European Network of Economic Policy Research Institutes

ADEQUACY OF PENSION SYSTEMS IN EUROPE:

AN ANALYSIS BASED ON COMPREHENSIVE REPLACEMENT RATES

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ENEPRI RESEARCH REPORT NO. 68
AIM WP 9

APRIL 2009

ENEPRI Research Reports publish the original research results of projects undertaken in the context of an ENEPRI project. This paper was prepared as part of the ***Adequacy of Old-Age Income Maintenance in the EU (AIM) project –*** which has received financing from the European Commission under the 6th Research Framework Programme (contract no. SP21-CT-2005-513748). The views expressed are attributable only to the author and not to any institution with which she is associated.

ISBN 978-92-9079-879-8
Available for free downloading from the ENEPRI website (http://www.enepri.org) or the CEPS website (www.ceps.eu)

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Summary

Providing access for all individuals to appropriate pension entitlements, public and/or private, which allow them to maintain, to a reasonable degree, their standard of living after retirement is considered a social policy objective.[1]

An exploration of the above objective can be performed by comparing the individuals' living standards when active and when retired. The aim of this paper is to develop indicators to highlight the ability of different national pension systems to enable individuals to maintain their living standards at retirement. We will perform the analysis using data – and projections – on different European countries. The proposed indicators will be computed both on actual and projected data.

We propose the use of a 'COmprehensive Replacement' (CORE) rate. The measurement is conceptually very simple, as it is based on the comparison (or, more precisely, on the ratio) of living standards after retirement with living standards when active.

Our aim is to compute, for a set of countries representative of the different European welfare and pension systems, both an actual (data-based) version of CORE, based on ECHP data, and to project its evolution into the future. To this end we will use the semi-aggregate simulation model CeRPSAM (Ferraresi & Monticone, 2008).

The paper is organised as follows. Section 1 provides a theoretical framework as well as a review of the literature on the topic. Section 2 contains the computation of replacement rates based on ECHP data. In Section 3 we use the CeRPSAM projections to compute COREs over time. Section 4 concludes.

1. The three dimensions of the 'adequacy' concept

In the latest World Bank report on pension reforms, Holzmann and Hinz (2005) define as adequate a pension system

> "that provides benefits to the full breadth of the population that are sufficient to prevent old-age poverty on a country-specific absolute level, in addition to providing a reliable means to smooth lifetime consumption for the vast majority of the population". (Holzmann & Hinz, 2005, p. 6)

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1 See "Supporting national strategies for safe and sustainable pensions through an integrated Approach", Communication from the Commission to the Council, the European Parliament and the Economic and Social Committee, Brussels, July 2001.

This definition is centred on two features implicitly derived from the two main objectives of a (public) pension system: the reduction of the risk of poverty in old age and the maintenance – at the individual level, i.e. according to his/her preferences and constraints – of the standard of living between the active part of the life cycle and retirement (the consumption smoothing function). To these, a third objective can be added, i.e. the establishment of a compact between generations, so as to avoid the formation of a (large) gap between the resources allocated respectively to workers and retirees (or to different cohorts of retirees), which imposes some constraints on contributions and pension indexation.

For clarity of exposition, it seems appropriate to rearrange the three objectives according to a change of perspective, from the individual/longitudinal one to an aggregate/cross sectional examination: consumption smoothing; prevention of poverty; generational compact.

The first objective – the 'consumption smoothing' function – seems essentially tied to the individual (family) problem of inter-temporal allocation of resources and does not carry, prima facie, clear implications for the 'adequacy' issue, except in terms of the rather obvious proposition of avoiding an unexpected drop in consumption at retirement. From an individual point of view, the problem is perhaps better described in terms of (in)adequate preparation (Diamond, 2004, p. 3) to the multiple decisions that would make up a satisfactory amount of retirement savings: how much to save, how to invest, how to transform accumulated wealth into an annuity, which type of annuity. Prior to these decisions, and perhaps equally problematic, is the (limited) capacity of individuals to predict their (changing) needs. To worsen this lack of preparation, various inadequacies arising from the market side, as the literature on insurance (starting from Stiglitz, 1983) has long highlighted, have to be accounted for.

From this perspective, the public pension system substitutes for the individual's poor capacity to make rational and far-sighted choices: within social security the degree of freedom left to the individual is thus very limited, including neither the payroll tax rate, nor the investment strategy, nor, by and large, the annuitisation strategy.[2]

An 'adequate' system should then incorporate some mistrust of the individual's planning capacity, far-sightedness, intertemporal consistency and consequently rules and/or incentives so as to substitute for/encourage individuals' planning capacity.

The second objective – the prevention of poverty in old age – arises from the fact that even good preparation, however important for the smoothing of consumption, is not in itself a sufficient condition to avoid a lack of resources in old age: health problems, a limited working ability and an unfortunate working career can hit prudent individual as well as myopic ones. When markets are imperfect and incomplete, characterising the (public) pension system with an explicit redistributive task is thus a good thing. This 'social protection' function – although in many countries historically prevalent – is not however necessarily intrinsic to the pension system, which could be fully modelled according to the principle of 'actuarial equivalence' (Disney, 2004 and Holzmann & Palmer, 2006). It would then provide insurance at fair prices, allowing for consumption smoothing but not for a specific antipoverty policy. While the latter can always be implemented outside the system and possibly paid for by taxes instead of

[2] To quote Diamond again (2004, p. 4): "these different shortcomings in preparation for retirement relate to different issues – inadequate overall provision for retirement relates to having a mandatory program, inadequate annuitisation relates to providing benefits in annuitised form, inadequate protection of family members relates to providing benefits for surviving spouses and young children". The lack of households' planning ability is also stressed by other authors, for example Engen, Gale & Uccello (1999) and Lusardi (2000).

earmarked contributions, there are arguments in support of having an explicit redistributive policy incorporated in the system, directed at altering the distribution of wealth. Drawing further from Diamond (2004, p. 12):

> "the progressivity in the (pension) formula uses taxes that distort labor supply in order to redistribute income and provide insurance. The progressive annual income tax also redistributes income, provides insurance against earnings uncertainty and distorts labor supply. Since these two institutions work on different tax bases and provide payments at different times there is room for each of them to contribute despite the presence of the other".

The argument here is that having two instruments instead of only one (the tax system), with one specifically directed at the elderly, may not only be a more effective solution, but also a more efficient one.

Taking the 'antipoverty' dimension of social security systems, the question arises as to whether the provision of a universal basic benefit, granted on a citizenship basis, should be preferred to either means-tested provisions or to an actuarially fair system that credits the worker with 'notional' contributions, paid out of general taxation, for the periods in which he/she is unable to do so (because temporarily out of work) and which, at retirement, integrates the accrued benefit if this is below a given minimum level. OECD (2007) reports the main features of the so-called "first tier" of pension provisions, in the forms of either a basic or a minimum pension, or a highly redistributive resource-tested benefit.

The third objective – establishing a generational compact – introduces a further dimension of the adequacy concept as to the comparison between the standards of living of the retirees and the active population. This implies switching from a longitudinal to a cross-sectional perspective. If there is adequate consumption smoothing at the individual level, the distance between workers and retirees will depend on aggregate shocks (demographic and economic); on the other hand, inadequate preparation is likely to determine a wider gap between the two groups, particularly in periods of high growth: the earnings of the active population will then grow faster than the pension benefits of the retirees; a rising life expectancy is likely to enhance the gap between generations.

1.1 Theoretical framework and background issues

The focus of this work is on the first objective outlined above, that is the consumption smoothing function of a pension system.

A natural setting for an interpretation of individuals' behaviour is the *life cycle hypothesis*, interpreted as a flexible parameterisation of a dynamic optimisation problem in which the decision unit is the household, rather than the individual.

In its simplest form, the life-cycle model predicts that individuals smooth their consumption patterns throughout their lives, regardless of *anticipated* income shocks. As far as retirement is correctly anticipated, this version of the model implies that consumption is smoothed at the time of retirement, and thereafter. The caveat about having "correct expectations" is a big one. On the one hand, retirement may happen as a result of an unexpected shock against which individuals cannot fully insure (such as the loss of job or a sudden worsening in health). On the other hand, individuals may have a poor understanding of the rules and formulae determining their pension level. A number of studies explore the degree of uncertainty individuals have about both the timing and resources of retirement (Gustman & Steimeier, 2001; Ameriks, Caplin & Leahy, 2002; Hurd & Rohwedder, 2003 and 2005). The evidence they provide is mixed, although some support is given to the hypothesis that individuals do expect consumption to drop at retirement.

Early research on the consumption smoothing hypothesis (e.g. Hamermesh, 1984) found that consumption levels actually fall after retirement, a phenomenon that has been interpreted as a failure to save enough for retirement.

Subsequent research has highlighted that more general versions of the life-cycle model imply that the marginal utility of consumption, and not necessarily consumption itself, is smoothed across time periods. Hence, in less restricted versions of the model, it may be *optimal to reduce consumption* at the time of retirement.

One way to generalise the model is to allow demographic characteristics to affect the (marginal) utility of consumption:

$$U_t(c_t) = (1+\delta)^{-t} u(c_t, z_t) \tag{1}$$

where c_t is consumption at time t, δ is the rate of time preference, and z_t are variables of demographic characteristics that affect the utility of family consumption at time *t*.

Equating the expected marginal utilities between time periods gives the first-order condition of the maximisation problem faced by the individual (or family) in an uncertain environment (Hall, 1978). The demographic variables affect the marginal utility of consumption: if the marginal utility of consumption is high in some periods of the life-cycle because of the effect of *z*, then consumption in those periods will be higher, since the marginal utility is decreasing in consumption. An important demographic variable has proven to be the size of the family (see for example Attanasio & Browning, 1995): when the family is larger, the marginal utility of additional consumption is also higher.

Banks, Blundell and Tanner (1998) estimate on UK data a specification in which age and family size are included as demographic variables affecting the marginal utility of consumption. They also allow for the mortality risk to have an effect, to capture the possibility that their ageing sample is getting richer as mortality is negatively correlated with wealth, or that discount rates may get higher as individuals get older. Finally, they introduce the labour market status of the head of the household into the analysis, thus capturing the effect of work-related expenses on the optimal consumption path. Both mortality risk and work-related expenditures are found to explain an important part of, but not all, the drop in consumption at retirement.

A further generalisation that has been considered in the literature is to specify the utility to depend not only on consumption, but also on leisure, *l*:

$$U_t(c_t, l_t) = (1+\delta)^{-t} u(c_t, l_t, z_t) \tag{2}$$

If utility is non-separable over consumption and leisure, that is if the marginal utility of consumption is also affected by leisure, then a discrete change in leisure – as usually occurs at the time of retirement – will be associated with an optimal change in consumption, in order to smooth the marginal utility of consumption. The sign of the change in consumption will depend on whether consumption and leisure are substitutes or complements: if they are substitutes, an increase in leisure at the time of retirement will result in an optimal decrease in consumption, while if they are complements the reverse will occur.

It can be noticed that some types of leisure are substitutes to consumption, as home repairs for instance, other are complements, such as travel, and some others are neutral (such as food). Which type will dominate depends on individual tastes and it is an empirical question to find the overall sign of the effect of leisure on consumption. It is important to stress, however, that if leisure affects the marginal utility of consumption, it may be optimal *not to smooth* consumption at retirement.

As estimation of a structural model in which preferences are not separable over consumption and leisure is particularly cumbersome, indirect evidence can be provided to support its implications. Hurd and Rohwedder (2006) use US data on anticipated and actual changes in consumption at retirement, as well as on activities or uses of time, to show that individuals do expect to lower consumption after retirement, and that, on average, the anticipated decline is even larger than the realised one. In addition, they also show that the pattern of spending and time-use before and after retirement is qualitatively consistent with models of household production in which time is combined with market-purchased goods to get utility. Hurd and Rohwedder (2006) therefore suggest that home production and the cessation of work-related expenditures explain the decline in consumption at retirement. Aguiar and Hurst (2005) reach a similar conclusion by comparing data on (food) *consumption* with data on (food) *expenditure*: while the second exhibits a drop, the first does not.

Whether the observed consumption drop is consistent with optimal behaviour – reflecting the lower expenditure needs of the retired – or is due to bad news or non-optimal behaviour is thus still an open question. The difficulty in resolving it is mirrored in the difficulty in assessing the relative amount of resources individuals need, during retirement, in order to *maintain their living standard*. The literature on replacement rates is typically silent about this issue, also because these are ratios of incomes not measures of consumption, which is more closely related to individuals' well-being. In what follows, we follow the practice of presenting our measures for comparison purposes, without referring to any optimal level, not without anticipating, however, some of the problems in measuring the living standard of retirees.

1.2 Measuring living standards

Measuring the living standard (or welfare) of an individual or a family poses some theoretical and practical problems: in this study we follow the practice of using the concept of money metric utility, whereby the indifference curves of individual preference orderings are labelled by the amount of money needed to reach them at some fixed set of prices (Deaton & Muellbauer, 1980). In order to avoid the specification of a parametric utility function, money metric utility can be approximated by some quantitative measure, most often disposable income or expenditure.

As for the choice between expenditure and income as a measure of living standards, from a theoretical perspective, according to the life-cycle model, consumption is detached from current income and it is therefore a superior indicator of lifetime welfare. From a practical point of view, on the other hand, household consumption is rarely measured because the collection data is much more demanding than in income surveys, which are consequently more widely used. In addition, income surveys are often longitudinal, allowing the measurement of family income for various successive years and thus enabling the construction of a more reliable measure of the living standard than is possible with cross section analysis of consumption.

Another issue concerns the unit of analysis: as surveys collect data at the level of the household, and not of the individual, the living standard measure based on consumption or income refers to the household. Even if income is collected at the individual level, there are components of household income that are not attributable to individual household members (e.g. income from assets). Consequently, it is possible either to measure welfare at the household level and treat the household as the unit of analysis, or to devise some rule to divide household income or expenditure between its members, and then treat individuals as the unit of the analysis. Equivalence scales are normally used to allocate household welfare to individuals.

1.3 Alternative replacement rates: the empirical literature

Replacement rates have been widely computed in the literature; nonetheless, there is not a unique definition of replacement rate. Here we review the main empirical issues that arise when calculating these relative measures, and we propose a taxonomy. Our discussion is not meant to be a comprehensive review of the studies that compute replacement rates; rather, we pay particular attention to the issues that arise when performing *international comparisons*.

1.3.1 Theoretical, empirical or simulated replacement rates

A first distinction can be drawn on the data source used to compute the replacement rates: calculations can be based on a – relatively small – number of 'typical' career patterns (*theoretical replacement rates*), on actual data (*empirical replacement rates*) or on data that are the result of some simulation model (*simulated replacement rates*).

Recent work on theoretical replacement rates has been undertaken by the Indicators Sub-Group (ISG) of the Social Protection Committee (2006), and by OECD (2005 and 2007) see Box 1. These replacement rates, calculated for a (necessarily limited) number of 'typical' cases (corresponding for example to the median earner and to multiples of the average earnings), are mainly useful to describe the pension systems rules and their evolution in the future, as described by the phasing in of the reform (if any).

Box 1. Theoretical replacement rates at retirement

The two main official studies dealing with the calculation of replacement rates at retirement are: ISG (2006) and OECD (2007).

In the report *Current and Prospective Theoretical Pension Replacement Rates* by the Indicators Sub-Group (ISG) of the Social Protection Committee (DG Employment) replacement rates are calculated for sample individuals to allow a comparison of similar work histories among different European countries (ISG, 2004 and ISG, 2006). The sample individuals have a career pattern lasting 40 years, from the age of 25 to 65, a full time job and a salary steadily equal to 100% of the national average wage. Other common assumptions include the inflation rate and the formula to calculate pension and survivors' benefits.

Replacement rates can be made comparable not only by setting common assumptions, but also by choosing the individuals who best represent the population of their country. In order to allow for higher comparability, some variations of replacement rates are calculated, considering lower earning profiles (2/3 of the national average wage), more dynamic careers (from 100 to 200 % or from 80 to 120 % of the average wage), or interrupted careers (lasting 30 years instead of 40, with a 10-year out-of-work period after the first 15 years).

In *Pensions at a Glance 2007* (OECD, 2007) gross and net replacement rates are calculated for sample individuals entering the labour market at the age of 20 and working until retirement. The gross replacement rate is calculated for workers with incomes equal to the median and to 0.5, 0.75, 1, 1.5 and 2 times the national wage. Net replacement rates take into account the individual's taxation and paid contributions. The calculation of supplementary pension benefits assumes a yearly actual return rate of 3.5%, net of administrative costs. Two sensitivity analyses are performed, considering individuals entering the labour market at the age of 25 and other return rates for supplementary pensions (1 and 6%).

A comparison between the ISG (2006) and the OECD (2007) theoretical replacement rates is made difficult by the different hypotheses supporting the calculations. For a comparison with our sample replacement rates, we use the ISG (2006) theoretical replacement rates.

Theoretical replacement rates raise several issues. First, a key difficulty in this context is the definition of the representative workers, which is particularly subtle when comparing different countries, as representativeness may vary across countries. Second, the focus is only on public/private pensions, and it ignores other resources, public or private, on which the elderly can live. Finally, the structure of the family is typically not accounted for.

Empirical replacement rates are computed using survey income data: the advantages of this technique lie in the possibility of accounting for heterogeneity, and in particular to control for different career patterns, family structures or income sources other than public or private pensions. Difficulties with this approach arise as a consequence of the scarce availability of longitudinal data, which are needed to compare incomes for the same individuals at different points in time (active/retired). International comparisons in this context are obviously limited by the availability of comparable data sources. Examples of empirical replacement rates in an international comparison can be found in Hauser (1997), Disney, Mira D'Ercole & Scherer (1998), Förster & Pellizzari (2000), Disney & Johnson (2001).

Simulation models can overcome most of the difficulties encountered when building theoretical and empirical replacement rates: in particular, microsimulation models, by constructing heterogeneous working careers and modelling many features of the real world, have the potential to solve the limits imposed both by the construction of 'typical' career patterns and by the data availability. International comparisons based on microsimulation models are however difficult to implement, due to the high technicality of the models and to the calibration problems. A semi-aggregate model such as the one proposed in Ferraresi & Monticone (2008) could be more appropriate for international comparisons.

1.3.2 Time horizon: actual or prospective replacement rates

While actual replacement rates give a picture of the present (or past) actual ratio between resources during retirement and resources when active, prospective replacement rates seek to project the evolution of this ratio into the future. Prospective rates are particularly useful due to the public systems changing rules and to the changing economic scenarios. In addition, prospective rates can incorporate already legislated changes to the pension systems or simulate new reforms.

Prospective rates are – quite obviously – either theoretical or the result of some simulation model: in addition to the points raised above (see 3.1) on these measures, it can be observed that the results depend heavily on the economic scenarios used and on the projection techniques.

Examples of theoretical prospective replacement rates can be found in the work of the Indicators Sub-Group (ISG) of the Social Protection Committee (2006).

1.3.3 Cross-sectional or longitudinal replacement rates

The cross-sectional replacement rate is computed using data at a particular point in time; in other words, income of the retired at a given time *t* is compared with income of the active at the same time *t*. Such a measure is therefore used to study the relative position of the elderly in a society, or intergenerational solidarity.

The longitudinal replacement rate compares incomes of the same individuals at different stages of their own life (working/retired): this measure can be used to study the degree of maintenance of an individual's own living standard, or the degree of consumption smoothing.

All the data-based international studies cited above (Hauser (1997), Disney, Mira D'Ercole & Scherer (1998), Förster & Pellizzari (2000), Disney & Johnson (2001) offer examples of cross-sectional replacement rates. The theoretical replacement rates computed by the Indicators Sub-Group (ISG, 2006) are examples of longitudinal replacement rates.

1.3.4 Aggregation: individual or average replacement rates

Having information on each individual's resources before and after retirement, it is possible to compute individual replacement rates, and from these to obtain a measure of the average individual rate. On the other hand, it is also possible to compute the average of the resources available to a group of individuals before and after retirement, and to take the ratio of the two as a measure of the average replacement rate.

Individual replacement rates are informative about the heterogeneity of resources the elderly are entitled to and are appropriate for a distributional analysis. When interested in a synthetic measure, however, averaging over individual replacement rates would result in an index that is strongly affected by a relatively small number of individuals with very high rates. These cases typically occur when individuals are poor during their working life, and should be excluded from an analysis on the maintenance of living standards since they had not the possibility to prepare for retirement.

Average replacement rates, defined as the ratio of the average resources before and after retirement, have also be used to overcome this problem and are also appropriate in measuring the mean outcome.

1.3.5 Unit of analysis: individual or family-based replacement rates

The unit of analysis also plays an important role: this can be the individual, the nuclear family or the household. While individual-based replacement rates are informative about the functioning of the pension system, family-based replacement rates are more informative about the overall economic situation of the elderly and could be more appropriate in the study of adequacy.

In order to account for the impact of household composition on the economic situation of each individual, it is usually the case that living standards are defined in terms of disposable equivalent incomes. By virtue of estimated equivalence scales, the income of each individual is re-scaled in such a way to account for heterogeneous household compositions. This solution allows us to maintain the analysis at the individual level, even if accounting for the implications of the household composition on the economic situation of each individual.

Taking into account the structure of the family, however, requires a great deal of information: while this is usually available in micro data sets, because of its complexity it rarely appears in simulation models.

1.3.6 Income measure: pensions or disposable income

The income measure to be used in the computation of the replacement rates is obviously crucial. Usually, the replacement rate is defined as the ratio of (public and private) pension income to working income. This definition is useful when the purpose of the index is to isolate the role of the pension system.

However, when the focus of the analysis is the assessment of the economic well-being of the elderly, more comprehensive measures of income may be used. For example, Disney et al. (1998) perform an international comparison of the resources of the elderly using a "comprehensive" replacement rate, defined on a broad definition of income for both the retired and the active. Disposable income should therefore include earnings, self-employment income, public transfers and private pensions.

Finally, it should be noticed that an important component of a living standard measure is the imputed rent from own-occupied housing, which should be added to both the numerator and the denominator of the replacement rate. Cross-country analyses often neglect this source of income due to (scarce) data availability.[3]

1.3.7 Net or gross replacement rates

Most studies use after tax income in the definition of the replacement rate: this is obviously crucial in a cross-country study, but it is also important in a single country analysis, as pensioners do not pay for their social security any more, and taxation of pension income may be different from working income.

The Indicators Sub-Group (ISG) of the Social Protection Committee (2006) is computing both gross and net (theoretical) replacement rates, defining the latter not only as net-of-tax income ratio but also including means-tested income support, when appropriate. Being the calculations based on theoretical working patterns, however, in most countries the amount of means-tested income the theoretical worker receives is equal to zero.

2. Computation of COREs based on ECHP data

2.1 Methodology

We will perform the analysis using data on eight countries: Italy, Spain, France, Germany, United Kingdom, Denmark, Netherlands and Luxemburg.

The measure we propose to use is conceptually very simple, as it is based on the comparison (or, more precisely, on the ratio) of the living standards after retirement with the living standards when active. As a measure of the living standards we use *disposable income.*[4] We know that consumption would be a better measure to appraise the individuals' standard of living, while "*permanent income*" should be preferred to assess the capability of individuals to smooth their consumption.

We use, however, disposable income mainly for two reasons. First, consumption is not available in the ECHP data base. Second, since the main source of income uncertainty – i.e. the uncertainty of labour income – is no longer relevant for retirees, it is to be expected that disposable income is not a bad proxy for permanent income. Indeed, it could be a suitable indicator of the adequacy of resources for retirement, which is the focus of this study.

By using the ECHP data, we are able to define disposable income in a very broad way, including pension income from public and private schemes, income from work, unemployment, disability, survivor, housing and other social benefits. Clearly, the weight of each component will vary according to the active/retired status of the individuals. As we perform a cross-country study, all the income measures are defined in net (after tax) terms.[5]

As the focus is on the maintenance of the own living standard, the index we propose to use is longitudinal, i.e. it compares incomes of the same groups of individuals at different points in time, specifically when they are active and when they are retired.

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[3] However, some national studies do take into account housing: see for example Munnel & Soto (2005).

[4] In their study of the resources of the elderly, also Disney et al. (1998) define a "comprehensive" replacement rate, using a broad definition of income for both the retired and the active.

[5] With the exception of France, for which only gross figures are available in the data.

With respect to the projections, the computations based on the ECHP data can serve both as an investigation of the current situation of the elderly and as a tool to compare the performance of different definitions of the index. In particular, information about the family structure in the data permits us to compute the comprehensive replacement rate both at the individual and at the family level, in order to assess the importance of the family structure in providing financial security to the elderly. The family-based index is computed pooling all incomes in the family and assigning them to individuals according to an equivalence scale (see section 2.5). The equivalised individual income is then used to compute the replacement rate.

The projected replacement rate, on the other hand, will necessarily be individual-based, as the family structure is not projected by the simulation model.

For comparison purposes, we will also compute standard replacement rates, defined as the ratio between pension and working income, to show how the inclusion of disposable income in the computation of the index affects the results.

2.2 Welfare regimes in the countries analysed

In this section we briefly review the social security systems in the countries analysed and provide a comparison between the theoretical replacement rates (computed by the ISG group) and the sample ones we compute.

A rationale for the choice of the countries included in this study, along with data availability, is to be found in the studies conducted together by Soede et al. (2004), and Soede and Vrooman (2008) in which countries are classified according to an Esping-Andersen-type criterion.

In particular, Soede et al. (2004) classify welfare regimes along two dimensions: scope – or size – of social security and extent of benefits. According to this classification, they identify an Anglo-Saxon type, characterised by an average size of social security and a very low level of pension benefits; a Nordic cluster, with a very sizeable social security and moderate pension benefits; a continental group, where the size of social security is neither low nor high, and pension benefits are slightly above the average; plus a Mediterranean group characterised by low size of social security but fairly well developed pension schemes.

The paper by Soede and Vrooman (2008), on the other hand, provides a classification according to the pension system existing in each country. They find that two main dimensions of the various pension systems are relevant: the average pension level of the pension schemes and the division between public and private in the mandatory systems. In their analysis, four clusters have been identified. A *corporatist* group has generally rather high earnings-related pension benefits. The *liberal* countries generally provide a more basic, means-tested pension. A '*moderate pensions*'-cluster was also detected in which the benefit levels are between the corporatist and the liberal clusters. The analysis also identified a fourth '*mandatory private*'-cluster, in which private arrangements are made within the mandatory pension system.

According to these classifications (both for welfare regimes and for pension systems), we can describe the analysed countries as follows:

- Italy and Spain belong to the Mediterranean welfare system group, characterised by small amount of social security but fairly well-developed pension schemes (it should be acknowledged, however, that Italy will profoundly change in the future, moving towards more insurance and less redistribution in the public pension scheme, and thus towards the Nordic style, in consequence of the full application of the 1995 reform, which introduced the NDC system).

- France, Luxemburg and Germany belong to the continental group, where the amount/scope of social security is neither low nor high, and pension benefits are slightly above the average. All these countries, characterised by high public pension benefits, are in the corporatist cluster as far as their pension system is concerned.
- The United Kingdom is of course the most typical example of the Anglo-Saxon type of countries, characterised, as compared to other countries, by an average size of social security and a very low level of pension benefits; from a pension system perspective, the UK belongs to the liberal cluster.
- The Nordic type, with a mandatory-private pension system, is represented in our analysis by Denmark, with a very sizeable social security system and moderate pension benefits. Other mandatory-private countries, present in our study, are Poland and the Netherlands. As for the Netherlands, it should be noted that, according to the Soede et al. (2004) study, it shares some features with both the continental and the Nordic type, being characterised by above average pension benefits and a higher level of social security with respect to the continental countries – but lower with respect to the Nordic ones.
- Finally, our data-based analysis excludes new member states: this is because we base our calculations on ECHP data and this dataset excludes these countries.[6]

In order to analyse pension systems in greater detail, in Table 2.1 we report the theoretical replacement rates computed by the ISG group (ISG, 2006): these country-specific calculations are based on a uniform methodology. However, the representativeness of the typical worker considered may vary across countries. According to this methodology, base-case replacement rates are computed for a single (male, if relevant) worker covered by the most general scheme, in full-time work, earning average earnings for his 40 year long career and retiring at 65. The pensions schemes included in the analysis are both the first pillar and, when relevant, the supplementary (occupational or personal) schemes. In Table 2.1 we report ISG (2006) results for the countries considered in our analysis: with the exception of Germany, which displays a total net replacement rate of 63%, in all other countries total net replacement rates are well above 70%. It should be noted, however, that in none of the countries considered is the average retirement age actually 65, as assumed in the theoretical calculations.

Table 2.1 Theoretical Replacement Rates (percentages)

	First Pillar	Second Pillar	Total Gross	Total Net
DK	45.1	3.6	48.7	**71.3**
NL	29.6	41.1	70.6	**92**
F	66.2	0	66.2	**79.7**
I	78.9	0	78.9	**87.8**
ES	90.5	0	90.5	**97.2**
D	43	0	43	**63**
LUX	90.8	0	90.8	**98.3**
UK	17	50	66	**82**

Source: ISG (2006).

Note: Total Net RR for Denmark includes housing benefits.

[6] However, Poland, Latvia, Hungary and the Slovak Republic are included in the projection analysis performed in Section 3.

In order to provide a first comparison, in Table 2.2 we report sample replacement rates based on our calculations from the ECHP data, and the theoretical replacement rates provided by the ISG (2006). For comparability, we report replacement rates based on the first and the second pillar, net of taxes, and for males only.[7] With the exception of Germany and France, all the sample replacement rates are lower than the theoretical ones, reflecting lower average retirement ages and, very likely, shorter working careers than those considered in the theoretical computations, which consist of 40 years.[8]

Table 2.2 Comparison between sample and theoretical replacement rates (males only)

Country	DK	NL	F	I	ES	D	LUX	UK
Sample	69	89	80	83	89	79	81	60
Theoretical	71	92	80	88	97	63	98	82

Source: Authors' calculations based on ECHP data and ISG (2006).

Note: sample RR for France is in gross (pre-tax) terms.

2.3 Data and definition of variables

We use data drawn from the European Community Household Panel (ECHP) both to compute actual replacement rates and as a basis for our projections. In the analysis, we use the survey years from 1996 to 2001 (that is from wave 3 to 8, the last available wave).

The ECHP is a longitudinal survey of a representative panel of households and individuals in each country, covering a wide range of topics: income, health, education, housing, demographics and employment characteristics, etc. The total duration of the ECHP is 8 years, running from 1994 to 2001. The two major areas covered in considerable detail in the ECHP concern the economic activity and personal income of the individuals interviewed. Being based on a standardised questionnaire the ECHP yields comparable information across countries, which we exploit by constructing replacement rate measures.

Having rich information on various income sources and on the family structure, we conduct our analysis at both the individual and the family level. In particular, we are able to compute both replacement rates (RR) and comprehensive replacement rates (CORE) at the time of retirement for individuals retiring between 1997 and 2001, considering the employees as well as the self-employed. As we aim to compute longitudinal measures, that is we want to compare resources after retirement with resources before retirement for each individual, we select those individuals retiring at time t which are observed in the sample also at time $t-1$. For the same individuals, replacement rates measures are computed using the resources of the whole family, equivalising incomes using the modified OECD equivalence scale (see par. 2.5).

We now turn to a more detailed definition of the variables we use in our analysis.

Definition of retirement: we use both information on old-age pension receipt and self-reported status; individuals receiving an old-age benefit and reporting themselves as retired are classified as retired. For the Netherlands the self-reported status is not available: we thus use information on main activity (or main income source).

[7] The methodology used to compute the sample replacement rates is described in detail in the next section.

[8] Indeed, most countries have some kind of early retirement provision allowing workers to retire having less than the so-called 'normal' retirement age, and thus also less than 40 years of seniority.

Definition of income for sample Replacement Rates: for the numerator we use monthly net old age pension benefits the year following the year of retirement. Old age benefit is defined as the benefit deriving from the first and second pillar. We consider the benefit in the year after retirement, as this procedure allows us to identify a ‘regular’ pension, e.g. it avoids considering lump sum payments received at the time of retirement. For individuals retiring in 2001 (last year of observation) we use information available in the same year of retirement. For the denominator we use monthly net income from work (earnings plus self-employment income) in the year prior to retirement.

Monthly figures are obtained by dividing the annual figures by the number of months in which the corresponding income was received.

Definition of income for CORE: Numerator: Net disposable income received the year after retirement (for individuals retiring in 2001, we use disposable income at the time of retirement). Denominator: Net disposable income in the year prior to retirement.

Definition of net disposable income. Income from work, self-employment, private income, unemployment, old-age, survivor, family, disability, education, housing, and social benefits. All income figures are in net (after tax) terms, except for France for which only gross figures are available.

Having computed individual replacement rates, we then present their median over the whole sample. In this way we take into account poor households: their extremely high replacement rates – due to redistributive fiscal policies – would misleadingly increase the average replacement rates computed. Alternatively, we could compute average replacement rates except from the sample poor households (according to some standard definition of poverty). The results do not change in any substantial way.

Box 2. Income sources (ECHP classification)

Income sources are derived directly from ECHP data, without any adjustment on our part.

Wages and salaries

Normal income from work as an employee or apprentice and additional earnings from overtime, commission or tips. Additional payments (13th and 14th month’s salary), holiday pay or allowance, profit-sharing bonus, other lump-sum payments and company shares are also covered.

Self-employed income

Data on income from a person’s own business, profession or farm are gathered as the pre-tax profit, i.e. the profit after deducting all expenses and wages paid, but before deducting tax or funds withdrawn for private use. This pre-tax profit is converted into net profit on the basis of a net/gross ratio.

Private income

- Income from property: rental income after deducting mortgage, repairs, maintenance, insurance. The value before tax is converted into a net figure on the basis of a net/gross ratio. Data on income from property is gathered at household level and divided equally among all adult members (persons aged 16 or more) of the household.
- Capital income: Interest on savings certificates, bank deposits and dividend from shares.
- Private transfers: Any financial support or maintenance from relatives, friends or other persons outside the household.

Source: Ferraresi & Monticone (2008).

2.4 An individual-based analysis

In this section we present the results based on individual data, while in the next we will take into account family structure. We begin our analysis by comparing individual 'standard' replacement rates (RR) and comprehensive replacement rates for each country, using the methodology and data described above. The results reported in Table 2.3 and in Figure 2.1 refer to the whole sample, male and females.

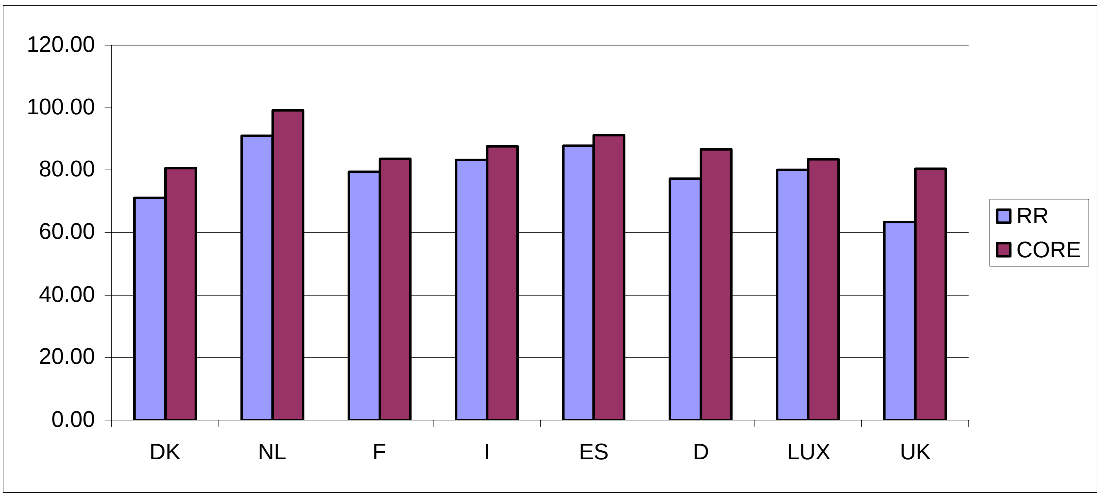
From our calculations, it appears the individual RR ranges from 91%, observed in the Netherlands, to 63%, observed in the United Kingdom. When comparing disposable income after and before retirement (that is, when computing CORE), the results indicate higher replacement rates for all countries, as well as less across-country dispersion.

Table 2.3 Median individual RR and CORE, Total Sample

Country	DK	NL	F	I	ES	D	LUX	UK
RR	71.18	90.91	79.50	83.27	87.76	77.27	80.02	63.38
(se)	*(64.93)*	*(120.83)*	*(57.39)*	*(107.94)*	*(124.27)*	*(112.34)*	*(59.67)*	*(92.20)*
CORE	80.69	99.15	83.55	87.53	91.28	86.64	83.51	80.39
(se)	*(61.70)*	*(114.74)*	*(38.93)*	*(100.08)*	*(105.42)*	*(66.34)*	*(22.33)*	*(86.62)*
NoB	132	150	358	504	200	282	124	178

Note: RR and CORE for France are in gross (pre-tax) terms.

Figure 2.1 Median RR and CORE by country, total sample



We then analyse the composition of income before and after retirement, for the whole sample. In Figures 2.2 and 2.3, we report the average income from each source, as a percentage of average disposable income. Country differences in income composition before retirement (Figure 2.2) are noticeable especially with regard to the three main components: wages, self-employment (more important in the Mediterranean countries and in France) and private income. After retirement (Figure 2.3), pension benefits – from both the first and second pillars – are the most important source of income in all countries. In the UK – and to a lesser extent in Denmark – the average pension benefits weigh less in the composition of the average disposable income. In these two countries wages are, even after retirement, an important component of income. In the Netherlands, and to a lesser extent in the UK, disability benefits are important after retirement.

Figure 2.2 Composition of income, year before retirement

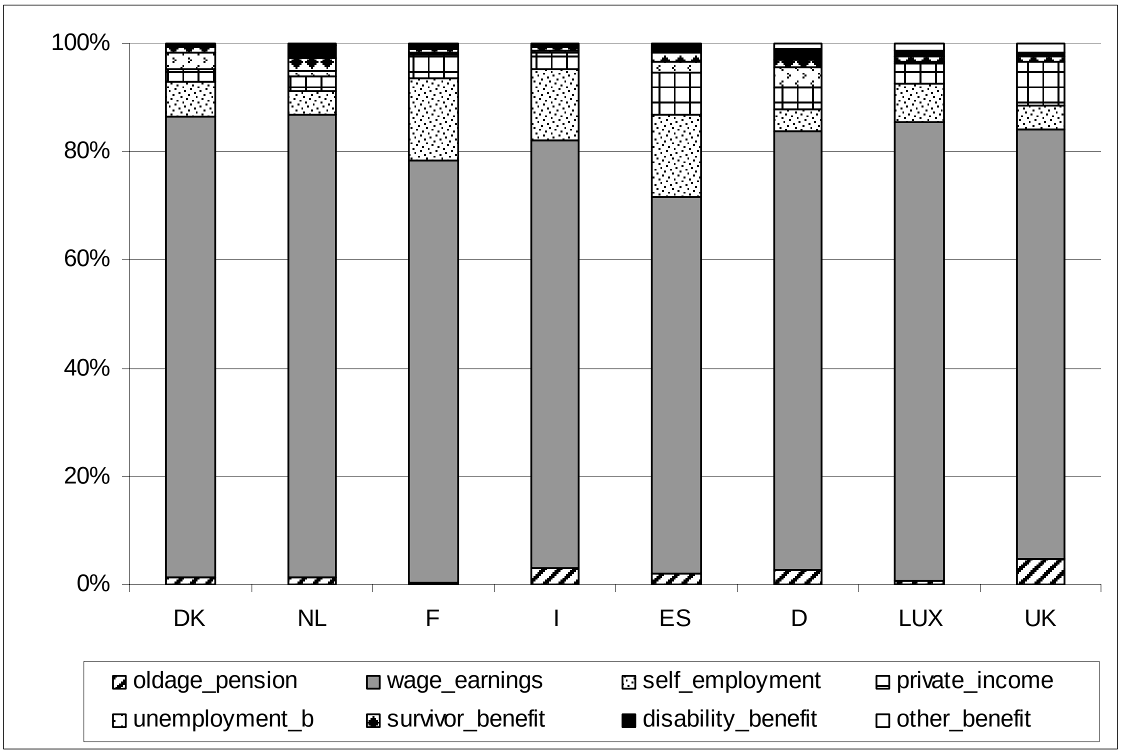


Figure 2.3 Composition of income, the year after retirement

We then analyse males and females separately: results are reported in Tables 2.4 and 2.5. The results, for both males and females, confirm the pattern found for the whole population: with no exceptions, in all countries CORE is higher than the simple RR. To facilitate comparison, we draw RR for males and females in Figure 2.4 and CORE for males and females in Figure 2.5. From Figure 2.4, with the notable exception of the UK, Denmark and the Netherlands, all replacement rates (RR) are lower for females than for males, reflecting the different labour market performance during active life. As Table 2.6 highlights, however, in most countries there are not significant gender differences in the age of retirement. The across-country pattern is similar to that observed for the whole sample: the UK and Denmark have lower than average replacement rates.

Turning to CORE, in Figure 2.5, comprehensive replacement rates are higher for women than for men in the three countries in which RRs are higher for women: the UK, Denmark and the Netherlands. In Italy, CORE is slightly higher for females than for males. Spain, France, Germany and Luxemburg preserve the result obtained with RR, that is a higher replacement rate for men than for women.

Table 2.4 Median RR and CORE; males only

Country	DK	NL	F	I	ES	D	LUX	UK
RR	68.95	89.13	80.27	83.40	88.78	79.14	80.68	60.19
(se)	*(70.54)*	*(54.36)*	*(62.54)*	*(105.02)*	*(91.66)*	*(87.95)*	*(64.51)*	*(60.56)*
CORE	77.52	96.94	84.03	87.16	91.36	90.81	83.95	73.60
(se)	*(61.71)*	*(27.73)*	*(37.79)*	*(79.53)*	*(68.24)*	*(38.89)*	*(22.30)*	*(71.77)*
NoB	77	107	214	371	147	177	103	98

Note: RR and CORE for France are in gross (pre-tax) terms.

Table 2.5 Median RR and CORE; females only

Country	DK	NL	F	I	ES	D	LUX	UK
RR	76.08	99.49	78.40	80.48	81.92	73.39	70.40	68.49
(se)	*(56.56)*	*(203.22)*	*(48.64)*	*(115.98)*	*(184.51)*	*(144.40)*	*(23.41)*	*(119.27)*
CORE	85.25	102.01	82.17	90.33	88.05	79.61	80.31	86.33
(se)	*(61.74)*	*(206.72)*	*(40.54)*	*(141.27)*	*(168.53)*	*(96.29)*	*(22.33)*	*(101.87)*
NoB	55	43	144	133	53	105	21	80

Note: RR and CORE for France are in gross (pre-tax) terms.

Figure 2.4 Median RR – Comparison males and females

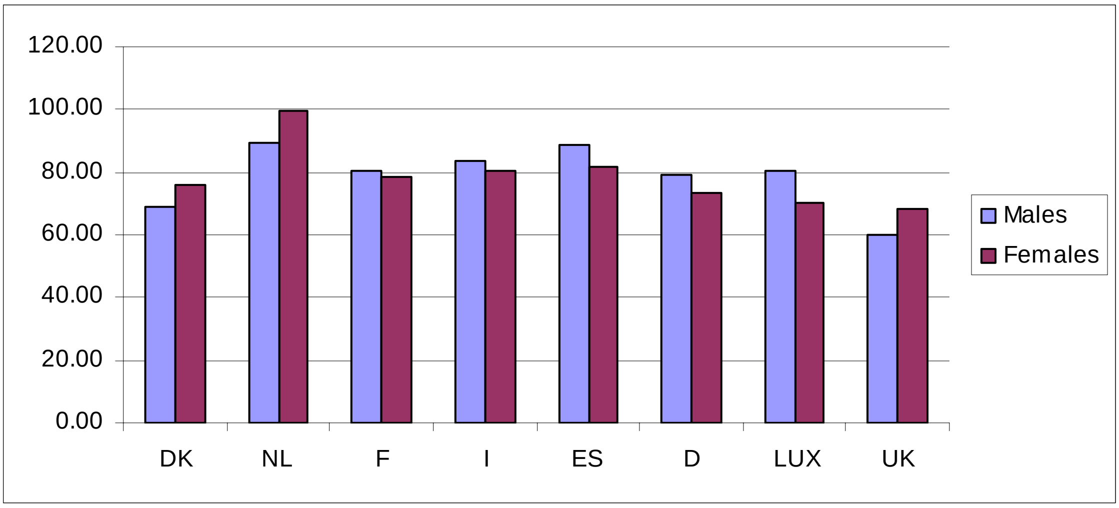


Figure 2.5 Median CORE – Comparison males and females

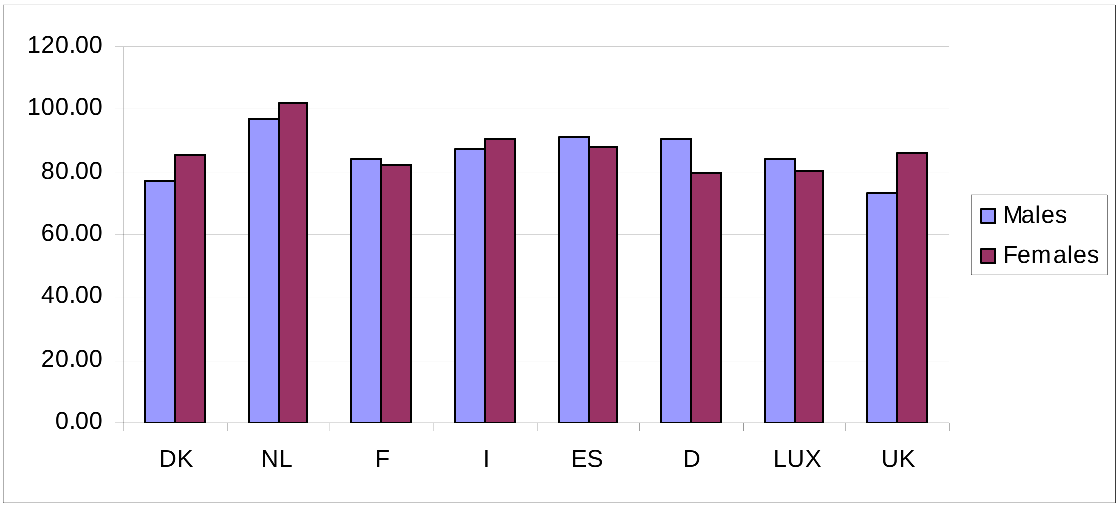


Table 2.6 Median age of retirement, by gender

COUNTRY	Male	Female	Total
DK	63	62	**63**
(se)	*(2.97)*	*(2.79)*	***(2.89)***
Nob	77	55	**132**
NL	61	61	**61**
(se)	*(2.48)*	*(2.93)*	***(2.63)***
Nob	107	43	**150**
F	61	61	**61**
(se)	*(3.64)*	*(4.15)*	***(3.87)***
Nob	214	144	**358**
I	59	59	**59**
(se)	*(5.07)*	*(4.97)*	***(5.06)***
Nob	371	133	**504**
ES	66	66	**66**
(se)	*(2.73)*	*(3.07)*	***(2.88)***
Nob	147	53	**200**
D	62	61	**62**
(se)	*(3.43)*	*(1.80)*	***(2.93)***
Nob	177	105	**282**
LUX	59	62	**60**
(se)	*(2.96)*	*(3.19)*	***(3.06)***
Nob	103	21	**124**
UK	62.5	61	**61**
(se)	*(4.63)*	*(3.25)*	***(4.08)***
Nob	98	80	**178**

Note: se: standard error; Nob: Number of observations.

As for the composition of income before and after retirement, we show in Figures 2.6-2.9 the results for males and females separately. When analysing gender differences, it should be borne in mind that sample sizes, in particular for women, are quite small. With this caveat, a few things are worth noting. Before retirement, unemployment benefits are particularly significant in Spain for men but not for women. After retirement, as in the aggregate picture, the most important source of income is old-age pension. In the Netherlands, it appears that a few women still rely on disability benefits after retirement (with the warning about the restricted sample size). In the UK, after retirement, about 20% of female disposable income is represented by wages, while for men this is less than 10%. In all countries, and not surprisingly, survivor benefits are an important source of income for women but not for men.

Figure 2.6 Composition of income. Males – before retirement

Figure 2.7 Composition of income. Males – after retirement

Figure 2.8 Composition of income. Females – before retirement

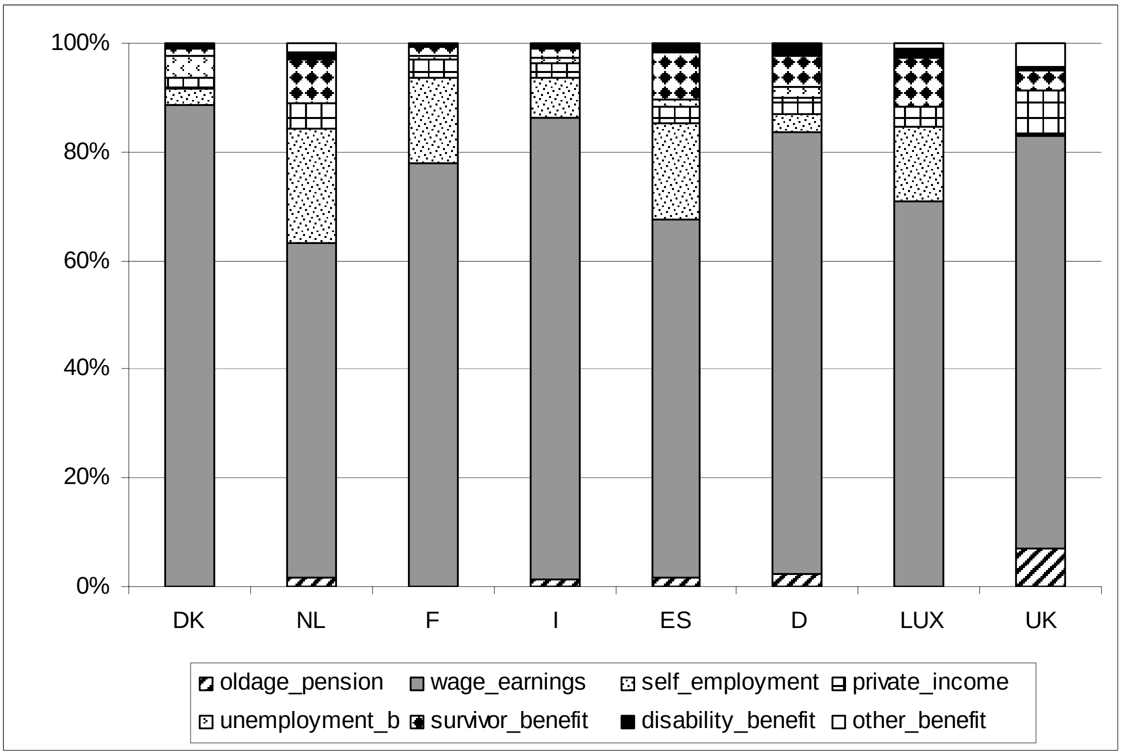


Figure 2.9 Composition of income. Females – after retirement

2.5 A family-based analysis

We now turn to a family-based analysis, which is, from a theoretical point of view, more suitable in assessing the resources available to each individual. Clearly, when considering all the resources within a family, standard replacement rates are not an appropriate measure; hence, we provide results only for comprehensive replacement rates. Unfortunately we have to stress again that the sample size is quite limited, and when breaking down individuals according to their family type, cell sample sizes are fairly small. We nevertheless compute CORE and show results for four family types: single, couples, single with children and couples with children.

We explicitly consider pensioners living with children as in some countries – especially Italy and Spain – the most frequent family structure of a retired person is the couple with children. We do not separately consider males and females as cell sizes in this case are too small to yield any reliable results. Family disposable income has been equivalised using the modified OECD equivalence scale. Results are reported in Table 2.8, while Figure 2.10 reports a comparison between family and individual CORE across countries.

Table 2.8 shows that, for all countries, CORE is higher for pensioners living with children, with or without a spouse. Living with children is extremely common in Italy and Spain, but is also not so unusual – perhaps somewhat surprisingly – in other countries like France, Germany, Luxemburg and the United Kingdom.

As Figure 2.10 shows, considering the pooled family disposable income always results in a higher median CORE.

Figure 2.10 Comparison between family and individual median CORE

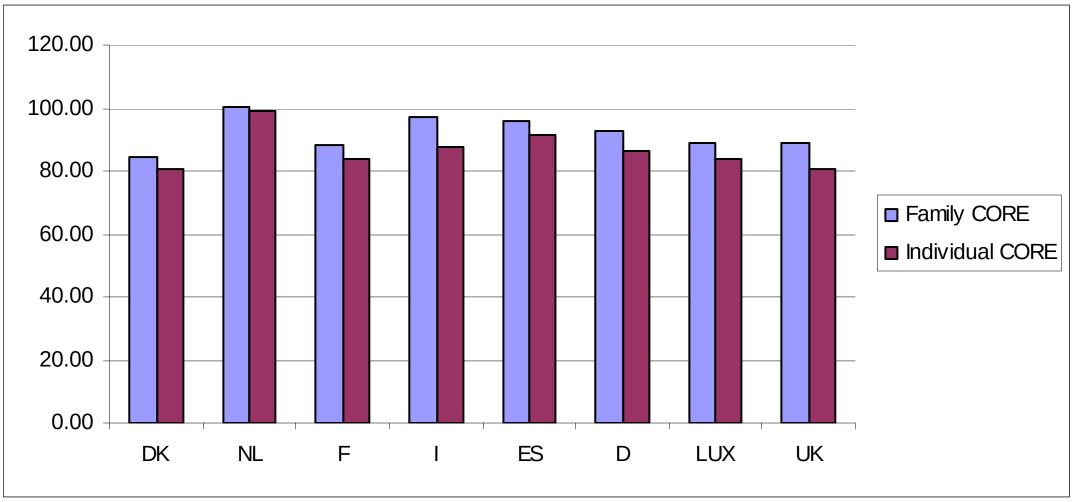


Table 2.7 Family-based median CORE

COUNTRY	Single	Couple	Single with children	Couple with children	Total
DK	84.19	82.59	103.91	102.03	**84.69**
(std.err.)	*(25.61)*	*(84.39)*	*(34.33)*	*(5.76)*	***(75.77)***
NObs	21	104	3	4	**132**
NL	99.68	100.33	92.85	105.34	**100.54**
(std.err.)	*(43.95)*	*(108.26)*	*(6.90)*	*(10.17)*	***(92.33)***
NObs	25	105	3	17	**150**
F	84.49	88.39	85.86	94.65	**88.53**
(std.err.)	*(37.22)*	*(22.97)*	*(34.37)*	*(40.49)*	***(31.46)***
NObs	50	195	27	86	**358**
I	93.17	91.09	97.75	98.46	**96.91**
(std.err.)	*(77.90)*	*(54.58)*	*(37.85)*	*(51.34)*	***(53.16)***
NObs	37	100	54	313	**504**
ES	98.17	87.10	100.82	97.54	**96.14**
(std.err.)	*(59.58)*	*(51.39)*	*(126.38)*	*(55.10)*	***(73.35)***
NObs	18	48	37	97	**200**
D	88.85	93.63	83.13	94.22	**92.51**
(std.err.)	*(30.37)*	*(44.97)*	*(25.34)*	*(50.38)*	***(43.80)***
NObs	38	171	14	59	**282**
LUX	82.34	82.81	96.57	94.15	**89.15**
(std.err.)	*(26.77)*	*(17.59)*	*(26.00)*	*(22.30)*	***(22.18)***
NObs	10	43	15	56	**124**
UK	94.37	85.64	82.81	98.62	**88.99**
(std.err.)	*(50.18)*	*(83.27)*	*(55.09)*	*(43.11)*	***(71.11)***
NObs	31	108	8	31	**178**

Note: CORE for France is in gross (pre-tax) terms.

3. Comprehensive Replacement Rates over Time: Projections

3.1 Methodology

We use projections over the period 2005-2050 provided by the CeRP semi-aggregate model CeRPSAM (Ferraresi and Monticone, 2008) to compute comprehensive replacement rates (CORE) for a range of countries.[9] The countries considered include the European countries analysed in the previous section, and for which ECHP data are available, with the addition of four new European members (Hungary, Latvia, Poland, and Slovakia) for which CeRPSAM provides projections.[10]

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[9] See Box 3 for a brief description of the projection model.

[10] Ferraresi & Monticone (2008) describe the methodology used to project incomes for countries not covered by the ECHP data.

Given the projection procedure developed in CeRPSAM there are some important differences with the sample comprehensive replacement rates we compute on the ECHP sample in the previous section.

Most importantly, CeRPSAM provides us with projections of average incomes for each source (wages, self-employment income, cash benefits, etc.) for groups in the population defined by gender and age class.[11] We are also provided with the number of individuals in each group of the population. Hence, the projected CORE will be a ratio of average incomes and not an average of individual ratios as in our sample analysis.

It follows that CORE cannot be computed at the time of retirement – as the semi-aggregate model does not identify such a time – but it is built by comparing (i.e. taking the ratio of) the average disposable income of a given age class (65-69, say) with the average disposable income of a younger age class (50-54).

More formally, CORE is defined for each country as:

$$CORE_t^{t-k} = \frac{DISP\_INC_p^t / N_p^t}{DISP\_INC_a^{t-k}(1+g)^k / N_a^{t-k}} \qquad [1]$$

were *DISP_INC* is net disposable income and *N* is the size of the considered cell, *p* is an age class in which most individuals are retired and *a* is an age class in which most individuals are active in the labour market. The choice of *k* (equal to zero or to *p-a*) determines whether the index is cross-sectional or longitudinal, an issue that is discussed below. The productivity growth, here assumed to be constant to simplify the notation, is denoted by *g*.

A few things are worth noting about formula [1].

First, the choice of the age classes is clearly discretionary: one might think that in the age class 60-64 most individuals are retired, while in the class 50-54 most individuals are active in the labour market. However, especially with the raise in retirement age expected in all countries, we believe that it is more appropriate to compare the age classes 65-69 and 50-54, as age classes in which most individuals are retired and most individuals are active, respectively.

The choice of *k* is also an important one, as it determines whether the comparison between average disposable incomes is cross-sectional (*k*=0) or longitudinal (*k*=*p*-*a*). In the first case, a comparison is made between active and retired individuals at the same time *t*: such an index is meant to measure the inter-generational distribution of income. When *k*=*p*-*a*, a comparison is made between average disposable income of individuals belonging to an age group, with their own average disposable income when they were active in the labour market: this longitudinal index captures the degree of maintenance of own living standards when retiring. Differences in the longitudinal and cross-sectional replacement rates mainly indicate differences in the participation in the labour market of different generations.

It should be noted that we consider productivity growth in the denominator of [1]: when we compute our longitudinal CORE we compare incomes that are far apart in time and, were we not taking growth into account, we would sensibly overestimate our replacement rates.

Although the formula in [1] does not specify it, we can compute CORE for men and women separately.

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[11] Age classes are defined by 5-year intervals.

CeRPSAM also allows us to construct different scenarios, and to study the effect of them on the distribution of disposable income across age classes. In particular we can make projections using different employment assumptions (e.g. assuming the Lisbon targets are met), or for different hypothesis concerning the theoretical replacement rates implemented in the future by the countries considered.[12]

As our analysis on the ECHP data shows, the main component in after-retirement disposable income is old-age pension benefits. Hence, it is important to review which factors are driving the projected old-age pension benefits in the semi-aggregate model.

The average pension benefit in CeRPSAM is made up of two components: the average pension of individuals retiring before turning 60 and the average pension of individuals retiring after that age. The first component is data-based, and it is computed projecting ECHP sample averages into the future. The second component is based on average projected earnings to which the theoretical replacement rates computed by the ISG group (ISG, 2006) are applied. When considering the age class 65-69, hence, the average pension for that age class will be the (weighted by the number of recipients) average of the pension benefit received by those who retired before turning 60 and those who retired after that age.

The above distinction is important when interpreting the results: the projected average benefit depends on the fraction of individuals retiring before or after turning 60. Changes in the employment hypotheses will modify these fractions if, for example, fewer individuals retire before turning 60, and, in consequence, will modify the average pension benefit.

The theoretical replacement rates also have an important role in determining the evolution of the average pension benefit: the CeRPSAM base-scenario uses the '100% of average earnings' replacement rates (ISG 2006), from 2005 to 2050. A sensitivity analysis of our results to changes in the theoretical replacement rates is provided below.

When computing the average disposable income in a given age-class, the number of income recipients is also crucial. In particular, different employment assumptions will change the number of earners in our 'active' age class (that is, the one aged 50-54) and, as a consequence, the number of pensioners in our 'retired' age class (aged 65-69).

When we are computing the ratio of available resources at different ages for the same generation (that is, the longitudinal CORE), changes in the number of active individuals in the age class 50-54 are mirrored in changes in the number of pensioners in the 65-69 age class. *Ceteris paribus*, the longitudinal CORE is insensitive to changes in the number of income recipients in the two age classes.

When computing the cross-sectional CORE, however, a change in the employment assumptions that has an uneven impact on different generations will have an effect on the ratio of disposable income of the active and of the retired.

[12] In principle we can implement different demographic assumptions. As these do not change our replacement rates, however, we do not show these results.

Box 3. A Semi-Aggregate Model (SAM) for social expenditure projections

CeRP's Semi-Aggregate Model (SAM) is a highly stylised and simplified model meant to capture the effects of population ageing on both the labour market and the social protection expenditure within differently shaped welfare systems. It was mainly developed to deliver semi-aggregate projections of income sources as an input for the computation of Comprehensive Replacement Rates (COREs). In addition, it can deliver aggregate macroeconomic projections of social protection benefits and an indicator that will help gain insights on the sustainability of the social security systems for different countries.

Even within a partial equilibrium framework, an analysis of certain specific issues has been performed, in particular:

- effects of demographic dynamics on the structure of the labour supply,
- effects of the changes in the structure of the labour supply on economic growth,
- effects on the sustainability and adequacy of the welfare state of changes in the age composition of the population, in the labour supply and in economic growth.

The major driving force of the model is constituted by the demographic projections provided by Eurostat. The evolution of the age structure of the population – together with assumptions on participation rates and unemployment – affects the time composition of the labour supply. The resulting development of employment and an exogenously assumed productivity growth are the basis for the projection of economic growth. Income sources, including social benefits, evolve again in line with demography and labour productivity growth. Old-age pensions have been modelled more carefully than other benefits, taking into account already legislated reforms. Other benefits for the computation of comprehensive replacement rates include survivors' pensions, invalidity and unemployment benefits, education, housing and family-related, and other social benefits according to the European classification adopted by the European Community Household Panel (ECHP) survey. Finally, projections of incomes, GDP and employment constitute the main ingredients for the computation of country-specific social protection benefits and expenditures up to 2050.

All the main assumptions, such as those concerning labour productivity growth, participation rates and unemployment, are drawn from the European Commission projections (EPC-EC, 2005), which provides a sound and comparable basis for the current exercise.

Source: Ferraresi & Monticone (2008).

3.2 Results: the base case

To present our results, we first graphically show the projected COREs for all the countries we consider, and then turn to a more detailed country-specific analysis.

Figure 3.1a show the evolution from 2020 to 2050 of the longitudinal CORE for France, Italy, Spain and Germany, Figure 3.1b for Luxemburg, Denmark, the Netherlands and the United Kingdom, and Figure 3.1c for Poland, Latvia, Slovakia and Hungary.

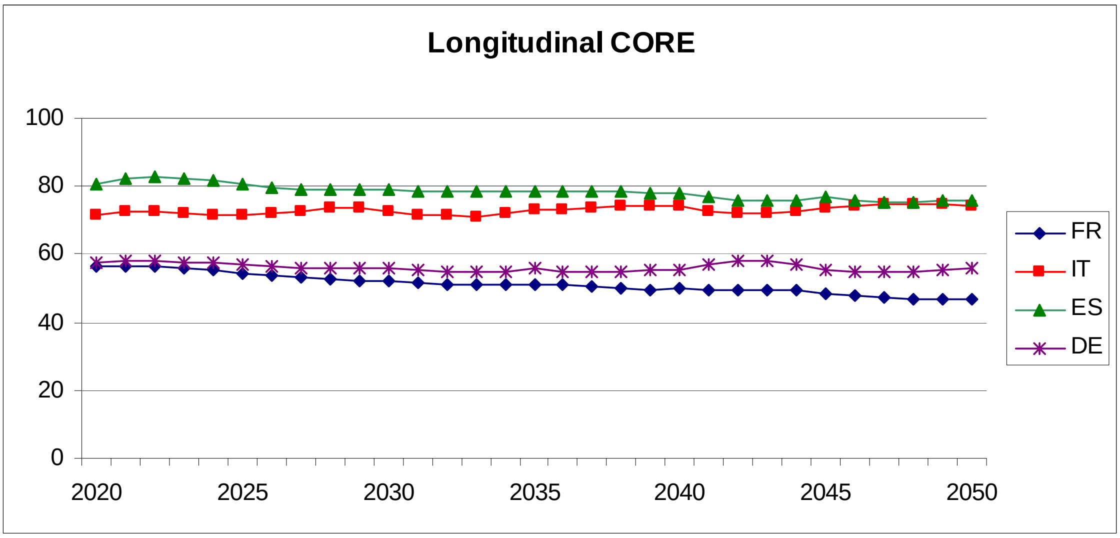
The longitudinal CORE shown in Figures 3.1a-3.1c is computed as the ratio of average disposable income in the 65-69 age class in a given year, over the average disposable income in the 50-54 fifteen years before.[13] As CeRPSAM provides figures from 2005 onwards, the first available longitudinal CORE is in the year 2020.

[13] The average income in the denominator is corrected for growth, see formula [1].

For the group of countries considered in Figure 3.1a there is a tendency to a reduction in the longitudinal CORE over time: while in 2020 this ranges from around 57% (France) to 81% (Spain), in 2050 it ranges from 47% for France to 76% for Spain. As for the other countries, while Italy is increasing its CORE by three percentage points over the period, Germany, Spain and France show a decrease by 1, 5, and 10 percentage points respectively.

The group of countries reported in Figure 3.1b presents a longitudinal CORE relatively more stable over time. CORE is slightly increasing over time for Luxemburg, Denmark, and the United Kingdom; it increases by 4 percentage points in the Netherlands.

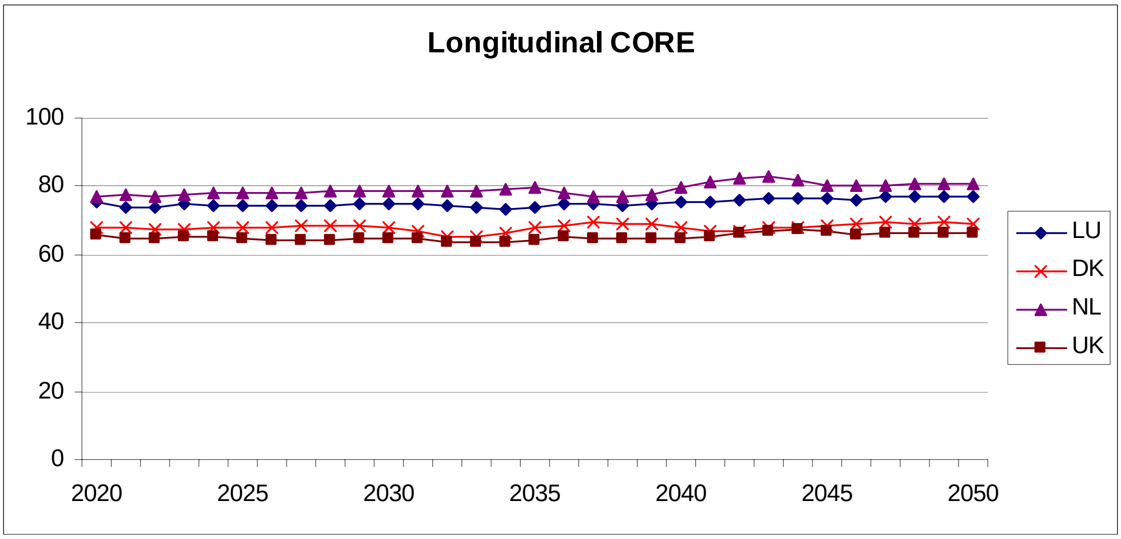
Figure 3.1a Longitudinal CORE. Age classes: 65-69 / 50-54



Source: Authors' calculations based on CeRPSAM projections.

Note: for France gross CORE is reported.

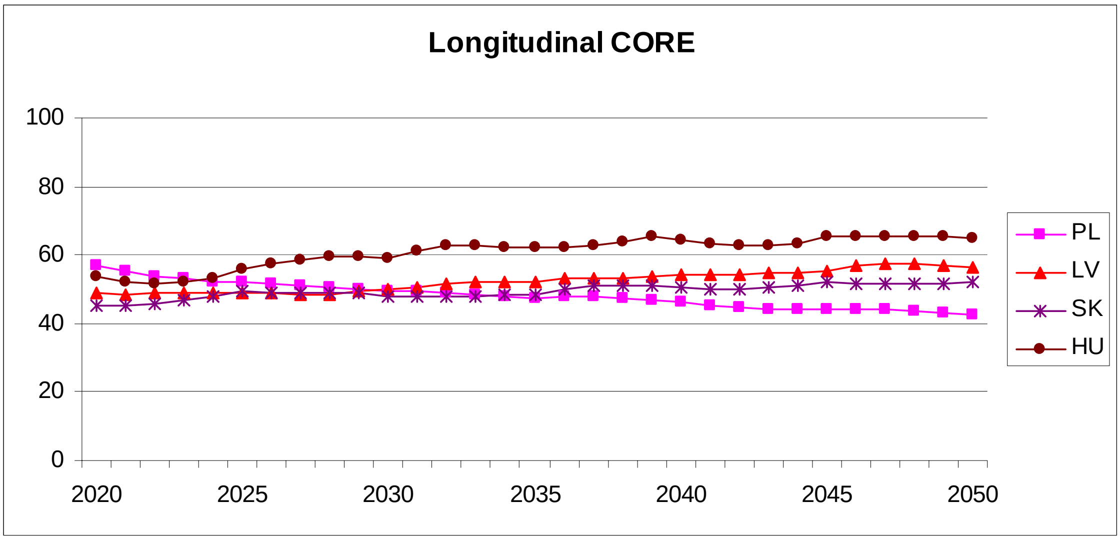
Figure 3.1b Longitudinal CORE. Age classes: 65-69 / 50-54



Source: Authors' calculations based on CeRPSAM projections.

Figure 3.1c shows our results for the four new member states considered in this study: Latvia, Hungary, Slovakia and Poland. The pattern followed by these countries is quite different: in particular, Poland shows a dramatic decrease in its longitudinal CORE, from 57% in 2020 to 43% in 2050. On the contrary, Hungary's comprehensive replacement rate is projected to rise from about 54% to 65% in 2050. Latvia and Slovakia also show an increase in their CORE, of about 7 percentage points.

Figure 3.1c Longitudinal CORE. Age classes: 65-69 / 50-54



Source: Authors' calculations based on CeRPSAM projections.

Given the general tendency depicted in Figures 3.1a-3.1c, it is of great interest to analyse what happens in each country, and what are the driving forces behind the results. For this purpose, we report in Table 3.1 more specific information for each country.

In particular, Table 3.1 reports, for each country and for the time period 2020-2050, the longitudinal CORE computed for males and females separately, as well as the overall (total) one. The cross-sectional CORE is also reported: as mentioned above, it is computed as the ratio of average disposable income in the age class 65-69 over average disposable income in the age class 50-54, both taken in the same calendar year. To better interpret the results, we also report the theoretical replacement rate (ISG, 2006) used in the model to compute pension benefits of individuals retiring after turning 60. The percentage of individuals receiving an old-age pension in the age class 65-69 is also reported.

The level results on the first country reported in Table 3.1, **France**, are to be interpreted with care as all the amounts for this country are gross, while for all the other countries net amounts are used. The trends in the indicators however should not change when taking into account net amounts, unless changes in the taxation system are hypothesised. The theoretical replacement rates reported for France are also in gross terms. The longitudinal CORE diminishes from about 57% in 2020 to less then 47% in 2050, in line with the theoretical replacement rate. The cross-sectional CORE is also reported, and it reflects the changes in participation over time that are incorporated into CeRPSAM. At the beginning of the projection period participation, and especially female participation, is increasing, so that at a given point in time the average resources earned by the 50-54 age-group are relatively higher than the resources earned by the eldest group. When participation and employment converge too they long run values and remain constant, the longitudinal and the cross-sectional COREs are virtually the same. It is also important to notice that the ISG theoretical replacement rates for France do not include any second pillar component.

The analysis for **Italy** gives a different picture: the longitudinal CORE is slightly increasing over time, from 71% in 2020 to 74% in 2050. Overall participation in the labour market is increasing over time: this is reflected both in the evolution of the cross-sectional CORE – which is increasing from 65% in 2020 to 74% in 2050 – and in the percentage of individuals receiving an old-age pension in the age-class 65-69. The Italian theoretical replacement rate is expected to increase in the considered period because of the introduction of a second (funded) pillar.

Like Italy, **Spain** has a high longitudinal CORE at the beginning of the simulation period, taking the value of about 81%. This value is however projected to decrease by 5 percentage points in 2050. This result occurs because of the decrease in the theoretical replacement rate (which does not include any second pillar component), although it is partially offset by the increase in participation into the labour market – reflected both in the pattern of the cross-sectional CORE and in the percentage of individuals receiving a pension.

In Germany the longitudinal CORE is decreasing over the projection period by approximately 1.5 percentage points, despite the increase in the theoretical replacement rate (of 4 percentage points). This result is driven by the increase in the average age of retirement, which results in a higher fraction of pension benefits computed with the new, more stringent rules.

The **United Kingdom** displays expectedly lower replacement rates: the longitudinal CORE is stable over the projection period at about 65%. The cross-sectional CORE is increasing over the period by 4 percentage points, reflecting a slightly higher participation into the labour market.

Luxemburg is characterised by longitudinal replacement rates that are higher for women (about 100%) then for men (about 68% in 2050). Female participation is lower compared to other European countries, and it is projected to increase over time.

Both **Denmark** and the **Netherlands** show a 5 percentage points increase in the theoretical replacement rates and a moderate increase in participation: these result in a moderate increase in the longitudinal CORE (by 1 and 4 percentage points respectively), which is consistently lower in Denmark (69% in 2050) than in the Netherlands (81% in 2050).

The semi-aggregate model CeRPSAM also computes projections for Latvia, Poland, Hungary and Slovakia: the input data are however incomplete and results are somewhat less reliable. The longitudinal CORE in **Poland** is decreasing dramatically, by 14 percentage points, in line with the decrease in the theoretical replacement rate. Participation in the labour market is however increasing. **Latvia**, on the contrary, displays a moderate decrease in the theoretical replacement rate, and a substantial increase in labour market participation: these two effects result in a longitudinal CORE rising from about 50% in 2020 to about 57% in 2050.

The comprehensive replacement rate in **Hungary** is also rising from 54 to 65% in 2050: the decrease in the theoretical replacement rate by 4 percentage points is more than offset by the increase in the labour market participation.

Finally, the **Slovak Republic** displays an increasing CORE over the projection period: from 45% in 2020 to 52% in 2050. This result is mainly due to the increase in (female) labour force participation, which compensates for the drop in the replacement rates faced by females, as a result of the recent pension reform.

Table 3.1 Base-case results

FRANCE *(gross)*	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	63.0	59.0	56.5	53.3
Female	47.4	41.4	39.2	36.4
Total	**56.7**	**51.9**	**49.8**	**46.9**
Cross-sectional CORE				
Male	61.5	58.6	56.3	53.4
Female	43.7	40.7	38.6	36.3
Total	**54.3**	**51.1**	**49.2**	**46.8**
Theoretical [(a)]	**66.2**	**-**	**-**	**49.3**
of which from pension funds	*0*			*0*
Pensioners in 65-69 (%)	79.6	82.8	85.1	85.7

ITALY	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	73.8	74.4	75.3	75.6
Female	68.8	70.8	72.5	72.4
Total	**71.4**	**72.7**	**73.9**	**74.2**
Cross-sectional CORE				
Male	71.3	73.2	74.6	75.5
Female	56.2	62.2	71.5	72.3
Total	**64.9**	**68.7**	**73.0**	**73.9**
Theoretical [(a)]	**87.8**	**-**	**-**	**92**
of which from pension funds	*0*			*17.89*
Pensioners in 65-69 (%)	70.5	76.8	81.5	81.7

SPAIN	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	81.3	80.7	80.6	79.0
Female	85.1	78.4	75.1	72.5
Total	**80.9**	**78.8**	**77.8**	**75.9**
Cross-sectional CORE				
Male	75.7	79.8	79.8	78.6
Female	62.4	68.3	73.5	72.7
Total	**69.9**	**74.5**	**76.9**	**75.8**
Theoretical [(a)]	**97.2**	**-**	**-**	**91.6**
of which from pension funds	*0*			*0*
Pensioners in 65-69 (%)	63.2	73.3	78.5	79.1

GERMANY	2020	2030	2040	2050
Longitudinal CORE				
Male	59.7	58.7	58.4	59.2
Female	55.5	52.6	51.3	51.3
Total	**57.4**	**55.9**	**55.3**	**55.8**
Cross-sectional CORE				
Male	57.4	57.8	58.4	59.2
Female	50.9	51.0	51.7	51.9
Total	**54.0**	**54.9**	**55.4**	**56.0**
Theoretical [(a)]	**63.0**	**-**	**-**	**67.0**
of which from pension funds	*0*			*20.94*
Pensioners in 65-69 (%)	80.4	84.2	85.0	85.9

UNITED KINGDOM	2020	2030	2040	2050
Longitudinal CORE				
Male	74.5	73.5	74.5	75.5
Female	49.0	50.0	50.8	51.7
Total	**64.5**	**64.5**	**65.5**	**66.6**
Cross-sectional CORE				
Male	71.2	73.1	74.8	75.5
Female	48.1	48.4	50.3	51.6
Total	**62.3**	**63.5**	**64.7**	**66.3**
Theoretical [(a)]	**82.0**	**-**	**-**	**85.0**
of which from pension funds	*62.12*			*61.59*
Pensioners in 65-69 (%)	82.4	83.8	84.8	85.6

LUXEMBURG	2020	2030	2040	2050
Longitudinal CORE				
Male	65.9	66.2	66.8	68.3
Female	101.4	101.7	100.9	100.6
Total	**73.8**	**74.8**	**75.6**	**76.4**
Cross-sectional CORE				
Male	61.6	65.8	66.8	68.5
Female	89.9	96.2	101.8	102.3
Total	**68.6**	**73.7**	**75.5**	**77.1**
Theoretical [(a)]	**98.3**	**-**	**-**	**98.8**
of which from pension funds	*0*			*0*
Pensioners in 65-69 (%)	61.3	67.0	68.1	69.2

DENMARK	2020	2030	2040	2050
Longitudinal CORE				
Male	76.3	76.8	77.6	78.7
Female	58.2	56.5	56.3	56.9
Total	**68.0**	**67.7**	**68.0**	**68.9**
Cross-sectional CORE				
Male	74.9	76.4	77.3	79.3
Female	57.0	56.1	55.7	57.7
Total	**66.7**	**67.4**	**67.4**	**69.5**
Theoretical [(a)]	**71.3**	**-**	**-**	**76.1**
of which from pension funds	*5.27*			*29.49*
Pensioners in 65-69 (%)	89.5	91.1	91.2	91.2

NETHERLANDS	2020	2030	2040	2050
Longitudinal CORE				
Male	81.1	81.8	82.1	83.2
Female	69.9	73.6	75.7	77.2
Total	**77.0**	**78.7**	**79.6**	**80.9**
Cross-sectional CORE				
Male	79.4	80.6	81.9	83.7
Female	64.7	70.3	74.8	77.4
Total	**74.1**	**77.4**	**79.0**	**81.0**
Theoretical [(a)]	**92.9**	**-**	**-**	**97.3**
of which from pension funds	*54.35*			*58.8*
Pensioners in 65-69 (%)	70.5	74.7	76.3	77.3

POLAND	2020	2030	2040	2050
Longitudinal CORE				
Male	64.4	55.1	51.4	47.3
Female	48.9	42.4	39.0	36.2
Total	**57.1**	**49.4**	**46.1**	**42.7**
Cross-sectional CORE				
Male	58.4	52.1	51.0	47.7
Female	40.9	38.0	38.5	36.4
Total	**50.1**	**45.7**	**45.6**	**42.8**
Theoretical [(a)]	**77.7**	**-**	**-**	**43.9**
of which from pension funds	*0*			*0*
Pensioners in 65-69 (%)	62.9	69.1	73.9	75.1

LATVIA	2020	2030	2040	2050
Longitudinal CORE				
Male	53.4	55.3	59.2	61.4
Female	48.9	47.3	50.8	53.2
Total	**49.2**	**50.1**	**54.2**	**56.6**
Cross-sectional CORE				
Male	49.5	55.4	59.7	61.6
Female	42.2	47.0	51.1	53.4
Total	**43.9**	**49.6**	**54.7**	**56.3**
Theoretical [(a)]	**77.6**	**-**	**-**	**71.8**
of which from pension funds	*0*			*0*
Pensioners in 65-69 (%)	82.5	85.0	86.1	86.8

HUNGARY	2020	2030	2040	2050
Longitudinal CORE				
Male	61.6	64.3	69.8	70.6
Female	46.6	54.7	59.3	58.9
Total	**53.9**	**59.0**	**64.5**	**65.1**
Cross-sectional CORE				
Male	55.0	63.3	69.5	70.5
Female	41.7	51.9	57.2	58.7
Total	**47.7**	**56.9**	**63.4**	**64.8**
Theoretical [(a)]	**83.1**	**-**	**-**	**79.9**
of which from pension funds	*0*			*21.6*
Pensioners in 65-69 (%)	64.6	72.5	74.6	74.5

SLOVAKIA	2020	2030	2040	2050
Longitudinal CORE				
Male	52.1	52.2	55.6	57.5
Female	37.3	44.1	44.3	44.8
Total	**45.0**	**48.0**	**50.4**	**51.9**
Cross-sectional CORE				
Male	46.4	51.4	55.4	57.5
Female	30.5	42.8	44.2	44.8
Total	**38.9**	**46.8**	**50.1**	**51.8**
Theoretical [(a)]	**63.1**	**-**	**-**	**63.7**
of which from pension funds	*0*			*0*
Pensioners in 65-69 (%)	66.9	82.6	83.0	82.7

[(a)] The theoretical replacement rate is reported for the years 2005 and 2050. It is assumed to converge smoothly to the 2050 value.

Source: Authors' calculations based on CeRPSAM projections.

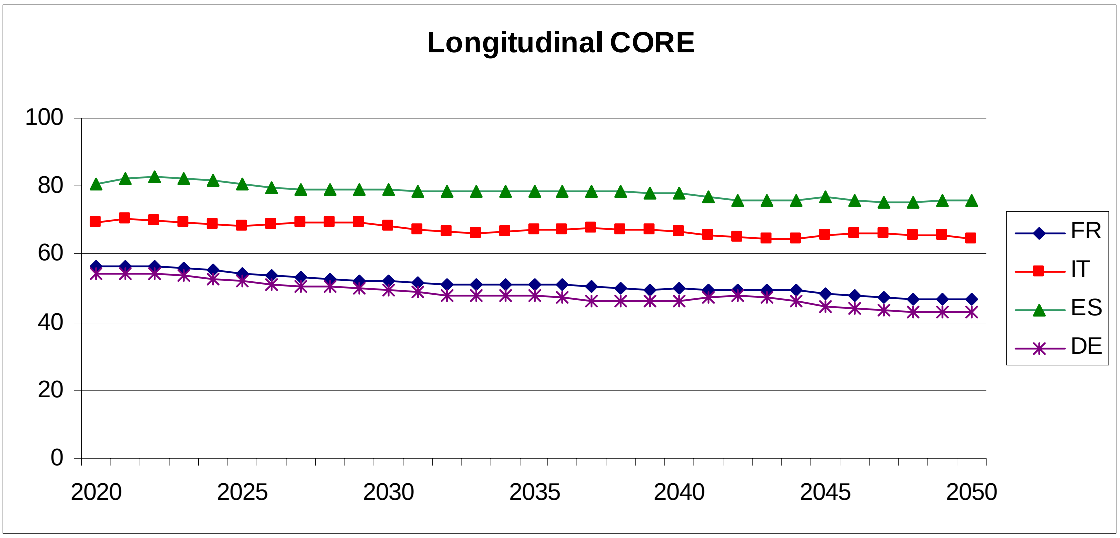
As it is clear from the above analysis, the results are affected by the hypothesis made on the second pillar component. In order to highlight the sensitivity of our projections to the proportion of the theoretical replacement rate coming from pension funds, we show in Figures 3.2a-3.2c results based on the theoretical replacement rates for the first pillar component only.[14] The countries affected by this change – that is the countries in which a positive second pillar component is included – are: Italy, Germany, the United Kingdom, Denmark, the Netherlands and Hungary.

The most notable difference in Figure 3.2a is given by Germany, confirming that that country relies heavily on the second pillar component in order to provide adequate resources to the elderly in the future. Italy, without hypothesis on the second pillar component, also displays a CORE in 2050 that is lower by about 10 percentage points.

Figure 3.2b depicts countries with a traditionally high second pillar component, with the exception of Luxemburg: the effect of removing the second component is dramatic for Denmark, the Netherlands and the United Kingdom.

The only country relying on the second pillar component in the group of countries considered in Figure 3.2c is Hungary: the effect of relying only on the first pillar component is dramatic also for this country, as its projected CORE falls in 2050 from 65% to 54%.

Figure 3.2a Longitudinal CORE based on first pillar only. Age classes: 65-69 / 50-54

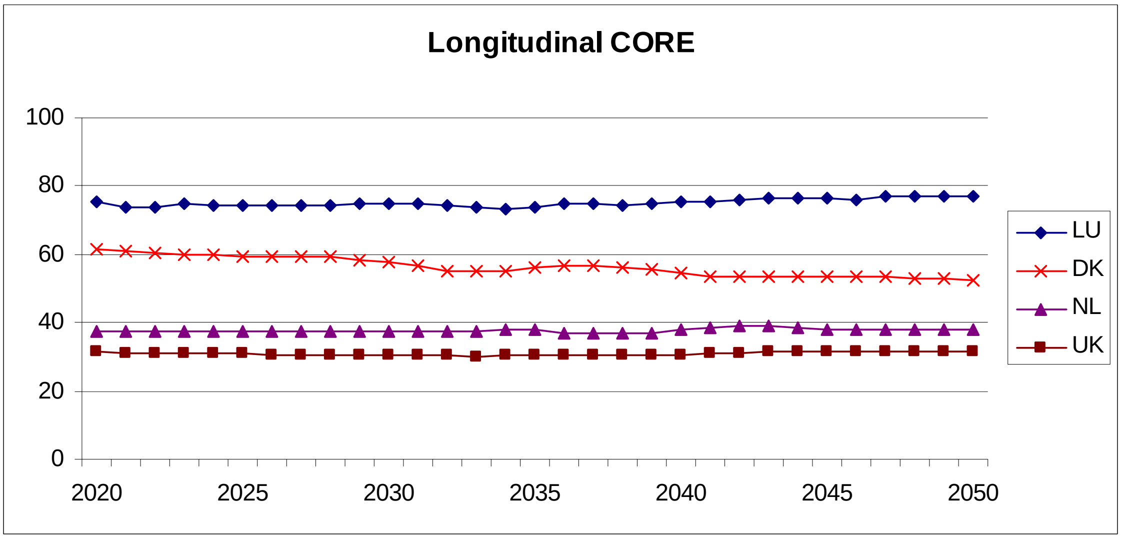


Source: Authors' calculations based on CeRPSAM projections.

Note: for France gross CORE is reported.

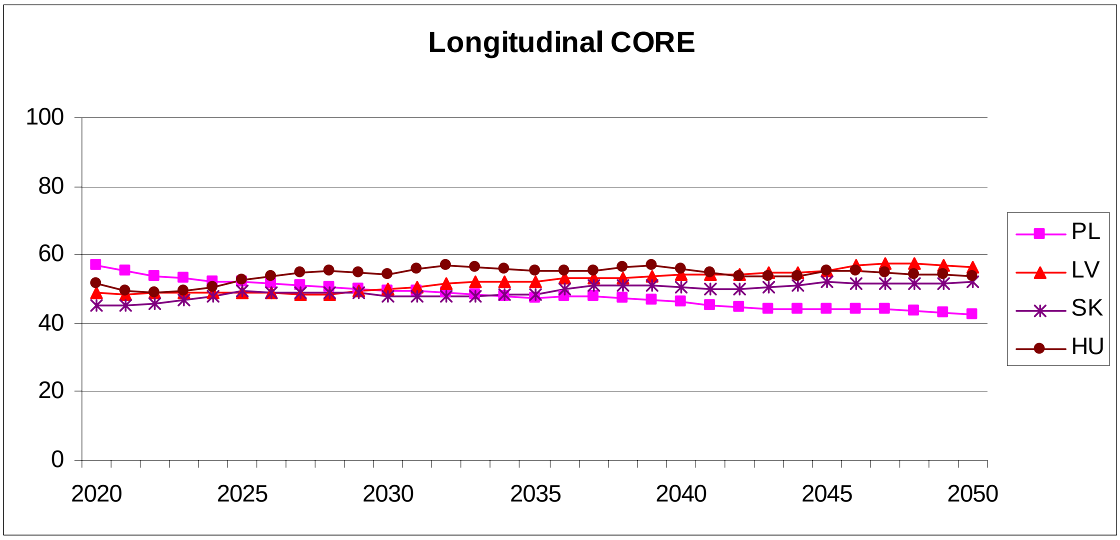
[14] The table in Appendix 1 displays the results in more detail.

Fig. 3.2b Longitudinal CORE based on first pillar only. Age classes: 65-69 / 50-54



Source: Authors' calculations based on CeRPSAM projections.

Fig. 3.2c Longitudinal CORE based on first pillar only. Age classes: 65-69 / 50-54



Source: Authors' calculations based on CeRPSAM projections.

3.3 Results: Lisbon scenario

We also computed results for alternative scenarios. In particular, as the results are sensitive to the participation and employment rate projections, we show the projected longitudinal COREs when all countries are assumed to reach the employment targets set in the Lisbon and Stockholm European Councils.[15]

[15] The employment targets imposed are: 70% for total employment, 60% for female employment, 50% for employment in the 55-64 age-class.

Applying the Lisbon target does not modify the projections for those countries already meeting the required targets, namely Denmark, Germany, the Netherlands and the United Kingdom. For the other countries in the analysis, it is assumed that they will meet the total employment Lisbon targets by 2010, so most of the action takes place by 2020.

Table 3.2 shows the difference between the longitudinal CORE under the Lisbon scenario and under the base for the countries that do not meet the Lisbon requirements in 2005. For Italy, Spain, Luxemburg, Poland, Hungary and the Slovak Republic applying the Lisbon targets results in higher replacement rates, as a result of the higher average retirement age. For France and Latvia in 2050 the COREs under the Lisbon scenario are very close to the base case. This is also due to the increasing average retirement, added to the fact that the average pension earned after turning 60 is lower than the average pension earned before turning 60. This effect is especially evident for Latvia, where the female CORE is reduced, under the Lisbon scenario, in all time periods.

Table 3.2 Difference between Lisbon scenario and base case (percentage points)

Year	**2020**	**2030**	**2040**	**2050**
FRANCE				
Male	2.0	0.0	-0.7	-0.4
Female	3.6	2.3	1.1	1.6
Total	**2.6**	**1.0**	**0.2**	**0.5**
ITALY				
Male	3.8	1.2	0.1	0.1
Female	19.4	6.7	3.6	3.6
Total	**8.7**	**3.0**	**1.3**	**1.3**
SPAIN				
Male	4.6	2.5	1.8	2.1
Female	6.1	0.9	1.2	2.2
Total	**4.9**	**1.9**	**1.6**	**2.2**
LUXEMBURG				
Male	15.3	14.1	15.6	14.9
Female	32.7	25.3	28.1	27.9
Total	**19.2**	**16.1**	**17.5**	**16.9**
POLAND				
Male	6.7	2.2	3.1	2.7
Female	14.4	4.8	5.7	5.1
Total	**9.2**	**3.1**	**4.0**	**3.5**
LATVIA				
Male	1.3	2.3	2.1	1.3
Female	-3.8	-1.3	-1.2	-1.8
Total	**-0.8**	**0.7**	**0.8**	**0.1**
HUNGARY				
Male	8.1	4.9	4.7	4.4
Female	11.9	1.4	0.9	2.8
Total	**9.3**	**3.5**	**3.2**	**3.7**
SLOVAKIA				
Male	9.0	5.5	6.7	6.4
Female	9.2	-3.2	-1.0	0.0
Total	**8.8**	**2.2**	**3.9**	**4.1**

Source: Authors’ calculations based on CeRPSAM projections.

3.4 Alternative theoretical replacement rates

To analyse the sensitivity of the results to the theoretical replacement rates used to make the projections, we performed our analysis using CeRPSAM projections based on two alternative theoretical replacement rates. These alternative replacement rates are obtained by adding or subtracting five percentage points to the theoretical replacement rates (ISG, 2006) in the year 2050. Therefore, the replacement rates used in this analysis are the same as in the base case in the year 2005, and they smoothly converge to the new value in the year 2050. We thus distinguish two cases:

1. Low RR case: in 2050 all individuals earn a replacement rate equal to the base case minus five percentage points, and
2. High RR case: in 2050 all individuals earn a replacement rate equal to the base case minus five percentage points.

While the choice of the alternative replacement rates is obviously discretionary, these calculations provide a basis on which to judge the sensitivity of our results to different theoretical replacement rates, while keeping employment and participation hypotheses constant with respect to the base case.

The tables with the results for cases 1 and 2 are reported in Appendices 2 and 3 respectively. Here we summarise the main results.

Individuals in case 1 (low RR) have, in the year 2050, a theoretical replacement rate reduced by 5 percentage points with respect to the base case. This reduction results in a basically constant CORE over the projection period for Italy, Luxemburg, Denmark, the Netherlands and the United Kingdom.

Individuals in case 2 (high RR) have, in the year 2050, a higher theoretical replacement rate with respect to the base case in all countries: despite the 5 percentage points increase, in France the longitudinal CORE is falling over the projection period by 7.5 percentage points.

It is important to notice that the pattern followed by CORE is determined by the theoretical replacement rates in conjunction with hypotheses about employment and participation to the labour market: for example, the Italian average CORE in 2050 is equal to 74% in the base case, to 72% in the low replacement rate case, and to 77% in the high replacement rate scenario.

4. Summary and conclusions

In this work we used both actual (ECHP) data and (CeRPSAM) projections over the period 2005-2050 to compute comprehensive replacement rates (CORE) for a range of countries. CORE is the ratio between net disposable income when retired and net disposable income when active, where the definition of disposable income - the broadest possible given data availability – includes wages, self-employment and private income, as well as all cash benefits provided by social security and welfare programmes.

Our descriptive analysis based on ECHP data confirms that, as we move from a narrower to a broader measure of replacement rate, European cross-countries differences in the resources allocated for retirement needs tend to decrease; the same is also true when comparing different ‘social models’. It thus seems that, on a comprehensive basis, different countries provide for almost the same retirement income in relation to pre-retirement income in their own way, as it is the composition, much more than the level, that varies across countries/systems.

When we use projected disposable income, we find that the projected comprehensive replacement rate is highest at about 75-80%, and quite stable over time, in four countries: Italy, Spain, the Netherlands and Luxemburg. In Germany, the United Kingdom, and Denmark CORE is also stable over time, but at a lower value (around 55, 65 and 70% respectively). In Hungary the comprehensive replacement rate is predicted to be 65% in 2050, 11 percentage points higher than in 2020; in Latvia and Poland the increase is slightly less pronounced, being about 7 percentage points.

On the other hand, the COREs for France and Poland are predicted to drop by 10 and 14 percentage points respectively, falling at less than 50% in 2050.

Our procedure based on the semi-aggregate model projections allows us to compute our comprehensive replacement rates, taking into account the evolution of both the theoretical replacement rates, as computed by the ISG group (2006) and of the participation/employment patterns. These two components, taken together drive the results and share the same importance: for example, the CORE in Spain is stable over the projection period even if the theoretical replacement rate is falling over time by about 6 percentage points.

We also find that for a group of countries (France, Poland and, to a lesser extent, Germany, Latvia and Slovakia) the comprehensive replacement rates are sensibly lower than for other countries, ranging from 43% in Poland to 57% in Latvia. While this result may be due to the hypotheses made in the construction of the theoretical replacement rates – neither country assumes a second pillar component, with the exception of Germany – these countries may be facing a problem in allowing individuals to maintain their living standards when elderly.

References

Aguiar, M. and E. Hurst (2005), "Consumption versus Expenditure", *Journal of Political-Economy*, 113(5), pp. 919-48.

Ameriks, J., A. Caplin and J. Leahy (2002), *Retirement Consumption: Insights from a Survey*, NBER Working Paper No. 8735.

Attanasio, O.P. and M. Browning (1995), "Consumption over the Life-Cycle and over the Business Cycle", *American Economic Review*, 85, pp. 1118-1137.

Bernheim, B.D., J. Skinner and S. Weinberg (2001), "What Accounts for the Variation in Retirement Wealth among U.S. Households?", *American-Economic Review*, 91(4), pp. 832-57.

Banks, J., R. Blundell and S. Tanner (1998), "Is There a Retirement-Savings Puzzle?", *American Economic Review*, 88(4), pp. 769-88.

Deaton, A. and J. Muellbauer (1980), *Economics and Consumer Behaviour*, Cambridge: Cambridge University Press.

Diamond, P. (2004), "Social Security", *The American Economic Review*, Vol. 94, No. 1, March.

Disney, R. (2004), "Are contributions to public pension programmes a tax on employment?", *Economic Policy*, 39, pp. 269-311, July.

Disney, R.F. and P.G. Johnson (eds) (2001), *Pension Systems and Retirement Incomes across OECD Countries*, Aldershot: Edward Elgar.

Disney, R.F., M. Mira d'Ercole and P. Scherer (1998), *Resources during retirement*, Ageing Working Paper No. 4.3, OECD, Paris.

Disney, R.F. and E.R. Whitehouse (2002), *The Economic Well Being of Older People in International Perspective: A Critical Review*, Luxemburg Income Study Working Paper No. 306.

Engen, E.M., W.G. Gale and C.E. Uccello (1999), *The adequacy of household saving*, Brookings Paper on Economic Activity, No. 2.

Ferraresi, P.M. and C. Monticone (2008), *A Semi-Aggregate Model (SAM): Finding the Middle Ground in Economic Projections*, ENEPRI Research Report No. 62, CEPS, Brussels.

Förster, M.F. and M. Pellizzari (2000), *Trends and driving factors in income distribution and poverty in the OECD area*, Labour Market and Social Policy Occasional Paper No. 42, OECD, Paris.

Gustman, A.L. and T.L. Steimeier (2001), *Imperfect Knowledge, Retirement and Saving*, NBER Working Paper No. 8406.

Hall, R.E. (1978), "Stochastic Implications of the Life-Cycle Permanent Income Hypothesis: Theory and Evidence", *Journal of Political Economy*, 86, pp. 971-87.

Hamermesh, D.S. (1984), "Consumption during Retirement: The Missing Link in the Life Cycle", *Review of Economics and Statistics*, 66(1), pp. 1-7.

Hauser, R. (1997), *Adequacy and poverty among the retired*, Ageing Working Paper No. 3.2, OECD, Paris.

Holzmann, R. and R. Hinz (2005), "Old-Age Income Support in the Twenty-first Century: An International Perspective on Pension Systems and Reform", Web Version of 18 February 2005, World Bank.

Holzmann, R. and E. Palmer (eds) (2006), *Pension Reform: Issues and Prospects for Non-financial Defined Contribution (NDC) Schemes*, World Bank, Washington, D.C.

Hurd, M.D. and S. Rohwedder (2003), *The retirement-consumption puzzle: anticipated and actual declines in spending at retirement*, NBER Working Paper No. 9586.

Hurd, M.D. and S. Rohwedder (2005), *Changes in Consumption and Activities in Retirement*, Working Papers wp096, University of Michigan, Michigan Retirement Research Center.

Hurd, M.D. and S. Rohwedder (2006), *Some Answers to the Retirement-Consumption Puzzle*, NBER Working Paper No. 12057.

Indicators Sub-Group of the Social Protection Committee (SPC) (2004), *Current and Prospective Theoretical Pension Replacement Rates*, Report by the Indicators Sub-Group of the Social Protection Committee, DG Employment and Social Affairs, February.

Indicators Sub-Group of the Social Protection Committee (SPC) (2006), *Current and Prospective Theoretical Pension Replacement Rates*, Report by the Indicators Sub-Group of the Social Protection Committee, DG Employment and Social Affairs, May.

Lusardi, A. (2000), *Explaining Why So Many Households Do Not Save*, JCPR Working Paper No. 203, North-western University/University of Chicago Joint Center for Poverty Research.

Monticone, C., A. Ruzik and J. Skiba (2008), *A comparative descriptive analysis of the present rules for calculation of survivor's benefits and women's pension rights in the various pension schemes in EU Member States and selected acceding and candidate countries*, ENEPRI Research Report No. 53, CEPS, Brussels.

Munnell, A.H. and M. Soto (2005), *What Replacement Rates Do Households Really Experience at Retirement?*, Center for Retirement Research, Boston College, WP 2005/10, August.

OECD (1993), *The Tax/Benefit Position of Production Workers*, Paris.

OECD (2005), *Pension Markets in Focus*, Issue 2, Paris, December.

OECD (2007), *Pensions at a Glance. Public Policies across OECD Countries. 2006,* Paris.

Soede, A.J., J.C. Vrooman, P.M. Ferraresi and G. Segre (2004), *Unequal Welfare States*, SCP, The Hague.

Soede, A. and J.C. Vrooman (2008), *A comparative typology of pension regimes*, ENEPRI Research Report No. 54, CEPS, Brussels.

Stiglitz, J. (1983), *Risk, incentives and insurance: the pure theory of moral hazard*, The Geneva Papers on Risk and Insurance, No. 26, January.

Whiteford, P. (1995), "The use of replacement rates in international comparisons of benefit systems", *International Social Security Review*, Vol. 48, No. 2.

Whitehouse, E.R. (2003), *The Value of Pension Entitlements: a Model of Nine OECD Countries,* OECD Social, Employment and Migration Working Papers, No. 9.

Appendix 1. Sensitivity analysis on theoretical replacement rates: comparison first pillar component / base case

FRANCE *(gross)*	2020	2030	2040	2050
Base case	56.7	51.9	49.8	46.9
First Pillar only	56.7	51.9	49.8	46.9
Theoretical [(a)]	**66.2**	**-**	**-**	**49.3**
of which from pension funds	*0*			*0*

ITALY	2020	2030	2040	2050
Base case	71.4	72.7	73.9	74.2
First Pillar only	69.6	68.3	66.9	64.7
Theoretical [(a)]	**87.8**	**-**	**-**	**92**
of which from pension funds	*0*			*17.89*

SPAIN	2020	2030	2040	2050
Base case	80.9	78.8	77.8	75.9
First Pillar only	80.9	78.8	77.8	75.9
Theoretical [(a)]	**97.2**	**-**	**-**	**91.6**
of which from pension funds	*0*			*0*

GERMANY	2020	2030	2040	2050
Base case	57.4	55.9	55.3	55.8
First Pillar only	54.4	49.7	46.2	43.3
Theoretical [(a)]	**63.0**	**-**	**-**	**67.0**
of which from pension funds	*0*			*20.94*

UNITED KINGDOM	2020	2030	2040	2050
Base case	64.5	64.5	65.5	66.6
First Pillar only	31.1	30.5	30.9	31.5
Theoretical [(a)]	**82.0**	**-**	**-**	**85.0**
of which from pension funds	*62.12*			*61.59*

LUXEMBURG	**2020**	**2030**	**2040**	**2050**
Base case	73.8	74.8	75.6	76.4
First Pillar only	73.8	74.8	75.6	76.4
Theoretical [(a)]	**98.3**	**-**	**-**	**98.8**
of which from pension funds	*0*			*0*

DENMARK	**2020**	**2030**	**2040**	**2050**
Base case	68.0	67.7	68.0	68.9
First Pillar only	61.2	57.7	54.7	52.3
Theoretical [(a)]	**71.3**	**-**	**-**	**76.1**
of which from pension funds	*5.27*			*29.49*

NETHERLANDS	**2020**	**2030**	**2040**	**2050**
Base case	77.0	78.7	79.6	80.9
First Pillar only	37.6	37.7	37.7	38.1
Theoretical [(a)]	**92.9**	**-**	**-**	**97.3**
of which from pension funds	*54.35*			*58.8*

POLAND	**2020**	**2030**	**2040**	**2050**
Base case	57.1	49.4	46.1	42.7
First Pillar only	57.1	49.4	46.1	42.7
Theoretical [(a)]	**77.7**	**-**	**-**	**43.9**
of which from pension funds	*0*			*0*

LATVIA	**2020**	**2030**	**2040**	**2050**
Base case	49.2	50.1	54.2	56.6
First Pillar only	49.2	50.1	54.2	56.6
Theoretical [(a)]	**77.6**	**-**	**-**	**71.8**
of which from pension funds	*0*			*0*

HUNGARY				
	2020	**2030**	**2040**	**2050**
Base case	53.9	59.0	64.5	65.1
First Pillar only	51.6	54.1	56.1	53.7
Theoretical [(a)]	**83.1**	**-**	**-**	**79.9**
of which from pension funds	*0*			*21.6*

SLOVAKIA				
	2020	**2030**	**2040**	**2050**
Base case	45.0	48.0	50.4	51.9
First Pillar only	45.0	48.0	50.4	51.9
Theoretical [(a)]	**63.1**	**-**	**-**	**63.7**
of which from pension funds	*0*			*0*

(a) The theoretical replacement rate is reported for the years 2005 and 2050. It is assumed to converge smoothly to the 2050 value.

Source: Authors' calculations based on CeRPSAM projections.

Appendix 2. Sensitivity analysis: low replacement rates case

FRANCE *(gross amounts)*	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	62.3	57.6	54.1	50.0
Female	47.1	40.5	37.8	34.4
Total	**56.1**	**50.7**	**47.7**	**44.0**
Cross-sectional CORE				
Male	60.8	57.2	53.9	50.0
Female	43.4	39.9	37.2	34.4
Total	**53.7**	**49.9**	**47.2**	**44.0**
Theoretical (a)	**66.2**	**-**	**-**	**44.3**
Pensioners in 65-69 (%)	**79.6**	**82.8**	**85.1**	**85.7**

ITALY	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	73.3	73.1	73.3	72.9
Female	68.3	69.7	70.6	69.8
Total	**70.9**	**71.5**	**72.0**	**71.5**
Cross-sectional CORE				
Male	70.8	72.0	72.7	72.9
Female	55.9	61.2	69.7	69.8
Total	**64.5**	**67.6**	**71.1**	**71.3**
Theoretical (a)	**87.8**	**-**	**-**	**87**
Pensioners in 65-69 (%)	**70.5**	**76.8**	**81.5**	**81.7**

SPAIN	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	80.5	79.0	78.1	75.7
Female	84.3	77.0	72.9	69.7
Total	**80.1**	**77.3**	**75.5**	**72.9**
Cross-sectional CORE				
Male	75.0	78.2	77.4	75.3
Female	61.8	67.0	71.4	69.9
Total	**69.3**	**73.1**	**74.6**	**72.7**
Theoretical (a)	**97.2**	**-**	**-**	**86.6**
Pensioners in 65-69 (%)	**63.2**	**73.3**	**78.5**	**79.1**

GERMANY	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	58.9	57.0	56.0	55.9
Female	54.9	51.4	49.5	48.7
Total	**56.7**	**54.4**	**53.1**	**52.8**
Cross-sectional CORE				
Male	56.7	56.2	56.1	56.0
Female	50.3	49.8	49.8	49.3
Total	**53.4**	**53.5**	**53.2**	**53.0**
Theoretical (a)	**63**	**-**	**-**	**62**
Pensioners in 65-69 (%)	**80.4**	**84.2**	**85.0**	**85.9**

UNITED KINGDOM	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	73.9	72.2	72.6	72.9
Female	48.8	49.4	49.9	50.3
Total	**64.0**	**63.5**	**63.9**	**64.5**
Cross-sectional CORE				
Male	70.7	71.9	72.9	72.9
Female	47.9	47.9	49.4	50.2
Total	**61.9**	**62.6**	**63.2**	**64.2**
Theoretical (a)	**82**	**-**	**-**	**80**
Pensioners in 65-69 (%)	**82.4**	**83.8**	**84.8**	**85.6**

LUXEMBURG	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	65.5	65.2	65.3	66.2
Female	100.8	100.4	98.8	97.6
Total	**73.3**	**73.8**	**74.0**	**74.1**
Cross-sectional CORE				
Male	61.2	64.9	65.3	66.4
Female	89.4	94.9	99.6	99.3
Total	**68.1**	**72.6**	**73.9**	**74.7**
Theoretical (a)	**98.3**	**-**	**-**	**93.8**
Pensioners in 65-69 (%)	**61.3**	**67.0**	**68.1**	**69.2**

DENMARK	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	75.5	75.1	75.1	75.4
Female	57.7	55.6	54.9	55.0
Total	**67.4**	**66.4**	**66.0**	**66.2**
Cross-sectional CORE				
Male	74.1	74.8	74.9	76.0
Female	56.6	55.2	54.3	55.7
Total	**66.1**	**66.1**	**65.5**	**66.8**
Theoretical (a)	**71.3**	**-**	**-**	**71.1**
Pensioners in 65-69 (%)	**89.5**	**91.1**	**91.2**	**91.2**

NETHERLANDS	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	80.4	80.4	79.9	80.2
Female	69.4	72.5	73.9	74.6
Total	**76.3**	**77.4**	**77.6**	**78.1**
Cross-sectional CORE				
Male	78.7	79.2	79.8	80.7
Female	64.2	69.2	73.0	74.9
Total	**73.5**	**76.1**	**77.0**	**78.1**
Theoretical (a)	**92.9**	**-**	**-**	**92.3**
Pensioners in 65-69 (%)	**70.5**	**74.7**	**76.3**	**77.3**

POLAND	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	63.7	53.8	49.2	44.2
Female	48.5	41.6	37.6	34.2
Total	**56.5**	**48.3**	**44.2**	**40.0**
Cross-sectional CORE				
Male	57.8	50.9	48.9	44.6
Female	40.6	37.3	37.1	34.4
Total	**49.6**	**44.7**	**43.7**	**40.2**
Theoretical (a)	**77.7**	**-**	**-**	**38.9**
Pensioners in 65-69 (%)	**62.9**	**69.1**	**73.9**	**75.1**

LATVIA	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	52.7	54.0	57.1	58.4
Female	48.3	46.2	49.0	50.7
Total	**48.6**	**48.9**	**52.3**	**53.9**
Cross-sectional CORE				
Male	48.9	54.1	57.6	58.6
Female	41.7	46.0	49.3	50.9
Total	**43.4**	**48.5**	**52.8**	**53.6**
Theoretical (a)	**77.6**	**-**	**-**	**66.8**
Pensioners in 65-69 (%)	**82.5**	**85.0**	**86.1**	**86.8**

HUNGARY	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	61.0	63.1	67.7	67.8
Female	46.2	53.7	57.5	56.4
Total	**53.4**	**57.9**	**62.6**	**62.5**
Cross-sectional CORE				
Male	54.5	62.2	67.5	67.7
Female	41.3	50.9	55.5	56.3
Total	**47.3**	**55.8**	**61.5**	**62.2**
Theoretical (a)	**83.1**	**-**	**-**	**74.9**
Pensioners in 65-69 (%)	**64.6**	**72.5**	**74.6**	**74.5**

SLOVAKIA	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	51.5	51.1	53.7	54.8
Female	37.0	43.1	42.8	42.7
Total	**44.5**	**46.9**	**48.6**	**49.4**
Cross-sectional CORE				
Male	45.8	50.2	53.5	54.8
Female	30.2	41.9	42.7	42.7
Total	**38.5**	**45.8**	**48.4**	**49.4**
Theoretical (a)	**63.1**	**-**	**-**	**58.7**
Pensioners in 65-69 (%)	**66.9**	**82.6**	**83.0**	**82.7**

(a) The theoretical replacement rate is reported for the years 2005 and 2050. It is assumed to converge smoothly to the 2050 value.

Source: Authors' calculations based on CeRPSAM projections.

Appendix 3. Sensitivity analysis: high replacement rates case

FRANCE *(gross amounts)*	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	63.7	60.5	58.9	56.7
Female	47.8	42.2	40.7	38.4
Total	**57.2**	**53.2**	**51.8**	**49.8**
Cross-sectional CORE				
Male	62.1	60.0	58.7	56.7
Female	44.1	41.5	40.1	38.3
Total	**54.8**	**52.3**	**51.3**	**49.7**
Theoretical (a)	**66.2**	**-**	**-**	**54.3**
Pensioners in 65-69 (%)	**79.6**	**82.8**	**85.1**	**85.7**

ITALY	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	74.4	75.7	77.3	78.2
Female	69.2	71.9	74.4	74.9
Total	**71.9**	**73.9**	**75.9**	**76.8**
Cross-sectional CORE				
Male	71.8	74.4	76.5	78.1
Female	56.6	63.1	73.3	74.9
Total	**65.4**	**69.8**	**74.8**	**76.4**
Theoretical (a)	**87.8**	**-**	**-**	**97**
Pensioners in 65-69 (%)	**70.5**	**76.8**	**81.5**	**81.7**

SPAIN	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	82.1	82.3	83.0	82.2
Female	85.8	79.9	77.3	75.4
Total	**81.6**	**80.4**	**80.2**	**79.0**
Cross-sectional CORE				
Male	76.5	81.4	82.3	81.8
Female	62.9	69.5	75.6	75.6
Total	**70.6**	**76.0**	**79.2**	**78.8**
Theoretical (a)	**97.2**	**-**	**-**	**96.6**
Pensioners in 65-69 (%)	**63.2**	**73.3**	**78.5**	**79.1**

GERMANY	2020	2030	2040	2050
Longitudinal CORE				
Male	60.5	60.3	60.8	62.5
Female	56.1	53.9	53.2	53.8
Total	**58.1**	**57.4**	**57.5**	**58.8**
Cross-sectional CORE				
Male	58.2	59.4	60.8	62.5
Female	51.4	52.3	53.5	54.5
Total	**54.7**	**56.4**	**57.6**	**58.9**
Theoretical (a)	**63**	**-**	**-**	**72**
Pensioners in 65-69 (%)	**80.4**	**84.2**	**85.0**	**85.9**

UNITED KINGDOM	2020	2030	2040	2050
Longitudinal CORE				
Male	75.2	74.8	76.5	78.2
Female	49.2	50.6	51.8	53.1
Total	**65.0**	**65.6**	**67.0**	**68.8**
Cross-sectional CORE				
Male	71.8	74.3	76.6	78.0
Female	48.3	49.0	51.2	53.0
Total	**62.8**	**64.5**	**66.2**	**68.4**
Theoretical (a)	**82**	**-**	**-**	**90**
Pensioners in 65-69 (%)	**82.4**	**83.8**	**84.8**	**85.6**

LUXEMBURG	2020	2030	2040	2050
Longitudinal CORE				
Male	66.4	67.1	68.3	70.4
Female	102.0	103.1	103.1	103.5
Total	**74.3**	**75.8**	**77.3**	**78.7**
Cross-sectional CORE				
Male	62.0	66.7	68.3	70.6
Female	90.5	97.5	103.9	105.3
Total	**69.0**	**74.7**	**77.1**	**79.4**
Theoretical (a)	**98.3**	**-**	**-**	**103.8**
Pensioners in 65-69 (%)	**61.3**	**67.0**	**68.1**	**69.2**

DENMARK	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	77.1	78.4	80.0	81.9
Female	58.6	57.4	57.8	58.9
Total	**68.7**	**69.0**	**70.0**	**71.6**
Cross-sectional CORE				
Male	75.7	78.0	79.7	82.6
Female	57.4	57.0	57.1	59.6
Total	**67.3**	**68.7**	**69.4**	**72.2**
Theoretical (a)	**71.3**	**-**	**-**	**81.1**
Pensioners in 65-69 (%)	**89.5**	**91.1**	**91.2**	**91.2**

NETHERLANDS	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	81.8	83.2	84.2	86.1
Female	70.4	74.8	77.5	79.7
Total	**77.6**	**80.1**	**81.6**	**83.7**
Cross-sectional CORE				
Male	80.0	82.0	84.0	86.6
Female	65.1	71.4	76.6	80.0
Total	**74.7**	**78.7**	**81.0**	**83.8**
Theoretical (a)	**92.9**	**-**	**-**	**102.3**
Pensioners in 65-69 (%)	**70.5**	**74.7**	**76.3**	**77.3**

POLAND	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	65.1	56.4	53.6	50.4
Female	49.3	43.2	40.4	38.3
Total	**57.7**	**50.5**	**48.0**	**45.3**
Cross-sectional CORE				
Male	59.0	53.3	53.2	50.7
Female	41.2	38.7	39.8	38.5
Total	**50.6**	**46.7**	**47.4**	**45.5**
Theoretical (a)	**77.7**	**-**	**-**	**48.9**
Pensioners in 65-69 (%)	**62.9**	**69.1**	**73.9**	**75.1**

LATVIA	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	54.1	56.6	61.3	64.3
Female	49.5	48.4	52.6	55.8
Total	**49.8**	**51.2**	**56.1**	**59.3**
Cross-sectional CORE				
Male	50.1	56.7	61.8	64.5
Female	42.7	48.1	52.8	55.9
Total	**44.5**	**50.8**	**56.6**	**59.0**
Theoretical (a)	**77.6**	**-**	**-**	**76.8**
Pensioners in 65-69 (%)	**82.5**	**85.0**	**86.1**	**86.8**

HUNGARY	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	62.3	65.5	71.9	73.4
Female	47.0	55.8	61.1	61.3
Total	**54.4**	**60.2**	**66.5**	**67.7**
Cross-sectional CORE				
Male	55.5	64.4	71.5	73.2
Female	42.0	52.9	58.9	61.1
Total	**48.2**	**57.9**	**65.2**	**67.3**
Theoretical (a)	**83.1**	**-**	**-**	**84.9**
Pensioners in 65-69 (%)	**64.6**	**72.5**	**74.6**	**74.5**

SLOVAKIA	**2020**	**2030**	**2040**	**2050**
Longitudinal CORE				
Male	52.7	53.4	57.6	60.3
Female	37.7	45.1	45.9	46.9
Total	**45.5**	**49.0**	**52.1**	**54.4**
Cross-sectional CORE				
Male	46.9	52.5	57.3	60.2
Female	30.8	43.8	45.7	46.9
Total	**39.3**	**47.8**	**51.8**	**54.2**
Theoretical (a)	**63.1**	**-**	**-**	**68.7**
Pensioners in 65-69 (%)	**66.9**	**82.6**	**83.0**	**82.7**

(a) The theoretical replacement rate is reported for the years 2005 and 2050. It is assumed to converge smoothly to the 2050 value.

Source: Authors' calculations based on CeRPSAM projections.

Appendix 4. Basic elements of the pension system

	Type of a pension system	**Benefit calculation rules**
Denmark	1) first pillar: - residence-based Social pension (*Folkepension*) composed of a flat-rate benefit financed as PAYG + income-tested supplement - compulsory contribution-related ATP 2) Occupational schemes, voluntary	<u>Social pension</u> • The annual amount (€7,650 as of January 2005) is reduced if the conditions for obtaining a full pension (40 years of residence) are not fulfilled. In this last case: 1/40 of full pension for each year of residence between the ages of 15 and 65 (67). The basic amount is also reduced according to the professional income of the pensioner: if the pensioner has earned income of more than €32,530 annually (as of January 2005), the basic amount is reduced by 30% of the part of the earned income that exceeds €32,530. • The pension supplement is €7,710 annually (as of January 2005) for single pensioners and €3,600 annually (as of January 2005) for married or cohabiting pensioners in 2005. The pension supplement is taxable and tested on the pensioner's or his/her spouse or cohabitee's means. In addition to the basic amount of public old-age pension and pension supplement, a supplementary pension benefit of €830 a year (as of January 2005) is granted. The supplementary pension benefit is taxable and paid once a year. <u>ATP</u> Annual amount of €2,998 (as of January 2005) if the insured has been affiliated to the supplementary scheme since 1 April 1964 and has always worked full-time since then. Different amounts are paid per year according to the level of contributions (there are 3 levels of contributions, varying according to the type of work) and the years during which the insured contributed. Supplementary pensions of less than €167 per year (as of January 2005) will be replaced by a lump-sum payment.
Hungary	Public PAYG DB (1st pillar) and compulsory funded DC (2nd pillar) 2nd pillar voluntary for those who entered the labour market between 1998 and 2003 and to those who were born in 1973 or later. Since 2003 obligatory.	The amount of pension depends on the insurance period and is expressed as a percentage of average monthly gross income earned since 1988: 53% for 20 years of insurance period; +2% for each of the insurance years between 21-25; +1% for each of the insurance years between 26-36; +0.5% for each of the insurance years between 36-40; +1.5% for each of the insurance years after 40 years.

	Type of a pension system	Benefit calculation rules
France	1) the first pillar is made of two tiers: 1ST TIER: earnings-related DB public pension (RGAVTS, *Régime général d'assurance vieillesse des travailleurs salariés*, for private employees in manufacturing and services) 2ND TIER: mandatory occupational schemes (ARRCO, *retraite complémentaire des salariés*, for employees and AGIRC, *retraite des cadres*, for managerial and professional) 2) second and third pillar: supplementary and voluntary funded schemes	RGAVTS: Pension Formula: Reference salary x t x n/154(maximum insurance duration). t = pension rate. Based on the age of the insured person and the number of years of contributions. Maximum rate of 50% if 160 quarters of insurance. If the maximum duration is not reached, the pension amount decreases from 5% per year (for generations before 1944) to 2.5% (for generations after 1952) with a minimum of 25%. The full rate is applicable for certain groups, regardless of the number of years of contributions (for example, for employees with 50% incapacity, female manual workers having raised 3 children, war veterans or victims) or if the insured person has reached the age of 65 at the moment the pension payment is due. n = duration of insurance. The maximum duration is set to 150 quarters for insured born in 1943 or previously. It progressively increases from 152 to 160 quarters for generations from 1944 to 1948. Reference salary = Annual average salary, limited to the social security ceiling (€ 30,192 per year in 2005) which is adjusted every year by decree. The average salary is calculated on the basis of the 22 best years for the insured born in 1945. The duration is increased by one year for every birth year up to 25 years in 2008, no matter the year of birth of the insured. ARRCO and AGIRC: Total number of points multiplied by the value of the point. Value of the point per year: € 1.0886 (*ARRCO*) and € 0.3862 (*AGIRC*).
Germany	The public pension system is of defined-benefit type Second pillar occupational pensions are voluntary	Pension formula: PEP x 1.0 x AR. PEP: Personal Earnings Points *(persönliche Entgeltpunkte)*. The number of Income Points is based on the level of income on which contributions were paid and the allowance credited for certain non-contributory periods, multiplied by the accession factor. The accession factor takes into account the various lengths of time pension will be drawn in the case of claim to an early retirement pension or of waiver of an old-age pension after the 65th year of age. 1.0: pension type factor (a factor established according to the respective insurance objective). AR: Current pension value *(aktueller Rentenwert)*: corresponds to the monthly pension paid to an average earner for each year he has been insured. It is adjusted annually to keep pace with net wages and salaries. Reference earnings: Insured employment income (up to contribution ceiling) during the entire duration of the insurance. The monthly contribution ceiling for 2004 is: West: € 5,200 and East: € 4,400.

	Type of a pension system	**Benefit calculation rules**
Italy	The first pillar underwent recent reforms: the new system (applying to new entrants into the labour force after 31 December 1995) with benefits calculated under NDC scheme. The old system applies to workers with at least 18 years of contributions at the end of 1995 who will have their benefits calculated under the defined-benefit method. A transitional *pro-rata-temporis* system applies to workers already in the labour force at the end of 1995 but having worked less than 18 years up to that moment.	*DB scheme (for workers with 18 years of contributions on 31.12.1995)*: • Earnings up to € 38,603.00 (ceiling): 2% x n x S • Partial amount up to € 51,341.99 (ceiling x 1.33): 1.6% x n x S. • Partial amount up to € 64,080.98 (ceiling x 1.66): 1.35% x n x S. • Partial amount up to € 73,345.70 (ceiling x 1.90): 1.1% x n x S. • Earnings over € 73,345.70: 0.9% x n x S. n = number of years of insurance (max.: 40). S = reference earnings: • For those who on 31 December 1992 had worked 15 years or more: average of salaries during the last 5 years with ceiling (€ 38,603). • For those who on 31 December 1992 had worked less than 15 years: average earnings over a variable period between the last 5 and 10 years, with ceiling (€ 38,603). *New system (entrants in the labour force after 1.1.1996)*: The calculation is based on the total of contributions of the entire working life. Contribution amounts are adjusted yearly, according to the average increase of the GDP within the last five years. The pension amount is calculated by multiplying contribution amounts by an actuarial coefficient which varies according to age (between 57-65). There is no longer a minimum pension. Annual salary ceiling only for workers to whom the NDC system applies. *Workers already in the labour force at the end of 1995 but having worked less than 18 years up to that moment*: transitional pro-rata temporis system.
Latvia	Public PAYG NDC and compulsory funded DC. Voluntary funded 3rd pillar.	P+K/G where: P: annual pension, of which 1/12 is the monthly pension; K: the pension capital of insured person; G: time period (in years), during which pension disbursements are planned, starting from the pension allocation year (projected life expectancy at a retirement age). Old-age pension formula during the transition period: P= (Ks + K)/ G where: P, K, G –see above; Ks: starting (initial) capital, calculated according to the following formula: Ks = Vi x As x 0.2 where: As: the insurance record until the year 1995; Vi: the average individual contribution earnings

	Type of a pension system	Benefit calculation rules
Luxembourg	The public pension scheme has two components: a flat-rate part depending on years of coverage and an earnings-related part. Occupational pension schemes are voluntary	The pension comprises two parts: a flat-rate part and an income-related part. • Flat-rate pension part *(majoration forfaitaire)*: € 344.75 per month (equivalent to around 12% of average earnings) for 40 years of insurance. For incomplete insurance, these benefits are reduced proportionally (1/40 per year). • Income-related pension part *(majoration proportionnelle)*: 1.85% of total earnings taken into account. The earnings measure used in the formula is lifetime average pay. For each year of work after age 55, the accrual rate is increased by 0.01 percentage points (staggered supplements, *majoration échelonnée)*. Furthermore, each year of contributions beyond 38 also attracts an additional accrual of 0.01 percentage points. The maximum accrual rate is 2.05% per year. There is a minimum and maximum amount liable for contribution. • Allowance at the end of the year *(allocation de fin d'année)* of € 564 (in case of a complete career of 40 years; otherwise proportional reduction).
Netherlands	Public residence-based flat-rate: National Old Age Pensions Act (*Algemene Ouderdomswet*, AOW) Earnings-related quasi-mandatory occupational schemes	Flat-rate benefits: • Single person: € 924.86 per month (in 2005) • Married and unmarried persons, both 65 and over (also same-sex cohabitants, and if a person lives with a brother, a sister, a grandchild but not a parent or a child under 18): € 631.81 per month for each person. • Pensioners with a partner younger than 65 (→ see supplement for spouse, *toeslag*): - if the AOW-pension took effect before 1 February 1994: € 924.86; - if the AOW-pension took effect on 1 February 1994 or later: € 631.81. • Single parent pensioners: € 1148.92

	Type of a pension system	**Benefit calculation rules**
Poland	Public PAYG NDC and compulsory funded DC	Old-age pension = 24%*base amount + individual calculation basis*(1.3% for each contributory year + 0.7% for each non-contributory year) Where: the base amount equals 100% of the average remuneration minus social insurance contributions collected from the insured person in the calendar quarter preceding the date of pension adjustment. Disability pension – depending on the degree of disability, calculated as either 75% or 100% of the hypothetical old-age pension. *Post-reform:* 1st pillar: Monthly old-age pension = [(initial capital + contributions paid to 1st pillar)*indexation]/ average life expectancy at the retirement age (expressed in months) 2nd pillar: Exact rules have not been decided yet but benefit will depend on contributions paid to an open pension fund, rate of return and average life expectancy at the retirement age
Slovakia	PAYG public pillar and DC funded pillar. A second funded pillar of old-age pension insurance started in 2005 Additionally: complementary pension insurance (3rd pillar)	Old-age pension formula in 1st pillar: OP = APEP x PPI x CPV APEP = Average Personal Earnings Point is determined as proportion of multiplication of personal points achieved during particular calendar years (during decision period) to the periods of pension insurance. The earnings points are determined as a proportion of the gross yearly income of the insurer to the average yearly wage in the Slovak economy. Ceiling of APEP is the value 3, but for the year 2004 only 1.95. PPI = Period of Pension Insurance (+ years remaining to retirement age in case of invalidity benefit). CPV = Current Pension Value = 1.25% of the monthly average wage in Slovak economy in the year previous to the year of retirement. 2nd pillar: life time annuities based on insurance principles.

	Type of a pension system	**Benefit calculation rules**
Spain	The Contributory Public Pension System includes: - Social Security Schemes (SS) *(Pensión de Jubilatión)*: earnings-based PAYG with DB formula. - State Scheme (CPE) *(Clases Pasivas del Estado, CPE)* with flat-rate benefit. Voluntary occupational and personal schemes.	SS (Social Security) Contributory Public Pension System: If the worker has contributed at least 35 years, he/she is entitled to the full old-age pension associated to his/her regulatory base if he/she retires at 65. On the other hand, if the number of years of contributions is equal to the minimum required (15 years), the worker gets only 50% of the regulatory base (RB). The percentage of the RB increases by 3 percentage points for each additional year of contribution until 25 and by 2 percentage points for each additional contribution year afterwards, up to 35. The Regulatory Base (RB) is calculated dividing by 210 the contribution base (CB) of the 180 months prior to retirement. The contribution base (CB) is essentially the monthly earned income. CBs corresponding to the 24 months just prior to retirement are computed in nominal terms. If in the period that will be counted towards the calculation of benefits there are months for which the worker had no obligation to contribute to Social Security, these contribution gaps will be integrated (to the exclusive purposes of calculation) to the minimum benefit basis at the time in the General Scheme. Contributory Public Pension System (CPE): Regulatory Base is fixed and depends on which group the civil servant belongs to.
United Kingdom	The public pension scheme is composed of a flat-rate Basic State pension (BSP) and the additional pensions State Earnings-related pension Scheme (SERPS), substituted by State Second pension (S2P) in 2002. Workers can contract out of State Second pension and opt for an Occupational, Personal or Stakeholder pension (these can also be joined on a voluntary basis)	Basic State Pension: Flat-rate amount of GBP 79.60 (€ 113) per week (paid pro-rata if number of qualifying years is less than the requisite number but at least a quarter of that figure). SERPS: Accrual rate of 1.25% a year, based on average indexed surplus earnings (after 1978 until 5th April 2002) between the lower and upper earnings limit. For persons attaining pensionable age from 06.04.2000 the accrual rate reduces over a ten-year transitional period to 1.00%. State Second Pension: From April 2002-March 2010, the accrual rate is: (i) double prevailing SERPS accrual rate for earnings between the annual Lower Earnings Limit (LEL) and the Earnings Threshold (ET) (ii) half the prevailing SERPS accrual rate for earnings between the ET and a figure which is (3 x ET) - (2 x LEL) (iii) the prevailing SERPS accrual rate for earnings between ((3 x ET) - (2 x LEL)) and the Upper Earnings Limit. From April 2010 onwards, the above accrual rates become: (i) 2.0% a year; (ii) 0.5% a year; (iii) 1.0% a year respectively.

Source: Monticone, Ruzik, Skiba (2008).

About AIM (Adequacy & Sustainability of Old-Age Income Maintenance)

The AIM project aims at providing a strengthened conceptual and scientific basis for assessing the capacity of European pension systems to deliver adequate old age income maintenance in a context of low fertility and steadily increasing life expectancy. The main focus is on the capacity of social security systems to contribute to preventing poverty among the old and elderly and more generally to enable persons to take all appropriate measures to ensure stable or "desired" distribution of income over the full life cycle. In addition it will explore and examine the capacity of pension systems to attain broad social objectives with respect to inter- and intra generational solidarity.

Furthermore it will examine the capacity of pension systems to allow workers to change job or to move temporarily out of the labour market and to adapt career patterns without losing vesting of pensions rights. The project will also address the specific challenges with respect to providing appropriate old age income for women.

A general objective of the research project is to clearly identify and analyse the potential trade-offs between certain social policy objectives and overall stability of public debt.

AIM is financed under the 6th EU Research Framework Programme. It started in May 2005 and includes partners from both the old and new EU member states.

Participating institutes

- Centre for European Policy Studies, CEPS, Belgium, coordinator
- Federal Planning Bureau, FPB, Belgium
- Deutsches Institut für Wirtschafsforschung (German Institute for Economic Research), DIW, Germany
- Elinkeinoelämän tutkimuslaitos, (Research Institute of the Finnish Economy), ETLA, Finland
- Fundación de Estudios de Economía Aplicada , FEDEA, Spain
- Social and Cultural Planning Office, SCP, Netherlands
- Instituto di Studi e Analisi Economica (Institute for Studies and Economic Analysis), ISAE, Italy
- National Institute for Economic and Social Research, NIESR, United Kingdom
- Centrum Analiz Spolleczno-Ekonomicznych (Center for Social and Economic Research), CASE, Poland
- Tarsadalomkutatasi Informatikai Egyesules (TARKI Social Research Informatics Centre), TARKI, Hungary
- Centre for Research on Pensions and Welfare Policies, CeRP, Italy
- Institute for Economic Research, IER, Slovak Republic
- Inštitut za ekonomska raziskovanja (Institute for economic research), IER, Slovenia