirees, eliminating the involvement of the contribution side in a PAYG pension scheme. As an application, we use contribution records of new German retirees to measure intra-generational redistribution in the German statutory pension scheme and the importance of certain additional benefits.

Keywords: PAYG pension systems; intra-generational redistribution; Beveridge vs. Bismarck; index; microdata; Germany

JEL Classification: H55, D31, C55

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1. Introduction

Demographic change and the ageing of societies have become major challenges to all industrialized countries. Pension reforms, especially in the first, pay-as-you-go (PAYG) financed pillar of public pension schemes, will therefore be unavoidable, but need to be backed by public acceptance and, ultimately, democratic support. Arguably, this support is stronger when pension reforms appear acceptable along two dimensions. First, the reforms need to balance the interests of the involved living, and possibly also yet unborn, generations, i.e., after the reform the pension system must still be seen as broadly *inter*-generationally fair.[1] Second, public pension systems are usually considered as a part of the broader public tax-transfer mechanism. Although controversial, the public and many politicians expect public pension systems to also redistribute *intra*-generationally, i.e., between different types of households of the same generation. Interestingly, the academic discourse focuses more on the first dimension; there is only a small literature that systematically investigates the politically highly relevant issue of intra-generational redistribution. Our paper aims at providing new insights on the relevance of *intra*-generational redistribution and the effects that even minor parametric reforms might have on it. We do so by introducing a new measure for intra-generational redistribution in PAYG pension schemes and apply it to micro-data from the German public pension system.

Public pension schemes differ according to the relationship between contributions and benefits. One polar case, sometimes called *Bismarckian* pension system (cf. Cremer and Pestieau 2003; Casamatta, Cremer and Pestieau 2000a,b), provides earnings-related benefits, where there is proportionality between earnings (and thus earnings-related contributions) during work-life and paid-out pension benefits after retirement. The other polar case assumes that there is no link at all between earnings and benefits, which is typically achieved by having flat benefits for every member of the pension scheme, regardless of one's personal level of contributions (or income-tax rates, given that these pension schemes are often tax-financed).[2] Pension schemes of this type may be labeled *Beveridgean.* Most real-world pension schemes are somewhere in-between these extremes, as Krieger and Traub (2011, 2013) show. This is because of the – above mentioned – fact that the majority of voters prefers some elements of redistribution even in traditionally Bismarckian pension schemes. A striking example, highlighting how intra-generational redistribution may enter a pension scheme, are benefits based on child-raising times, where mothers receive benefits *as if* they were working, although they did not.

Apparently, one approach to measure intra-generational redistribution in a public pension scheme is thus to identify benefits payments which are not backed by contribution payments, add them up and relate them to total benefits (as, e.g., in Börsch-Supan and Reil-Held 2001). However, not all benefits can be clearly identified as non-contribution backed. In order to overcome this problem, broader measures of intra-generational redistribution have been proposed. These measures include the "index of non-contributiveness" by Lefèbre and Pestieau (2006) and Lefèbre (2007), the "index of progressivity" by the OECD (2013), correlation analyses between individual contributions and individual pension entitlements as suggested by Stöwhase (2016), and the "Bismarckian factor" proposed by Krieger and Traub (2008, 2011, 2013). While all of these measures work in theory, they are difficult to employ empirically unless rather strong assumptions are applied. For instance, if it is assumed that the income distribution does not change over time, this would allow to compare different generations (i.e., workers and pensions) at the same point of time. In Krieger and Traub's works this makes it possible to use data on distributions of incomes and retirement benefits as

[1] While potential "generational conflict" is a topic in public debate and academic discourse, the existing empirical evidence in its favor is not overly robust (for a summary of evidence cf., e.g., Krieger and Ruhose 2013).

[2] Due to the larger degree of redistribution, Beveridgean pension schemes are typically smaller (less generous) in absolute terms than Bimarckian pension schemes (cf. Conde-Ruiz and Profeta 2007).

provided by the Luxembourg Income Study (LIS).[3] Let us delegate a closer inspection of the existing measures to the next section of this paper.

Our own measures of intra-generational redistribution in pension systems takes a different avenue, as we are able to make use of a rich data-set on individual earnings histories from the German public pension system.[4] In a first step, we propose theoretically a new index measure of intra-generational redistribution. This measure relates work-life contributions to the pension scheme and the resulting benefit entitlements to a benchmark, which rests on the ratio of two hypothetical benefit distributions resulting from idealized Beveridgean and Bismarckian pension systems. The construction of our measure resembles broadly the construction of Lorenz curves and the Gini coefficient, however we also take concepts for measuring inequality in tax systems like the SUITS index (Suits, 1977) into account.

Our paper is structured as follows. Chapter 2 discusses existing measures of Intra-Generational Redistribution and derives the proposed index. Chapter 3 presents an empirical application of the index on micro-data of German retirees and Chapter 4 concludes.

2. Measuring Intra-Generational Redistribution

2.1 Existing Measures of Intra-Generational Redistribution

As stated above, there exists only a limited number of measures that allow for a comparison of intra-generational redistribution over time, between countries, or even between specific subgroups of a population. One of these measures is the "index of non-contributiveness" (INC) introduced by Lefèbre and Pestieau (2006) and Lefèbre (2007). INC, denoted by β^{INC}, is defined as the ratio of the income share of public pensions in the bottom quintile, B, to the same share in the top quintile, T:

$$\beta^{INC} \equiv \frac{P_B/Y_B}{P_T/Y_T} = \frac{P_B}{P_T}/\frac{Y_B}{Y_T}, \tag{1}$$

where Y_i and P_i, $i \in \{B, 2,3,4, T\}$, are the mean income and the mean pension benefit, respectively, of the ith quintile of the income distribution. A pure Beveridgean pension system with equal benefits for all retirees implies $P_B/P_T = 1$ and hence $\beta = 1/(Y_B/Y_T) > 1$. A purely Bismarckian system which relates benefits solely on previous earnings would yield $P_B/Y_B = P_T/Y_T$ and therefore $\beta = 1$. Although it is possible to normalize this measure to fit into the $[0,1]$ interval (cf. Krieger and Traub, 2013), there are some obvious disadvantages for the measurement of intra-generational redistribution.

First, considering only the ratio between the top quintil and the bottom quintil of the income distribution, potentially one loses important information contained in the complete income distribution.[5] Second, the INC compares two completely different generations with each other, the working population and the pensioners, thereby implicitly assuming that the income distribution does not change from generation to generation. The same needs to be assumed for any redistributive measures introduced by governments at different times. Clearly, neither can be taken for granted. A suitable measure should rather compare the

[3] LIS is not a panel but rather a collection of independently sampled waves. This implies that one cannot resort to individual earnings histories.

[4] Note that the downside of our approach is that we are not able to compare pension schemes of different countries, as, e.g., those papers can which employ LIS data.

[5] For instance, if pension benefits are calculated differently at different income levels, INC will be biased. Consider a Bismarckian pension scheme that covers the middle class only, i.e., there is a tight link earnings and benefits in the second, third and fourth quintile, while at the bottom and the top of the distribution only a flat minimum benefit is received. Then, $\beta^{INC} > 1$ since $P_B/P_T = 1$. For the middle-class members of the scheme (ignoring the third quintil for simplicity), we have $\beta_{2,4}^{INC} = 1$ since $P_2/P_4 = Y_2/Y_4$. Hence, since $\beta^{INC} > \beta_{2,4}^{INC} = 1$, the INC based on B and T only obviously lacks complete information.

benefits of current retirees with their previous contributions, which then includes intra-generationally redistributive measures during work-life. As a consequence, it is preferable to consider individual contributions and benefits at the micro level.

The "index of progressivity" (IOP) as applied by the OECD in its publications on pension politics (OECD 2013) resolves the first, but not the second disadvantage. IOP, denoted by γ^{IOP}, relates inequality in pension benefits to inequality in earnings:

$$\gamma^{IOP} \equiv 1 - \frac{G_P}{G_Y}, \tag{2}$$

where $G_P = 1/2\bar{P}n^2 \sum_{i=1}^{n} \sum_{j=1}^{n} (P_i - P_j)$ and $G_Y = 1/2\bar{Y}m^2 \sum_{k=1}^{m} \sum_{l=1}^{m} (Y_k - Y_l)$ are the Gini coefficients of pensions and earnings, respectively, $\bar{P}$ and $\bar{Y}$ are mean pensions and mean earnings, n the number of pensioners, and m the number of employees. In a pure Bismarckian pension scheme, $\gamma^{IOP} = 0$ since $G_P = G_Y$. In contrast, in a Beveridgean scheme $\gamma^{IOP} = 1$ because $G_P = 0$. Compared to INC, the IOP makes use of the complete distribution of both pension benefits and earnings. However, this measure still relates current pensions to current earnings without linking individuals' contributions and pension entitlements.

If information on both contributions c_i and pension entitlements p_i for all individuals i, $i = 1, \dots, N$, is available, a simple alternative to the above measures could be a correlation analysis. Stöwhase (2016) calculates the coefficient of correlation of a contribution vector $C = \{c_1, c_2, \dots, c_n\}$ and a benefit vector $P = \{p_1, p_2, \dots, p_n\}$ for all N pensioners. While it is straightforward that a pure Bismarckian system implies $corr(C, P) = 1$, a measure that is exclusively based on this correlation suffers from the problem that it cannot be normalized. This is because in a Bevedirgean pension scheme its value would depend on the distribution of pension benefits P, which is not accounted for. Hence, any $corr(C, P) \neq 1$ is hard to interpret. However, the measure of correlation could be a good starting point for developing a new measure of intra-generational redistribution if a normalization will be possible.

2.2 Introducing a New Measure of Intra-Generational Redistribution

In order to introduce our new measure of intra-generational redistribution, we assume a population consisting of two groups at time t: N retirees, indexed and ordered by $i \in \{1,2, \dots, n\}$, and K working-age contributors, indexed and ordered by $j \in \{1,2, \dots, k\}$. Until her retirement, each individual i has personally paid a certain amount of e_i into a country's pension scheme system and are defined as:

$$e_i = \sum_{l=1}^{m} Y_l^i \lambda_l \ , \ m \leq t,^{6} \tag{3}$$

with m representing the time of retirement, Y representing personal income respectively the contribution assessment basis, and λ being the contribution rate that has to be paid in each period. This sum of own contributions is used to calculate the personal pension entitlement PE_i. Using (3), we can define entitlements for either the Beveridgean or the Bismarckian pension system:

[6] Note that $m \leq t$ ensures that the individual has retired in the past or in the most recent period t. That is, we consider current pensioners only at this stage.

Beveridge: $PE_i^{Bev} = \frac{\sum_{i=1}^{n} e_i}{N}\ \delta,$ (4)

Bismarck: $PE_i^{Bis} = e_i\delta,$ (5)

where PE_i represents the pension entitlement of individual i and δ is a measure of generosity, which indicates how contributions e_i are valued. More generally speaking, the generosity measure indicates the level of redistribution between generations (Krieger and Traub 2013). It depends on the development of societal key indicators like income or demography in the long run, while it is often decided upon by legislators in the short run (thereby ignoring – in a non-sustainable manner – their decision's long-run implications). For the sake of convenience, we assume that δ is not varying over time. Eq. (4) represents an idealized Beveridgean pension scheme, in which the total sum of contributions is evenly distributed and each individual is awarded the same entitlement. Equation (5) is designed as an idealized Bismarckian system, where each individual's pension entitlement is solely depending on her own past contributions.

Next, we define the actual pension system:

$$PE_i^{PS} = G(e_i, x_i)\delta \quad (6)$$

$$\sum_{i=1}^{N} G_t(e_i, x_i)\delta = \sum_{j=1}^{K} Y_t^j \lambda_t + SG_t \quad (7)$$

Eq. (6) represents how personal entitlements are calculated in the actual pension scheme. The individual pension entitlement depends on own contributions e_i as well as other individual factors x_i. How these factors are valued depends on the actual (redistributive) design of the pension scheme represented by function $G(\cdot)$. Equation (7) is the budget constraint of the pension scheme. The sum of pension entitlements is funded by the sum of contribution payments of all contributors and a state grant SG that may subsidize the pension scheme.

Equations (6) and (7) indicate legislators' various options for modifications, or reforms, of the pension scheme: the state grant and the contribution rate could be adjusted; the contribution assessment basis could be changed; or the group of contributors could be adjusted. However, these options only affect *inter*-generational redistribution. Regarding *intra*-generational redistribution, legislators only have the option to modify the redistribution function $G(\cdot)$. For instance, the importance of own contributions e in determining pension entitlements could be shifted relative to the influence of individual factors x. This will change the degree of intra-generational redistribution for the current group of retirees. Note that the fact that intra-generational redistribution is affected only through $G(\cdot)$ allows us to drop Eq. (7) in the following. More specifically, in order to measure intra-generational redistribution, only information regarding contributions and individual factors as well as the functional form of $G(\cdot)$ are required to calculate equations (4)-(6).

As a next step, we define $F_E(e)$ as a cumulative distribution function of PE depending on e with corresponding density function $f_E(e)$. We normalize the distribution of e to the interval from 0 to 1. Since we are only interested in the distribution of e in equations (4)-(6), we can drop the constant generosity measure β. This yields the following equations:

Beveridge: $F_E^{Bev}(e) = \int_0^1 f_E^{Bev}(e)de := Bev(e)$ (8)

Bismarck: $F_E^{Bis}(e) = \int_0^1 f_E^{Bis}(e)de := Bis(e)$ (9)

Actual pension system: $F_E^{PS}(e) = \int_0^1 f_E^{PS}(e)de := PS(e)$ (10)

Using Equations (8)-(10), we can define our index of intra-generational redistribution as follows:

$$R = \frac{PS(e) - Bis(e)}{Bev(e) - Bis(e)} \tag{11}$$

Our index measures intra-generational redistribution by relating contributions and the resulting entitlements to a benchmark, which rests on the ratio of the two hypothetical distributions of the idealized Bismarckian and Beveridgean pension schemes. It is closely related to standard measures of inequality, in particular Lorenz curves and the Gini coefficient, which should generally satisfy four main criteria that are briefly discussed below.

R satisfies the condition of scale or mean independence. If all own contributions and pension entitlements were doubled, R remains unchanged. The applied normalization ensures that R is not dependent on the size of the retiree population, meaning that N has no direct effect on R. The order of individuals depends solely on contributions, which satisfies the criterion of symmetry. The transfer of pension entitlements from retirees with high contributions to those with lower contributions increases the index, meaning that R moves towards the Beveridgean benchmark of entirely equalized benefits. Therefore, the index also satisfies the criterion of the Pigou-Dalton transfer sensitivity.

Another desirable feature of an inequality measure is decomposability, meaning that the index can be calculated for different subgroups. The index also satisfies this criterion, since pension entitlements are always measured depending on any subgroup's own contributions. Note, however, that even though the index allows for decompositions, the sum of index values for different subgroups does not yield the index value of the entire population.

Our index yields 0 for the Bismarckian or 1 for the Beveridgean benchmark, but it is not confined to this range. For example, pension systems that are more restrictive than an idealized Bismarck system (e.g., if they redistribute regressively) would yield a negative index value. It is also possible, that $PS(e)$ intersects $Bis(e)$ (possibly, even more than once). In this case, it might be, that the calculation results in $PS(e) = Bis(e)$ and the index would yield a value of 0, although redistribution occurs. Values greater than 1 are feasible, if the underlying pension system is extremely generous, such that $PS(e)$ intersects or lies above $Bev(e)$. This is also possible, if all retirees have very small own contributions such that $Bev(e)$ is not sufficient to provide basic welfare.

For a better understanding, Figure 1 presents a graphical approach to derive Index R. Using normalized values for a given sample population of retirees, Quadrat I relates own contributions to pension entitlements. In this depiction, the first benchmark, an idealized Bismarck system as defined in equation (9), is represented by the bisector of Quadrant I. In this benchmark system pension entitlements are solely depending on own contributions, thereby strictly adhering to the principle of equivalence. Equation (8), the beverdigian benchmark, is derived via Quadrants II-IV. Quadrant III represents the distribution of own contributions with the horizontal axis depicting the number of retirees, ordered and normalized by contributions. The resulting curve represents the composition of the underlying sample population and consequently the income distribution and the contribution scheme prior to retirement. If contributions are determined via proportional contribution rates, a curve with a sharp increase in the upper parts of the retiree distribution would therefore be a representation of unevenly distributed incomes. A steadily increasing curve would be the result of a population with evenly distributed incomes. Note that such a curve could also occur, if the underlying pension scheme would not utilize a proportional contribution rate but a flat contribution. The distribution of Quadrant III has now to be converted to Quadrant I to receive the desired second benchmark. This is achieved via Quadrants II and IV. Contributions are mirrored to Quadrant I via Quadrant IV, while the required pension entitlements are determined and transferred via Quadrant II. The second

quadrant relates the cumulated number of retirees to cumulated pension entitlements. Therefore, the bisection of this quadrant represents the idealized Beveridge system of Equation (8) because every sample member receives exactly the same pension entitlements. After constructing the two benchmarks, the actual pension entitlements of the retirees can used to construct the curve that represents the pension system in Quadrant I. The principle of index R is now, that it measures how much the curve of the pension system is trending towards one of the two benchmarks. Using Figure 1 equations (8)-(10) can be represented as the areas of Quadrant I:

$$Beveridge: A + B + C$$

$$Bismarck: A$$

$$Pension\ System: A + B$$

Therefore we can write equation (11) as:

$$\frac{A + B - A}{A + B + C - A} = \frac{B}{B + C}$$

If the actual pension system would be situated directly in the middle between the Bismarck and Beveridge curves, meaning area B would be exactly half of B+C, then our index would yield a value of 0.5.

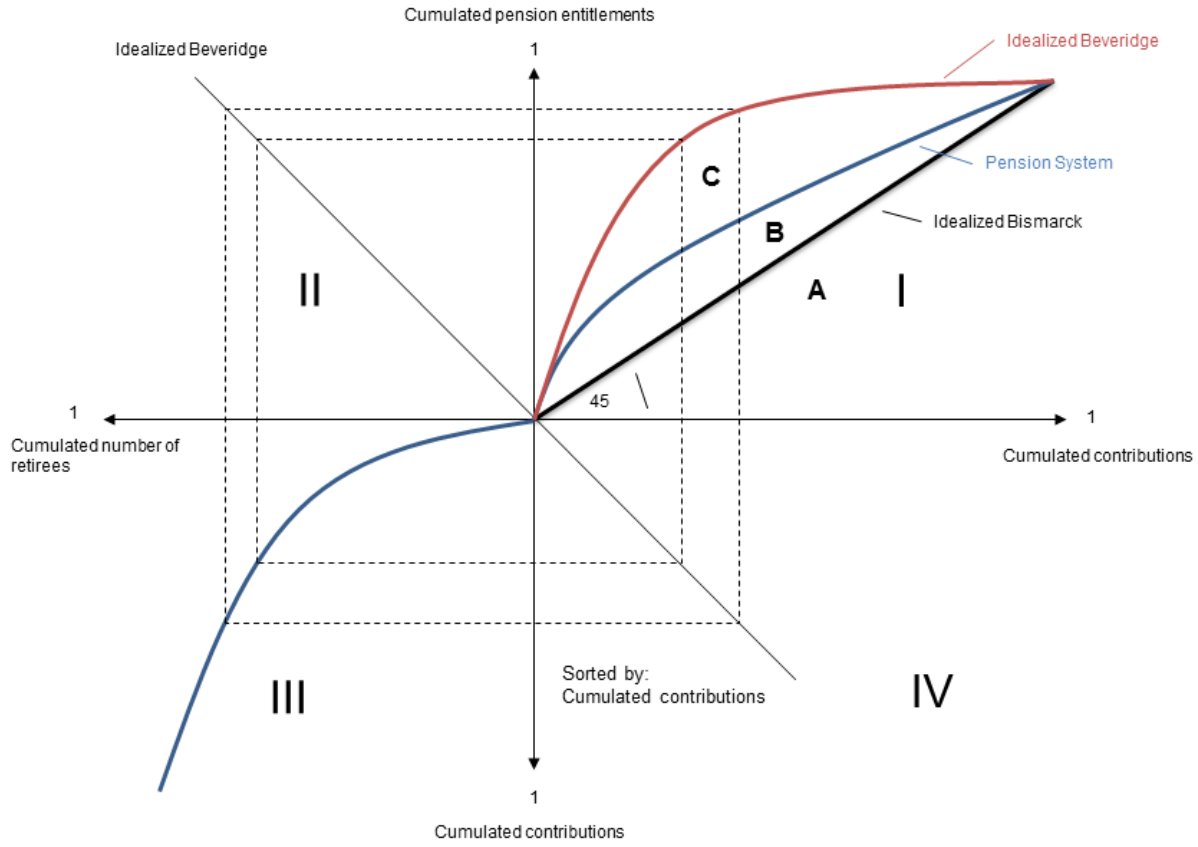

Figure 1: Graphical derivation of Index R

3. Empirical application on German contribution records.

3.1 The German old-age pension system

The German statutory pension plan is designed as an earning related pay-as-you-go scheme based on the principle of equivalence. Regular old-age pensions can be claimed at the statutory retirement age which is as of now gradually increasing form 65 to 67 for individuals born after 1964. Furthermore, a minimum of five years with paid contributions is required to be entitled for an old-age pension.

Equivalence is achieved by income related earning points. Contributing at the average earnings of all contributors in a certain year yields one earning point. Contributions above and below the average yield the corresponding fraction of an earning point - e.g. earning half the average will result in 0.5 points. The sum of earning points forms the basis for determining pension claims at retirement. This design is of strong Bismarckian character, because these derived claims are solely depending on own contributions. Furthermore, additional non-earning related pension points can be awarded. These are primarily those listed in Table 1.

Additional benefits
Compensation for war victims of World War II
Periods of childcare and domestic care
Periods of education, unemployment, illness or other work-related circumstances
Early retirement
Minimum pension
Pension adjustments due to German reunification
Miscellaneous

Table 1: Additional, non-earning related benefits

Additionally, earning points can be deducted due to a settlement of pension entitlements in case of a divorce or due to pension claims in another country ("Vertragsrenten"). Due to the non-contribution relation, the extent of those additional benefits determines the intra-generational redistribution of the German statutory pension plan. At retirement, earning points are evaluated with a pension value resulting in the final pension entitlement.[7] This pension value is valid for all pensioners and is adjusted yearly regarding the development of gross wage growth and demographics.[8]

3.2 Data

We use data on new retirees (Versichertenrentenzugang) provided by the Research Data Centre of the German Pension Insurance from 2007 to 2015. The Research Data Centre offers cross-sectional and longitudinal datasets on individuals who are insured in the Federal Pension Insurance on an annual basis. Our data on new retirees is a 10 percent sample of

[7] The so called "pension formula" adjusts earning points also with an access factor, that measures early/ late retirement and with a pension type factor, that for example is applied for a widow's pension. In case of a regular old-age pension ("Regelaltersrente") these factors have the value 1.

[8] For a more detailed information about the German pension system see, for example, Boersch-Supan and Wilke (2004).

individuals that enter retirement in a certain year and provides sociodemographic and pension specific information. In 2015 this data compromises around 105,000 individuals.

3.3 Measuring Intra-Generational redistribution for new German pensioners

In the following section we will apply our measure R on data of pensioners that entered retirement in a certain year. We focus on new retirees, because developments and differences across several years of new retirees are more pronounced in contrast to looking at all pensions in payment. We focus on those new retirees that claim a regular old-age pension, which is the standard pension claim in the German Statutory Pension Insurance (GRV), to avoid distortions due to early retirement or invalidity.[9]

Since we are using data of the German Statutory Pension Insurance, we will use two primary reference values of the earning points system. Our measure for paid contributions is the sum of own earing points (EP) that an individual accumulated during its contribution period. Own earning points can only be earned by being employed and paying contributions. As described above one year of employment yields a certain number of earning points depending on the average gross income. In a pure Bismarckian pension system, these points would be the only relevant basis for a pension entitlement.

Regarding pension entitlements, we use the sum of personal earning points which is the final sum of earning points after adjustments. Personal earning points are defined as:

$$Personal\ EP = \underbrace{own\ EP}_{own\ contributions} + \underbrace{additional\ EP - deducted\ EP}_{not\ depending\ on\ own\ contributions} \tag{12}$$

Since we are looking at regular old-age pensions, personal earning points are the main determining factor of an individual's pension entitlement. There are regional differences due to German reunification, but these differences do only affect how the sum of personal earning points is valued or they are already corrected during the contribution phase.

[9] Early retirement generally results in a reduced pension entitlement depending on the years left to the statutory retirement age. Invalidity pensions are paid depending on a reduction in earning capacity before the statutory retirement age.

Figure 2 shows the results for new pensioners in 2015. The actual pension system as defined in equation (10) is represented by the GRV curve:

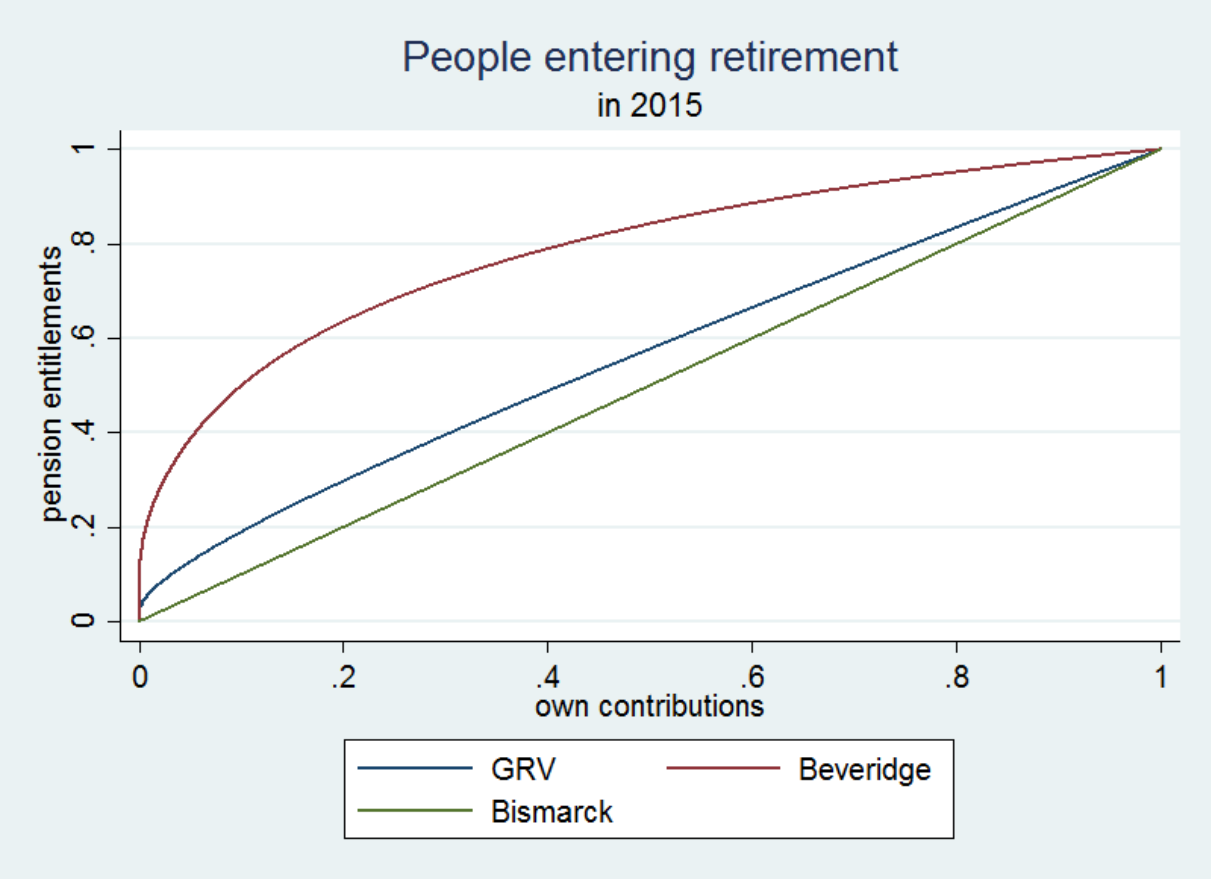

Figure 2: New retirees in 2015

As can be seen from the shape of the Beveridge curve, the majority of retirees are located in the lower 40 percent of the distribution of own earing points. Regarding the GRV curve, we find existing redistribution in terms of personal entitlements, that is especially pronounced in the lower half of the distribution of own contributions. Therefore, the corresponding value of R is different from zero with a value of around 0.23.

Figures 3 and 4 show the underlying curves depending on the sex of a new retiree. First of all, it can be seen, that the GRV curve is much closer to a Bismarckian system for men than for women. Furthermore, we find differences in the underlying distribution of own contributions. The Beveridge curve for women concentrates more mass in the lower quantiles of the distribution of own contributions, while male contributions are more evenly distributed.

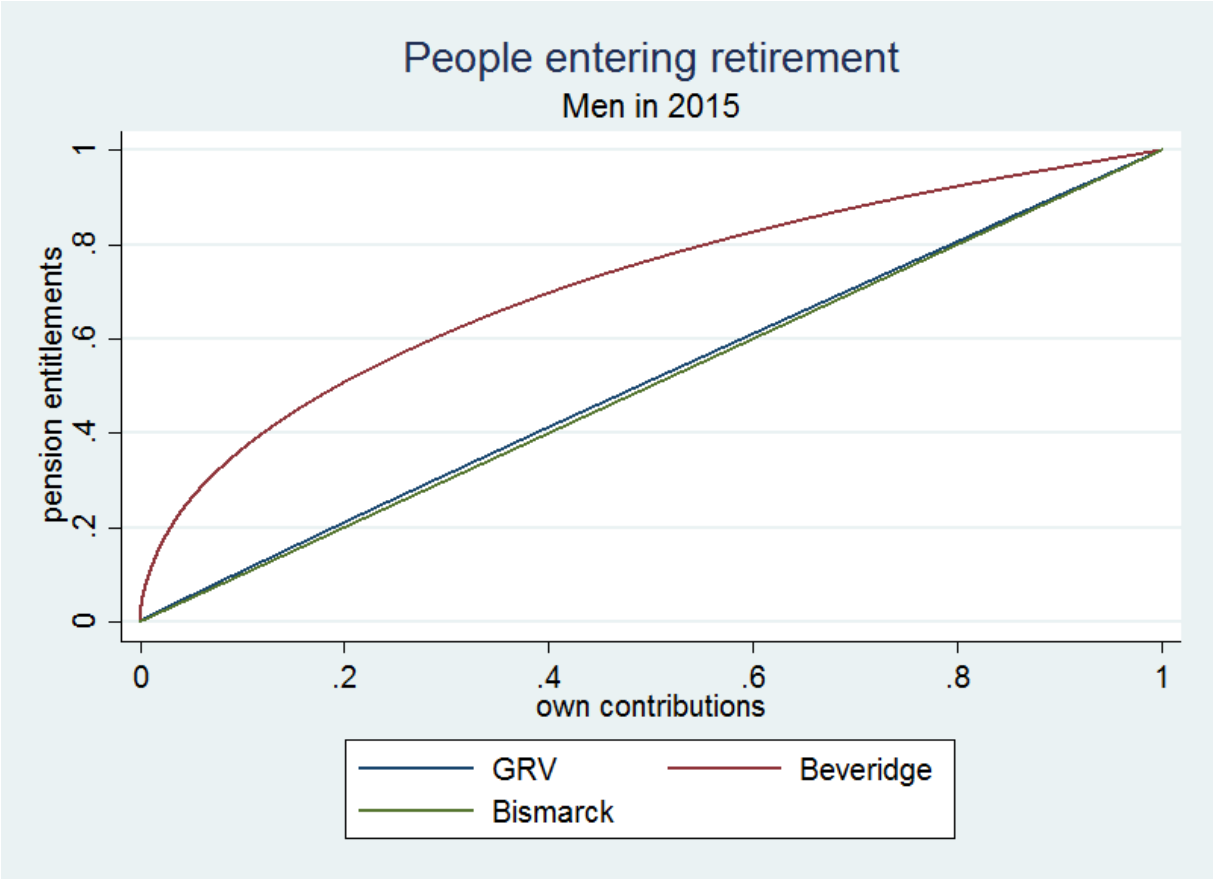

Figure 3: New retirees in 2015 - Men

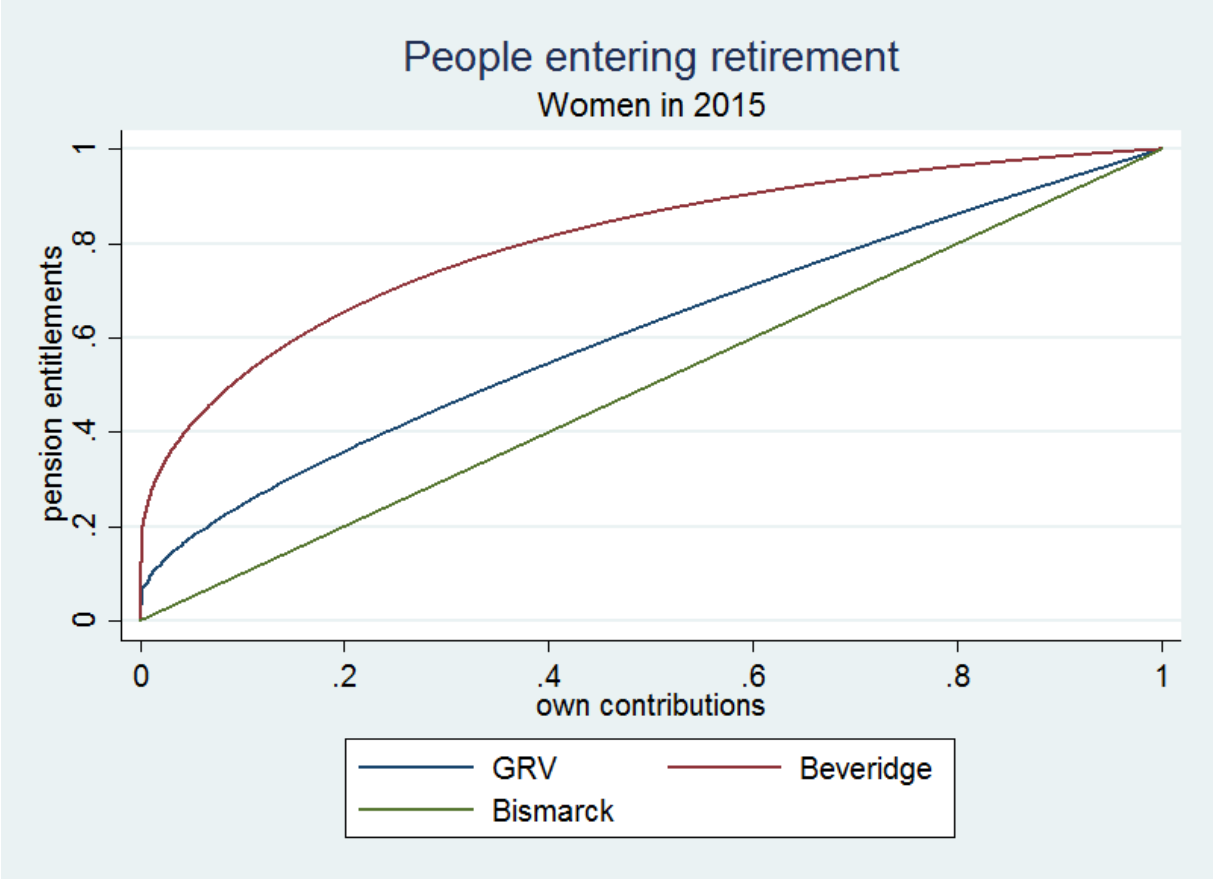

Figure 4: New retirees in 2015 - Women

In terms of our measure R, we receive values that show clear differences in the amount of redistribution by gender (see Table 2). As can be seen from Figures 3 and 4, the R for men is much smaller than for women, which shows that, measured in terms of own contributions, men receive significant less additional entitlements above the Bismarckian line of own contributions than women. This is not surprising, because women are more likely to gain additional earning points that are detached from own contributions (e.g. raising children), and are on average more likely to receive bonus points in case of divorces. It is important to note, that the total value for R is measuring the effects of the whole population with both genders being part of the distribution of own earning points and pension entitlements. Therefore the total value of R should not be interpreted as a function of the values for men and women.

Total	0.23
Men	0.04
Women	0.36

Table 2: Index Values - 2015

Since we have data on new retirees from 2007 to 2015, we can also calculate R for several cohorts. Figure 5 shows the development over time for the overall population as well as for the two different genders.

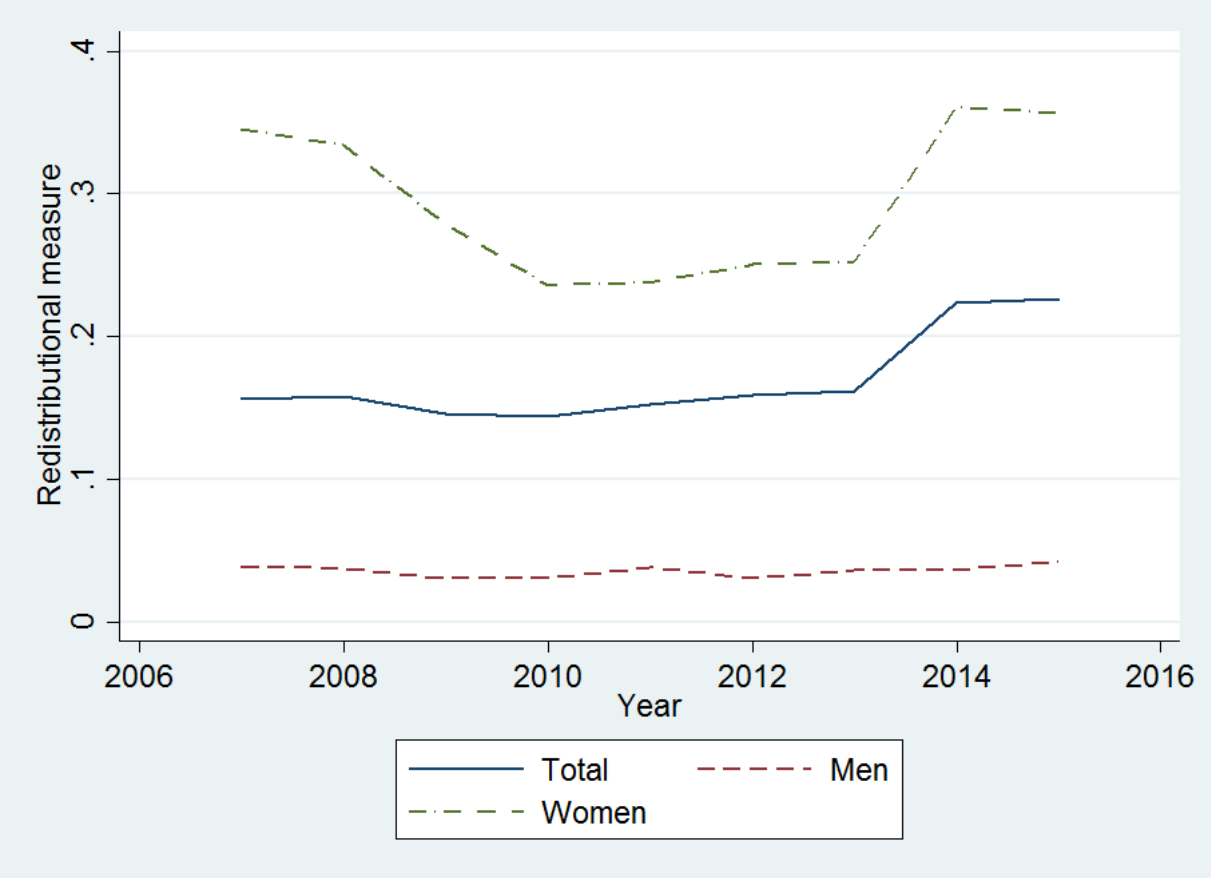

Figure 5: Index Values over Time.

The R calculations for the total populations show a slight increasing trend in the last years with a significant jump in 2014. This increase can be attributed to a recent reform that significantly increased the number of obtainable earning points due to childcare.[10] Therefore, it is not surprising that we see an increase in the R for women but not for men. The R for men remains nearly constant across the years. Prior to 2014, women showed a trend of reduced redistribution. This reduction was primarily caused by a significant reduction of redistributional entitlements which we measure by $GRV(e)$. From 2007 to 2013, received entitlements above the Bismarck line dropped around 25 percent. Own contributions, measured by $Bev(e)$ did in fact increase in this time period, but only for about 3 percent. Therefore we can conclude that women showed a tendency for reduced dependency on redistributional pension claims and an increased dependency on own contributions prior to 2014. This tendency might still be valid after 2014. Data on future retirees will show if a downward trend is still persisting.

3.4 Intra-generational redistribution of certain additional benefits

As shown above, our measure R shows pension entitlements above the equivalence line of a pure Bismarckian system. In this section, we will take a closer look at how non-earning related additional benefits have an influence on these findings. We will present results for two of the more important additional benefits that we can clearly distinguish in our data, namely settlements due to a divorce and periods of childcare. As a measure of importance, we will use the difference between the R with all pension entitlements and the resulting R if we omit the additional benefit in question.

3.4.1 Settlements due to divorces

In case of a divorce, a settlement of claims is conducted for former spouses, with each side receiving either a deduction or a bonus on their accumulated pension points. This is especially valuable for stay at home mothers that rarely manage to accumulate own earning-related pension points. We corrected pension entitlements for such divorce related adjustments and calculated the resulting differences in R across time. As can be seen in Figure 6 the overall difference in 2015 is expected to be relatively small, since the adjusted curve without divorce based claims is very close to the overall GRV curve. The corresponding difference in R is at around 0.03. Divorce related redistribution is of no significant importance across our timeline. Nonetheless we can see an interesting development if we take a look at the gender specific differences as shown in Figure 7. Female non-earning related pension entitlements show a clear downward trend in recent years. Simultaneously, male pension entitlements increased over time, showing that more recent male retirees are more likely to have a net-benefit in a divorce induced settlement, whereas women are less likely to win in a settlement.

[10] "Gesetz über Leistungsverbesserungen in der gesetzlichen Rentenversicherung"; June 2014

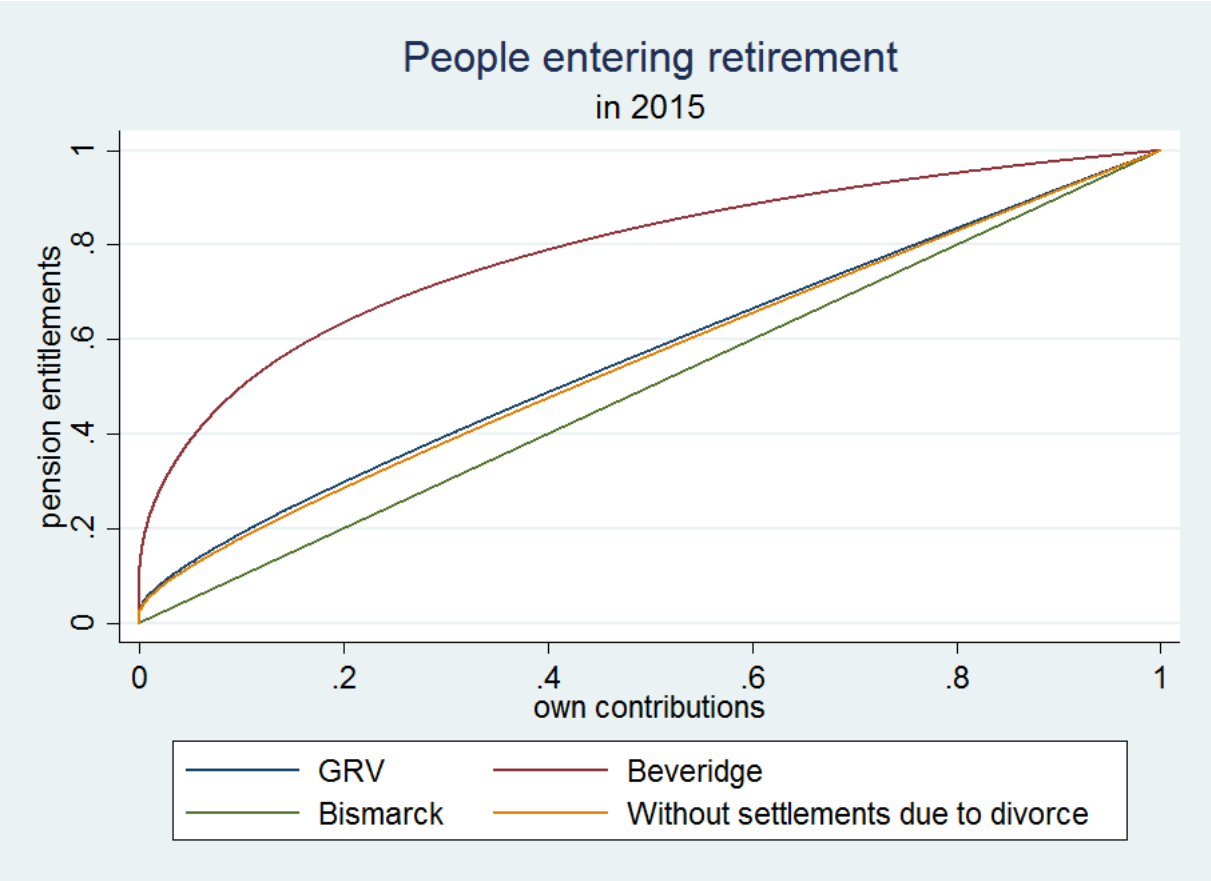

Figure 6: Results with and without settlements due to divorce

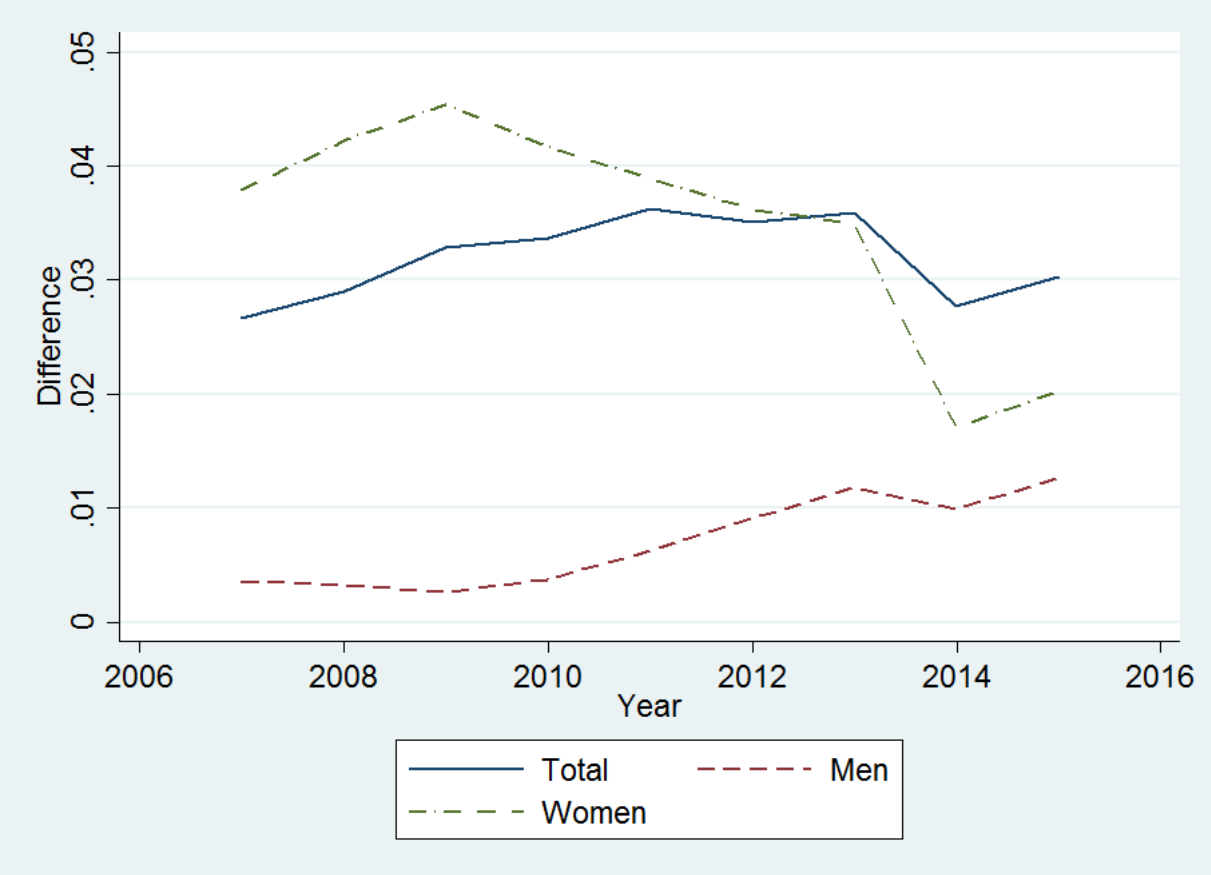

Figure 7: Differences in the redistributional effect of settlements due to divorce over time

3.4.2 Childcare

The German statutory pension system awards non-earning related pension points for raising children. Currently, it is possible to claim up to 3 years as child care periods, if the child was born after the year of 1992. For children born before 1992 it was possible to claim a child care period of one year. In 2014 this period was increased to two years. Generally, each year of childcare yields one pension point, which means that a mother is awarded the equivalent of having been employed with an average income.

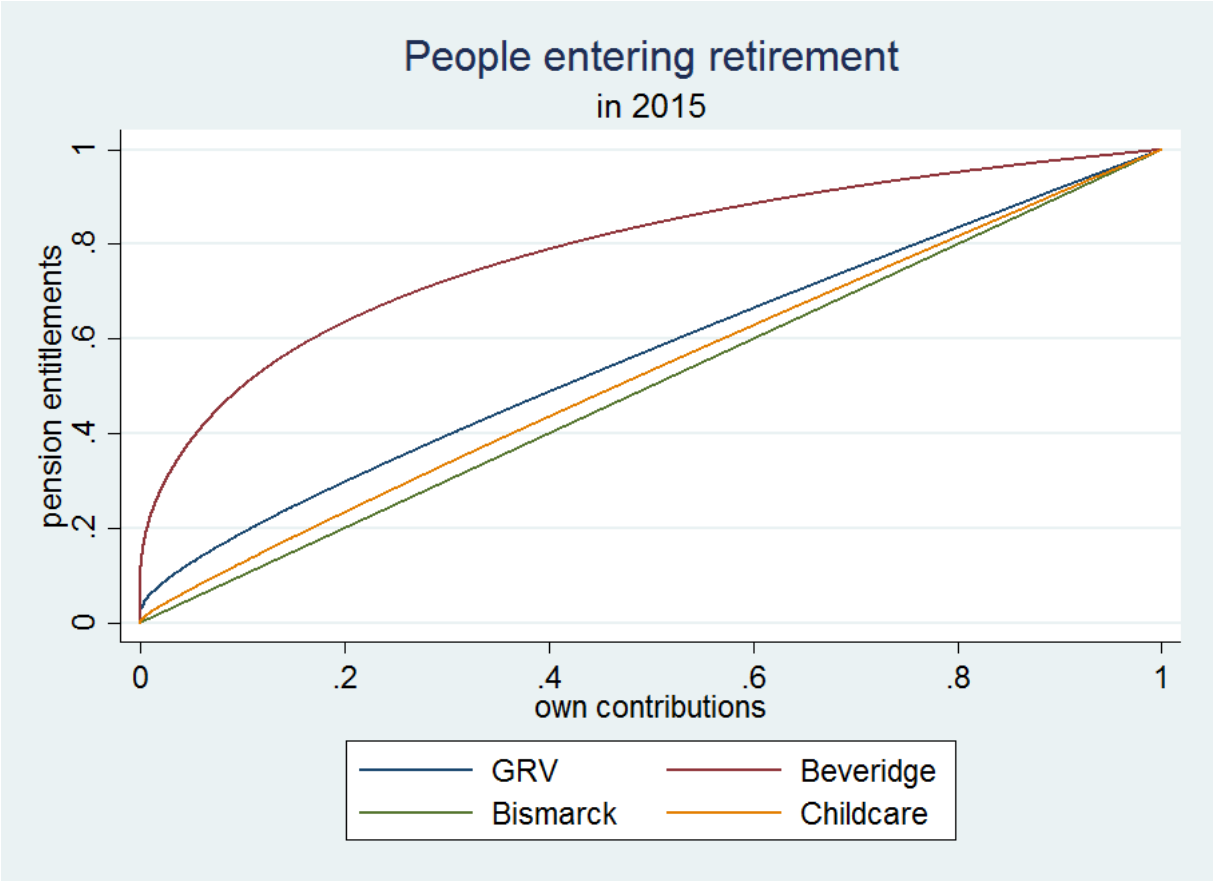

Figure 8: Results with and without childcare

Compared to settlements due to a divorce, Figure 8 clearly shows that the importance of childcare is quite substantial. If we remove childcare related pension entitlements, retirees in 2015 are significantly closer to the Bismarck line. Not surprisingly, this type of additional benefit is of much greater importance for women. The difference for male pension claims is nearly non existent (in 2015, the difference for men is 0.002). The reform of claimable childcare periods is also clearly visible in Figure 9. The difference for women increases significantly which can also be seen in the overall development of R in Figure 9.

Figure 9: Differences in the redistributional effect of childcare over time

4. Conclusion

Due to recent and future demographic changes, caused by low fertility and rising longevity, societies with pay-as-you-go pension schemes face an increasing need for reform, especially in their public social insurance systems. Reforming a pension scheme might require to deviate from the current level of intra-generational redistribution, which has – up to that point in time – also represented an accepted social consensus. This deviation will be of crucial importance regarding the feasibility of reforming an established pension scheme, as the new level of redistribution must also be accepted widely in society.

The purpose of this paper is to introduce a new index that enables the measurement of intra-generational redistribution in a pay-as-you-go pension system. Existing measures, like the index of non-contributiveness or the index of progressivity are limited by setting different generations into relation, while information on own contributions and resulting pension claims are not taken into account. Extending on the concepts for measuring inequality in tax systems like the SUITS index (Suits, 1977), we derive an index that relates paid contributions and resulting pension entitlements to a benchmark, which rests on a ratio of two hypothetical distributions, an idealized Beveridge system and an idealized Bismarck system and is therefore not depending on information of the contributor side. Furthermore, the index utilizes the complete distribution of pension claims and own contributions rather than relying only on certain quintiles or moments. This specification also allows to compare intra-generational redistribution across different generations, as well as for different subgroups within a generation.

Applying our index on contribution records of new German retirees, we are able to measure the development of intra-generational redistribution across different cohorts. We find that the index stays nearly constant before the year of 2014 even though woman show a

slow reduction. In 2014 our index increases significantly due to a legislative extension of awarded child care benefits that primarily affects female retirees. Furthermore, we show that the importance of divorce related received settlements decreases for women over time, while men show a slight increase.

As an extension, it would be of interest to apply our index on cohorts of different pension schemes, especially if those pension schemes underwent significant changes to the underlying principle of equivalence. If some societies are subjected to a similar reform of their pension schemes, like for example the exclusion of certain benefits, this might lead to different results due to these societies placing dissimilar importance in that benefit. Measuring how such a similar reform affected the intra-generational redistributions would yield valuable information for policy makers trying to implement future changes. Furthermore, looking at different cohorts in different pension systems we would also be able to observe effects of socio-economic change. As an example, the increased labor participation of women should lead to a decrease in the dependency of awarded pension claims in Germany, but other societies might progress on quite different paths.

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