Identifying Generosity and Effectiveness of Old-Age Pensions – Advantages and Disadvantages of Replacement Rates

Uwe Fachinger and Harald Künemund

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Prof. Dr. Uwe Fachinger

Economics and Demography
Centre for Research on Ageing and Society
University of Vechta
Driverstraße 23
49377 Vechta, Germany

uwe.fachinger@uni-vechta.de

Prof. Dr. Harald Künemund

Research Methods
Centre for Research on Ageing and Society
University of Vechta
Driverstraße 23
49377 Vechta, Germany

harald.kuenemund@uni-vechta.de

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1. Introduction

"The present times can be characterized as ones of change and reappraisal for social policy… and … there is a sense that older social policy values and priorities … are making a comeback"[1]. One may argue that the main goals of social policy remained the same: abolishing poverty or social exclusion and securing the living standard of people, solely the means to achieve these goals have changed. But what went wrong and what made a change in methods necessary? The answer to this question is not easy and there will – most probably – always be contrary opinions. However, to be able to learn from the past implies to know (at least something about) the past: t is inevitable to have adequate and generally accepted indicators to describe social reality and to evaluate social policy. Making mistakes here – or not being well informed about restrictions and limitations of such indicators – might result in misleading policy recommendations. In the light of the upcoming challenges of an ageing and shrinking population in the next decades, especially evaluating social policy becomes increasingly important because it is vital to know, whether the measures taken are adequate to reach the long term goals of social policy.

In this paper, we focus on the evaluation of old-age pension systems as one of the core elements of social security systems, mostly by far the largest in quantity[2]. A very common instrument to assess and compare pension systems over time or between countries is the replacement rate. This indicator is widely used in the discussion about old age security systems. But until now, no generally accepted definition or measurement procedure exists. Some calculations are based on fictive "model households" or on constructed occupational careers, others are based on empirical data. In the latter case, aggregate data are used most often, for example by calculating the replacement ratio by dividing the average pension by an average income of workers. To make things worse, while the mathematical formula to calculate a replacement rate looks rather simple, the calculation could be very intricate. To adequately calculate replacement rates, at least the following questions have to be addressed:

- What types of income are taken into account both in the employment and the retirement phase?

- What statistical measures should be used – the mean or median? And what about further information about the distribution?

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1 Call for papers of the … Conference of the Social Policy Association..

2 In 2007 in Germany the expenditures were around 10 per cent of Gross Domestic Product (OECD / EU Daten??).

– Are the samples (or points in time) really comparable?

We will discuss the conceptual problems of such replacement rates first. Secondly, we will give an overview of the heterogeneous situation with respect to the use of replacement rates as a measure of the effectiveness of old age pension systems. It will be shown that the existing results of empirical analyses are hardly comparable. Thirdly, to give an idea about the consequences of using different measures, we will present results of empirical analyses based on longitudinal micro data from the Research Data Centre of the German Federal Pension Insurance. Based on the discussion of the different constructions of replacement rates and on the results of the empirical analysis we will finally discuss some requirements concerning the indicator and provide some recommendations on how replacement rates should be constructed to fulfil those requirements.

2. On conceptual problems of replacement rates – a short survey

A look on the analyses of replacement rates so far yields considerable heterogeneity concerning the definition of the applied indicators, the empirical data, and the methodological procedures.. A short survey of the approaches used in the literature will be given. The survey will be carried out along three dimensions: income, time, and research unit. Furthermore, the methods have to be taken into account. [3]

2.1 Income dimension

One of the fundamental decisions that needs to be made in order to calculate an appropriate replacement rate is the choice of the adequate income[4]. In principle, the operationalisation has to be carried out according to the research question. For example, it has to be decided whether gross- or net-incomes should be used. Furthermore, , wen need to distinguish carefully between the income which has to be replaced and the replacing income[5]. In doing so, different sources of income have to be taken into account. At this point, finding an appropriate pendant for the income that should be replaced seems to be a major issue. If the type of income in the retirement phase is explicitly defined as a replacement by the pension system, the assignment is more or less predetermined, e. g. as for the old-age pension in Germany: and the gross earnings, liable to insurance deductions. The task is also undemanding if the income source remains the same before and after retiring, as is the case with

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[3] For an early work on concepts to measure replacement rates see Boskin and Shoven (1987); a newer survey is given in Mitchell and Phillips (2006) or Biggs and Springstead (2008).

[4] See also e. g. Biggs and Springstead (2008).

[5] Biggs and Springstead (2008) give a more detailed overview of different income definitions which could be used as denominator for calculating replacement rates in the US.

income from assets. In most cases, however, the picture is more complex. For example, should income from private pension schemes or insurances be included? If yes, what is the corresponding income during the employment phase ? Furthermore, concerning the comparability of replacement rates between various countries or different points in time, the results will be massively impeded by legal regulations.

In Table 1 an overview of income components used in research is given. The scope ranges from a rather narrow income concept, which concentrates on a single category of income such as earned income, which is itself subject to social insurance contributions to aggregate gross incomes, which comprises income from all resources. In some simulation studies even the entire value of home equity is considered[6].

Table 1: Important income components, contributions and taxes of private households

Sum of gross income coming from …
– earned income as employee and from self-employment – unearned income (without insurance) – pensions and civil servant pensions from social security institutions, pubic budgets, professional pension schemes of the liberal professions, companies und private insurance – further cash transfers from territorial authorities such as social assistance and housing benefits – Cash Transfers between private households, especially interfamilial transfers
… results in the sum of gross income, minus …
– income tax – social security contributions for old-age pension insurance, health insurance, long term care insurance and for unemployment insurance. – comparable contributions if someone is not covered by the social security system
… results in the sum of net income, plus …
– earnings from liquidation of financial and tangible assets – non monetary elements of earnings (transfers in kind) among others from public budgets and private households, especially intrafamily transfers – price deductions – indirect taxes – additional payment in case of illness or long term care
… what results in the material standard of living

Source: Following Fachinger (2002), p. 13.

In genral, the income concept for the pre- and post-retirement phase has to be consistent. This is not always an easy task[7] as some income components are difficult to measure and measurement errors may distort the results in many different ways. In

[6] See e. g. Munnell and Soto (2005).

[7] This is contrary to Biggs and Springstead (2008), p. 3, who state that “the numerator of the replacement rate calculation is relatively easy to determine”.

conclusion, it may be stated that variations in the use of income components impose serious limits to the comparability of such results.

2.2 Time dimension

The calculation of a replacement rate is often a comparison of income at two different points in time, e.g. employment and retirement.Of course, a uniform period of time is often used as well, e. g. average earnings and pensions in a certain year, but this is obviously not an accurate calculation on an individual level. Inthese cases, the relevant dimension is the research unit (see below). However, with respect to the time dimension we may distinguish three variants:

1. the relation of, e.g., monthly or yearly income immediately before retiring and yearly pensions after retiring from work,

2. the ratio of mean income in two time periods – for example several years before and after retirement, or the whole employement period and the entire retirement phase (for example, based on average life expectancy),

3. a combination of the two methods: a time-period and a point in time approach (e.g., a mean of lifetime income from earnings compared to a monthly pension).

In general, here it is necessary to pay attention to unusual cases or periods. For example, it is well known that using the last monthly or yearly income before retirement as nominator does not reflect the income situation adequately[8]. Often this income is not the income, which has to be replaced by pension, but income from part time work or unemployment benefits. If someone calculates the rate by using such income, the replacement rate will be far “too high”. The case is quite the reverse if the income shortly before retirement is unusual high. For example if a certain worker is paid according to seniority rules the replacement rate appears to be “too low”.

Another problem in conjunction with the time dimension is that there are different paths of entering retirement which also can allow for simultaneousness of employment and drawing of pensions. Consequently, different paths of transition should be considered.

2.3 Dimension of research unit

Another relevant category for the analysis of income replacement rates is the research unit. In principle here it can be distinguished between two levels: the micro and the macro-level.

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[8] See also e. g. Bosworth et al. (2000).

On the micro-level it has to be differentiated between two research units: the individual – this situation is characterised as individual pension level – and the household. Furthermore, with respect to the household as the research unit, is has to be defined when the household has to be considered as a pensioner household. On the one hand this could be the case when just one member receives benefits from an old age pension system, on the other hand when each and every household member is a beneficiary. With respect to the concept of living standards the household as research unit seems more appropriate as the living standard depends mainly on that of all household members.. However, if the replacement of one single income source is considered, the individual as a research unit seems to be more on target.

On the macro-level, that is, using the average income of aggregate populations, the average income of groups is correlated. As an example for such specification, the entirety of all beneficiaries as numerator and the entirety of all employee groups as denominator can be mentioned. Another definition of such two groups would be the employees in the private industry and the beneficiaries of old-age pensions from statutory pension systems. A third possibility is the differentiation according to social strata or status, e. g. the average income of all households with the status “retiree” is related to the average income of all households with the status “employee”, or pensioneers (formerly civil servants) versus the civil servants.

Here, both intertemporal and international comparability have to be assured. It can not be taken for granted that the definition of such groups remained the same, or was internationally the same.. Even when international organisations such as the OECD carry out comparative studies, their results should be viewed sceptically. For example, in Germany the definition of people who are compulsory insured in the German statutory pension insurance scheme (GRV) changed over time.

2.4 Method

Aside from these three dimensions, different methods and data sources could be applied. For example, income data could come from surveys or may be “process produced”, originating from social security institutions, respectively. We could also construct hypothetical data on the basis of more or less realistic assumptions or plausible considerations. And there are even more possibilities as it may be adequate to not use one single data source, but a mix of different methods, where – for example – the numerator is calculated on the basis of real data – e.g. the average income on the basis of a longitudinal survey – and the denominator is a hypothetical average income based on the complete retirement phase. An example for the use of such a hybrid method is the so called standard pensioner (§ 145 Abs. 3 Nr. 2 SGB VI), which is very often used in the discussion about the restructuring of the old age pension system

in Germany. To calculate this indicator the average income of employees as numerator and a fictitious pension[9] as denominator is used.

With all these different methods astatistical aspects have to be mentioned. There are several methods to calculate an "average". Often used are the arithmetic mean, the median, and the modus, the results will usually differ according to the distribution. However, these measures of location yield insufficient information about the distribution, so that measures of variation are needed as well.

2.5 Conluding remarks

The juxtaposition of the indicators and measurements used in the existing literature made clear that the calculation of replacement rates to judge old age pension systems can be carried out in many ways. It is not self-evident, which of these indicators and procedures is advantegous compared to others. An assessment of these indicators with respect to the adequacy for income replacement also has to consider the particular system specific aims or objectives of old age provision. Take for example Germany, here the objective of the old age pension system is to ensure an – as politically adequate considered[10] – living standard during the retirement phase. This protection should not be ensured by one single system, but in combination with public, occupational and private provision. However, to increase the relevance of the second and third pillar, the level of GRV was intentionally reduced by the government. This should have promoted a compensation through "benefits" from occupational or private pension insurances and the reduction of assets during the retirement phase[11]. To further encourage workers to sign contracts for personal pension schemes, financial incentives have been established This was a rigorous paradigm shift as it is intended that occupational and private pensions are replacing instead of supplementing benefits from public scheme (Schmähl 1997 and Ginn et al. 2008). However, to what extent this will happen, still remains an open question.

To determine the effectiveness of such an old age pension system on the basis of a simple replacement rate, the examination of a replacement rate consisting of individual pension from the statutory system and gross income, which is subject to social insurance contribution, is not sufficient. Furthermore there is almost always the

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[9] This is a pension based on 45 years of insured employment, and with 1 so called pension point earned per year for example, through 45 years on average earnings.

[10] As there is no objective measure for the adequacy of pensions, the level was changed over the years since 1957 and more drastic since 1989, resulting in ceteris paribus lower public pensions.

[11] However those additional insurance is not mandatory; see for a detailed description and discussion Ginn et al. (2008).

need to take social stratification into account, for example people or households with and without pensions from private insurance.

3. The use of replacement rates

One would assume that the prescribed concepts are used carefully and with awareness of the specific aspects, but this is rarely the case. The empirical studies are as heterogeneous as it comes, if not contrdictory. A comparison of the specific results is nearly impossible. As nevertheless a lot of empirical work was published with respect to the measurement of replacement rates, in the following section only some exemplary studies are mentioned to indicate the variation of methods[12]. We will provide an overview of the heterogeneous situation with respect to the use of replacement rates as a measure for the effectiveness of old age pension systems[13].

3.1 Income dimension

As one would expect, the underlying concepts regarding the income dimension vary from a very narrow notion of income to a very broad or comprehensive definition. However, in the choice of income the researcher is not always free as it depends heavily on the data, which are available. Data restrictions limit the potential of analysis as e. g. the standard of living concept needs information about monetary and non monetary income. If the data provides only information about one source of income, e. g. earnings out of employment, a broader income concept can hardly be used.

A narrow range of income is used in the study of Fachinger et al. (2008)[14]. For the employment phase (denominator) they made use of earned income, which is subject to social insurance contributions to the GRV, and of the pension from the GRV for the phase after retirement (numerator). The reason is that the pensions are meant to substitute the specific individual earned income from employment, from which contributions for social insurance were paid. A broader approach is applied by Organisation for Economic Co-Operation and Development OECD (2007) or Martin and Whitehouse (2008). In those studies the concept of gross/net pre-retirement earnings and gross/net pension entitlements is used for calculating gross/net replacement rates[15]. Unfortunately it is not clearly described, which income components are considered – it is only referred as earnings when working (Organisation for Economic

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12 A complete review of the literature is beyond the scope of this article.

13 See also Engen et al. (1999), Haveman et al. (2003),

14 □□□ ausländische Analysen mit data from social security administration ??? Haveman et al. (2006) using Social Security covered earnings records .

15 To calculate the net values, personal income taxes and social security contributions are taken into account; Organisation for Economic Co-Operation and Development OECD (2007), p. 34.

Co-Operation and Development OECD (2007), p. 6). The numerator includes income from "... all mandatory pension schemes for private-sector workers, regardless of whether they are public or private." (Martin and Whitehouse (2008), p. 11). In this approach the concept of correspondence is also adapted as it concentrates on earnings and mandatory pension schemes – implicitly assuming, that the earnings are the sources for financing the mandatory pension schemes or in the case of civil servants are the basis for assessment of pensions.

However, in many studies a much broader concept is used for calculating the numerator. While the above listed studies concentrate on the aspect of income substitution, where an income source from the employment phase is replaced with an income source from the phase after retirement, there is also a much broader approach used, which concentrates on the living standard.

Haveman et al. (2006) are using financial and property resources, net value of own home (home value less outstanding mortgage), the present discounted value of future expected pension benefits, and the present discounted value of future expected Social Security retirement benefits to calculate the numerator. As denominator the Social Security covered earnings are used, which is a rather narrow income concept and does not compare very well to the definition of the numerator as e. g. income from other resources such as unearned income during the employment phase are neglected. However, the authors are believe, that this income "… reflects the level of living prior to retirement …". While using most recent individual earnings for the denominator, Gustman and Steinmeier (1999) also concentrates only on income from employment. For the calculation of the numerator, current assets and annuities income from financial assets, housing assets, Social Security wealth, and pension wealth were added together. The authors then compare the annuitized value of resources with the current earnings of the household for calculating the replacement rate. A similar approach is used by Butrica and Uccello (2004)[16]. For the denominator individual earnings based on hourly wage rates, hours worked per week, and weeks work per year are used. The measurement of the "pension wealth" is be used with a much broader scope, as also non-pension assets as vehicles or farm and business equity is added. A very broad income concept like the sum of gross earned and unearned income inclusive imputed rent from one's own flat and even the residual value of the house is used by Munnell and Soto (2005).

All those studies are trying to cover the complete (material) standard of living of a person or household. However, they fail as they do not consider e.g. transfers between

[16] Other studies using such an approach are e. g. Engen et al. (1999), p. 97, Engen et al. (2005) …

private households[17], price deductions or the differences in indirect taxes which may exist.

As the overview illustrates, there is a wide variety of income concepts, which are used in empirical studies, and it is a neither an easy task to determine the denominator nor is it easy to define the proper numerator, as both have to be consistent with each other. However in most analysis normally it is strived for a consistent income concept for the pre- and post-retirement phase. Therefore, at least analyses of replacement rates are for the most part cohesive with respect to the income dimension.

The analyses so far are varying not only with respect to the different categories of income but also in regard to the underlying time dimension.

3.2 Time dimension

Like income the time dimension sometimes is set by the data. For example in using cross section data, the development of individual income over time can not be considered and the researcher depends on models to draw conclusions about income in the pre- or post-retirement phase. If one tries to take the development of earnings over time into account, simulation methods have to be used, which are heavily influenced by the chosen theoretical model and the parameters. Therefore, the chosen time dimension in studies reflects the intention of the researcher as much as the quality of the data. The variety of studies regarding the time dimension to some part can be explained by the used data set.

In Gustman and Steinmeier (1999) the denominator is based on household earnings on a point in time (1992). Such cross section approach is also used by McGill et al. (2005) or in the concept of the standard pension level in Germany, where the sum of pensions in one year is divided by the sum of earnings of the same year[18].

As income at some point of time can not be considered as representative for the income situation of an individual, family or household due to income mobility[19] many studies use information over periods of time to get a better picture of the income position of the research unit.

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17 Transfers in cash or in kind are quite common within families, where the members not necessarily living in the same household; see for a Künemund / Kohli □□□

18 See e. g. Deutsche Rentenversicherung Bund (2007), p. 27.

19 The magnitude of income mobility can be rather high even for a single income source, see e. g. Fachinger and Himmelreicher (2008) or Fachinger (1991). For an overview of income mobility see Fields and Ok (1999).

With regard to the employment phase Butrica and Uccello (2004) are using earnings between the ages 50 and 54 to calculate the average, as they assume that this are usually the years with the highest income. A slightly different approach is used in Haveman et al. (2006). They calculate the nominator as the average from the five highest earnings out of the interval from ages 50 to one year prior to retirement. In Grad (1990a) pre-retirement earnings are defined in two ways: 1) as an average of the five highest years of earnings and 2) as an average of the earnings in the five years just prior to retirement. The whole employment phase is taken into account in Organisation for Economic Co-Operation and Development OECD (2007), Martin and Whitehouse (2008), and Butrica (2007)[20].

Relating to the post-retirement phase, in most studies researchers are trying to consider all income and total assets, annuitising the total wealth over the remaining (expected) years of living. There are only few studies to our knowledge which looks at the position of people in later life. Butrica (2007) takes a look at the economic situation of older adults at ages 67 and 80. The study by Haveman et al. (2006) examines changes in the adequacy of retirement savings during the first 10 years of retirement. Johnson et al. (2005) are analysing adults aged 70 and older[21], Biggs and Springstead (2008) takes a look at the aged 79 to 81, and Coile and Milligan (2006a) uses the Health and Retirement Study (HRS) to examine how asset holdings change after retirement over the whole post-retirement phase[22].

However, the interpretation of the results has to be carefully carried out. If just two points in time are considered, in principle no evidence can be reached about the living standard during the retirement phase. For such analyses, the whole retirement phase should be taken into account as shorter time periods give only an impression (but no evidence) about the adequacy of income replacement.

3.3 Research unit

In empirical research individuals, families, and households are used as research unit. Unfortunately, there is not always a clear distinction between the family and the household, sometimes the terms are used as if they were identical. Households could be defined e. g. to be one person living alone, or a group of persons who either share living accommodation or one meal a day, and who have the address as their only or main residence (Burgess et al. (2000), p. 17). In comparison to this, family members are not necessarily sharing living accommodations or living in the same house or flat –

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[20] Butrica (2007) uses the average of wage-indexed shared earnings between ages 22 and 62.

[21] See for a comprehensive Johnson et al. (2006)

[22] See also Coile and Milligan (2006b).

but they have to be married and even if they are living apart, would form a family but not a household.

On individual level analyses, sometimes income records from administrative data are used, which are individual records. Examples are Fachinger et al. (2008) or Biggs and Springstead (2008). The analysis of Martin and Whitehouse (2008) also concentrates on a single person only.

Therefore, it is not known, whether the individual lives in a household by oneself (single household), is married, living in a two-person-household[23], or lives in an even larger household with more than three members. In such analyses the household situation can not be taken into account. On the basis of such analysis it is not possible to draw any conclusions about the living standard of the single person. Thus only the replacement rate of individual attributable income can be analysed. However, the analysis of Johnson et al. (2005) refers to married and single households, but is conducted at the individual level, trying to take the risk of widowhood or divorce into account. The wealth of married households is adjusted for household size by dividing married respondents' wealth by 1.62. Munnell and Soto (2005) also analyse replacement rates of single-person and married households but without adjusting for household size. A slightly more specific household concept is used by Butrica and Uccello (2004) as they consider gender and marital status when looking at two person households.

Even when using the term household, one cannot assume that the research units are identical. For example in Engen et al. (2000) the empirical analysis is focused on couples. In Coile and Milligan (2006a) different household sizes are considered, whereas Coile and Milligan (2006b) study the replacement rates for households, implicitly couples, where widowhood is taken into account. Therefore, sometimes also specific households with only one member are taken into account. The research units of Haveman et al. (2003) are single person households and couples.

3.4 Methods

Aside the three above mentioned dimensions, in which the existing studies diverge, also the methods differ widely from each other. For example the income data are based on surveys or "process produced" data, originating from social security administration, respectively. But it also could be hypothetical data on the basis of more or less realistic assumptions or plausible considerations.

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[23] This is sometimes referred as married household (Engen et al. (1999), p. 92, or Haveman et al. (2006)).

Sometimes a mix of different methods is applied, where the numerator is calculated on the basis of real data – e.g. the average income of a longitudinal survey – and the denominator is a hypothetical average income based on the complete retirement phase. An example for the use of such a hybrid method is the so called standard pensioner, which is very often used in the discussion about the restructuring the old age pension system in Germany. To calculate this indicator the average income of employees is used as denominator and a fictitious pension[24] as numerator.

Sometimes instead of real data as in Fachinger et al. (2008), simulations are done to calculate the earnings in the employment phase and in the phase after retirement as in Butrica and Uccello (2004), Martin and Whitehouse (2008), to name a few. As can be seen in Mitchell and Phillips (2006), where a comparison is done between replacement rates of actual and hypothetical earner profiles, the results are quite different. Instead of yielding more clarification, therefore the usage of simulations are contributing to the confusingness even more – as important as such studies for e. g. preparing political decisions may be – because they make comparisons all the more difficult as the assumptions are quite different for e. g. price adjustments or interest rates. Sometimes no references to the research unit are given. If aggregated data are used, for example calculating the replacement ratio by dividing the average pension by an average income of workers.

Another methodological aspect, where the studies are widely differing is the use of different average measures. Still in calculating average income, in some studies the mean and in other the median is applied. Grad (1990b), Engen et al. (1999), Johnson et al. (2005), Haveman et al. (2006), or Biggs and Springstead (2008) are using the median, Fachinger et al. (2008) is applying the mean, whereas Bosworth et al. (2001) uses both measures. A combination of both methods is used in Butrica (2007): they calculate the median value as the mean value between the 40th and 60th percentiles of the distribution. All this makes the comparability and especially the interpretation of results even more difficult. High replacement rates, as is typical for Greece, may mask low values in the denominator or considerable social inequality. Social service reports and comparisons of old age pension systems on the basis of replacement rates are so far rather un-illuminating.

Another short coming has to be pointed out: nearly all studies make use of average values; other statistical measures for the description of the income distribution are ignored.

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[24] This so called “standard pension” (§ is a pension based on 45 years of insured employment, and with 1 so called pension point earned per year for example, through 45 years on average earnings.

In summary it may be said that up to date despite some work on the matter, we do not have a clear picture of replacement rates with respect to old age pension system. Neither with respect to single income concepts nor to aspects of maintaining one's living standard.

4. Some empirical results

4.1 Data and method

To give an idea about the consequences of using different measures, we will present results of empirical analyses based on longitudinal micro data from the Research Data Centre of the German Federal Pension Insurance[25]. We use the Scientific Use Files Completed Insurance Biographies 2004 and 2005 (SUF CIB 2004 and SUF CIB 2005)[26]. This data comprise individual records, which are process-produced, from the first time, a contribution has been paid or from age of 17 - if the first contribution was paid later in life - until retirement. For each period, in which a contribution is paid, the insured earnings are recorded[27]. It is a longitudinal data set in which all contribution periods and relevant[28] non-contributory periods are registered on a monthly basis, showing e. g. periods of insurance liability, illness, unemployment, marginal employment, child-raising, or unpaid care giving. Therefore we have the opportunity to track individual workers' actual earnings patterns for calculating the replacement rates.

Since we focus on the evaluation of old-age pension systems as one of the core social security systems, we use the information about the insured earnings as denominator and the pensions, calculated from these earnings records as numerator[29]. The replacement rate measure is tied to workers' own past earnings and yields information about the real replacement rate of the GRV because the pensions are meant to replace the insured earnings.

We calculate the mean and the median of replacement rates respectively. This is done to show the effects of using different measures for computing an average of replacement rates. It is well known that the mean is more sensitive to outliers than the median. As we use different time periods from 1 to 10 years before retirement we can demonstrate 1) the effects of the time period extension on mean and median and 2) the relevance of the choice of a proper time period. However, it is not possible to consider the diversity of the insured earnings by using measures of location. Therefore

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25 The analysis is extensively described in Fachinger and Künemund (2008).

26 For an in-depth description of the data see Himmelreicher and Stegmann (2008).

27 Earned income, which is subject to social insurance contributions to the GRV.

28 Relevant information is only those which are necessary to calculate pensions. No additional …

29 For a detailed description see Fachinger and Künemund (2008).

we calculate the coefficient of variation to give an impression about the magnitude of variation. Because the variation can be due to social stratification, we also differentiate for gender and pension type to obtain more homogeneous groups. In the following we present some selected results of our analysis[30].

4.2 Results

For the assessment, whether an „optimal" phase for calculating the denominator exist, we extend the time period – starting with 2005 – step by step until 1995. As can be seen in Table 2, the replacement rates descend to a decreasing extent and the inequality of the distribution is decreasing as well. With this, the values for mean and median are

Table 2: Individual replacement rate in 2005, all pension types, West-Germany

Relative Position	Mean	Median	Coefficient of Variation
2005	195.6	96.3	1.6
2005 and 2004	121.4	68.8	1.4
2005 until 2003	95.6	60.1	1.2
2005 until 2002	83.1	55.8	1.1
2005 until 2001	75.8	53.2	1.0
2005 until 2000	71.5	51.4	0.9
2005 until 1999	68.2	50.2	0.9
2005 until 1998	65.9	49.5	0.9
2005 until 1997	64.5	49.1	0.9
2005 until 1996	63.3	48.8	0.8
2005 until 1995	62.5	48.8	0.8

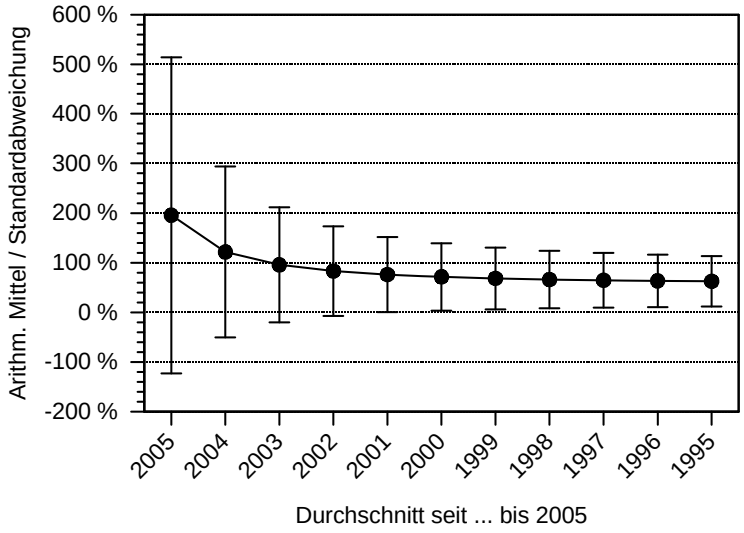
Source: SUF CIB 2005, own calculations, n(MIN) = 50

The development which is expressed in Table 2 by and large is the same for all groups analysed as is shown in the following figures. In the presentation, to mark the extension on the abscissa of the time period for calculating the averages in the numerator, only the first year is used, that is 1998 stands for the time period 1998 to 2005.

Figure 1 exemplifies the development of mean and variance of the individual replacement rates while extending the time period. It can be seen that if one uses just the year in which a person retires, the mean and the variance are extremely high. Because the denominator is the same for all time periods, Figure 1 indicates low insured earnings in the year of retirement. However, the influence of those "outliers" is more and more cancelled out by extending the time period. A differentiation by gender yields no other results on principle. However the variance for men is higher than for women, the trend is identical though.

[30] The complete findings can presented in Fachinger and Künemund (2008).

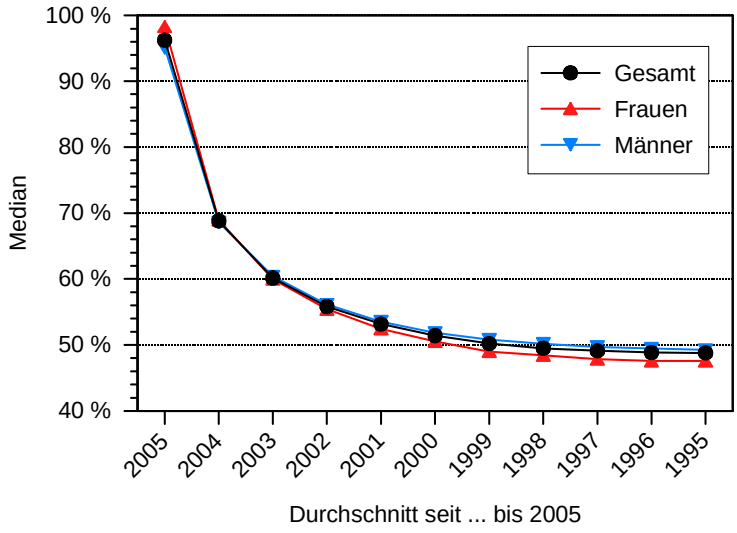
Figure 1: Individual replacement rate in 2005, all pension types, West Germany



Source: SUF CIB 2005, own calculations, n(MIN) = 50

Basically our results show, that the median should be preferred for the characterisation of the average of replacement rates, which should not be come as a surprise. The influence of outliers on the median is not as strong as on the mean. The level of the median is clearly lower than that of the mean – whereas the trend for both measures is the same. For women and men level and trend are widely consistent as well. At the same time it becomes obvious, how atypical the calculation turns out even in the case of median if values are used from a period just shortly before retirement for the computation.

Figure 2: Median of the individual replacement rate in 2005, all pension types, West Germany



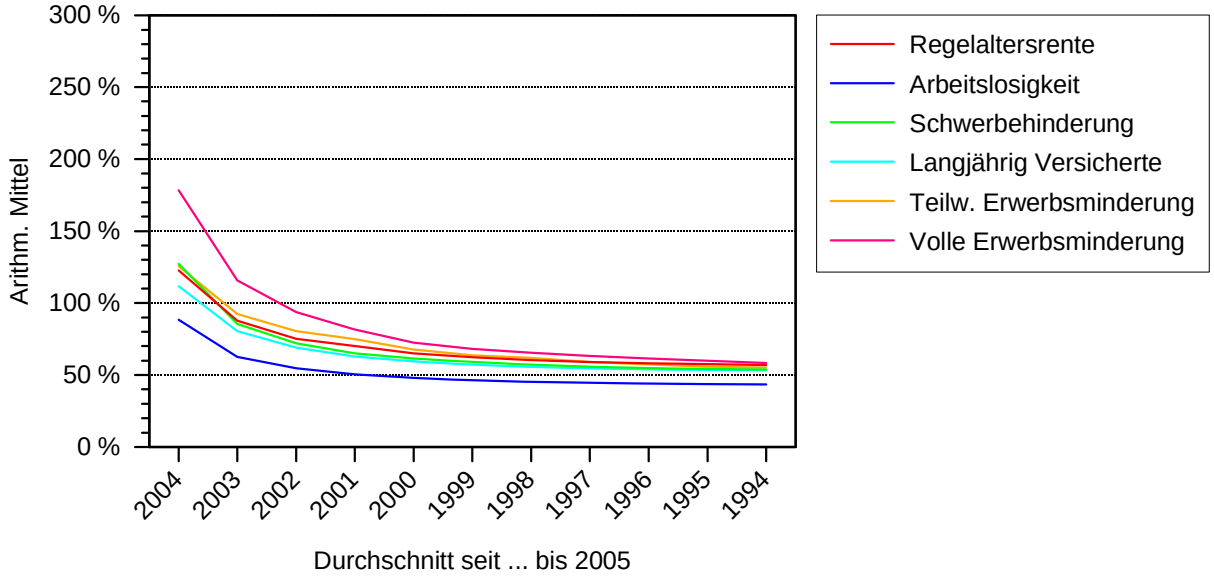
Source: SUF CIB 2005, own calculations, n(MIN) = 50

To clarify the effects of the heterogeneity of the sample on the level and variation of the replacement rate, more homogeneous groups were formed. As the extremely high replacement rates in the last years before retirement indicate, the insured income seems to be very low. Because workers have to fulfil special legal requirements to be entitled for a specific pension, low insured earnings in the last years before retirement may be more likely in particular pension types than in others. Therefore, the data are categorized according to the pension types. In addition, to demonstrate the effects of the different time periods not only for an "average" case but also for the "middle" one, we omit the upper and lower 20 percent of the distribution. For this reason, the variance is dramatically lower and at the same time the results are less influenced by singular cases. However, now also the mean can be used to illustrate the effect of the choice of time period.

As it becomes evident in Figure 3 and Figure 4, the trends of the profiles are more or less the same but the levels especially in the shorter time periods are distinctly different according to the pension types and gender. The mean of the replacement rates are especially high for standard pensions and - in the case of women - for pensions for people with long terms of insurance[31]. In case of the standard pension, it can be assumed, that a considerable portion of the insured in the last years before retirement entering the calculation with very low insured earnings, because they just need some more years (one or two) to fulfil the waiting period to be entitled for pension. Independent of the type of pension, the replacement rates for most pension types settle down around 50 percent for time periods which cover at least 5 years.

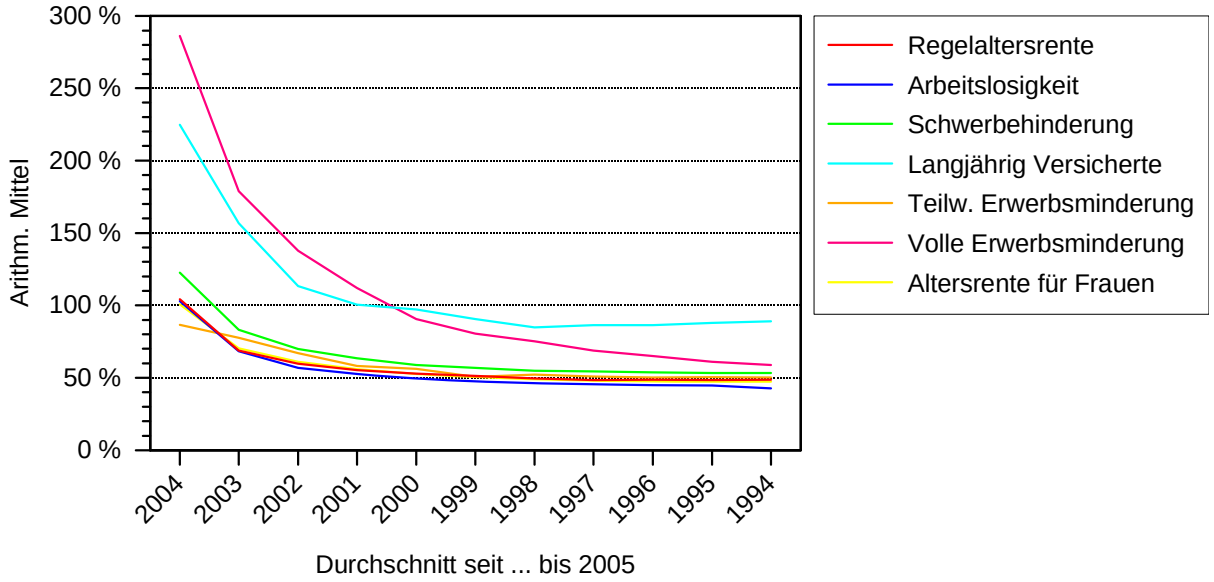
[31] They have to have at least 35 years of membership in the GRV.

Figure 3: Mean of the individual replacement rate in 2005 for pension types, West Germany, men



Source: SUF CIB 2005, own calculations, n(MIN) = 50

Figure 4: Mean of the individual replacement rate in 2005 for pension types, West Germany, women



Source: SUF CIB 2005, own calculations, n(MIN) = 50

To summarise the results regarding the research question whether there exists an optimal time period before retirement which should be used for calculating a replacement rate, the analysis shows, that a time period covering only one or two years has to be considered as irregular. Even when the median or only the middle 60

percent of the distribution is used by calculating the mean, a larger time period should unconditionally be used. Because of earning mobility, i. e. the unsteady development of insured earnings, and the often atypical employment and uncharacteristically earnings situation in the period short before retirement, it would make sense to use time periods covering the 4 or 5 years before retirement. The analysis confirms that the average of replacement rates becomes more set by further extension of the time period – independently of the pension type.

5. Requirements and recommendations

One objective of our analyses was to systematically discuss the fundamental methodological problems of calculating replacement rates with reference to procedures used in empirical analyses. In our empirical analyses, we have demonstrated the consequences of variations in the basis of calculations and of the differentiation in subsets of the sample regarding time period, gender and pension type. Based on the discussion of different methods to construct replacement rates and on the results of our empirical analysis we will draw some conclusions concerning the indicators and provide some recommendations on how replacement rates should be constructed to fulfil those requirements.

The comparison of indicators revealed a great variety in procedures and measurement of replacement rates. On the income dimension, the range encompasses special types of incomes (up to household earnings inclusive imputed rent from one's own property). On the time dimension, perspectives based on one single point in time (cross-section) as well as lifetime perspectives are used. The research unit differs extremely from single persons to households, and even the labour force on an aggregate level is considered. However, such differences occur not only between analyses, but sometimes also within an analysis. For example, different concepts are chosen for the numerator and denominator. Finally, different statistical measures ar used.

In the empirical analysis, we have demonstrated the consequences of using different measures, time frames, and social strata. The insured earnings were used as denominator and the pensions, calculated from these earnings records as numerator and – consequently – individuals were chosen as research unit. We dealt with the following questions:

1. Which are the consequences of the chosen time period for the level of the replacement rate and its variance?

2. Which social groups show uncharacteristically high values?

3. Is there an optimal phase before (and after) retirement, which should be considered?

An extension of the time frame stabilises the average and reduces the variance. It became evident that the selection of statistical measures has a considerable influence on the level of the replacement rate due to the high inequality of the income distribution shortly before retirement. Mean and median differ widely, if only a short time period is considered. The extension of the period results in a convergence of mean and median – however, even the median stabilises in a long-term perspective.

The considerable deviation of mean and median and the high variance are pointing towards an extensive heterogeneity of the population. For homogenisation gender- and type-of-pension-specific differentiations were carried out. The analyses show social differentiations. For example, the replacement rates for women who receive regular old-age pensions are comparatively high, while those for women who receive old-age pensions because of unemployment or after part-time work for employees over 55 are relatively low. However, an answer to the question, if and to what extent the labour market specific gender differentiation is also reflected in replacement rates remains a question for futher analyses.

Our analysss makes clear, that the nominator income should be based on a larger time period. As a rule of thumb, income from the last four of five years before retirement should be included. The pensions, calculated from earnings records of the GRV were used as numerator – that is the income, which is seen as the replacement for earned income –should be discussed in more extent: which types of pensions and payments are actually considered? Which taxes and contributions are taken into account? Aall these aspects can vary with the period of observation, e. g. because of amendments[32].

In analyses going a step further, other types of income from the phase before and after retirement should be considered additionally, e. g. to draw conclusions about the level of living standard that the social security systems are supposed to ensure. Such research perspectives – and also further social differentiation – should be addressed in a broader research perspective. Especially in view of the changes in statutory old-age pension systems and the new role of private and occupational pensions such analysis are of considerable relevance.

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[32] An example is the reduction of the current pension value (aktueller Rentenwert, § 68 SGB V).

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