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On using dynamic microsimulation models to assess the consequences of the AWG projections and hypotheses on pension adequacy:

Simulation results for Belgium, Sweden and Hungary

May 2015

Gijs Dekkers[1], Raphaël Desmet[2], Ádám Rézmovits[3], Olle Sundberg[4], Krisztián Tóth[3]

1 Federal Planning Bureau, and CESO, KULeuven, Belgium, and LISER, Luxembourg. Contact author: gd@plan.be, +32(0)2/5077413

2 Federal Planning Bureau, Belgium.

3 Central Administration of National Pension Insurance (ONYF), Hungary.

4 Olle Sundberg works at the Ministry of Finance, Sweden, and is a member of the Ageing Working Group.

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Federal Planning Bureau
Avenue des Arts - Kunstlaan 47-49, 1000 Brussels
telephone: +32-2-5077311
fax: +32-2-5077373
e-mail: contact@plan.be
http://www.plan.be

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Central Administration of National Pension Insurance
address: 1081 Budapest, Fiumei út 19./a.
postal address: 1392 Budapest, Pf.: 251.
telephone: (+36) 1 270 8000
e-mail: onyf@onyf.hu
url: http://www.onyf.hu

On using dynamic microsimulation models to assess the consequences of the AWG projections and hypotheses on pension adequacy:

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Abstract - Since a couple of decades, the pension policy of member states is a focal point of attention on the European level. Securing financial sustainability by the AWG requires a prospective vision on ageing, labour market developments and social policy. But a sensible assessment of financial sustainability cannot do without taking into account the prospective development of pension adequacy. The SPC does this through prospective theoretical replacement rates and benefit ratios. However, prospective values of the key ISG indicators, such as the risk of poverty rate or the Gini are not available.

It was decided in the SPC WG AGE that Belgium, Hungary and Sweden would use their dynamic microsimulation models to simulate possible developments of pension adequacy, while taking into account the projections and hypotheses of the AWG.

In Belgium, gross public pension expenditure increase by 3.5% of GDP between 2013 and 2060, while the poverty risk as well as inequality among pensioners would decrease. In Sweden, the assumption of an unchanged retirement age results in projected gross public pension spending as a percentage of GDP to decrease by 1.5 percentage points, while lowering the benefit ratio and causes the risk of poverty among the pensioners to increase. Finally, pension expenditures in Hungary are projected to decline by 0.1%-points. This is mainly the result of the shorter service years, which themselves are the results of the great transition in Hungary, and which cause the poverty risk of pensioners to increase.

The results of this paper not only show the consequences of the AWG hypotheses and projections on prospective poverty risks, but also demonstrate the potential value of using dynamic microsimulation on the EU level. Finally, the simulation results on the various scenarios for Belgium and Sweden also show that increasing the employment of older workers not only reduces pension expenditures as a share of GDP, but also reduces the poverty risk among the elderly. So although they are two sides of the same coin, careful policy design allows to jointly reinforce sustainability and adequacy.

Jel Classification - C1, C5, J11, I32, H55

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[1] Federal Planning Bureau, and CESO, KULeuven, Belgium, and LISER, Luxembourg. Contact author: gd@plan.be, +32(0)2/5077413

[2] Federal Planning Bureau, Belgium.

[3] Central Administration of National Pension Insurance (ONYF), Hungary.

[4] Olle Sundberg works at the Ministry of Finance, Sweden, and is a member of the Ageing Working Group.

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1. Introduction

1.1. A description of the project

Since a couple of decades, the pension policy of member states is a focal point of attention on the European level. Traditionally, the focus was primarily on securing the financial sustainability. This clearly requires a prospective vision on ageing, labour market developments and social policy. But a sensible assessment of financial sustainability cannot do without taking into account the social impact of ageing, budgetary and pension policy. Specifically could the prospective development of pension adequacy be taken into account The ISG does this through prospective theoretical replacement rates and benefit ratios. However, prospective values of the key ISG indicators, such as the risk of poverty rate or the Gini, are not available.

After a proposition by the Belgian delegate to the SPC WG AGE (Dekkers and Englert, 2014), it was decided that some countries that have dynamic microsimulation models would use these to fill this information gap by simulating possible developments of (pension) adequacy while taking into account the projections and hypotheses of the AWG as much as possible. As such, this project is intended to show what contribution dynamic microsimulation could contribute to the work of the SPC WG AGE.

The idea to use the AWG projections as a starting point for dynamic microsimulation, thereby assessing as-consistent-as-possible projections on pension adequacy is by itself not new (see Dekkers *et al.*, 2010) but the feeling was that the availability of models in various EU member states, their level of development and the data underlying them are now on a level which allows for a sensible simulation exercise.

The results will not only show the consequences of the AWG hypotheses and projections on prospective poverty risks, but will also demonstrate the potential value of using dynamic microsimulation on the EU level.

As for the indicators to be presented later in this report, a first argument in the choice of the indicators of course was that they should allow for an assessment of the consequences of the AWG projections and hypotheses on the adequacy of pensions. Furthermore, they needed to be as complementary as possible with the indicators produced in the context of the AWG itself. And finally, the indicators could conceptually not be too close to the AWG-indicators themselves, for this could result in confusion.

Three indicators were selected and will be presented for four subgroups for all projected periods available.

1. The indicators:

   a) The at-risk-of-poverty (AROP) rate (using 60% of median equivalent household income as the threshold and using the modified OECD equivalence scale (1, .5, .3))

   b) The overall Gini (based on the same equivalent household income)

   c) The Income quintile share ratio S80/S20 (based on the same equivalent household income)

2. The subgroups:

d) Total population

e) Pensioners: those that receive a retirement benefit

f) Elderly (65+)

g) Working

Note that the decision not to include the replacement ratio is a deliberate one. As said, the indicators chosen should conceptually not be too close to the AWG-indicators themselves. Since theoretical forward-looking replacement rates are at the core of the AWG indicators, it was thought wise not to include them in our analyses. Finally, all projections are under the well-known assumption of "unchanged policy" taking into account the currently known and decided current and future changes to the system.

1.2. Dynamic microsimulation models

Microsimulation models in recent years have gained popularity in the assessment of the impacts of demographic changes and social policy on the adequacy of social security benefits, and specifically pensions. The characteristics that distinguish micro-simulation models from other models are (i) that modelling is done at the level of the individual and the household, and (ii) that the point of departure of simulations is a survey or an administrative dataset representing actual individuals at a certain point in time (Dekkers *et al.* 2010). Microsimulation models thus differ from (semi-)aggregate budgetary models in that they simulate the impact of policy measures and schemes on real people, and not on averages or "representative agents" (Atkinson, 2009).

Contrary to static microsimulation models, of which EUROMOD is the most well-known, the models used in this project are of the "full" dynamic type in that they include a notion of time. This involves "updating each attribute for each micro-unit for each time-interval" (Caldwell, 1990, in Harding, 1996, 4). Taking a certain dataset, individuals face probabilities of a change in each of their attributes. In the modelling process, this is simulated by chance. The number of variables that can be modelled this way depends entirely on how much information on transition probabilities or risks are available (Dekkers and Belloni, 2009, 12). A dynamic model therefore builds up complete synthetic life histories for each individual in the dataset, including data on mortality, labour market status, retirement age, savings and so on (Emmerson, *et al*., 2004, 3). So individuals are born, go through school, marry or cohabit, enter the labour market, retire and, finally, die. During their active years, they build up pension rights, which result in a pension benefit when they retire.

A discerning character of microsimulation models relative to (semi-)aggregate models is that the dimensions by which the simulation results can be presented, is a priori undefined. A semi-aggregate model that discerns age and gender as modelling categories, cannot present its results for single mothers only. For a typical microsimulation model, this is not a problem since the output of any model is essentially a cross-section (in case of a static model) or a panel-dataset. Which data is then used for presentation is independent of the model itself. So, one could for example check the development of the poverty risk among single mothers, or households with a low work intensity, and so forth. Besides the usual limitations by the size of the dataset, there is no bound on the number of possible combinations.

Dynamic microsimulations through various techniques allow taking into account exogenous information (Li *et al.*, 2014, section 10.3.9). This has made it possible to assess the impact of pension reform (Dekkers *et al.*, forthcoming) or changing economic circumstances (Baroni *et al.*, 2014) on pension adequacy in a prospective setting. The founding father of microsimulation, Guy Orcutt in his seminal article of 1957 (1975, 122; reprinted as Orcutt, 2007, 7) already noted that "these models could be used either for unconditional forecasting or for predictions of what would happen given specified external conditions and governmental actions". It is exactly for this purpose that this project means to use dynamic microsimulation.

1.3. Microsimulation and theoretical replacement ratios

Theoretical replacement rates (henceforth TRRs) are a key indicator of the Social Protection Committees Indicator Subgroup. Of these, the prospective TRRs describe the "foreseen situation of people retiring in the future" (DG EMPL and SPC, 2012, 88) under the pension legislation enacted by the current year, "including transitional rules to be implemented gradually that may be legislated in enacted reforms" (*op. cit.*). So the base case is a man or woman, entering the labour market today and retiring at 65 with a career of, say, 40 years. There is a clear relation between TRR and the adequacy of pensions, since TRRs "provide the possibility to look at individual case studies and evaluate to what extent current and future pension systems ensure that the elderly have the resources to support adequate standards of living." (ISG, 2009, 1).

A straightforward way to assess the complementarity between the TRRs and the abovementioned indicators describing poverty risks, and inequality should start by returning to the definition of "pension adequacy". Holzmann and Hinz (2005, 6) define a pension system to be adequate if it provides benefits sufficient to prevent old-age poverty, in addition to provide means to smooth lifetime consumption for the majority of the population. This definition coincides by that held by the European Commission (EC, 2010, box 2, 125) and establishes a direct link tween TRRs and the income-smoothing dimension of pension adequacy:

> "In order to account for the second dimension in the definition of adequacy, the OMC indicators look at measures of replacement income, i.e. the extent to which pension systems enable workers to preserve their previous living standards when moving from employment to retirement and the relative income of the elderly. The main indicator is the aggregate replacement ratio. However, this only looks at pensions currently in payment. But given the long-term implications of pension reforms, theoretical replacement rates are useful as an additional analysis tool. This gives us the possibility to look at the adequacy of the replacement income provided by pension systems for theoretical cases." (*op. cit.*)

Hence, where the TRRs cover the "consumption smoothing dimension" of pension adequacy in the above definition, the various indicators on poverty and income inequality among the elderly clearly fall under the "income security dimension" of adequacy. The two groups of indicators therefore are complements and together provide a full and prospective assessment of pension adequacy.

This complementarity also surfaces by a comparison of the different technical characteristics of TRRs and the indicators that come from a dynamic microsimulation model. Even though TRRs are prospective, they are "snapshots" in that the characteristics of the theoretical individual remain fixed. In contrast, the simulation results of a microsimulation model are aggregate indicators of adequacy, underneath all kinds of social and economic changes that are taking place. Thus, in Belgium for example, the average age of the population changes, more women enter the labour market, the average size of the household declines, and so forth. All these developments affect the results of the microsimulation model, which is of course an advantage. In contrast, one may question the representativeness of the theoretical individual that is the basis of the TRR, and especially how this representativeness will change in the future.

A TRR therefore does not reflect the intertemporal development of adequacy indicators. But assessing the separate impact of all these changes and developments in a microsimulation model is a very complex and time consuming task, and the TRR is therefore more straightforward in its simplification. Furthermore, theoretical replacement rates do cover indexation issues pertaining to the (future) link between earnings and parameters in the calculation of the benefit at retirement, but they do not cover indexation issues after retirement: i.e. the linkages in the development of benefits of pensioners and earnings of workers, i.e. the degree to which benefits are indexed in real terms, if any[5].

1.4. Some general observations

In this section, we make a first and tentative attempt to combine the conclusions on financial sustainability in the various country fiches, to be published in the course of this calendar year, with the simulation results describing prospective adequacy to be presented in more detail later in this report.

In Belgium, gross public pension expenditure increases by 3.5% of GDP between 2013 and 2060 (see Federal Planning Bureau (2014, Table 10, page 19)). This increase occurs mostly between 2020 and 2030 and comes entirely from the earnings-related old-age pensions and early pensions. Over the whole projection period, the main driving factor behind the rise in public pension expenditure is the increasing dependency ratio (+5.8%). The contributions of all other ratios such as the coverage ratio and benefit ratio is negative. Put differently, the pension expenditure rise in Belgium results from the population ageing and this effect is not mitigated by reductions of the relative benefit level (which occurs only in the second half of the simulation period, and are therefore not 'translated' in increases of the poverty rate within the simulation horizon) or of especially the early age coverage ratio (number of pensioners ≤65 / population 50-64). According to the simulations done with the microsimulation model MIDAS, the poverty risk as well as inequality among pensioners would decrease, mainly because of increases of the minimum pensions, of the increasing employment rate of women in the first half of the simulation period, and of the lower productivity growth rate in the first half of the simulation period. Thus, the

5 Except that the TRR variant "ten years after retirement" (ISG, 2009, section 3.1, 19).

reduction of the benefit ratio which occurs only in the second half of the simulation period, will only result in increases of the poverty rate beyond the simulation horizon of 2060.

In Sweden, projected gross public pension spending as a percentage of GDP decrease by 1.5 percentage points from the starting year 2013, arriving at 7.8% in 2060 (Ministry of Finance Sweden, forthcoming). Although the contribution of the demographic dependency ratio remains positive (*op. cit.*, 17) it is considerably smaller than in previous AWG projections, and it is more than offset by the decreasing benefit ratio and employment effect. The benefit ratio and replacement ratio decrease because the AWG assumes an unchanged retirement age. Seeing that the benefit in the NDC PAYG pension is a function of the individual's account value down rated by a function of the life expectancy at the date of retirement. Since life expectancy at birth is expected to increase by 5.5 years for both sexes from 2013 to 2060, the average pension benefit given the average account value and given the age of retirement will decrease. The same applies for actuarially defined occupational and private pensions. This lowers the benefit ratio and causes the risk of poverty among the pensioners as well as the 65+ to increase by roughly 10%-points over the simulation period. In turn, this compresses the incomes of the elderly at the low end of the distribution, resulting in lower income inequality. The effect on the pensioners' disposable income is mitigated by increasing importance for occupational and private pensions. Thus the total pensions to GDP ratio remain approximately unchanged, increasing from 11.8% in 2013 to 11.9% in 2060.

Pension expenditures in Hungary are projected to decline by 0.1%-point (from 11.5% to around 11.4% of GDP) over the period 2013-2060 (European Commission, The 2015 Ageing Report, p. 347). This process however has a U-shaped form. Public pensions to GDP will decrease up to 2030, and then increase again. There are two factors behind the U-shape in the development of public pension expenditure. Firstly, the demographic factor implies that in the next years the baby boom generation of the 1950s is going to retire. The dependency ratio therefore increases markedly, over the whole simulation period but especially up to 2020. The impact of this is however mitigated by the decrease of the early age coverage ratio. The statutory retirement age is increasing between 2012 and 2021 from 62 to 65. This gradual decrease of especially the early age coverage ratio (fewer pensioners in relation to the older active population) has a downward effect on the pension expenditure, especially until 2020. The latter effect is stronger than the former in the first decade of the simulation period, which explains the decreasing public pensions to GDP. However, from 2020 on, the former effect wears off, while the latter comes in full force. Hence, public pension expenditures to GDP again start to increase. Finally and over the whole simulation period, the replacement rate and benefit ratio continuously decrease due to the shorter service years. This also explains the continuous increasing poverty risk among the elderly (especially first half of the simulation period) and pensioners. These effects are themselves the results of the great transition in Hungary. The convergence of the poverty and inequality between pensioners and elderly in the long run is because the proportion of retired non-elderly is decreasing with the lowering of the early age coverage ratio.

The next and second chapter presents and discusses the models and simulation results for Belgium, Sweden and Hungary.

2. Country results for Belgium

2.1. MIDAS

MIDAS is a cross-sectional dynamic microsimulation model that simulate individuals and households between 2002 and 2060. The starting dataset is an administrative sample of 300 000 individuals, which is expanded to 2.2 million individuals using the frequency weights (Dekkers and Cumpston, 2012, 59). MIDAS consists of various modules that can be grouped in five blocks: demographics, labour market, social security and pensions, taxation and output. These blocks contain the following processes (among other things):

– Demographic block: mortality, fertility, partner selection, marriage or cohabitation, separation or divorce, educational attainment level, being in education.

– Labour market block: continuing or starting to work, hours of work, earnings per hour, ceasing to work, unemployment, disability, unemployment with company allowance, and retirement.

– Social security and pensions block: this block simulates the social security benefits depending on the state that the individual occupies: unemployment benefit, unemployment benefit with company allowance, disability benefit and retirement benefit. Other benefits simulated are independent on the state of the individual: means-tested minimum guaranteed income, means-tested Guaranteed Income for the Elderly and children-benefits.

– Fiscal block: gross-net trajectory, depending on the income source(s).

– Output: all kinds of tables, calculation of equivalent gross and net household income, poverty risks, Gini, Income quintile share ratio, etc.

MIDAS does not include private savings or pensions from the second or third pension pillars, wealth and housing. Immigration and emigration are not included either but are currently under development.

MIDAS makes use of the methodological facilities provided by LIAM2 (de Menten *et al.*, 2014), an open-source language designed for the development of static and dynamic microsimulation models. A discerning characteristic of MIDAS is that it is designed to replicate exogenous (semi-)aggregate data. In this case, this feature is used to incorporate and replicate macro-economic and socio-demographic results of the Belgian MALTESE system of models that has been used to produce AWG projections for Belgium. It insures that the simulations pertaining to adequacy are as consistent as possible with the budgetary results (Federal Planning Bureau, forthcoming). See Dekkers *et al.*, 2012 and Dekkers *et al.*, forthcoming, for applications. Alignment is a general term for all processes that constrain the output of the microsimulation model to external macro-data (Li *et al.*, 2014). Alignment procedures are extensively used in the different 'channels of consistency' (Dekkers *et al.*, 2012) between the microsimulation model MIDAS and the Belgian MALTESE system of models.

There exist three 'channels of consistency'. The first is the most important and allows to replicate socio-demographic projections of the MALTESE system of models. It concerns mainly the numbers of workers, their status, and the number of unemployed, disabled and unemployed with company allowance. This is done through alignment by sorting probability procedures (Li and O'Donoghue, 2014, 222). This involves having the model rank individuals according to the risk of an event happening while the alignment procedure sets the number of transitions in order to match the exogenous totals. So for example, suppose that we know from the MALTESE system of models that the proportion of men of 50 years of age that are working is, say, 80%. Then all men are ranked according to the 'risk' of working, where the latter is usually provided by the estimation results of micro-level logistic regressions. Thus, those with a lower level of educational attainment *cet. par.* have a lower rank than those with a higher educational attainment level; those that were working in the previous period often and *cet. par.* have a higher rank, and so forth. Then an individual logistic random effect is included in this rank in order to prevent that the same individuals are selected always or never and that the variance in the starting dataset is maintained, and the 80% individuals with the highest rank is selected to be in work. But a feature that is very important in the development of MIDAS is the ability to a priori in- or exclude individuals from the 'risk set' in the alignment process, while automatically altering the alignment probabilities. For example, suppose that we align the number of individuals who move from being in work to unemployment to an exogenous probability. Then all working individuals would be ranked, and the first x% would be selected. But in practice, civil servants very rarely lose their job, and when they do, they cannot go into unemployment. Thus, all civil servants are a priori excluded from the risk set and the probability y>x% is increased accordingly to maintain the number of transitions. In the inverse can the modeller a priori selects individuals and LIAM2 will then automatically adapt the probability in order to correct the remaining number of individuals making the transition. The advantage of automatizing all these transitions is that the resulting model is highly flexible and can easily be adjusted to other alignment data.

The second channel of consistency is also known as 'monetary alignment' (Dekkers *et al.*, 2010) and involves proportionally adjusting the micro-level earnings each period, so that the growth rate of the average earnings of the micro-level is equal to the growth rate of earnings from the semi-aggregated cohort simulation model.

An important feature of any microsimulation model is that it is possible to include all kind of social and fiscal parameters in the model. MIDAS therefore reflects the same actual or decided policy changes as MALTESE does. This is the third channel of consistency.

The reason why MIDAS is designed to be complementary to MALTESE is the institutional setting in which it has been developed and is used today. Following the "Silver Fund Law" of 2001 (Zilverfondswet, 2014), a Study Committee for Ageing was established within the High Council of Finances. This Study Committee should assess the budgetary *as well as social* consequences of ageing, and report to the federal government though an annual report (High Council of Finances, 2014). The Federal Planning Bureau supports the work of this Committee through its expertise and its simulation results. Thus, in order to make a comprehensive assessment of the budgetary and social consequences of ageing, the microsimulation model MIDAS was designed complementary to MALTESE.

2.2. The Belgian pension system

This section describes the pension system of Belgium. It is closely based on the description in chapter 1 of the Country Fiche Belgium 2014 (Federal Planning Bureau, forthcoming).

Like is the case with many European countries, the Belgian pension system consists of three pillars. The first pillar is a statutory public pension scheme with defined benefits, completed by a means-tested assistance scheme. It is the most important with 12.2% of GDP in 2013 and it is based on the pay-as-you-go financing (PAYG) principle.

The second pillar of the Belgian pension system consists of private occupational pension schemes. Pension spending in this second pillar only amounts to 1.2% of GDP in 2012 for retired wage earners dependent on collective contracts entered into with insurance companies or institutions for occupational retirement provision. Due to lack of data, it is not possible to model pension expenditures in this pillar, and hence the second pillar is not included in the simulations provided to the AWG, nor in the microsimulation model MIDAS.

The third pillar finally consists of private voluntary individual pension schemes, but no estimate for pension expenditure is available at this stage, nor are private pension savings included in MIDAS.

The first pillar includes three main pension schemes:

1. the scheme for wage earners (47% of total pension expenditure in 2013 – AWG definition[6]),
2. the scheme for the self-employed (7% of the total) and
3. the scheme for civil servants (32% of the total).

Furthermore, there is a means-tested assistance scheme named "Guaranteed Income for the Elderly" (1% of the total pension expense). The rest of total pension expenditures comes from the unemployment with company allowance and the disability schemes that are - according to AWG definitions - part of pension expenditures.

The statutory retirement age in the first-pillar old-age pension scheme is 65 for both men and women. Previously, early retirement was possible from the age of 60 on, subject to a career-length condition. The 2011 pension reform that came in effect in 2013 restricted access to early retirement in all three schemes, by gradually raising the minimum early retirement age to 62 and the minimum number of career years required for eligibility to 40 years. In the self-employed scheme, an actuarial penalty for early retirement between 60 and 64 was abandoned. Financial stimuli to continue to work after 60 were harmonized for the three schemes. Previously, a pension bonus in the wage earners' and self-employed schemes of 2 EUR per working day (in prices of 2007) was granted from the age of 62 or to those with 44 years of career. In the scheme for civil servants, finally, there was an age supplement equal to 0.125% of the

[6] Pension expenditures in the AWG definition include "pensions and equivalent cash benefits granted for a long period (over a year) for old-age, early retirement, disability, survivors, and other specific purposes which should be considered as equivalents or substitutes for […] pensions due to reduced capacity to work of due to labour market reasons" (European Commission, 2014b, 105). This is different from the national definition of pension expenditures in Belgium, which do not include disability pensions nor unemployment benefits with company allowance, and the sum of the benefits paid out in the three schemes hence does not equal total expenditures.

annual pension rate for each worked month between 60 and 62. The 2011 pension reform introduced a harmonized "pension bonus" for the three pension schemes. This is a lump-sum amount for each additional effectively worked day, increasing with the number of additional working days (currently from 1.5 EUR per day during the first 12 months up to currently 2.5 EUR per day after 5 years).

Before turning to the discussion of the simulation results, it should be noted that the reform by the current Michel administration is not included in the AWG projections nor in the MIDAS projections, since these concrete measures remain to be voted.

2.3. Simulation results for Belgium in the base scenario of the AWG

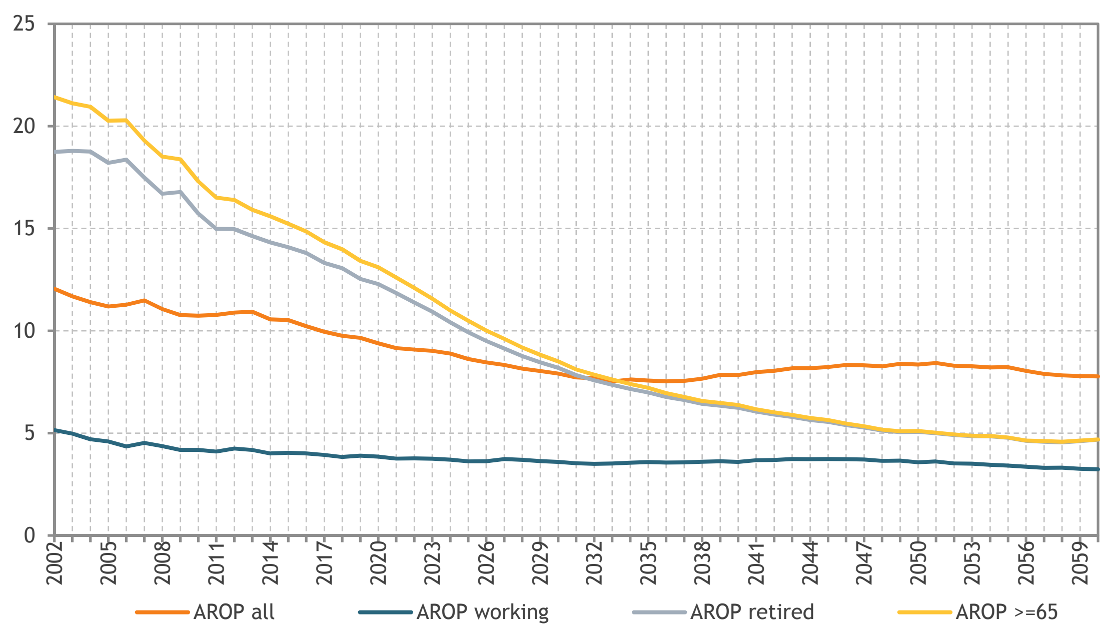
Following AWG results for Belgium, gross public pension expenditures as percent of GDP would increase from 12.2 in 2013 to about 15.8 in 2040 and then end up around 15.7 in 2060 (Federal Planning Bureau, forthcoming, Table 10, page 19). The question then is which development of pension adequacy comes with this budgetary cost of ageing? Pension adequacy is in this study described by three key indicators. The at-risk-of-poverty rate (AROP), the GINI index and the income quintile share ratio.

These results will be presented for the population as a whole, for the working and the retired population and the elderly (65+). In the definition of the WGA, unemployment with company allowance and disability schemes are part of pension expenditures. In the below Figures, however, the retired are only those who actually receive an old-age pension benefit.

2.4. At-risk-of-poverty rates (AROP)

The following Figure shows the projected development of the at-risk-of-poverty rate (henceforth AROP) in Belgium.

Figure 1 **At-risk-of-poverty (AROP) rates**
in percent



The poverty risk of the elderly and pensioners starts off higher than that of the population as a whole, but decreases over the simulation period. Not surprising, the reasons for this decline in the poverty risk among pensioners are in broad lines the same as for the development of the replacement rate discussed in the Belgium Country Fiche (Federal Planning Bureau, forthcoming, Table 14, page 24).

A first reason for this decrease is the result of the considerable increase of both the minimum pension benefit and the means-tested minimum protection for elderly in the second half of the 2000s (see Dekkers, Inagaki and Desmet, 2012, for a discussion of this issue) and the higher growth rate of the different pension minima relative to wages until the mid-2020s. Indeed, this situation comes from the combination of the low wage growth rate applied in the budgetary simulation results by the AWG and the indexation regime in vigour in Belgium. Although the long-term wage growth hypothesis is still 1.5% per year, it is assumed to be only 0.7% on average between 2013 and 2030 (Federal Planning Bureau, forthcoming, box 3, page 17). Furthermore, and this is a discerning characteristic for Belgium, benefits are automatically indexed to CPI but also adjusted to living standards in real terms. This procedure is not automatic, and defined by the Generation Pact of December 2005 as the choice of the social partners within a budget set by parameters that are independent from productivity growth. These include an annual growth of 1.25% for the wage-ceilings, 0.5% for non-lump-sum allowances and 1% for lump-sum allowances (*op. cit.*, section 1.1.3.a., page 6). In both the simulations of MIDAS and MALTESE these parameters are used to simulate the developments of the parameters and index the benefits. Thus, seeing that the real development of benefits is independent from the growth rate of wages, the low wage growth rates in the period up to 2030 results in relatively increasing benefit rates (*op. cit.*, Table 12, page 22), and a decreasing poverty risk among the pensioners and elderly.

Furthermore, the employment rate of women is increasing, and this increase is projected to continue in the decades to come. As a result of this increased activity rate, women over time become eligible to higher pensions at retirement. The replacement of the stock of women with short careers by women with long(er) careers causes the average pension benefit to increase and therefore results in a decreased AROP of both men and women in retirement. This growing participation of women in the labour market combined with the decreasing number of married persons results in a lower share of new male pensioners receiving a household pension with dependent spouse (rate of 75%). As the household pension is only 25% higher than the individual pension (75%/60%), whereas the equivalence scale of a partner is 50%, the decreasing proportion of household pensions comes with an increase of equivalent income of the elderly, and therefore a decrease of the poverty risk among the elderly.

The implicit equivalence scale of the Guaranteed Income for the Elderly is also lower than the one used for the computation of the equivalent household income. A couple of two beneficiaries of the Guaranteed Income for the Elderly will have a total income 33% higher than a single beneficiary. As the equivalence scale of a partner is 50%, the couple in this situation will be worse off. Here also, as the number of single person households increases, the number of households more exposed to the poverty risk decreases.

From the end of 2020's, the growth rate of pension minima (1%) will be lower than the wage growth rate that will, from that date, quickly converge to 1.5%. The decrease of the AROP among the elderly will therefore slow down and the first signs of an increase are revealed at the end of the simulation period[7]. Finally, the effects of the longer average career for women will have reached full maturity by that time, and will therefore no longer change the development of the AROP.

The level of the AROP among the working population is lower than that of the population as a whole, which is simply because earnings on average exceed pensions or other social security benefits.

The poverty risk among the 65+ in the beginning of the simulation period exceeds the poverty risk of the retired population somewhat. As explained in more detail in the appendix, those without a retirement benefit that report another activity are not considered retired, also if they are older than 65. Those are therefore not taken into account in the poverty risk of the pensioners, but are included in the poverty risk of the 65+ category, which explains why the latter exceeds the former. Furthermore, those that receive a retirement benefit while being younger than 65 are obviously not included in the group of 65+. The 65+ thus *cet. par.* retired more years ago than the former, which given a constant indexation regime means a lower pension benefit. Moreover, those that have the option to retire before the mandatory retirement age of 65 must fulfil conditions pertaining to the length of the career. We observe in simulation results that they have on average higher retirement benefits. Indeed, contrary to an important proportion of individuals retiring at 65 that are unemployed (with or without company allowance) or disabled the years prior to retirement, those who retire before 65 enter retirement from work. So, even if they have slightly shorter career on average, because they careers are more intensively based on work, individuals retiring before 65 usually benefit from higher pensions. This also explains why the poverty risk of the 65+ exceeds that of the retired.

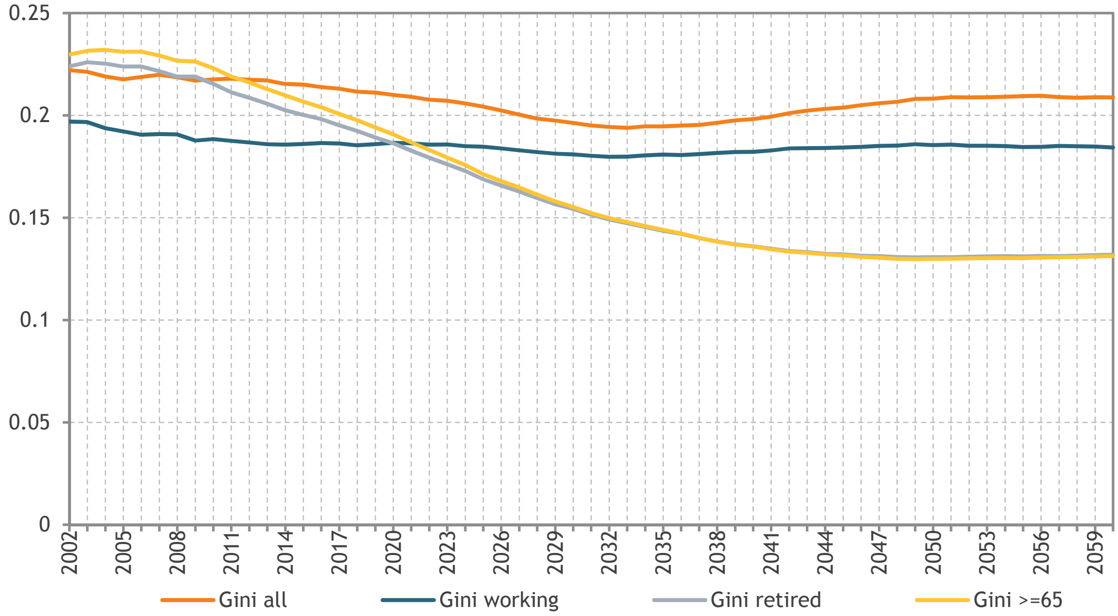
However, the poverty rates among the retired and the 65+ are converging over time. Due to the increased labour market participation of women, the proportion of elderly without any pension benefit is over time decreasing to zero, which explains why the difference between the poverty rate among the retired and the 65+ is converging. Another reason is the increasing average age of retired, which means that the proportional size of the group retired younger than 65 declines, also because of the increased age and career conditions for early retirement that have been introduced in recent years (Federal Planning Bureau, forthcoming, section 1.2). For this and other reasons, the number of 65+ in proportion to the pensioners increases continually over the course of the simulation period (*op. cit.*, Table 15, page 25).

[7] Note that in a Bismarckian pension system like that of Belgium, the increase of the productivity growth rate will eventually lead to higher pensions. However, this effect pertains only to new pensioners, so the impact of increased productivity on pensions will reach full effect only after a full career of 45 years, which is even further past the simulation horizon as the effects mentioned in the main text.

2.5. Gini

The following Figure shows the development of inequality, measured by the Gini, for the various groups.

Figure 2 Gini



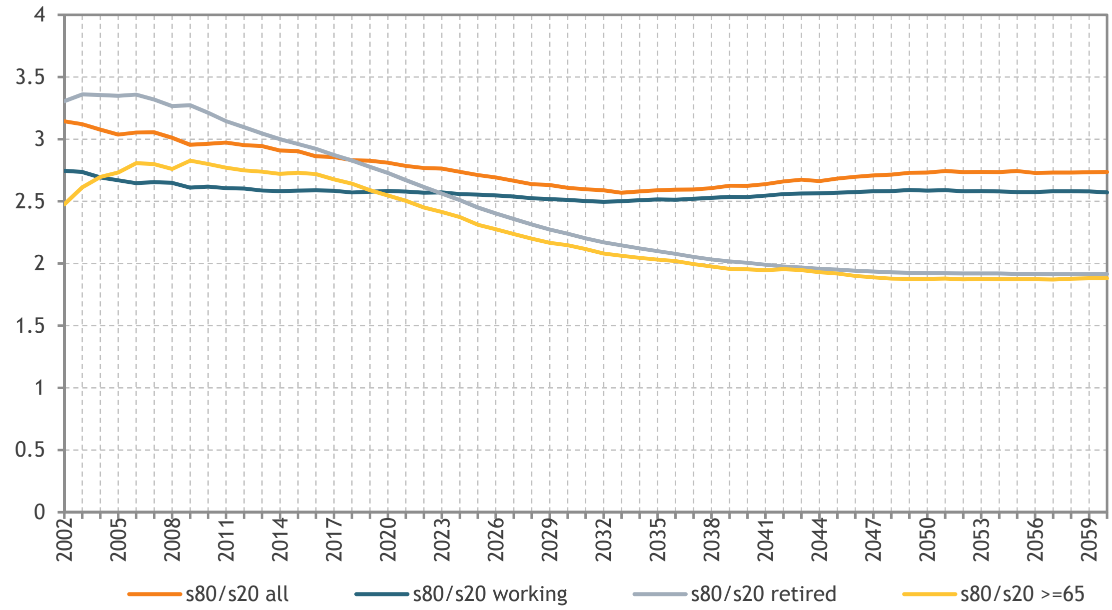
The overall Gini exceeds that of the working category, which is mainly because the overall population and its revenues are more heterogeneous than the earnings of the working population. Furthermore, the model might not fully capture the distribution of earnings in the tails of the distribution. This might explain why, before 2020, the Gini of workers are lower than that of pensioners. The Gini of the retired and the 65+ are very close to one another and both show a clear decrease over time. There again are various reasons for this decreasing inequality: first of all, as a result of demographic ageing and the decrease of the average household size, the proportion of 'mixed households' decreases. As a result, the contribution of earnings to the household income of a retired individual decreases, and the income inequality among the retired therefore decreases. Other explanations for the decreasing inequality among pensioners or elderly are analogous to those used to explain the lower poverty rates. The inequality of retirement benefits also decreases as a result of recent revaluation of minimum pension benefits and Guaranteed Income for the Elderly, and because of the increasing participation rate of women. Finally, as argued in Dekkers (2014), a large cohort of older workers moving into retirement causes the pension benefits to converge, and inequality therefore to decrease.

As measured by the Gini, the inequality among 65+ is a bit higher than inequality among the retirees. This probably comes from the small proportion of 65+ without any pension. Over the course of the simulation period, the difference between the retired and 65+ is reduced, mainly because the proportion of 65+ without any pension benefit gradually goes to zero with the increased labour market participation of women.

2.6. Income quintile share ratio (s80/s20)

The income quintile share ratio (S80/S20) compares the mass of income held by 20% of the persons with the highest incomes to that held by 20% of the persons with the lowest incomes. As such, it is more sensible to changes in the extremes of the income distribution than the Gini, which focuses more on the centre of the distribution. The following Figure shows the development of the S80/S20 for Belgium.

Figure 3 Income quintile share ratios



On the whole the development is not much different from that of the Gini. Again, inequality is higher among the total population than among workers, and inequality among pensioners/retired decreases over time, again because of the decreasing proportion of elderly without a pension benefit, because of the increased average age of retired and because of the increased age and career conditions for early retirement. The most remarkable difference with the Gini however is that inequality among those older than 65 is now considerably lower than inequality among pensioners in the first half of the simulation period. The reason for this might be the means-tested Guaranteed Income for the Elderly, which brings up the pension benefit of those eligible at the very low end of the income distribution to a minimum, thereby decreasing the income quintile share ratio. This Guaranteed Income for the Elderly however applies not to all retirees, but only to those of 65 and older. That this effect is not shown in the Gini could be because the latter focuses more on changes in the centre of the income distribution than the income quintile share ratio.

2.7. Simulation results for Belgium in the other scenarios of the AWG

The AWG acknowledges that the "baseline projections cannot capture all the direct and indirect channels through which ageing can influence economic and budgetary developments" (European Commission, 2014, p. 91). Besides there is by definition discussion and uncertainty pertaining to the assumptions used for the long-run projections. Thus, the AWG developed a number of scenarios "in order to quantify the responsiveness of projection results to changes in key underlying assumptions". (*op. cit.*), and one policy scenario where the retirement rates are linked to the development of life expectancy. The scenarios are discussed briefly in Table I.5.1 and chapter 5 of the technical paper of the 2015 Ageing Report (*op. cit.*, 2014, 91-97) and include:

– Scenario 1 (scenario "HLE"): higher life expectancy at birth - an increase of two years by 2060

– Scenario 2: lower migration.

– Scenario 3 (scenario "HEMP"): higher employment rate: 2 p.p. higher for the age group 20-64, introduced linearly up to 2025.

– Scenario 4 (scenario "OLDEMP"): higher employment rate among older workers (55-74): 10 p.p. higher, introduced linearly up to 2025.

– Scenario 5 (scenario "HPROD" and "LPROD"): higher/lower labour productivity: the increase/decrease is introduced linearly during the period 2016-2025, and productivity remains 0.25 p.p. above/below the baseline thereafter.

– Scenario 6 (scenario "RISK"): lower TFP.

– Scenario 7 (scenario "policy"): linking retirement ages with increases in life expectancy.

The names by which the scenarios are described will return in the below figures and discussions. Seeing that MIDAS in its current version does not include immigration, it is not possible to simulate the impact of scenario 2 on pension adequacy. Analysing the impact of scenario 7, the policy variant would have demanded a large work of modifications in modelling. The results for the other tests will be presented next, albeit very briefly.

Usually, the results of simulation scenarios are expressed relative to the base scenario. However, according to the AWG (*op. cit.*, 91) "the presentation and assessment of the impact of ageing populations [...] should be made with reference to all scenarios". Thus the below three figures show the values of the three indicator (AROP, Gini and income quintile share ratio) for retired individuals in the base scenario as well as in the scenarios. Together they provide a "confidence interval" - in the strict non-statistical sense of the word - of the simulation results. Next, to allow discussion, for all three indicators, the values for retired individuals in the various scenarios are divided by the value of the base scenario.

Hence we first start with the Figures presenting the developments of the three indicators in the base scenario as well as the various scenarios.

Figure 4 At-risk-of-poverty rate for retired in the base variant and scenarios, in percent

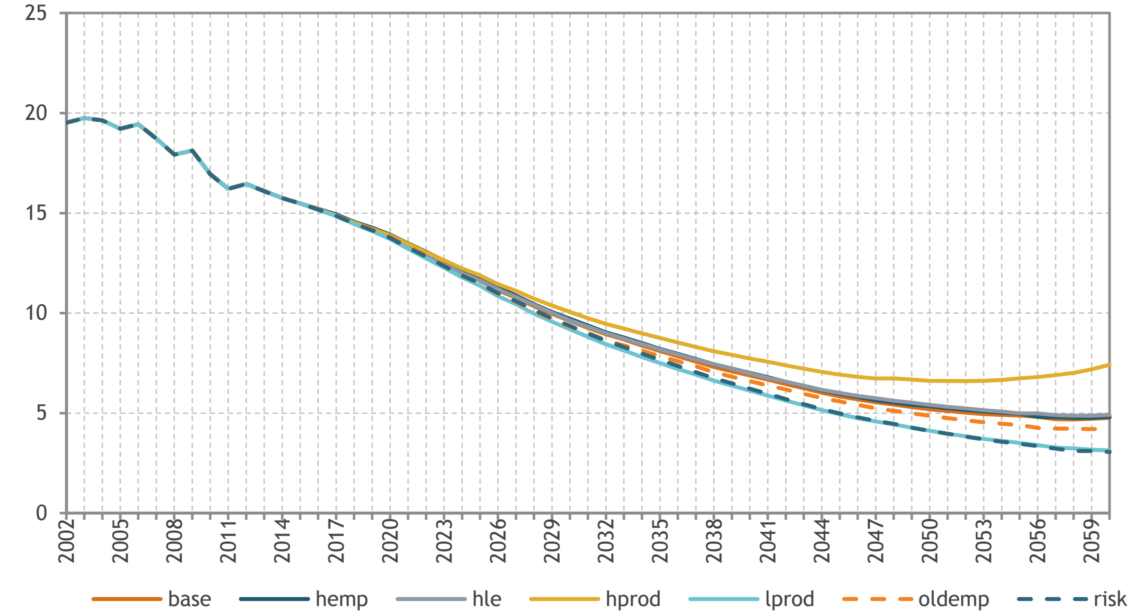


Figure 5 Gini for retired in the base variant and scenarios

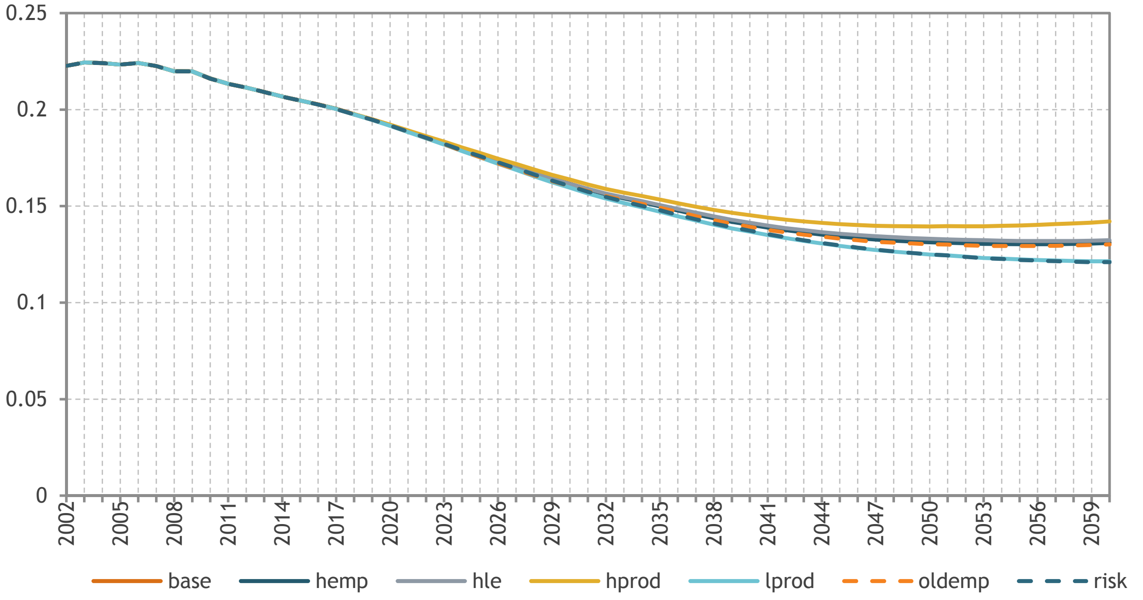
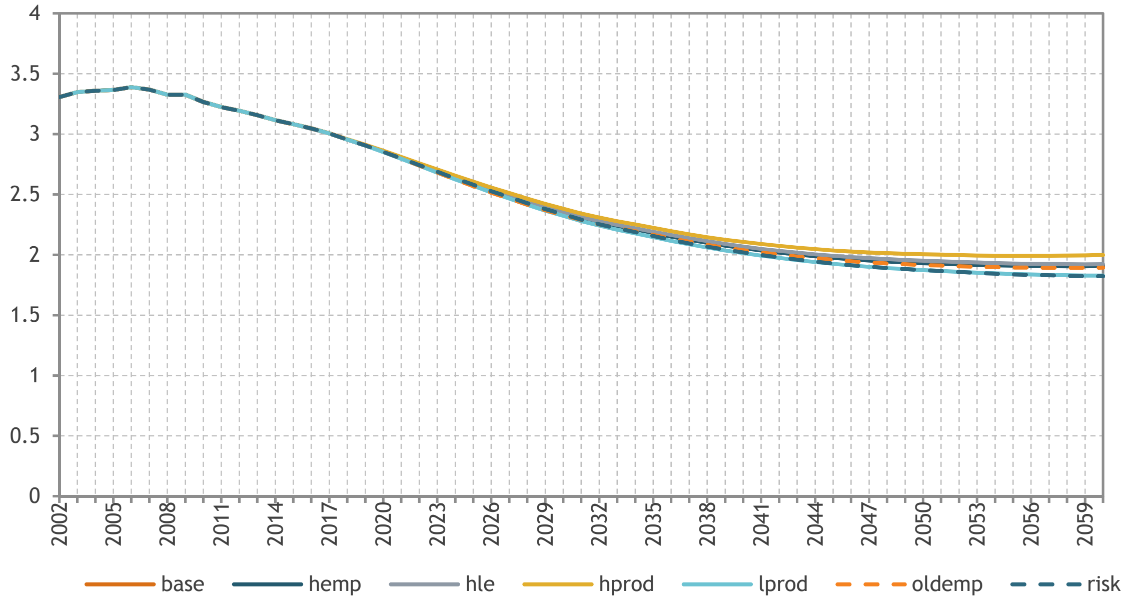


Figure 6 Income quintile share ratio for retired in the base variant and scenarios



The main conclusion is that the impact of the scenarios is stronger on the poverty risk than on the two indicators of inequality. This is because the income of many pensioners are only slightly higher or lower than the poverty line. As a result, only a small "nudge", be it directly on the income of the pensioners or via a change of the poverty threshold itself, can have important consequences on the numbers of pensioners going in or out of poverty. Furthermore, changes in productivity growth rates that affect income alter the poverty line, and therefore directly affect the poverty risks. The impact of the Gini and S80/S20 is only indirect, namely via the slow variation of pension through the variation of earnings and via those few pensioners that share a household with somebody working. Hence the impact of productivity changes on the poverty risk will, in this case, be stronger than on inequality measures.

Next, for all three indicators, the values for retired in the various scenarios are expressed relative to the value in the base scenario. A value exceeding unity thus shows that the scenario results in an increase of the indicator relative to the base scenario.

Figure 7 Impact of scenarios on the at-risk-of-poverty rate of retired

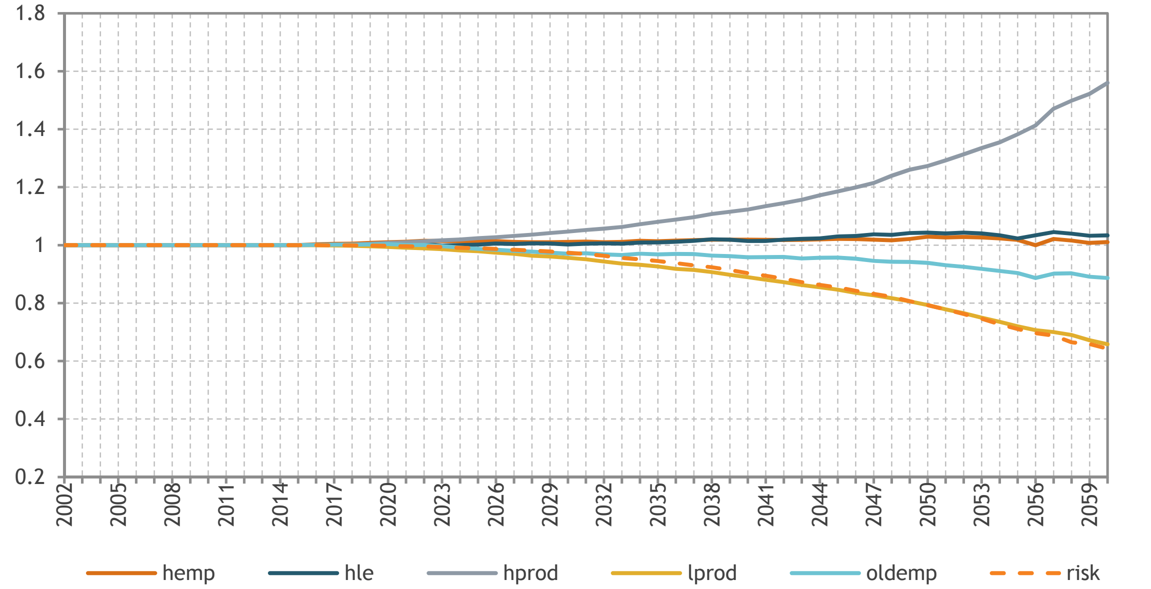


Figure 8 Impact of the scenarios on the Gini of retired

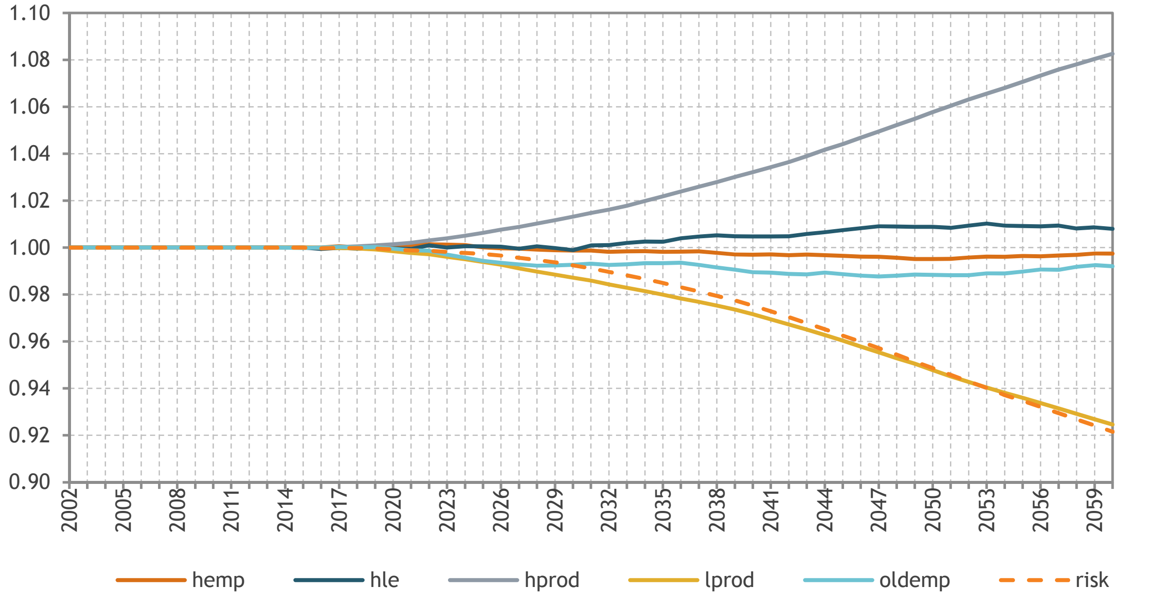


Figure 9 Impact of the scenarios on the income quintile share ratio of retired

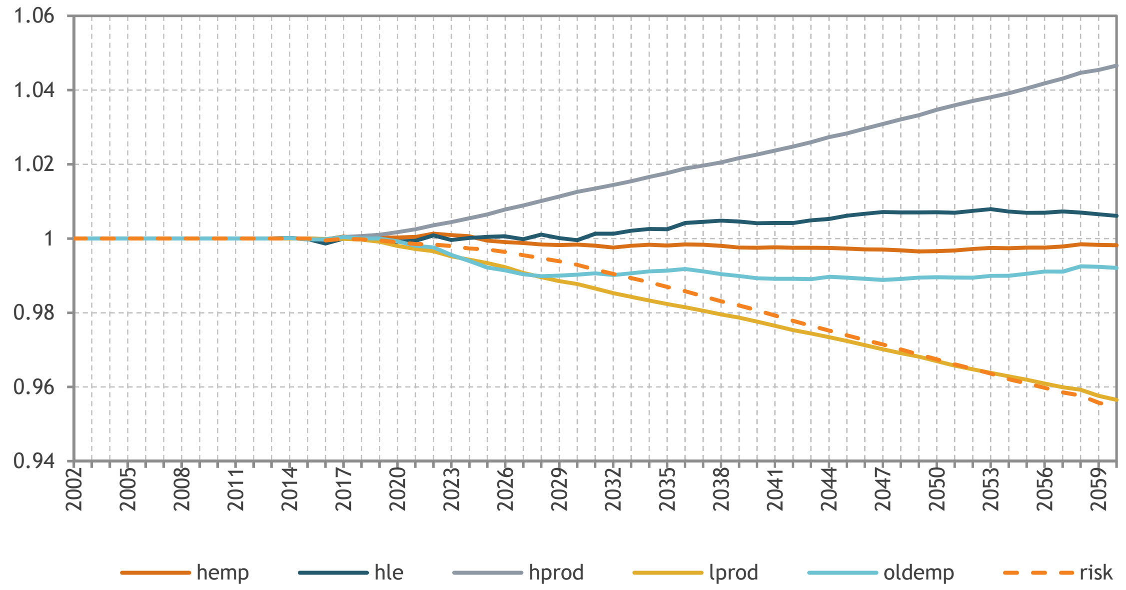


Figure 7 to Figure 9 again confirm that the impact of the scenarios is the most outspoken on the poverty risks than on the indicators of inequality. Figure 7 shows the results for the poverty risk of pensioners. The scenarios that have the largest impact on the poverty risks among the retired are those that affect productivity ("HPROD" and "LPROD"), the employment rate among the elderly ("OLDEMP") and the change of the TFP (the "RISK" scenario). The high/low productivity scenarios result in the poverty risk being 56% higher and 34% lower than in the case of the base scenario at the end of the simulation horizon. This is the difference between an AROP of 7.4% (HPROD) and 3.1% (LPROD) with the AROP in the base scenario, which is 4.8% in 2060. Thus, in percentage points, the difference is 2.7 (HPROD) and -1.6 (LPROD). For the two inequality indicators, the difference between the two productivity scenarios and the base-scenario is about plus and minus 8% (or 0.01) for the Gini and a bit more than plus and minus 5% (or 0.08) for the income quintile share ratio.

To see why there is a positive impact of productivity on the poverty risk, note, first of all, that Belgium essentially has a Bismarckian pension system, so higher wages will ultimately result in higher pension benefits. This is the direct effect. This effect will however apply to new pensioners only, and will therefore reach full maturity after a full career of at most 45 years. Secondly, there is an indirect effect of higher wages on the poverty risk of pensioners, which runs via the poverty threshold. Higher wages will increase the poverty threshold, which in turn will increase the poverty risk among pensioners. This effect is more immediate and stronger than the direct effect.

As discussed earlier, that the indexation regime of the benefits and parameters of the pension system in Belgium is independent of the development of wages is a key factor explaining the evolution of poverty among pensioners. In these productivity scenarios, the role of this mechanism appears clearly. A higher productivity path leads, on the one hand, to a shorter period where pension minima evolve faster than wages in the first part of the simulation period, and on the other hand, to a larger gap between these two growth rates in the long run. Therefore the poverty risk among pensioners first decreases less than in the base scenario and starts to increase earlier.

All in all, a higher level of productivity will increase the poverty risk among pensioners in the HPROD scenario[8], and *mutatis mutandis* will a lower level of productivity (the LPROD scenario) decrease the poverty risk among pensioners. Seeing that labour productivity growth equals TFP growth divided by the labour share (*op. cit.*, 78), the results of the RISK scenario with lower TFP growth are very close to those of the LPROD scenario. Finally, an increase in the employment rate among older workers (the OLDEMP scenario) will over time result in longer careers of retired, and therefore of a lower poverty risk. Compared to the LPROD and HPROD scenarios, this decrease will set in only later, because i) it only shows when these older workers actually retire, and ii) it is neutralised in the short run by a small yet positive effect of the increased employment rate on the poverty line.

Before closing the discussion on the simulation scenarios, let us take a brief look at the budgetary impact of these scenarios, as they have been simulated through the semi-aggregate model Maltese. These are presented in the next Table 1.

Table 1 Public pension expenditures under different scenarios

Scenario	Public pension 2013-2016 (%-point difference from base scenario)
Higher life expectancy (HLE)	0.7
High productivity (HPROD)	-0.9
Low productivity (LPROD)	1.0
Higher employment (HEMP)	-0.4
Higher employment older workers (OLDEMP)	-1.1
Lower TFP rate (RISK)	1.0

Source: FPB, 2015, Table 25, page 32. Expenditures to GDP; deviation from the baseline.

Now it becomes clear that there is in most cases a trade-off between the budgetary impact of a scenario and the impact on the poverty risk and inequality among the elderly, and this relative to the base scenario: those scenarios that result in lower pension expenditures, such as the higher labour productivity (HPROD), come with a 'price' of a higher poverty rate. Others that increase pension expenditures result in lower poverty rates; this is the case with the higher TFP scenario (RISK) and the lower labour productivity scenario (LPROD). However, there are exceptions to this rule. First of all, the scenario with higher life expectancy (HLE) will result in higher public pension expenditures without this having an important impact on the poverty risk among the elderly. But more interestingly are the two employment scenarios: the higher employment scenario (HEMP) results in lower pension expenditures while not having a strong impact on the poverty risk. And the scenario with higher employment of older workers (OLDEMP) not only results in the most important reduction of pension benefits relative to the base scenario, but it is also the only scenario where a cost reduction comes with a lower poverty risk among the elderly.

8 A similar scenario is discussed in Dekkers, Inagaki and Desmet (2012).

2.8. Conclusion

This section presents the Belgian microsimulation model MIDAS and its simulation results aiming at the assessment of the consequences of the AWG projections and hypotheses on pension adequacy. Because of its institutional setting and the requirement to make a comprehensive assessment of the budgetary and social consequences of ageing for the Study Committee for Ageing, MIDAS was designed complementary to MALTESE. This note makes use of this feature of complementarity in the European context.

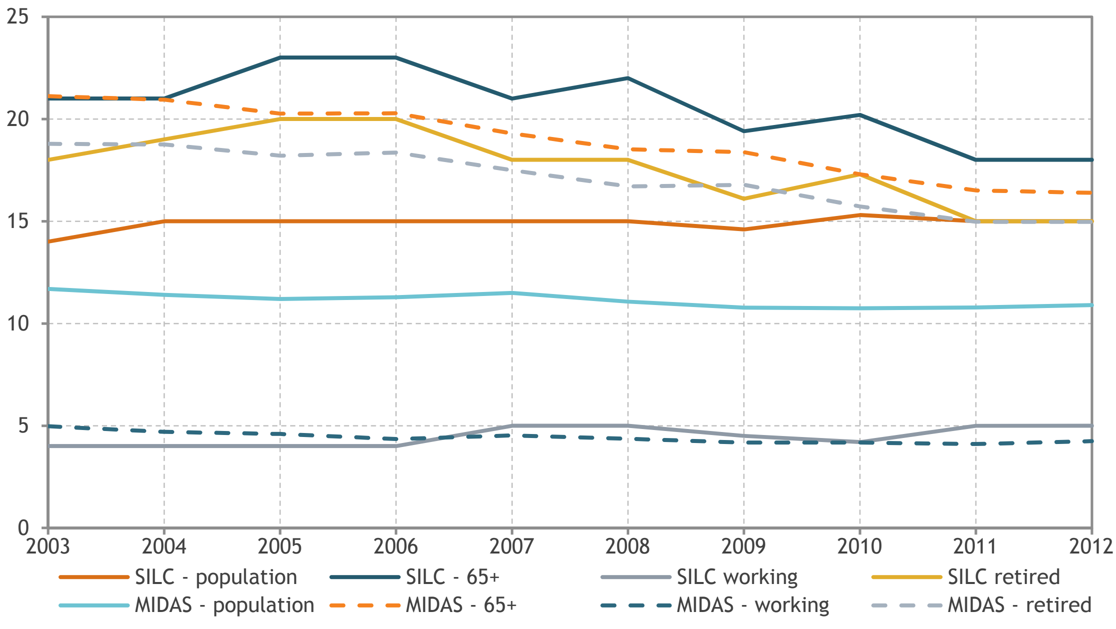
The broad conclusions are that the poverty risk of the elderly and pensioners, as well as their Gini and income quintile share ratio decrease over the simulation period. Key reasons are the increase of female labour participation, the recent revaluation of minimum pension benefits and the Guaranteed Income for the Elderly, and, last but not least, the rather low productivity growth rates of productivity in the first half of the simulation period, combined with the fact that the indexation regime of the benefits and parameters is independent of the development of wages.

Finally, the impact of the scenarios is stronger on the poverty risk than on the two indicators of inequality. The scenarios that have the largest impact are those that affect productivity, the employment rate among the elderly and the change of the TFP. Furthermore, especially the scenario with higher employment of older workers results in the most important reduction of pension benefits relative to the base scenario, while at the same time reducing the poverty risk among the elderly.

2.9. Appendix for Belgium: Comparison between the SILC official AROP and the simulation results of MIDAS_BE

The following Figure shows the simulation results of MIDAS and the official AROP risks (without imputed rents) that are derived from the Belgian SILC.

Figure 10 The AROP in the SILC and MIDAS



Both the level and development of the AROP among the specific groups (retired, 65+, workers) are quite comparable between MIDAS and the SILC. Only the overall AROP is underestimated by MIDAS comparable to the SILC. This is because a mismatch in the "residual groups" (unemployed, disabled, CELS beneficiaries).

The AROP among the 65+ is higher than among retired. There is obviously a large overlap between the two groups, but not entirely (High Council of Finances, 2014, 37):

- About 15% of the pensioners is younger than 65. The observed poverty risk in this group is only 9% in the SILC.
- Those of 65 and older that do not have a personal pension benefit in the SILC report a status different than pensioner. This is about 11% of the group of 65+, and their poverty risk is 31% in the SILC.

3. Country results for Sweden[9]

3.1. The model SESIM and its base data

The projections have been made with the dynamic microsimulation model SESIM. [10] This is a general microsimulation model that can be used for a broad set of analyses. All the AWG projections and model simulations have been made at the Ministry of Finance, the Economic Affairs Department.

SESIM is a mainstream dynamic microsimulation model in the sense that the variables (events) are updated in a sequence, and the period between the updating processes is a year. The starting point is 1999 and the initial sample of the Swedish population is approximately 300 000 individuals. All individuals are subject to a large number of possible events, reflecting real life phenomena, such as education, marriage, parenthood, work or retirement.

SESIM has a recursive structure, where different modules are executed in a predetermined order, see Figure 12 below. The unit of simulation is the individual but the household also plays a significant role. Many of the simulated processes refer to household as well as individual properties. The simulation sequence starts with a set of demographic modules (mortality, adoption, migration, household formation and dissolution, disability pension, rehabilitation and regional mobility). In the next step, calculations concerning education and the labour market (unemployment, employment etc.) are executed.

Every year the individuals are assigned a status. Each individual can have only one out of nine different statuses during a specific year. Every status is related to a source of income. Employment results in earnings; retirement brings pensions etc. For employed individuals an earnings equation is used to determine the income. For other kind of statuses, for example unemployment, different rules are applied to obtain the income. After the calculation of income, a module for wealth capital income and housing is executed. Four separate assets are considered in the household portfolio: financial wealth, owned homes, other real wealth and private pension savings.

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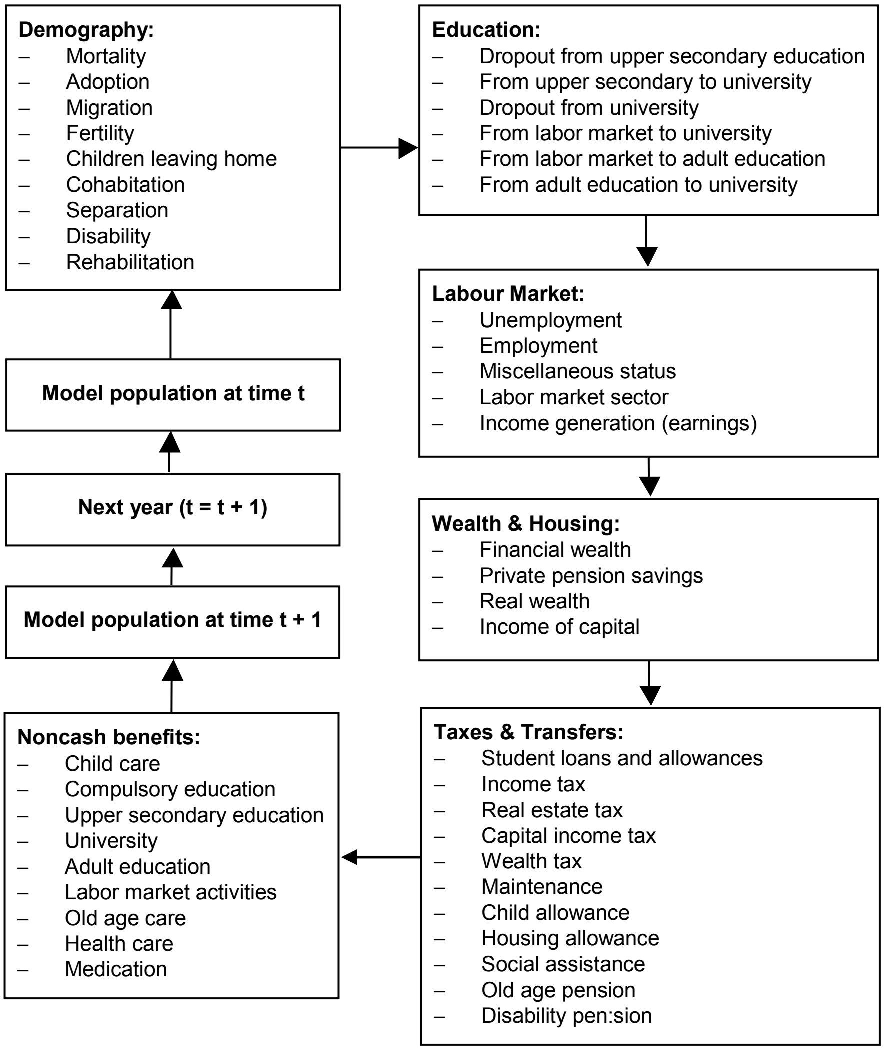
9 This report is based on *Swedish pension fiche prepared for the AWG projections for age-related public expenditure 2015*, previously presented for the EU EPC Ageing Working Group (AWG).

10 Documentation that is more detailed can be found in Flood et.al (2012), or at www.sesim.org.

Figure 11 Structure of SESIM



After the wealth/housing module taxes, transfer and pensions will be calculated. The rules for all three pillars of pensions have been implemented in all relevant detail (i.e. public, occupational and private pensions). All persons are assumed to claim full time pension, since the model cannot not handle part time retirement (mixed statuses), but can also earn work income.[11] Given the information above the household disposable income can be defined.

In the AWG analysis, the models for the labour market are central, especially regarding employment, unemployment, retirement or disability. These models are statistical rather than economic, i.e. in the sense that the risk of these events is influenced by individual characteristics but not by changes in financial incentives. For example, the probability of retirement is a function of the individual's education, age, gender, income etc., but not by the marginal taxes. The retirement model also accounts for the fact that spouses tend to coordinate their retirement decisions.

[11] Also, the automatic balancing mechanism is implemented in the model, but switched off. In the current AWG calculations the balancing index is exogenous until 2019. After this no further balancing is probable given the AWG scenarios.

There are several ways of simulating the date of retirement. People retire according to an empirical distribution. Most people retire at 65. Note that the average pension age pensioners is endogenously determined, although the average effective retirement age is aligned to track the AWG labour market assumptions. Some pensioners continue to work after they started to pick up their public pension, and might thus be counted as employed in LFS terms.

3.1.1. Data Issues

The primary database for SESIM, both for the estimation of the statistical models and for the creation of the base population, is the Statistics Sweden longitudinal database LINDA. The database is created from administrative registers and covers about 3.5 percent of the Swedish population. In 1999, the primary sample was 308 000 individuals. Including their household members the total sample size was 786 000 individuals. The selected individuals are followed over time and all relevant information is collected. Some information, for instance pension rights, can be traced as far back as to 1960. New individuals replace individuals that are omitted from the data due to death or emigration in order to maintain the statistical representativity.[12]

3.2. A brief word on the first-pillar pension system that the model covers

The Swedish public old-age pension system consists of an earnings-related component based on notional accounts, a private mandatory defined contribution system and a pension-income-tested top-up, the guarantee pension. Most employees are covered by occupational pension plans. The possibility to make tax-deductions for private pension savings will be reduced in 2015 and abolished in 2016

3.2.1. The Swedish public pension system

The reformed Swedish public old-age pension system was fully implemented in 2003. The reformed earnings-related old-age pension system consists of a notionally defined contribution (NDC) PAYG component and a fully funded, defined contribution (DC) pension system. Both are based on lifetime earnings and individual accounts. In addition, there is a pension-income-tested top up, the guarantee pension, which is financed with general taxes from the central government budget. The same rules apply to all persons regardless of occupational sector and for employees and self-employed alike.

The old Swedish pension system consisted of a flat-rate pension provided in full to everyone with at least 40 years of residence in Sweden between the ages of 16 and 65. Further, it included an earnings-related pay-as-you-go (PAYG) component providing a benefit based on 60 per cent of an average of the contributors best 15 years of earnings, with 30 years required to receive a full benefit.

The reformed system covers individuals born 1938 and later, with transition rules for persons born 1938-1953. Given the actual pension pattern, the last cohorts with pension rights in the old system will retire around 2020. As a result, it will take a couple of decades until all beneficiaries have all of their benefits calculated according to the reformed rules.

[12] For a more detailed description of the data set, see e.g. Flood et al (2012) and Edin & Fredriksson (2000).

Pension rights are credited to the individual accounts for 18.5 percent of the annual pensionable income up to the pension ceiling amounting to 8.07 income base amounts. 16 percentage points are paid to the NDC PAYG system and 2.5 percentage points to the funded DC system. The insured person pays a pension contribution amounting to 7 percent of the gross pensionable income, and the employer 10.21 per cent. Contributions over the pension ceiling is transferred to the central government budget as general tax and have no connection to the income-based pension system. Contributions are also paid by the central government to cover pension entitlements credited for income replacement social insurances, e.g. for unemployment, sickness, disability or parental leave.

The retirement age is flexible and individuals can claim benefits from the age of 61 without any upper limit. Under the Employment Protection Act, an employee is entitled to stay in employment until his/her 67th birthday.

3.2.2. The DC PAYG system

The NDC PAYG pension system works on an actuarial basis. At the time of retirement an annuity is calculated by dividing the individual's account value by a divisor reflecting unisex life expectancy at the specific date of retirement. The individual can counteract the negative effect on the annuity caused by increasing life expectancy by postponing the date of retirement. Hence, incentives are strong to prolong the working career. If for example an individual born in 1946 delays the retirement from 65 to 67 the annuity divisor decreases from 16.31 to 15.16 and the NDC pension consequently increases with 7.6%.

The PAYG-pensions in payment are on average indexed by wages, but are front-loaded in the sense that pensioners receive a share of the real economic growth in advance. The NDC savings is as a primary rule indexed by the average rate of growth of earnings per contributor. In case of financial sustainability problems though, the automatic balancing mechanism is activated and the indexation will be reduced until stability is restored. This guarantees that the system will be able to finance its obligations with a fixed contribution rate and fixed rules regardless of the demographic or economic development. The balancing indexation was activated for the first time in 2010 because of the financial crisis in 2008. The balancing is assumed to stay in effect until 2017 (this is in line with budget forecast previously made by the Swedish Pension agency).

3.2.3. Non-earnings-related minimum pensions and basic security

The pension-income-tested top-up, the Guarantee pension, is financed by general tax revenues. The benefit is proportionally reduced if the number of residence years in Sweden falls short of 40. The guarantee pension, together with the means-tested housing supplement for pensioners (BTP), is higher than the minimum income standard in the system for social assistance. All forms of basic security benefits for the elderly can only be received from the age of 65. The guarantee pension is price indexed and fully taxed.

The guarantee pension is means-tested against public pension income and survivor benefits, but not against work income etc. For low incomes, the benefit is reduced krona by krona, and for higher incomes, the benefit is reduced by 48 per cent. The annual benefit amounts to a maximum of 2.13 price base amounts (PBA) (EUR 10 100 year 2014) for single households, and 1.90 PBA:s per person (EUR 9 000 year 2014) for cohabitants. The guarantee pension is fully phased out when the income pension reaches 3.07 PBA:s for single households and 2.72 PBA:s for cohabitants.

Formally outside the old-age pension system, but de facto closely interlinked, there is the tax-free means tested Housing supplement for pensioners (BTP). There is also a Special housing supplement (SBTP) for pensioners with low income and high housing costs. Finally, there is a tax-free means-tested program, Maintenance support for the elderly (ÄFS), which ensure that pensioners with very low income, usually immigrants with few years of residence in Sweden, do not become dependent on social assistance. The size depends on household income and housing costs, but is by design always higher than the social assistance benefit.

3.2.4. Early retirement, disability and survivor’s pension

It is possible to retire at the age of 61 but the loss is twofold for the individual. First, the benefit is based on lifetime contributions, which implies that all years with earnings will increase the benefit. Second, the level of the benefit is calculated using the cohort-specific life expectancy at the date of retirement. Hence, leaving early implies both a lower (notional) pension capital and a longer period of payment, and therefore the annual benefit will be lower compared with a later retirement age. Regardless of the flexibility in the reformed pension system there is a strong tendency to claim public pension at age 65, which was the norm in the old system. However, to claim pension is not the same as leaving the labour market. In 2013 the average age for withdrawal from the labour market was estimated to 63.6 years, which is the highest age since the beginning of the 1980:ies.

The reformed pension system is individual-based. The previous widow’s pension (women only) has been replaced by a new, temporary and gender-neutral, so-called adjustment allowance. However, due to the long phase out period, widow’s pensions will continue to be paid out for several decades. In the reformed system, a survivor will receive an adjustment allowance for 12 months as a standard, but the payments continue as long as the survivor has children younger than 12 years. The size of the adjustment allowance, as well as the widow’s pension, is based on the deceased’s earnings.

Disability benefits, which are equivalent to disability pensions in most European countries, are formally a part of the sickness insurance scheme. Individuals with disability benefits continue to accumulate pension entitlements in the public pension system. The contributions are paid by the central government budget. Public old-age pension benefits for disabled persons are based on lifetime earnings, just as for everyone else.

3.2.5. Occupational pensions

The absolute majority of all employees, both in the public and the private sector, are covered by semi-mandatory occupational pension plans based on collective agreements between the unions and the employers’ confederations. These occupational pension schemes, financed through employers’ contributions, provide a supplement to the public system, and a top-up for incomes above the public pension system ceiling. Thus, these schemes are most important for high-income earners. There are four major occupational plans: blue-collar workers in the private sector, white-collar workers in the private sector, central government employees and local government employees.

Mandatory private premium pension

The public system also consists of a private mandatory fully funded defined-contribution part, the Premium pension. The system is administered by the state and financed by a contribution rate of 2.5% of pensionable earnings, following the same transition rules as the PAYG system. Individuals can choose from a large number of mutual funds when investing their capital. A government run default fund caters for people who do not make an active choice. The individual mutual funds earn a market rate of return. At retirement, at any age from 61 years, individuals can choose a fixed or variable annuity, in part or in full.

3.2.6. Voluntary private pensions

It is also possible to make tax-deductions for private pension saving, something that is especially important for self-employed who are not covered by an occupational pension plan. The maximum yearly deduction allowed is SEK 12 000 (EUR 1 280), which will be reduced to SEK 1 800 (EUR 260) in 2015 and abolished altogether in 2016. For self-employed not eligible to occupational saving plans, deductions will be allowed even after 2016. In 2011 approximately 38 per cent of the population 20-64 years old made tax-deductions for private pension savings, on average SEK 5 600 (EUR 600) and in total SEK 11 400 billion (EUR 1 120 billion).

3.2.7. Tax status

Old-age (including guarantee pension), disability and survivors pension, is subject to income tax (but not payroll taxes). The means-tested basic security allowances (BTP, SBTP and ÄFS) are tax-free. Private tax-deductible pension savings, as well as funded occupational pensions are taxed ETT (contributions Exempt, returns Taxed, benefits Taxed). The mandatory premium pension is taxed EET.

3.3. What incomes are included (and what are not)

SESIM allows for an extensive definition of disposable income. In these calculations the disposable income includes capital income and capital gains, resulting in higher income dispersion than e.g. the numbers in EU-SILC published by Eurostat. All major income sources as well as taxes are calculated. However, the model structure with different statuses linked to a main source of income, somewhat underestimates heterogeneity seen in reality.

3.4. How the calibration is done

The most important exogenous economic macro variables in SESIM are inflation, real income growth per capita, short- and long interest rates and return on stocks. All relevant macro numbers are implemented in line with the AWG assumptions in the baseline scenario.[13] In the calculations, the model is aligned in order to achieve exogenous average unemployment and participation rates (for 5-year groups). The simulated population and labour force tracks the AWG-assumptions closely. The "raw" model results are calibrated to NA levels 2013 where possible. This also applies for the adequacy measures presented here, with the difference that, due to data limitations, the base year is 2012.

All calculations are made in current prices.[14] The indexation rules are implemented in detail in the model. Items that are price indexed by legislation, have been income indexed from 2019 in the projections (e.g. the housing allowance for pensioners and the guarantee pension). It is also assumed that the rate of return on the funded assets in the individual public DC funds and the individual occupational pension accounts will be the same for all individuals.

Sesim is a stochastic model, and the population is endogenous, but of course based on the AWG assumptions. The population is therefore aligned (calibrated). Despite the alignment the total model population varies from +0.5% in 2013 to +0.1% of the Eurostat population in 2060. The reason for the positive bias is that Sesim is counting the continuously growing population the 31st of December, but AWG in the middle of the year. The bias disappears if the same measurement date would be used. Apart from the bias, there is also some stochastic variation. In general the deviations are bigger the smaller the studied stratum is. However, the errors are small and even out in the long run.

For outcome and medium term years, the results have been validated against National Accounts, and calculations from The Swedish Pension Agency. The results have also been validated against the AWG demographic and macroeconomic assumptions.

3.5. What should the reader take into account when considering the simulation results?

- The results are presented for different age groups, not working and pensioners strictly. This makes it easier to compare the results with different sources, e.g. EU-SILC. Working is defined as all individuals in active age between 20 and 64 years. Regarding the groups Pensioners and Elderly (65+) the difference is very small in the baseline scenario, as the retirement age is assumed unchanged.
- Households with negative disposable income have been removed in the calculation of the measures.

The results are sensible to the choice of income indexation of minimum pensions and basic security. All types of pensions, benefits and thresholds in the pension and tax systems are income indexed from 2019 in the calculations, regardless if legislation states otherwise.

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13 The real interest rate, 3 percent, is used in all scenarios.

14 The exchange rate 8.9870 SEK/Euro, the projected average rate in 2014 according to Eurostat (2014-07-30) has been used from 2014 on.

3.6. Results

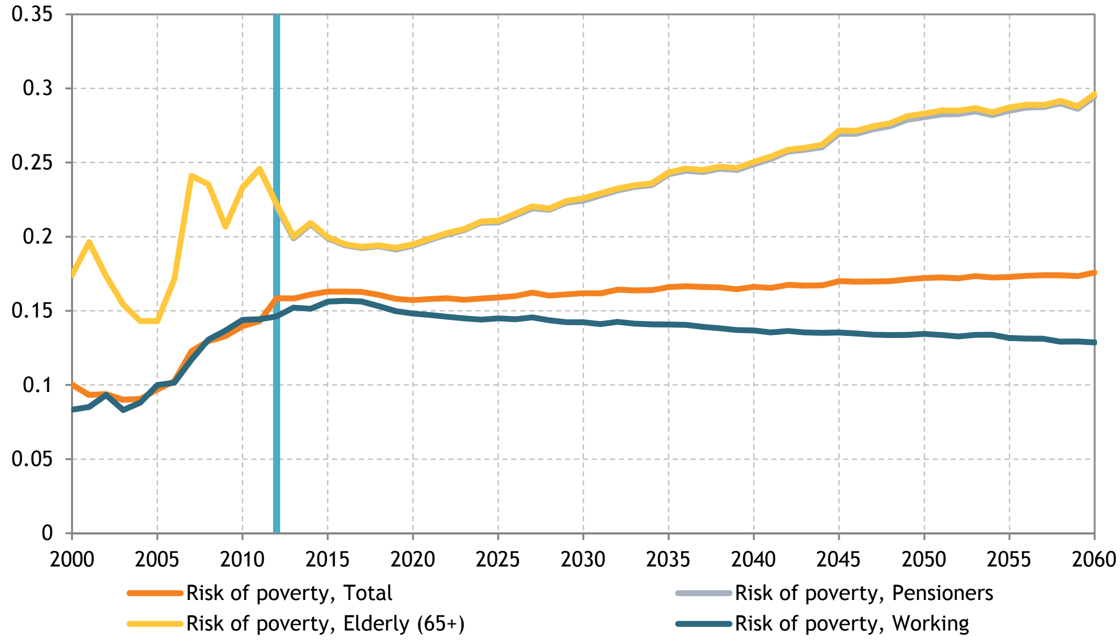
3.6.1. Risk of poverty (60% of median equivalent household income)

– The most striking feature is the increasing risk of poverty for 65+. This is the result of the assumption about fixed retirement age at 65 years in the base scenario. This will gradually press down the pensions when the annuity divisors, which are based on the longevity, grow. On the other hand the risk of poverty for the working age population is decreasing, resulting in only a slightly higher risk for the total population.

– The results for pensioners are very sensible to the choice of equivalence scale. Here the modified OECD scale (1, .5, .3) has been used. In 2012 the R60 for 65+ with the Statistics Sweden Equivalence scale is 12.8% compared to 22.2% with the OECD scale.

– The increase 2006 to 2010, especially for pensioners, is partially explained by the introduction of the Earned Income Tax Credit (EITC). The following decrease until 2013 might partially be explained by the new special basic tax deduction for individuals 65+ that was introduced in 2009, and then increased in several steps.

Figure 12 Risk of poverty



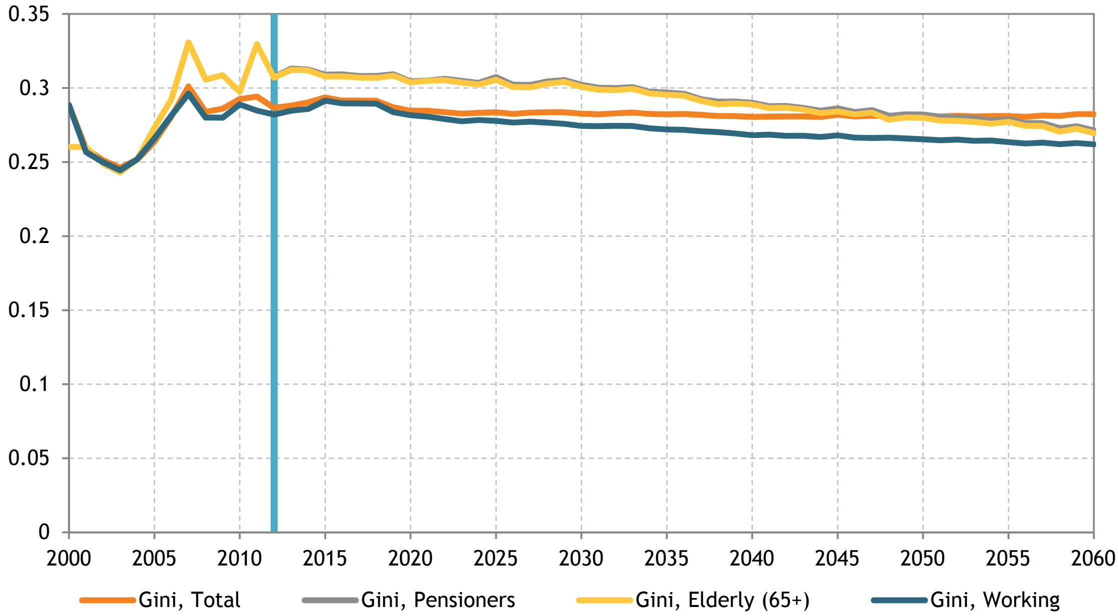
Note: Outcome from Household income survey until 2012. The projections from 2013 adjusted to the outcome levels in 2012

3.6.2. Gini

– The Gini for the total is expected to be stable during the whole projection period, but the Gini will decrease for both the working age population and the pensioners. This is due to decreasing Gini within both the groups, at the same time as the difference between the groups is increasing. This in turn is due to gradually lower pension replacement rates.

– As a result of the increasing risk of poverty among 65+, the Gini for pensioners will fall relativity more than the total Gini. The explanation for this is that more and more pensioners will get guarantee pension that is limited by a ceiling. That means that the income distribution for pensioners will become more compressed.

Figure 13 Gini coefficient of equivalised disposable income



Note: Outcome from Household income survey until 2012. The projections from 2013 adjusted to the outcome levels in 2012.

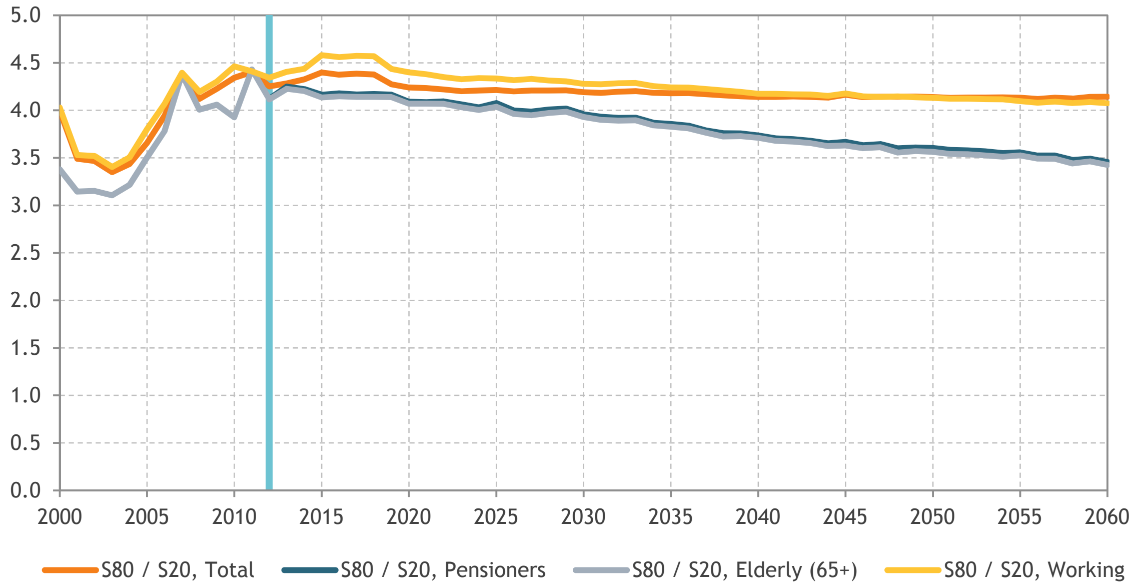
3.6.3. The Income quintile share ratio S80/S20

– The S80/S20 measures show a decreasing trend for the working age population and especially for 65+. The reason for the latter is the same as for the Gini, i.e. that more pensioners will get guarantee pension.

– The S80/S20 measure is substantially higher than the numbers published in EU-SILC for outcome years (3.7 for the total in EU-SILC 2012 compared to 4.3 here). This might be explained by that capital gains are included in the model definition of the disposable income, but not in the numbers published by Eurostat.

– The model is stylized compared to the real world. To recreate the variety techniques for variance reduction are used. However, in such a long time frame as here, 2060, the quality of the results are an open issue. Especially the results for the S80/S20 might be sensible, as they are calculated in the tails of the income distribution.

Figure 14 S80/S20 income quintile share ratio



Note: Outcome from Household income survey until 2012. The projections from 2013 adjusted to the outcome levels in 2012.

3.7. Sensitivity analysis for Sweden

Beside the baseline scenario AWG also decided to make an additional set of eight sensitivity scenarios in order to quantify the responsiveness of results to changes in key drivers, such as macroeconomic, population and policy variables. The sensitivity scenarios are:[15]

- Higher life expectancy at birth - an increase of two years by 2060
- Higher/Lower labour productivity +/-0.25 p.p. The increase/decrease is introduced linearly during the period 2016-2025
- Higher employment rate: 2 p.p. higher for the age group 20-64, introduced linearly up to 2025.
- Higher employment rate among Older Workers (55-74 years): 10 p.p. higher, introduced linearly up to 2025.
- Lower migration (-20%).
- Risk Scenario: TFP assumed to converge to 0.8% in 2060 (1% in Baseline).
- Policy scenario: Linking retirement age with increase in life expectancy

The sensitivity scenarios work through different channels, which have different effects on the outcome:

- Productivity (Higher / Lower/ Risk)
- Demographics (Higher life expectancy, Lower migration)
- Labour market (Higher employment, Older workers, Policy)

15 See Ageing report 2015, table II.1.29 and the Swedish pension fiche "The pension system and pension projections until 2060" for details.

When analysing the results it is important to remember that all systems (tax brackets, ceilings etc.) are income indexed and will grow at the same pace as GDP in the calculations.[16]

In the sensitivity scenarios the pension age is normally based on the current pension behaviour. However, in the Older workers' scenario and the Policy scenario, the age limits and the pension behaviour is shifted in line with the AWG labour market assumptions in order to increase the average exit age. In the model this is technically achieved by having older cohorts mimic the labour market behaviour of younger cohorts. In the policy scenario also, all relevant age limits are increased with 2/3ds of the increase in longevity, approximately keeping the percentage of adult life spent at retirement constant.[17]

The results are presented as deviations from the "baseline" in the same manner as in the AWG pension fiches. Tables 2-4 below shows the values of the three adequacy indicators[18] for different age groups (Total, 20-64, 65+). Together they provide a *"confidence interval"* - in a strictly non-statistical sense of the word - of the simulation results.[19] In the text below the results are commented briefly for the different indicators. The focus will be on the effects for the group Elderly (65+).

3.7.1. At risk of poverty (R60)

The general picture is the increasing risk of poverty for the Elderly (65+). This is to a large extent the result of the AWG:s assumption about a fixed effective exit age, except for the Older workers and the Policy scenarios.

- In the Older workers' scenario and the Policy scenario with increased employment among elderly, resulting in a higher exit age, the hike in Risk of Poverty is mitigated. Hence, the poverty risk in these scenarios ends up lower than in the baseline scenario. This being the case, the poverty rate will also in these scenarios increase over time, albeit less fast than in the case of the base scenario. This is because the relevant age limits are only increased with 2/3ds of the increase in longevity and that some groups, for example disability pensioner, has left the labour market before the current age limits and thus are unable to prolong their working lives.
- During the first decades the risk of poverty will increase in the Policy scenario, due to that more individuals are working at the same time as the impact on paid out pensions is limited. The prolonged working careers will gradually lead to higher pensions, and the risk of poverty will instead start to decrease around 2030. The decrease will become bigger as long as the longevity is increasing.
- Higher productivity as well as higher employment rate increases the poverty risk for the group Elderly (65+) as the income for group Working age increases immediately, which causes the poverty line (defined as 60% of the median income) to increase as well. This is the indirect effect of a productivity change on poverty of the elderly. But there is also a direct effect, being that the income for

[16] It may also be informative to read Section 3.5 in the Swedish Pension fiche, where the results of the aggregated sensitivity calculations are presented.

[17] This is in line with the proposals from the Swedish Pensions age committee.

[18] See section 1.1 for definitions of the indicators and the subgroups.

[19] The results are presented for different age groups, i.e. the groups Working and Elderly are classified by age, not by source of income etc. This makes it easier to compare the results with different sources, e.g. EU-SILC. Working age is defined as all individuals between 20 and 64 years. Regarding the groups Pensioners and Elderly (65+) the difference is very small in the baseline scenario, as the retirement age is assumed unchanged, but might be more substantial in scenarios with increasing exit age.

pensioners will increase as well, as productivity increases, albeit with a substantial time lag. Hence, as is the case in the Belgian results, the indirect effect outweighs the direct effect and a higher productivity will therefore increase the poverty risk of the Elderly. Following the same line of reasoning, mutatis mutandis, the Lower productivity scenario and the Risk scenario lower the poverty risk of the Elderly.

- The effects in the sensitivity scenarios are small on the group Working compared to the effect on Elderly (65+), particularly for the productivity scenarios. Unlike for Elderly (65+), the poverty risk for Working age (20-64) is decreasing slightly in the Baseline scenario. The aggregated effect of this will be a somewhat higher risk of poverty for the total population.
- The increased risk of poverty in the Policy scenario in the group Working age (20-64) is explained by that more people work under this scenario and that this pushes up the poverty line.

A quick comparison with the Belgian results show that the impact of the variants on the poverty risk of the Elderly population goes in the same direction for the two countries. The impacts for Belgium however tend to be more marked than for Sweden, which probably is due to the fixed indexation system in vigour in Belgium, compared to the assumption about income indexation in the Swedish calculations (even though the legislation states price indexation or no indexation at all in Sweden).

3.7.2. Gini coefficient

The effects of the scenarios on the income distribution are complex; they depend on the trajectory of different variables, and the development in different subgroups. In this context it is again important to remember that all systems (tax brackets, ceilings etc.) are income indexed. In some cases, it is impossible to determine the sign of the effects on theoretical grounds only.

- As a result of the assumption pertaining to the fixed pension age, the drop in income inequality among the Elderly in the baseline scenario is more important than that for the population as a whole, something which is also the case for Belgium but not for Hungary. Among other things, the fixed retirement age causes an increasing proportion of pensioners to gather around the minimum pension level.
- The decrease in the baseline scenario in the Gini for Elderly (65+) is also explained by the historic increase in the participation rate for women, i.e. that woman that entered the labour market before approx. 1995 had a shorter contributory period on average than men. This effect is expected to fade out until about 2030.
- The effect of the sensitivity scenarios is limited in most cases, except for the scenarios where people are working longer.
- The most evident effects on the Gini for the Elderly (65+) are in the Older Workers and the Policy scenarios. The reason for this is that the fraction of pensioners will decrease and more individuals 65+ will work. As the income dispersion is higher for working than for pensioners, the combined effect will be an increase in the Gini. For the total population the Gini will instead decrease as the spread between the groups Working (20-64) and Elderly (65+) will decrease.

- In the Policy scenario the Gini for the total population decreases more than either of the components Working age (20-64) or Elderly (95+). This might be explained by that the income in the groups converges when the exit age becomes higher, resulting in a more compressed income distribution.
- In the Higher labour productivity scenario the Gini is decreasing for the group Elderly (65+), and consequently increasing in the Lower productivity and the Risk scenarios. This is the reversed results compared to those presented for Belgium in section 2.7.

3.7.3. Income quintile share ratio (S80/S20)

The effects on S80/S20 are generally small and similar to the effects on the Gini when looking on sign and rank.

- In the same way as for the Gini the effect are most obvious for the Older workers and the Policy scenario, where people work after 64 to a greater extent.
- For the Total and Working (20-64) the effects are close to zero, except for the scenarios with higher employment.

Table 2 Risk of poverty (R60) for different groups under different scenarios
Deviation from the baseline in p.p.

	2013	2020	2030	2040	2050	2060
Total						
Baseline	*15.8*	*15.7*	*16.2*	*16.6*	*17.2*	*17.6*
Higher life expectancy (2 extra years)	-0.1	0.0	-0.2	0.0	0.0	-0.4
Higher lab. productivity (+0.25 pp.)	0.0	0.1	0.1	0.2	0.2	0.4
Lower lab. productivity (-0.25 pp.)	0.0	-0.1	-0.1	-0.1	-0.2	-0.6
Higher emp. rate (+2 pp.)	0.0	-0.1	-0.3	-0.1	-0.1	0.0
Higher emp. of older workers (+10 pp.)	0.0	0.2	0.0	-0.2	-0.7	-0.7
Lower migration (-20%)	0.0	0.2	0.2	0.1	-0.1	-0.4
Risk scenario	0.0	0.1	0.0	-0.2	-0.5	-0.8
Policy scenario: linking retirement age to life expectancy	0.0	0.7	0.4	0.2	-0.2	-0.1
Elderly (65+)						
Baseline	*20.0*	*19.5*	*22.6*	*25.1*	*28.3*	*29.6*
Higher life expectancy (2 extra years)	0.0	0.0	0.0	0.2	0.2	-1.0
Higher lab. productivity (+0.25 pp.)	0.0	0.0	0.5	0.9	0.9	1.3
Lower lab. productivity (-0.25 pp.)	0.0	-0.3	-0.2	-0.4	-1.3	-2.3
Higher emp. rate (+2 pp.)	0.0	0.4	0.7	1.0	1.3	1.1
Higher emp. of older workers (+10 pp.)	0.0	0.0	-0.4	-1.9	-3.4	-3.0
Lower migration (-20%)	0.0	0.3	0.5	0.2	-0.6	-1.2
Risk scenario	0.0	0.1	-0.3	-0.9	-1.6	-2.7
Policy scenario: linking retirement age to life expectancy	0.0	1.5	0.3	-1.6	-4.0	-3.9
Working age (20-64)						
Baseline	*15.2*	*14.8*	*14.2*	*13.7*	*13.4*	*12.9*
Higher life expectancy (2 extra years)	-0.1	0.0	-0.1	-0.2	-0.3	-0.5
Higher lab. productivity (+0.25 pp.)	0.0	0.1	0.0	0.0	-0.1	0.0
Lower lab. productivity (-0.25 pp.)	0.0	0.0	0.0	0.0	0.1	-0.1
Higher emp. rate (+2 pp.)	0.0	-0.2	-0.6	-0.6	-0.8	-0.6
Higher emp. of older workers (+10 pp.)	0.0	0.0	-0.1	0.1	0.1	-0.1
Lower migration (-20%)	0.0	0.0	0.1	-0.1	-0.2	-0.4
Risk scenario	0.0	0.1	0.1	0.1	-0.1	-0.1
Policy scenario: linking retirement age to life expectancy	0.0	0.4	0.4	0.7	1.0	1.3

Table 3 Gini for different groups under different scenarios
Deviation from the baseline in p.p.

	2013	2020	2030	2040	2050	2060
Total						
Baseline	*28.8*	*28.5*	*28.3*	*28.0*	*28.1*	*28.2*
Higher life expectancy (2 extra years)	-0.1	0.0	0.2	0.2	0.2	0.2
Higher lab. productivity (+0.25 pp.)	0.0	0.1	0.0	0.0	0.1	0.0
Lower lab. productivity (-0.25 pp.)	0.0	0.0	0.1	0.0	0.1	-0.1
Higher emp. rate (+2 pp.)	0.0	-0.1	-0.2	-0.1	-0.3	-0.3
Higher emp. of older workers (+10 pp.)	0.0	0.0	-0.3	-0.4	-0.6	-0.7
Lower migration (-20%)	0.0	0.0	0.1	0.1	0.0	0.0
Risk scenario	0.0	-0.1	0.1	0.0	0.0	-0.2
Policy scenario: linking retirement age to life expectancy	0.0	0.4	0.1	-0.2	-0.7	-0.9
Elderly (65+)						
Baseline	*31.2*	*30.4*	*30.1*	*28.9*	*28.0*	*27.0*
Higher life expectancy (2 extra years)	-0.2	0.2	-0.1	0.0	-0.2	-0.4
Higher lab. productivity (+0.25 pp.)	0.0	0.1	-0.4	-0.4	-0.8	-0.9
Lower lab. productivity (-0.25 pp.)	0.0	-0.1	0.3	0.4	0.7	0.7
Higher emp. rate (+2 pp.)	0.0	0.1	0.0	-0.1	-0.2	-0.3
Higher emp. of older workers (+10 pp.)	0.0	0.5	1.3	1.2	1.7	1.7
Lower migration (-20%)	0.0	0.2	-0.1	0.0	-0.3	-0.4
Risk scenario	0.0	-0.1	0.4	0.2	0.5	0.4
Policy scenario: linking retirement age to life expectancy	0.0	1.5	2.4	3.2	3.5	4.7
Working age (20-64)						
Baseline	*28.5*	*28.2*	*27.4*	*26.8*	*26.5*	*26.2*
Higher life expectancy (2 extra years)	0.0	0.0	0.2	0.0	0.0	-0.1
Higher lab. productivity (+0.25 pp.)	0.0	0.1	0.0	0.0	-0.1	-0.2
Lower lab. productivity (-0.25 pp.)	0.0	0.0	0.2	0.1	0.2	0.1
Higher emp. rate (+2 pp.)	0.0	-0.2	-0.2	-0.2	-0.4	-0.3
Higher emp. of older workers (+10 pp.)	0.0	0.0	-0.3	-0.2	-0.4	-0.4
Lower migration (-20%)	0.0	-0.1	0.1	0.0	0.0	0.0
Risk scenario	0.0	-0.1	0.1	0.1	0.1	0.1
Policy scenario: linking retirement age to life expectancy	0.0	0.2	0.0	0.0	-0.2	-0.2

Table 4 Income quintile share ratio (S80/S20) under different scenarios
Deviation from the baseline

	2013	2020	2030	2040	2050	2060
Total						
Baseline	*4.28*	*4.24*	*4.19*	*4.14*	*4.14*	*4.14*
Higher life expectancy (2 extra years)	-0.01	0.00	0.02	0.02	0.02	0.00
Higher lab. productivity (+0.25 pp.)	0.00	0.01	0.00	0.01	0.01	0.00
Lower lab. productivity (-0.25 pp.)	0.00	-0.01	0.01	0.01	0.01	-0.02
Higher emp. rate (+2 pp.)	0.00	-0.01	-0.04	-0.02	-0.04	-0.04
Higher emp. of older workers (+10 pp.)	0.00	0.00	-0.03	-0.04	-0.09	-0.10
Lower migration (-20%)	0.00	0.01	0.02	0.02	0.00	-0.01
Risk scenario	0.00	-0.01	0.01	0.00	-0.01	-0.03
Policy scenario: linking retirement age to life expectancy	0.00	0.11	0.06	0.03	-0.04	-0.04
Elderly (65+)						
Baseline	*4.23*	*4.07*	*3.93*	*3.71*	*3.56*	*3.43*
Higher life expectancy (2 extra years)	-0.04	0.02	-0.02	0.00	-0.03	-0.05
Higher lab. productivity (+0.25 pp.)	0.00	0.01	-0.07	-0.05	-0.10	-0.11
Lower lab. productivity (-0.25 pp.)	0.00	-0.02	0.05	0.07	0.09	0.09
Higher emp. rate (+2 pp.)	0.00	0.01	0.00	0.00	-0.02	-0.03
Higher emp. of older workers (+10 pp.)	0.00	0.09	0.28	0.27	0.30	0.27
Lower migration (-20%)	0.00	0.03	-0.02	0.00	-0.03	-0.04
Risk scenario	0.00	-0.01	0.06	0.04	0.07	0.06
Policy scenario: linking retirement age to life expectancy	0.00	0.32	0.50	0.69	0.69	0.90
Working age (20-64)						
Baseline	*4.40*	*4.40*	*4.28*	*4.17*	*4.13*	*4.08*
Higher life expectancy (2 extra years)	0.00	-0.01	0.03	0.01	-0.01	-0.02
Higher lab. productivity (+0.25 pp.)	0.00	0.01	0.01	0.00	-0.01	-0.02
Lower lab. productivity (-0.25 pp.)	0.00	0.00	0.03	0.01	0.02	0.01
Higher emp. rate (+2 pp.)	0.00	-0.04	-0.07	-0.06	-0.10	-0.08
Higher emp. of older workers (+10 pp.)	0.00	-0.02	-0.07	-0.05	-0.08	-0.09
Lower migration (-20%)	0.00	-0.02	0.02	0.00	0.00	-0.01
Risk scenario	0.00	-0.02	0.02	0.01	0.00	0.00
Policy scenario: linking retirement age to life expectancy	0.00	0.06	0.00	-0.02	-0.04	-0.04

3.7.4. Adequacy and budgetary impact

The AWG only analysed the scenarios from a fiscal perspective and no analysis of the effects on the adequacy and the income distribution was done. When reading about the sensitivity analysis for the adequacy measures it might be interesting to contrast these results against the budgetary costs that was presented in the Swedish AWG pension fiche.[20]

Table 5 Public and total pension expenditures under different scenarios
Deviation from the baseline in p.p.

	2013	2020	2030	2040	2050	2060
Public Pension Expenditure						
Baseline	*9.3*	*8.6*	*8.2*	*7.8*	*7.5*	*7.8*
Higher life expectancy (2 extra years)	0.0	0.0	0.1	0.1	0.2	0.2
Higher lab. productivity (+0.25 pp.)	0.0	0.0	0.0	0.0	0.0	0.0
Lower lab. productivity (-0.25 pp.)	0.0	0.0	0.1	0.1	0.0	0.0
Higher emp. rate (+2 pp.)	0.0	-0.1	-0.2	-0.2	-0.2	-0.1
Higher emp. of older workers (+10 pp.)	0.0	-0.5	-0.6	-0.3	-0.3	-0.3
Lower migration (-20%)	0.0	0.0	0.2	0.2	0.3	0.2
Risk scenario	0.0	0.0	0.0	0.1	0.1	0.1
Policy scenario: linking retirement age to increases in life expectancy	0.0	-0.8	-0.6	-0.4	-0.4	-0.8
Total Pension Expenditure						
Baseline	*11.8*	*11.7*	*11.9*	*11.8*	*11.3*	*11.9*
Higher life expectancy (2 extra years)	0.0	0.0	0.1	0.1	0.3	0.4
Higher lab. productivity (+0.25 pp.)	0.0	0.0	-0.1	-0.2	-0.3	-0.3
Lower lab. productivity (-0.25 pp.)	0.0	0.0	0.1	0.2	0.3	0.3
Higher emp. rate (+2 pp.)	0.0	-0.1	-0.3	-0.3	-0.2	-0.2
Higher emp. of older workers (+10 pp.)	0.0	-0.8	-0.9	-0.5	-0.4	-0.5
Lower migration (-20%)	0.0	0.1	0.2	0.3	0.4	0.4
Risk scenario	0.0	0.0	0.1	0.2	0.3	0.4
Policy scenario: linking retirement age to increases in life expectancy	0.0	-1.4	-1.4	-1.1	-1.0	-1.7

Source: Ministry of Finance, forthcoming, Table 15, page 28.

There is no clear cut trade-off between the budgetary impact of a scenario and the impact on the poverty risk and inequality among the elderly, relative to the base scenario. The budgetary cost will decrease compared to the baseline in the scenarios with higher employment, remain approximately unchanged in the productivity scenarios and increase in the demographic scenarios (higher life expectancy, lower migration).

– In the higher employment scenarios (Older workers, Policy) it is a win-win situation; the risk of poverty will decrease at the same time as the pension expenditure as a share of GDP decreases.

[20] Ministry of Finance.

- In the productivity scenarios the budgetary cost as a share of GDP remains approx. unchanged. In the case with higher productivity the risk of poverty will increase, but at the same time the disposable income for pensioners will grow. Regarding the scenarios with lower productivity the reverse applies; the risk of poverty as well as the disposable income decreases.
- Finally, in the demographic scenarios it is lose-lose; higher expenditures and increasing risk of poverty. Also the disposable income decreases.

4. Country results for Hungary

4.1. The model

The model used here belongs to the MIDAS dynamic microsimulation model family developed by the Federal Planning Bureau of Belgium. It is a cross-sectional model of the whole population that simulates processes at the level of the individual and household, and then at the annual period level. The development of the population in this model is the result of birth and death processes only and not by migration.

The starting data for the model consists of a 20% random sample of the 2012 population stratified by age, gender, work status (employed, unemployed) and type of provision (old-age pension, widow's pension and orphan's allowance) and, therefore, the first simulated time period is 2013. The simulated data were aligned according to the baseline scenario of the Hungarian AWG macroeconomic data, e.g. forecasted work activity and employment rates, average gross income, inflation, and mortality rates. When a particular AWG forecasting for alignment was not available, e.g. marriage or divorce, then the corresponding Central Statistical Office in Hungary (hereinafter referred to as CSO) data were used for model adjustment. The adjustment was always based solely on proportions and not on the absolute numbers.

An outline of the model is shown in Figure 15. Main modules of the model include:

– marriage market,

– labour market, and

– pension register module with a pension calculator.

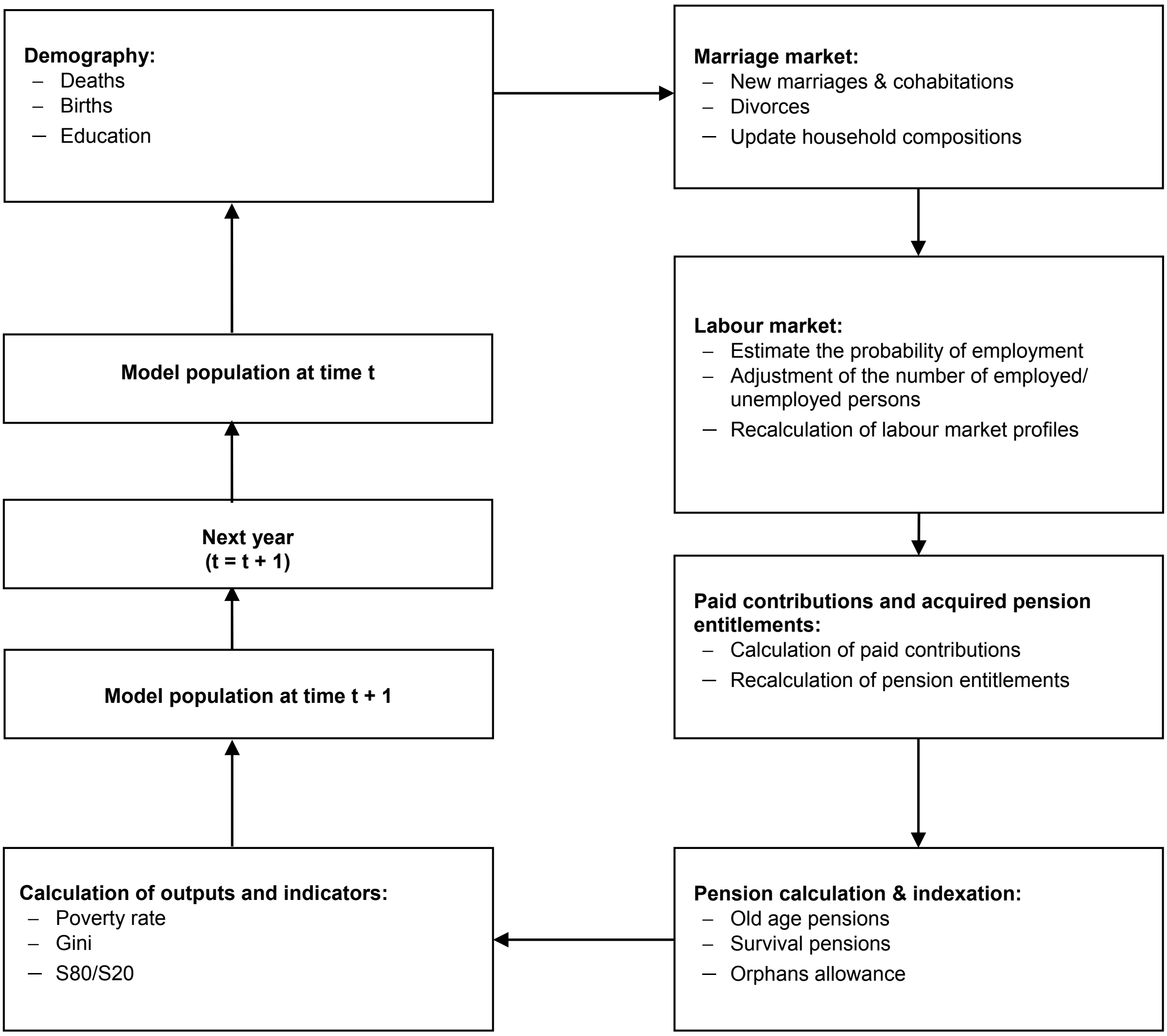
4.1.1. Marriage market module

The original data consisted of various socio-economic characteristics of the subjects. It however did not include any information on the family relations between the individuals. Therefore, in order to be able to simulate the marriage market, various family relationships, e.g. marriage, cohabitation, parent-child relationships were imputed using logistic regression models, whose coefficients had been estimated using the 2011 census data. If needed, adjustments were made using the corresponding CSO data.

4.1.2. Labour market module

The simulation of the labour market activity in the model is based on logistic regression models as well. Two characteristics play a central role in these models. The first is the lagged employment status (employed or unemployed) of the individual. The second key variable describes the so-called labour market profile, which reflects for each individual the long-term event history of the occupational changes since 1990; a period which includes large-scale political, societal and economic transformations in Hungary.

Figure 15 Structure of MIDAS_HU



4.1.3. Pension calculator and pension register module

Within this module the amount of pension is calculated in several steps according to law. During the pension payment period the amount paid is indexed until the time of death.

4.2. Main features of the Hungarian pension system

The Hungarian compulsory pension system is a one-pillar, pay-as-you-go, defined benefit system. Old-age pension and widow's pension together with orphan's allowance are two main types of pension benefits, which are not subject to means testing. Specific indexation of pension benefits is introduced in January each year based on forecasted inflation rate for the coming year.

Two main determinants of the amount of pension calculated are the length of service during the whole life -which is basically the time of national insurance contributions supplemented with some other time entitling to pension- and the average net income earned since 1988. The latter consists of both permanent and casual earnings. Between March 1992 and 2012 a contribution ceiling was in use, while before and afterwards it was not. Some kinds of income, e.g. dividends are not considered for the pension calculations, which is why these are not simulated by the model either. Hence only the wage-like income subject to compulsory contribution is included in the model.

4.3. Model calibration

For model-checking and cross-calibration the validation sample of 2013-2014 was used against the development sample of 2012 within the framework of microsimulation modelling with alignments.

4.4. Results

The indicators used within the models presented here were based on the simulated median equivalent household income using the modified OECD equivalence scale (1, .5, .3). Each indicator was simulated for the whole population as well as for pensioners aged 65 or older and the active workers. The following indicators were computed with the simulations of the pension system for the 2015-2060 time period:

– Poverty rate using 60% of median equivalent household income as the threshold assuming pension but not other social transfers;

– Gini-index;

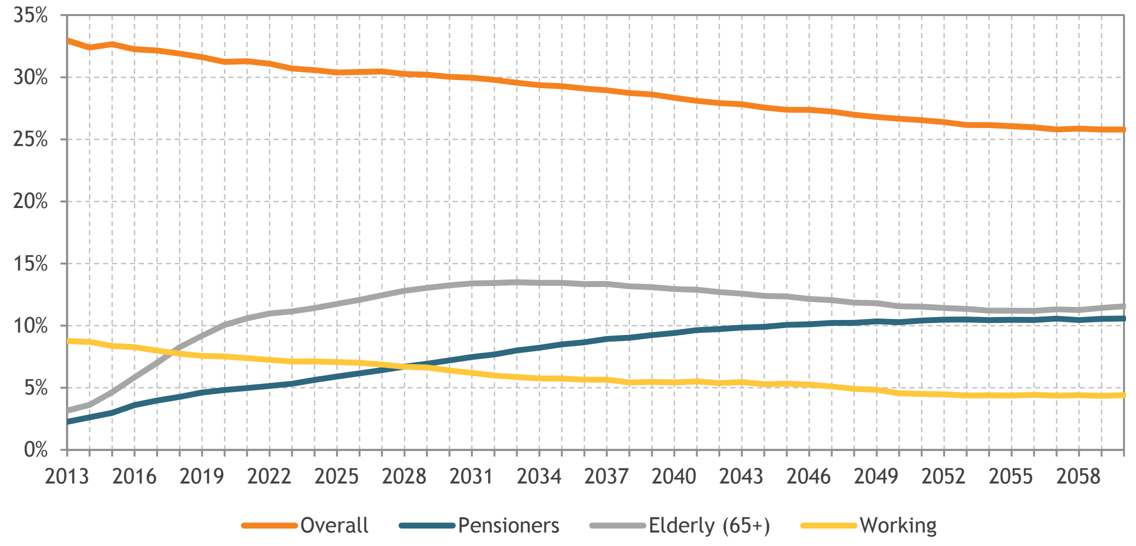
– Proportion of the upper and lower fifth part of income (S80/S20).

Explanation of the results

The increase in abovementioned indicators for elderly (65+) and pensioners is due to the decreasing service years after the great transition in Hungary. This long-lasting increase results from the transition's significant unfavourable effects for all the then active generations. Thus, this process has had a long term-effect on the amount of pensions. In contrast, the indicators for the current active generations decrease as their earnings are strongly determined by the actual labour market situation, which is significantly better than 2 to 3 decades previously.

The rise in the reported indicators of elderly (65+) is steeper than that of pensioners since the former group includes not only the old-age pensioners, but also those who receive old-age allowance (a social assistance benefit for those above the retirement age). Furthermore, the number of those who receive the social assistance benefit is growing due to the steadily declining average service years. Consequently, the poverty indicators show further increase in case of the first group where the minimum 15 years of service has not been reached.

Figure 16 Poverty rate



The decreasing poverty rate of the whole population can be attributed to the improving labour market situation and primarily to the increasing number of employees. It is expected that the effect of this improvement will be detectable from the early 2030s on, since people with more favourable career will reach old age (65) from this time onwards. Their gradual influx will lower the increase of the old-age poverty rate even from 2021 onwards. The reduction of the old-age poverty rate will speed up during the thirties due to the fact that people born in the second half of the 1960s will progressively reach the pension age.

Members of this generation born in the second half of the 1960s stepped in the labour market just around the great transition of this market and, therefore, employees of the then young generation could accommodate to the labour market changes more quickly and easily than older generations could, and could also make a career with a higher pension than the previous generations. The decreasing number of people of the older generations who typically had a less favourable career will also contribute to the decreasing poverty rate.

Figure 17 Gini-index

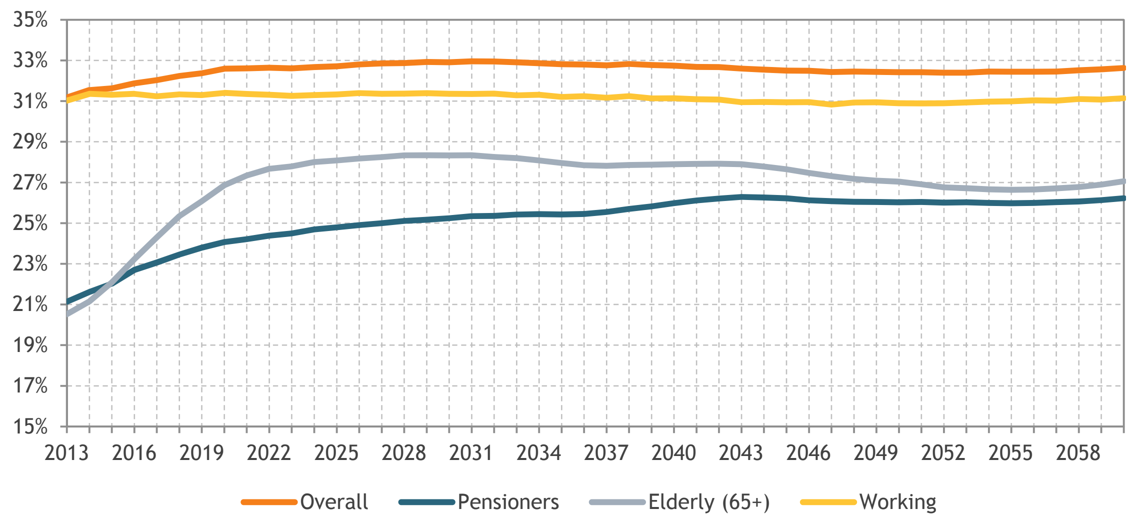
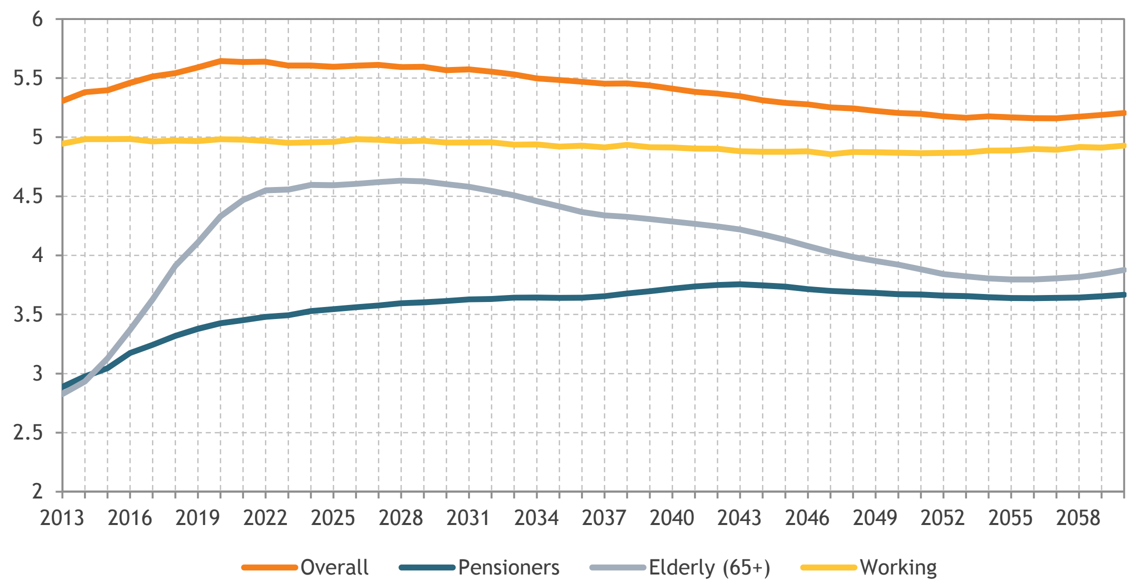


Figure 18 S80/S20 Indicator



The Gini-index and S80/S20 ratio will increase among pensioners and people older than 65 until 2028, which is due to a continuously increasing standard deviation of the amount of new provisions paid. The reason for this is that the labour market changes of the 1990s affected mostly those at the lower end of the earnings distribution. In addition, people who earn more have generally a longer service time, leading to an increased standard deviation of pension and old-age allowance. A further factor contributing to the increasing income gap between rich and poor is that a growing number of people will until 2028 receive no pension but only and old-age allowance.

5. Conclusion

The core of this paper is to use dynamic microsimulation models to simulate possible developments of (pension) adequacy in Belgium, Hungary and Sweden, while taking into account the projections and hypotheses of the AWG as much as possible. As such, it demonstrates the potential value of using dynamic microsimulation on the EU level.

In Belgium, gross public pension expenditure increases by 3.5% of GDP between 2013 and 2060, while the poverty risk as well as inequality among pensioners would decrease. In Sweden, the assumption of an unchanged retirement age results in projected gross public pension spending as a percentage of GDP to decrease by 1.5 percentage points, while lowering the benefit ratio and causes the risk of poverty among the pensioners to increase. Finally, pension expenditures in Hungary are projected to decline by 0.1%-points. This is mainly the result of the shorter service years, which themselves are the results of the great transition in Hungary, and which cause the poverty risk of pensioners to increase.

Finally, the simulation results on the various scenarios for Belgium also show that increasing the employment of older workers not only results in the most important reduction of pension benefits relative to the base scenario, but also considerably reduces the poverty risk among the elderly. The results are similar for Sweden; increasing the employment and the exit age for older workers leads to lower pensions benefits as a share of GDP, at the same time as the risk of poverty decreases. So although sustainability and adequacy are two sides of the same coin, a trade-off is not always necessary. Careful policy design allows to jointly reinforce sustainability and adequacy.

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