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Mind the GAp in PEnsions (MIGAPE Project)

Projections of the Gender Pension Gap in Luxembourg using MIDAS_LU 2020

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- *Please do not quote* -

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This report is produced in the context of the MIGAPE (Mind the Gap in Pensions) research project, work package 3. See www.migape.eu for more information on the project.

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Contents

List of Tables

List of Graphs

1. Introduction

Prior Notice and Acknowledgements

This note results from a collaborative work aiming to address the same research question in several EU-countries. Given this common basis and when relevant in the Luxembourg context, we may reproduce in the present report items coming from experts in MIGAPE project, in particular Gijs Dekkers and Karel Van den Bosch from the Federal Planning Bureau in Belgium, the scientific coordinators of the project. Those extracts involve mainly the *introductory Section,* are made on a free basis and engage exclusively the author of the present note.

We are indebted to all participants in the MIGAPE project, including Mikkel Barslund from CEPS in Belgium, general coordinator of the project.

We also acknowledge the Minister of Social Security and the Minister of Equality between Women and Men in Luxembourg for their support to the project, stakeholders in Luxembourg for their comments and proposals, the General Inspectorate of Social Security (IGSS) for providing the necessary administrative data feeding the model MiDAS_LU, as well as Anne-Sophie Genevois and Nizamul Islam, from LISER, for their support in preparing the input dataset from administrative data.

The present note is a work in progress, represents the views of the author only and is his sole responsibility. Any remaining errors are author's ones.

The goal of the project "MInd the GAP in Europe" (MIGAPE) is to analyze gender differences in pension income, and to do this from various perspectives while communicating the lessons learned to policy makers and the audience at large. This project is a collaboration between researchers from CEPS, the Federal Planning Bureau and the KU Leuven in Belgium, the University of Liechtenstein, the University of Lisbon in Portugal, the IER in Slovenia and LISER in Luxembourg.

A summary of the project can be found on the MIGAPE website (http://www.migape.eu/) and more specifically the project description. The objectives of this project can be grouped along three related axes. The first Axis aims at providing the public at large with relevant information on the consequences that their choices may have on their future pension. The goal of the second Axis is to provide policy makers of various EU countries with information on the possible future developments of Gender Pension Gaps. A third, and complementary Axis will study how to raise people's awareness of the consequences of employment decisions. This report is part of the second Axis, reporting on results for Luxembourg.

The Gender Pension Gap (hereafter "GPG") reflects by how much women's pensions are lagging behind those of men.

Luxembourg has a Bismarckian-style first-tier (public) pension system, where the pension an individual receives at retirement is a function of the past career and earnings. The GPG therefore depends on labour market characteristics, such as differences between men and women in the prevalence of part-time work, un-employment, withdrawals from the labour market, and the pay (hourly wage) gap. These differences may be related to other gendered behaviour, such as the impact of parental leave on wages after return. All these inequalities are cumulated over a person's lifetime and impact the pension benefit during retirement[1].

However, the relation between the earnings gap and differences in participation rates, on the one hand, and GPGs later in life, is far from linear and depends on many mediating aspects, including state transfers and especially the "compensating" or redistributive elements embedded in the public pension systems. Also, women are the main beneficiaries of survivor pensions, which mainly depend on the career of the former partner, and these have an important dampening effect on the GPG (when considering the standard definition, based on the means – by gender – of all pensions for persons 65 and over).

This information is by large and presently unavailable for next decades and the complexity of interactions makes their analysis rather demanding. We propose in MIGAPE to build on a dynamic microsimulation model, MiDAS_LU (version 2020), to generate missing information, then being in position to derive projections of the GPG for Luxembourg, on top of helping in clarifying the underlying developments and determinants behind these results.

The report is structured as follows. In *Section 2*, we introduce materials useful throughout this part of the MIGAPE project, that is definitions, methods implemented, hypotheses made and data used. *Section 3* is the core of the report and delivers main outcomes about the simulations in the so-called BASE scenario, building on standard definitions and hypotheses and showing that the GPG is expected to be lowered through time. *Section 4* is examining alternative yet by far theoretical scenarios that can help us understanding better the impact of a series of future factors on the rate of decline of the indicator. And *Section 5* concludes.

Note that MiDAS_LU has been recently upgraded for the purpose of MIGAPE project from a former and partial version set up in 2015. Therefore, this is a recent tool, classically needing additional effort for further validation, and the outcomes presented in this report should be seen as prior results, showing up possibilities based on a consistent and basically checked apparatus, rather than proposing firm answers.

1 For more details about such embedded mechanisms in Luxembourg, see Liégeois and Vergnat (2020).

2. Definitions, Method, Hypotheses and Data

2.1. The Gender Pension Gap (GPG)

The Gender Pension Gap (GPG) refers to the fact that women generally receive a lower gross pension than men. It is often measured as one minus the ratio of the average pensions of women and men. In the measure of the standard GPG as published by Eurostat and based on EU-SILC, pensions include gross old-age pensions (including disability cash benefits, ahead the age of 65, which is our target) and gross survivors' pensions. People with zero pensions, as well as everyone below (<) age 65 are excluded from the calculation. Furthermore, the standard GPG is calculated for the whole group of "pensioners", irrespective of age.

Formally, this can be written as :

$$1 - \frac{\text{avg (old age pension + survivor pension, } \mathit{if\,Woman\,65{+}\,and\,Pension} > 0)}{\text{avg (old age pension + survivor pension, } \mathit{if\,Man}\,65 + \,\mathit{and\,Pension} > 0)} \qquad (1)$$

However, this is not the only possible measure of the GPG. In a general form, the GPG(*l, x*) can be written as :

$$1 - \frac{l(x)_f}{l(x)_m} \qquad (2)$$

where *l* can be another statistics than the mean and *x* any other metrics than the gross pensions.

Variants of the standard GPG can be distinguished according to four dimensions.

First, the pension to which they refer can include only retirement (and disability) pensions, or alternatively both old-age and survivor pensions. Furthermore, the GPG at the mean according to the definition by Eurostat (all pensions including those from private plans, population aged 65 and more) involve private pensions, on top of public ones. However, due to limitations in data made available for the present exercise and methodological constraints, we do not consider private pensions in MIGAPE project. Those, anyway, are less prominent in Luxembourg, compared to other countries covered by MIGAPE.

Second, the standard Gender Pension Gap does not take into account zero-values of benefits considered. However, it can in some cases be interesting to compare the GPG with and without zero-pension values. The GPG including zero pensions is indeed a combination of the standard GPG and the gender pension coverage gap, which measures the extent to which beneficiaries (and especially women) have their own independent access to pension system benefits (European Commission, 2018a, p. 71f).

Third, the GPG can be calculated using any measure of location (percentile, decile). In this report, we focus on the GPG at the mean as well as the 25th, 50th (median) and 75th percentiles.

Fourth, going ahead and in addition to the GPG in the group of pensioners aged 65+, we can present breakdowns by age groups 65-74 and 75+.[2] It might also be interesting to look at the GPG of people in the year when they retire but we donot cover this specific case in the present report.

2.2. The Dynamic Microsimulation Model MiDAS_LU 2020

Our main objective is to derive the GPG for later times in Luxembourg, hence pensions, both presently distributed already and to be claimed in the future. Therefore, we must find a way to generate all information relevant for the computation of pensions. The pensions are derived through a complex and non-linear technology from lifetime (gross) earnings, hence public transfers and regulations (including considerations about maximum and minimum pensions and income sources accumulation rules) as well as events on the labor market and demographic considerations. Morevover, if a willingness to consider well-being on top of gross incomes, which is not our specific focus in the present analysis, we have also to go from gross to net incomes. Finally, the analysis undertaken here implying for some aspects income distributional concerns, we need a tool able to overcome such questionings.

Table 1 **: MiDAS_LU 2020 – Internal sequence of simulation blocks**

This version as for MIGAPE project, 2019-2021

Year "*t*" : 2016 (input - IGSS datawarehouse & SILC), 2017, 2019, 2021, ... , 2066 (simulated)						
[I] Demographic Module						
Birth [*] (including Education & Gender)		*Survival* (hence Death)	*Mariage Market*	*Migration* (Chenard's algorithm for Net migration or Immigration versus Emigration [**])		
[II] Labour & After Labour Status and Earning Modules						
Working ?	*Employee ?*	Public (*civil servant*) or private sector ?	Months of work	*Part-time/Full-time* and Hours worked	Hourly wage	⇒ **Labor Earnings**
	Self-employed ?					
Not working ?	Retired	*Unemployed*	Early-retired	*Disabled*	⇒ Other inactive	
[III] Tax-benefit Module						
Unemployment benefits	Family benefit	**Pensions** (and from abroad)	Old-age	Social assistance		⇒ **Net income**
			Disability	Social contributions		
	Maternity & so		Survival	Taxes		
[IV] Summary statistics and Indicators						
Adequacy /"Micro" :	Poverty, S80/S20, Gini, Replacement rates, **GPG** ...			Sustainability (Residents only) / "Macro"		
Next simulated year "***t+1*** "						

[*] *Items in italics are referring to Alignement procedure*

[**] Grey fonts are referring to items to be implemented later in MiDAS_LU 2020

This engine retained in MIGAPE to reach the point is the dynamic microsimulation model MiDAS_LU 2020. MiDAS_LU is more generally designed to simulate for Luxembourg the long-term prospective

2 Eurostat publishes the GPG for the 65+, those aged 65-74 and 65-79; https://ec.europa.eu/eurostat/data-browser/view/ilc_pnp13/default/table?lang=en.

impact (up to 2070) of demographic ageing and social policies on income inequality and poverty measures. For its Demographic and Labour modules, it is inspired from MIDAS_BE, a model developed since years by the Federal Planning Bureau (FPB) in Belgium. MiDAS_LU is an update of a former one set up in 2015 and part of the MIGAPE project was devoted to the upgrade of this old version, thanks to the support of other teams in MIGAPE and particularly FPB (Gijs Dekkers, Karel Van den Bosch and Raphaël Desmet).

The *Table 1* tells more about the model black box and may be read from the bottom to the top : the GPG, our ultimate goal (*Summary statistics and Indicators module*), rest on pension computations (*Tax-benefit module*) themselves depending on earnings (*Labor and After Labor Status and Earnings Modules*) and family or personal dimensions, including migrations (*Demographic Module*).

MIDAS_LU uses data from a large, administrative dataset as its starting dataset, provided by the General Inspectorate of Social Security in Luxembourg (IGSS) and prepared for input in MiDAS_LU by Anne-Sophie Genevois and Nizamul Islam in LISER. The full data are covering the resident population, hence excluding cross-border workers or retirees. On the whole, the model MiDAS_LU 2020 is starting from a picture of the population in 2016 and generates through simulations all dimensions needed for successive years.

2.3. The Main Drivers for the GPG in the Long Run

The Gender Pension Gap (GPG), building on differences between men and women with regard the pension income, is a stock-type variable. Even if valid for a given period, it expresses in a synthetic indicator the outcome of numerous so-called drivers accumulating their impacts through time. We are now identifying some of them and give a flavor of their impact on the ultimate indicator, the GPG.

Schematically, drivers can be distinguished based on their stock-type (or backward-looking, when considering the simulation exercise) versus flow-type (or forward-looking) nature.

For sake of simplicity, the first category may be seen composed of so-called accrual rights and pension benefits already served as observed at the initial period of observation (or simulation). The accrual rights refer to periods, past incomes and personal events “accumulated up to there” by women and men not retired yet and to be considered when entering retirement for the computation of the initial pension benefit[3]. Both accrual rights and the pension benefits already served at initial period of simulation result from a series of past ingredients and are therefore backward-lookup stock-type variables.

At the opposite and since first period of simulation, we may know a little more about the drivers that will compose later on, together with the backward-looking drivers, main components for the computation of “new” pensions on further times. Those forward-looking ingredients involve, at the aggregate level (even if “known” from input dataset or generated through the simulation at individual level), dimensions related to demographic or labour-market considerations.

At the demographic level, the fertility and survival rates, marriages or divorces, inflows of migrants and so may play a role on future labour market outcomes hence on pensions. Given the nature of public

3 See Liégeois and Vergnat (2020), CNAP (2019) and OECD (2019) for more details about the system of public pensions (first-pillar) in Luxembourg.

pension system in Luxembourg, making a strong link between lifetime individual earnings and pension benefits when retired, the labour market sphere is telling more about the socio-economic status, the labour supply, both at the extensive and intensive margins, and wage rates. The extensive margin considers the activity (including unemployment) and employment rates. The intensive margin is focusing more on the share of full-time and part-time workers and the hours spent on work per period. Those dimensions are of flow-type, even if obviously, most of them can depend for their present value on past outcomes as well.

Considering and disentangling the whole bunch of impacts from flow- (backward-looking) and stock-type (forward-looking) drivers to pensions and the gender gap is definitely not an easy task provided that it would even be feasible. In particular, passing from flow-type observations to stock-type pensions generated is a demanding and anyway approximate exercise, the new ingredients implying effects on stocks (relevant for pension calculations) progressively only. Moreover, the relation between drivers and the ultimate target, as well as inter-dependence between drivers, are of a highly non-linear nature.

Therefore and practically, we usually focus more on some aspects that are generally considered as relevant and more important, while qualitatively making the link between what is observed in drivers and pensions, first, GPG next. However, due to limitations on time made available, we are considering here only forward-looking ingredients, leaving aside the backward heritage, despite the importance of the latter. In the next sections, we are most often focusing on the period 2020-2050. Despite the simulation running more largely from 2017 to 2070 in MiDAS_LU, it seems sensible not to go too far in illustrations at this stage of development, the exercise being a picture of what might happen in conformity with all hypotheses made and equations or inter-dependences embedded in the model. Therefore, the further we go, the weaker our conclusions based on that large combination of statements.

2.4. Hypotheses

We now emphasize a key-dimension of our simulations in MiDAS_LU and MIGAPE : the hypotheses formulated about the evolution of those drivers. We consider first an environment of simulation that is called the BASE scenario. Variants will be introduced later on.

The simulation for Luxembourg is based on projections of employment rates by age group and wage growth produced for the 2018 Ageing Report by the Working Group on Ageing Populations and Sustainability (AWG) of the Economic Policy Committee (EPC) (European Commission, 2017) for its projections of the financial and social sustainability of the Luxemburgish pension system. This means that the model is designed so that key-dimensions follow at the macro level the hypotheses made up by this group, which involve also to some extent the EUROSTAT population projections. Those figures are completed by experts in Luxembourg (IGSS) and we stick to those indications as well, under our sole responsibility. This so-called "alignment", hence some conformity of MiDAS to the AWG indications, allows projecting the social indicators about pensions in accordance with the budgetary sustainability assessment of the pension system (Dekkers et al., 2015).

This, together with additional *ad hoc* choices partly done in conformity with methodological decisions by the MIGAPE team as a whole[4], lead to a picture summarized in *Table 2* as for the labour market and

4 See the MIGAPE "*Gender Pension Gap comparative report*" on http://migape.eu/.

pensions. With regard the labour market, an essential dimension is that, given hypotheses retained, gender differences observed on average at initial point of the simulation are sometimes maintained throughout times, even if evolutions and some narrowing of the gender gaps may be implemented.

Table 2 **: MiDAS_LU 2020 – Hypotheses for the Long run in BASE scenario**

Main Components	Starter in BASE scenario	Evolution on the longer run
Population	2016 input micro-data	Based on AWG projections (*), including for net migrations
Participation (Working)	2016 input micro-data	Proportions based on AWG projections
Status, out of retirement	2016 input micro-data	Proportions (unemployed, civil servants, private employees, self-employed, disabled) based on AWG projections (**)
Part-time / Full-time Work	% derived from 2016 micro-data input, by sub-groups	% constant since 2016, by Gender & Class_Age_AWG (***)
Hours worked (per year)	Averages derived from 2016 micro-data input, by sub-groups	Average constant since 2016, by Gender, Class_Age_AWG and Part-time/Full-time
Hourly Wage	Overall averages (Σ labour earnings / Σ hours,) derived from 2016 micro-data, by sub-groups	Overall average (****) growing as productivity of labour AWG (and price index), by Gender
Retirement	As soon as possible, given rules in LU	

(*) European Commission (2017 and 2018b), Ageing Reports, and complementary developments from LU-experts (IGSS)

(**) For students, we follow the same strategy as in Liégeois and Genevois (2015)

(***) Class_Age_AWG : [15-24], [25-54], [55-74]

(****) The overall wage/hour is defined as, all workers taken into account, Σ (labor earnings) / Σ hours

The demography, essentially not covered in the present report, is governed either by the standard AWG projections or more specific considerations relevant for Luxembourg[5] (marriage, divorce, education attainment, etc). However and before turning to more labour market-oriented indicators, we show in *Graph 1* the evolution of the aged dependency ratio which is increasing in Luxembourg as in many other countries from 2020 to 2050. This indicator is defined as the ratio between the size of resident population aged 65+ over the one in age to be active (from age 15 to 64 included).

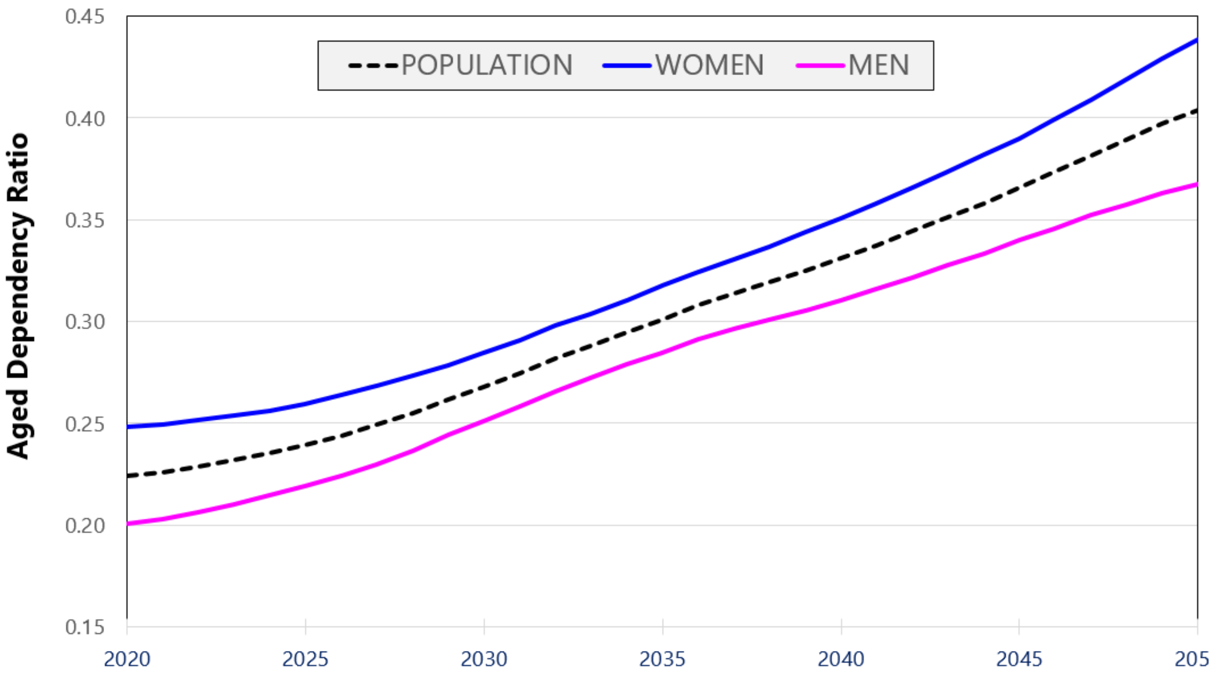
We can make the indicator more specific and have a look on gender differences, which is our transversal focus in the present analysis. Building on AWG assumptions, we expect a greater dependency ratio for women compared to men. This does not depend only on better survival probabilities. We consider here a ratio between the size of age groups that depend on parameters other than survival conditions, for example migrations. However, the former dimension is obviously playing an important role. One

[5] See Liégeois and Genevois (2015) for more details about a former version of the model, yet still relevant for MiDAS_LU 2020.

consequence, would other parameters be identical by elsewhere, is straightforward : women will benefit from survival pension benefits sooner (the men dying earlier) and will benefit from pensions (if ever happening at the individual level) longer than men.

***Graph 1* : Aged Dependency Ratio**

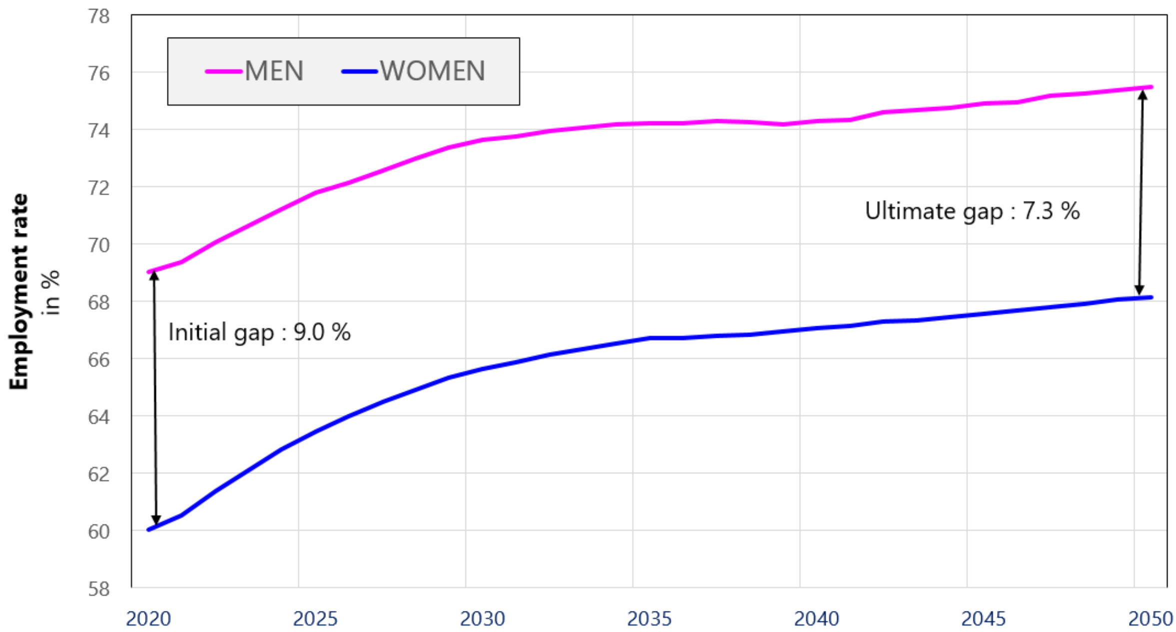
[65+] / [15-64]



Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

***Graph 2* : Employment Rate**

Working, in % of population in age of activity but not in education



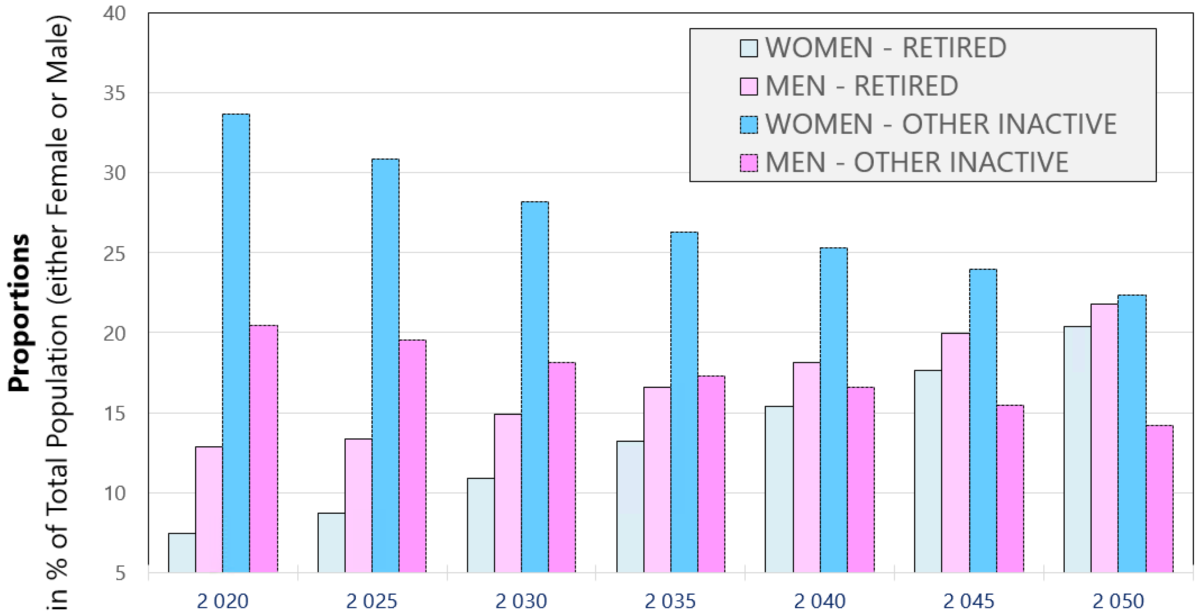
Source : MiDAS_LU - Version 2000 - 22 Mar 2021

We are now considering labour market-oriented components. At the extensive margin, a central driver for pension benefits is definitively the employment rate, defined here as the share of population at work in total population in age to be active but not in education any more. On average and in broad terms, the higher it is, the greater might be the proportion of population in position to get an old-age hence survival pension later on and/or the better might be the pensions. By extension, if the employment rate is developing differently for women and men, the relative positioning of those with respect pension earnings might be impacted as well.

The *Graph 2* shows that employment rates are expected increasing through times (about 7-8% between 2020 and 2050), confirming past tendencies and whatever the gender, with a negative gap maintained (yet slightly reduced) between women and men.

Graph 3 **: Proportion of Retired and Other Inactive, by Gender**

In % of total population (examined separately for women and men)



Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

The two aspects evoked up to now (survival probabilities and employment rates) are of main importance as soon as gender gaps are at stake, given that they keep "active" differences from the beginning, whatever the hypotheses formulated by elsewhere. This will add-up to other backward-looking items evoked earlier that must be taken as given as well, in form of past careers and pensions already served nowadays.

We do not need to tell too much about the intensive margin. Given initial positioning and hypotheses retained about their evolutions (see *Table 2*), it can be shown that differences between men and women remain stable during the whole period. The gender gap as defined in the previous *Section* is stable, about 0.11 for hours worked per year (if employed). The comment remains true for the change in wage per hour[6], which is stable at 0.15, maybe the strongest hypothesis with regard the gender gaps. This results

[6] The overall wage/hour, by gender and for all workers, is at stake here : Σ (labor earnings = individual wage/ hour * hours) / Σ hours

greatly from an overall increase in labour productivity which sticks to AWG projections that propose an evolution identical for men and women with that respect at the macro level. Therefore, the initial gender gap as observed in the input dataset is essentially maintained.

The *Graph 3* completes this information by the expected evolution of a couple of socio-economic statuses of resident population, by gender, as it results from hypotheses. We can observe an increasing share of retirees (defined in this representation as benefitting from an old-age pension), with the curve being steeper for women who go from 7% to 20% between 2020 and 2050, whereas the evolution is only from 13% to 22% for men. This outcome is obviously a direct consequence of the higher participation of women to the labour market, observed up to now already and expected for future times. Obviously, the other inactive (defined here as neither active, nor student or disabled or old-age retired) are evolving the other way round and become less represented in the population, whatever the gender. The proportion of other socio-economic statuses is in general more stable through time.

3. Base Results

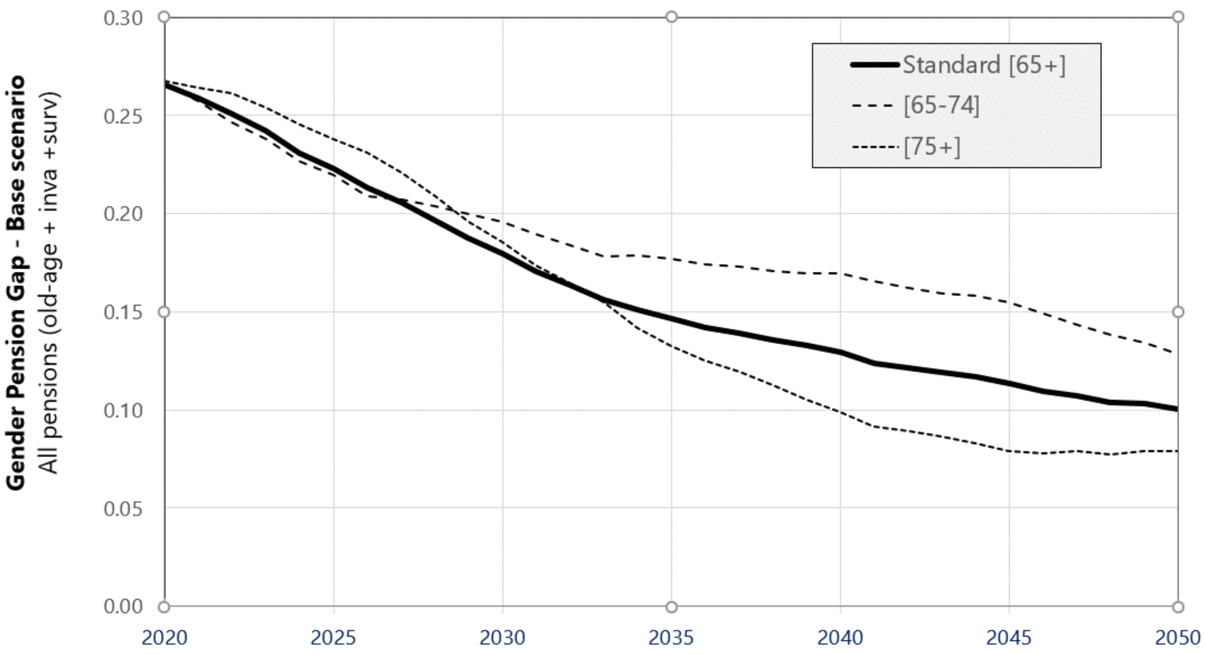
In this Section, we present the Gender Pension Gap (GPG) and main drivers as obtained through the microsimulation of MiDAS_LU for the BASE scenario. We do not analyze the *past* evolution of the GPG and main components under scrutiny. The *MIGAPE Gender Pension Gap comparative report*[7] shows by elsewhere relevant outcomes for close countries, including sometimes for Luxembourg.

3.1. Evolution of standard GPG "at the mean" in the Long Run

The *Graph 4* gives an overview of the projection results, where the GPG is evaluated at the mean. The pensions involve old-age retirement benefits (including disability ones) and survivors' benefits. The population covered in the standard GPG is any resident aged 65 or more and benefitting from at least one positive amount among those benefits.

***Graph 4* : The Gender Pension Gap over the Long Run (2020-2050)**

Standard approach : all pensions considered (old-age, Invalidity and Survivor)



Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

After a first period up to the mid-30s where curves are not that far from each other, mostly an inheritance from past conditions and accumulations, new entrants in pension beneficiaries make the curves deviating a little more in relative terms.

The GPG (thick line) decreases at a decelerating rate over the period here represented. Starting from 0.27 in 2020, its value is 0.10 in 2050. We will see in *Graph 12* that it reaches a minimum is 0.09 in 2057,

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[7] See http://www.migape.eu/.

before gaining one p.p. and then stabilizing over the long run. The strongest decrease is up to the mid-30s. The other lines in *Graph 4* show that a similar pattern over time occurs in all groups that are distinguished. Among pensioners aged 65-74, the GPG is a bit higher since the late-20s, and the decline somewhat slower ; while among the oldest pensioners aged 75 and over, the GPG shows a sharper fall since the late-20s up to the late-30s and is somewhat less than among all 65+ since the early-30s. So, since the late-20s, the GPG is lower the longer pensioners are in retirement. This is due to the impact of survivor pensions, which gets more importance with increasing age (see *sub-Section "Including zero pensions"* below).

3.2. Including Zero Pension Incomes and the Gender Coverage Gap

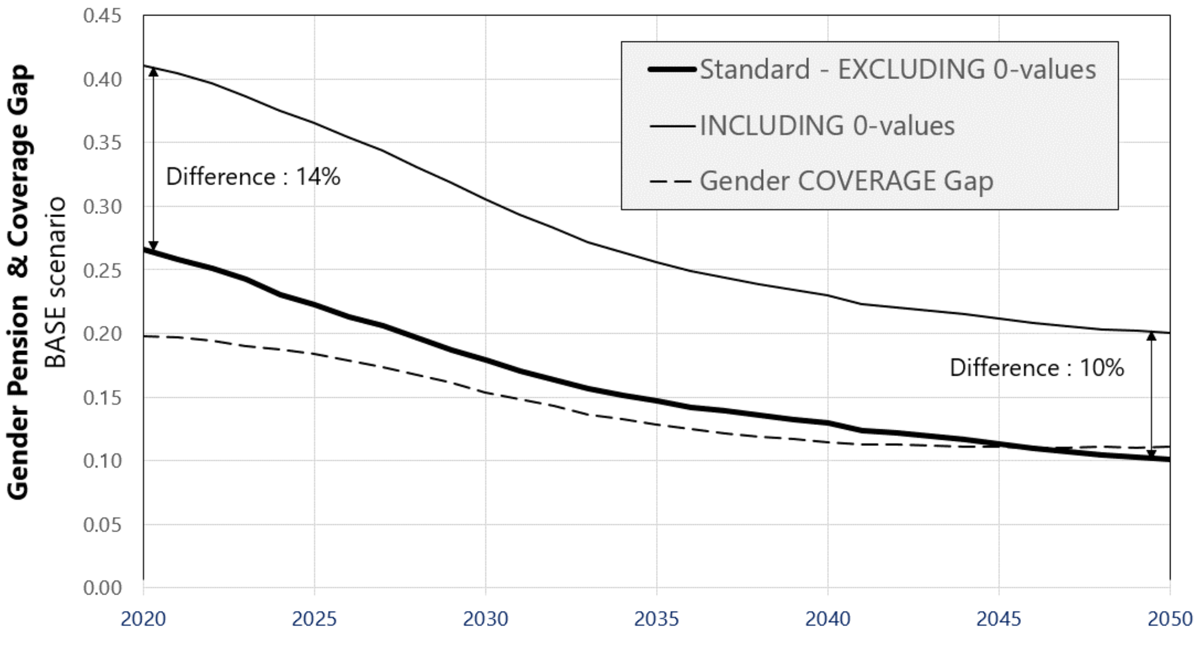
Obviously, the picture shown through the standard GPG is not telling the whole story. We might need measures of the extent to which beneficiaries (and especially women) have their own independent access to pension system benefits (European Commission, 2018a, p. 71f). This is done while including zero pensions in the GPG : the population covered is now all residents aged 65 or more, whatever benefitting from a pension or not.

If defining the Gender Pension Coverage Gap (GCG) as one minus the ratio between the percentage of women receiving a positive amount and the same indicator for men, we can show that the standard GPG (excluding the residents with 0-values for total pension benefits) and $GPG_{including\text{-}0s}$ (including zero pensions) are related this way :

$$1 - GPG_{\text{including-0s}} = (1 - GPG_{\text{excluding-0s}}) * (1 - GCG) \quad (3)$$

Graph 5 **: The Gender Pension Gap Excluding or Including 0-values and the Coverage Gap**

One benefit positive among old-age/disability and survivor ones – Age 65+



Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

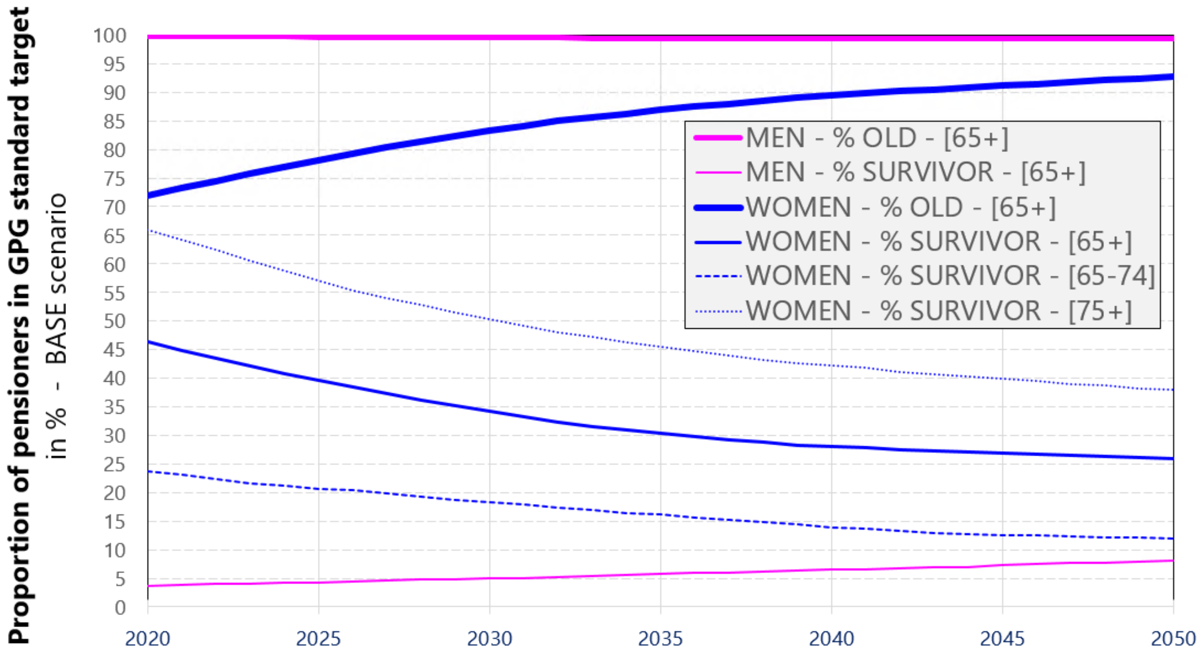
Therefore, the GPG when including zero pensions is a combination of the standard GPG and the GCG between women and men. If the GCG is positive (fewer women receive benefits, in proportion of their group size, than men), therefore the Gender Pension Gap *including* 0-values is greater than the standard GPG (*excluding* zeros).

This is what we observe in Luxembourg through the *Graph 5*. Moreover, the (positive) GCG is decreasing through time, from 0.20 in 2020 to 0.11 in 2050. How explaining this ?

Indeed and on one side, women are less often (and, if so, to a less intensive extent) employed than men (see previous *Section*), which implies that they benefit less from old-age pension benefits from their own than men and, if so, with lower pensions, on average. However, the growing employment rates observed in past times and implemented both for women and men for the next decades (see *Graph 2*) is proportionally leading more women to personal old-age pension benefits, while men are already largely covered nowadays. It can be shown from simulations that the proportion of men aged 65 or more in 2020 and benefitting from an old-age (including disability) pension is 0.92, while it is 0.53 for women. In 2050, the proportions will be 0.88 for men, 0.73 for women. By itself, this pushes the GCG downwards.

Graph 6 **: Proportion of Old-age and Survivor Pensioners**

In p.p. of standard population : any pension > 0 and age > 64, (unless otherwise mentioned)



Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

This tendency is illustrated another way through the *Graph 6* which represents coverages in proportion of the standard population as targeted by the GPG (one benefit positive, among old-age –including disability- and survivor ones, and age greater or equal to 65, unless otherwise mentioned). We confirm the general tendency of a large coverage by old-age benefits for men (the thick rose curve), around 100%, and an increase for women (the thick blue curve), from 72% in 2020 to 93% in 2050. The ratios in 2020 and 2050 differ from the ones evoked earlier given that the population observed in the precedent paragraph was the total population aged 65 or more.

On the other side and due to lower old-age pension benefits, if women are dying, they are less often transmitting -and if so, lighter- survivors' pension rights to their partner, then men. They are also living longer (see *Graph 1*, as an illustration). All in all, they are therefore greater beneficiaries of survivor pensions than men : it is shown from simulations that in 2020, 34% of women aged 65 or more are covered by a survivor benefit, while 3% of men are in the same situation. Regarding the long run, old-age pensions more frequently served to women, together with increasing survival probabilities for men (see *Graph 1*), can drive to an increase of the coverage by survivor benefits for men, whereas older men may penalize their partner with that respect. We do not mention here the rules applied when combining survivor and old-age pension benefits, which may play a role as well in the overall coverage. We had no time enough through MIGAPE to explore those prior statements in detail but the general outcome is known from simulations : in 2050, the proportions of coverage by a survivor benefit become 20% for women, 7% for men (13% of difference, against 31% in 2020), still considering the whole population aged 65 or more.

This tendency is illustrated another way through the *Graph 6*, again. The coverage through survivor pensions is slightly increasing for men, yet at low levels (from 4% in 2020 to 8% in 2050) and going down for women (from 46% in 2020 to 26% in 2050). The *Graph 6* is also showing the coverage through survivor benefits for women aged 65 to 74, or more than 75. We see that the younger cohort is (logically) significantly less covered than the oldest one with that respect. This better coverage for older women is obviously pushing downwards by itself (and everything equal by elsewhere) the standard pension gap for that age-category, compared to the general one, as was evoked previously (see *Graph 4*).

So, the reduction of the coverage through survivor pensions in the long run for women might push by itself the GCG upwards. However and keeping in mind that the percentages at stake with survivor benefits are lower than those put forward for old-age pensions, the latter may a priori be expected to dominate the whole tendency. This is confirmed by simulations and drives the GCG from 0.20 in 2020 down to 0.11 in 2050, as mentioned earlier. Moreover, this decreasing value is helping in reducing the gap between the GPG excluding 0s (from 0,27 in 2020 to 0,10 in 2050) and the one including 0s (from 0.41 in 2020 to 0.20 in 2050[8]), with a difference which therefore goes from 0.14 in 2020 down to 0.10 in 2050.

3.3. Disentangling the Impacts of Survivor and Old-Age Pensions

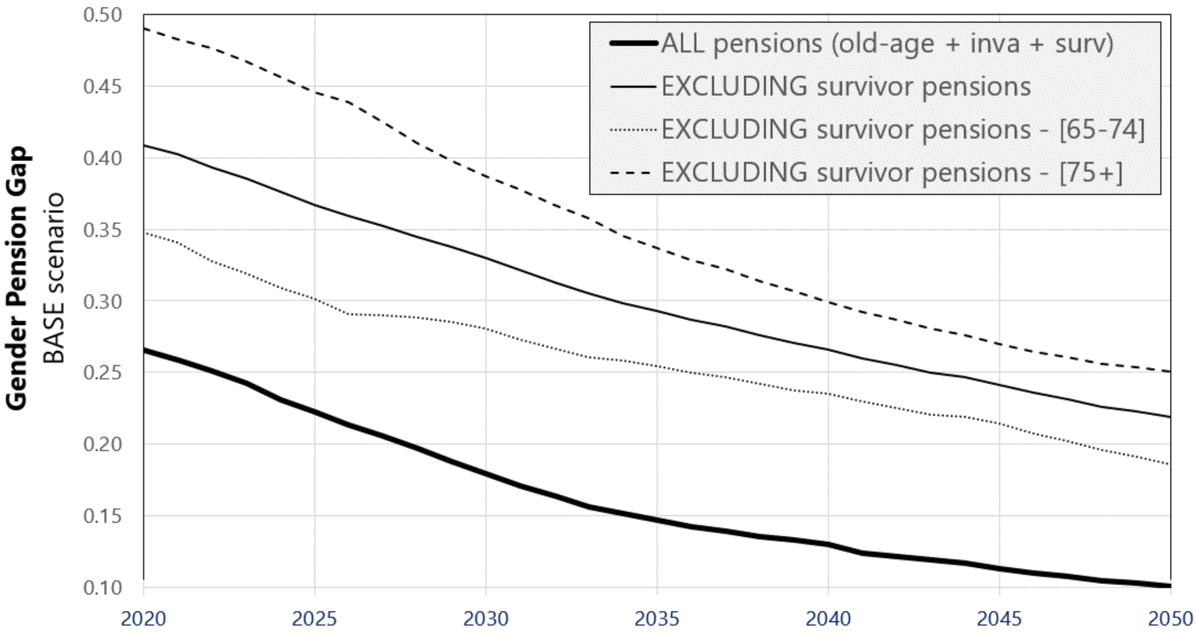
If considering survivors' benefits as derived rights not in relation with the survivors' own working life, we might want to disentangle those benefits from "direct" ones (old-age or disability), as was partially done already, at the qualitative level, in the previous paragraphs.

The $GPG_{\text{old-age}}$ where old-age (and disability) pensions are taken into account can be represented as :

$$\text{GPG}_{\text{excluding survivor pensions}} = 1 - \frac{\text{avg (pension old age , } if\, Woman\ 65{+}\ and\ Pension{>}0)}{\text{avg (pension old age ,} if\ Man\ 65{+}\ and\ Pension{>}0)} \quad (4)$$

[8] Equation (3) gives for 2020 : 1 – 0.41 = (1 – 0.27) * (1 – 0.20) ; while for 2050, we find : 1 – 0.20 = (1 – 0.10) * (1 – 0.11)

***Graph 7* : The Gender Pension Gap with or without Survivor Pensions**



Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

The *Graph 7* shows along the thin solid curve what the GPG is becoming when excluding from its computation the survivor pensions. The standard GPG (thick curve) is also reminded for comparison. As introduced qualitatively in the previous *sub-Section* and expressed here in broad terms, the survivor benefits profit more to women, both in terms of coverage and probably also when considering their levels : women's dead partner old-age benefit, the basis for survivor one, is greater, on average, than the equivalent basis for male widows. Therefore, excluding survivor pensions from the indicator and concentrating on the sole old-age pensions, which themselves are and will remain less generous for women on average, is penalizing this part of the population and logically increasing the gender gap. As stemming from the simulations, we observe that the $GPG_{\text{excluding survivor pensions}}$ is 0.41 in 2020 (0.27 for the standard GPG) and 0.22 in 2050 (0.10 for the GPG). The gap is even higher for the oldest cohort, reaching 0.49 for the population aged 75 or more. This is the least well served for women with regard the old-age pensions, grounding on considerations with regard the labour market during past careers.

The *Table 3* is illustrating the point another way and builds on the following expression of the standard GPG, which can be shown as equivalent to (1) :

$$\text{GPG (standard)} = 1 - R_{\text{old\_pension}} * \frac{\left(1 + \frac{\%\text{surv\_pension}}{\%\text{old\_age\_pension}} * \frac{\text{Mean(survivor pension)}}{\text{Mean(old age pension)}}\right) \textbf{ if W}}{\left(1 + \frac{\%\text{surv\_pension}}{\%\text{old\_age\_pension}} * \frac{\text{Mean(survivor pension)}}{\text{Mean(old age pension)}}\right) \textbf{ if M}} \quad (5)$$

where :

- $\%surv\_pension$ is the percentage of women (resp. men) receiving a survivor pension among the standard covered population (that is aged 65+ and benefitting from any positive amount of old-age -including disability- or survivor pensions)
- the averages *Mean()* are targeting the beneficiaries of each specific pension

- and $R_{\text{old\_pension}} = \frac{(\%\text{old age pension } * \text{ Mean(old age pension)}) \textbf{ if W}}{(\%\text{old age pension } * \text{Mean(old age pension)}) \textbf{ if M}}$, hence represents the ratio between women and men of Mean(pension old age) when targeting the whole standard covered population

Therefore, the GPG can be seen as depending on three factors : $\frac{\%\text{surv\_pension}}{\%\text{old\_age\_pension}} * \frac{\text{Mean(survivor pension)}}{\text{Mean(old age pension)}}$ (respectively for women and men) and $R_{\text{old\_pension}}$. Those factors being invariant to the monetary basis, we normalize "$\%\text{old age pension } * \text{ Mean(old age pension)}$" for women en 2020 to 1 and then be ready for a comparison between 2020 and 2050 outcomes.

Table 3 : The Change in GPG from 2020 to 2050 in BASE scenario

Impact analysis of factors involving old-age and survivor determinants

	FACTORS	Impact on GPG if an increase, out of R (*then via R alone [*]*)	BASE scenario 2020	BASE scenario 2050	**Absolute change in GPG** if one Factor goes from its 2020-value to the 2050 one (*and proxy of **1st derivative** = change in GPG / change in Factor Mean_Surv/Mean_Old_age*)
WOMEN					
%(survival_pension > 0, in "standard population" [**]) * Mean (survival_pension, if >0 in standard)	(1)	- (=)	0.745	0.777	
%(old_age_pension > 0, in standard population) * Mean (old_age_pension, if >0 in standard) [***]	(2)	+ (-) ⇒ ?	1.000	2.657	(6)
⇒ Mean(survival_pension) / Mean (old_age_pension), in standard population	SO2050_W = (1)/(2)	-	0.745	0.292	**0.19**
			(7)	(8)	*(-.42)*
MEN					=(6)/[(8)-(7)]
%(survival_pension > 0, in standard population) * Mean (survival_pension, if >0 in standard)	(3)	+ (=)	0.029	0.175	
%(old_age_pension > 0, in standard population) * Mean (old_age_pension, if >0 in standard)	(4)	- (+) ⇒ ?	2.348	3.643	
⇒ Mean(survival_pension) / Mean (old_age_pension), in standard population	SO2050_M = (3)/(4)	+	0.012	0.048	**0.02**
					(.7)
WOMEN versus MEN, old_age_pension					
$R_{old\_pension}$	(5)	- (+) ⇒ -	0.43	0.73	**-0.52**
					(-1.72)
Standard Gender Pension Gap (GPG)			**0.27**	**0.10**	**-0.17**

[*] It a positive impact on $R_{old\_pension}$, this implies a negative impulse for GPG, hence "-" mentioned here if so
[**] Age > 64 and receiving any pension : old_age (including disability) or survival
[***] The computations on R and GPG are neutral to the monetary basis retained
⇒ this Factor (for women in 2020) chosen as the common reference base

In 2020, the survival pension served to women was, on average if considering the standard population[9], 74.5% of the old-age benefit. The latter was 2.348 times higher for men compared to women, while men received little amounts in terms of survival pensions (2.9% compared to women old-age benefit on

[9] 46.31% of the standard female population is benefitting from a survivor pension (see *Graph 6*), whose gross level is on average 34,209 EUR / year. Meanwhile, 71.94% of women receive an old-age benefit of 29,548 EUR / year on average. This results in a ratio of 0.4631 * 34,209 / (0.7194 * 29,548) = 0.745. Therefore, despite the mean survivor benefit being higher (for women who receive such a benefit) than the mean old-age one, the ratio when considering the whole standard population is < 1.

average). All this results in a factor $\frac{\%\text{surv}_{\text{pension}}}{\%\text{old}_{\text{age}_{\text{pension}}}} * \frac{\text{Mean(survivor pension)}}{\text{Mean(old age pension)}}$ equal to 0.745 for women. The same factor for men is 0.012. Meanwhile, the ratio $R_{\text{old\_pension}}$ between old-age benefits of women over men, computed on average when targeting the standard population, is 1.000 / 2.348, that is 0.43. We will see that this factor is the most influential one when examining the changes through time. All in all and given (5), we conclude with a GPG = 1 – 0.43 * (1 + 0.745) / (1 + 0.012) = 0.027[10].

What is happening in 2050, compared to 2020 ? For women, the simulations return an average old-age benefit of 2.657 (basis 2020), whereas the survivor benefit did not change so much, to 0.777 (the benefit when served is greater but the % of survivors has decreased, as seen in *Graph 6*). Therefore, the ratio for women is now 0.292, significantly lower in 2050 than in 2020. For men, we go from 0.012 to 0.048. Just mention aside that the average old-age benefit is increasing much more for women than for men : +166%, compared to +55%. Among the 166%, an important part is explained by a better coverage (+21 p.p., see *Graph 2*). $R_{\text{old\_pension}}$ is now significantly increased, from 0.43 in 2020 to 2.657/3.643=0.73 in 2050. Therefore, the GPG is becoming 0.10, a reduction between 2020 and 2050.

We can have a look on influential drivers in changing one factor at a time, which is done in the rightest column of *Table 3*. If changing the women's factor $\frac{\%\text{surv}_{\text{pension}}}{\%\text{old}_{\text{age}_{\text{pension}}}} * \frac{\text{Mean(survivor pension)}}{\text{Mean(old age pension)}}$ from 0.745 to 0.292 and nothing else, applying the formula (5) drives to a GPG equal to 0.46, hence an increase of 0.19 compared to 2020. Given (5), the effect of this factor is not ambiguously negative. As the factor is lowered from 2020 to 2050, the GPG increases. The result shown into parentheses below the change in GPG is a proxy of the first derivative, that is the change in GPG per unit of change of the factor : 0.19 / (0.292 – 0.745) = -0.42. The corresponding factor for men generates a change of 0.02 in the GPG. Despite a unit impact of 0.7 (positive), the limited absolute increase in the factor does not produce a big effect on the GPG. Finally and more importantly, the separate impact of the change in $R_{\text{old\_pension}}$, the ratio between old-age pension of women versus men, on average, is generating a negative impact on GPG by -0.52, which is by far the most important one among the three factors tested.

Altogether, however, the relation between the GPG and the factors shown in (5) is not linear. Therefore, we cannot simply add up separate impacts to derive the total change in GPG which is indeed and "only" -0.17. But the specific partial impacts illustrate that $R_{\text{old\_pension}}$ and its change between 2020 and 2050 explains a significant part of the evolution of the GPG, even if the other two factors are mitigating and reducing this specific old-age ratio impact.

3.4. The Gender Pension Gap at Percentiles 25, 50 and 75

Finally, the GPG measured at the mean of pension benefits distribution provides a rather targeted view of pension differences between men and women which does not necessarily provide a fully adequate perception of the pension gender differences. Il might happen that women deviates differently from men all along the income curve, compared to the what is observed around the means. For example, if a greater proportion of women are benefitting from pensions significantly lower than the mean, compared

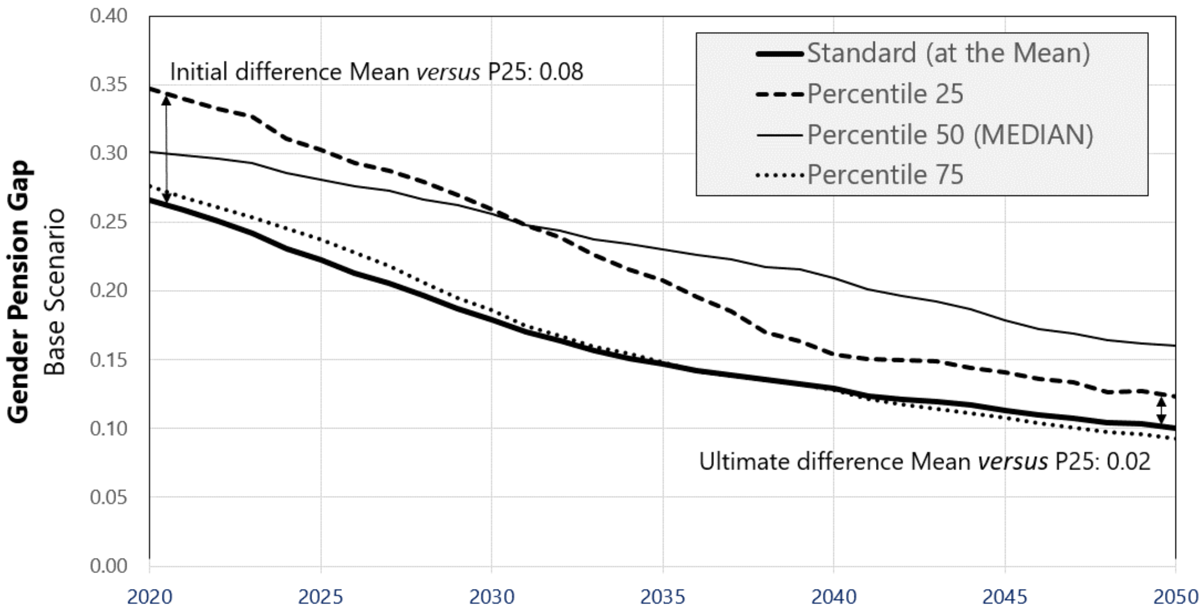
[10] 0.026 is outcome of the computation on left, but all figures given here are rounded, which explains that difference.

to men, then the gap will be higher around this focus point. This would be of course a relevant supplementary signal with regard the relative situation of women. Moreover and theoretically, the average pension of men could be pushed upwards by a few very high values, while apart from those extremes no difference in mean pension between women and men would be observed.

For this reason, it is useful to look at the GPG at various points in the distribution of pensions, The *Graph 8* shows the outcomes at percentiles 25 (P25), 50 (median) and 75 of the distributions, rather than the mean. A percentile is the value below which a certain percentage of data, in this case pensions, falls. The gender gap in pensions at the median resulting from the simulations is higher than the GPG measured at the mean and following the same temporal decreasing tendency, yet being less rapidly evolving. The difference is doubling during the period considered here, going from 3 p.p. in 2020 to 6 p.p. in 2050. The "P25" GPG, measured at the percentile 25, is also higher than the GPG derived from means, even if the difference is progressively narrowing through time, from 8 p.p. in 2020 to 2 p.p. in 2050. Finally, the "P75" curve is quite similar to the GPG at the mean, just a little bit sharper.

Note that those outcomes, and in particular the interval shown by the simulations, may be due to the model itself, which is a simplifying representation of the real world and generates outcomes that replace or complete progressively flow- and stock-type data as observed in 2020. Determining whether the internal logic of the data, the hypotheses about the parameters and the policy rules (including minima and maxima) are logically generating the differences mentioned here, more than the *ad hoc* building-up of the tool and other simplifications embedded will have to be explored during the next steps of validation of MiDAS_LU 2020.

Graph 8 **: GPG at the Mean, P25, P50 (Median) and P75**



Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

4. Variant scenarios : towards narrowed gender differences

In the previous Section, we examined the evolution of the GPG in Luxembourg as stemming from our simulations through MiDAS_LU in a context largely designed based on AWG projections and hypotheses. In this Section, we depart from this BASE scenario and introduce briefly new hypotheses about future developments. More details about developments and interpretations can be found, for example for Belgium, in the report by the Federal Planning Bureau's team (and model) in MIGAPE. The variant scenarios are therefore given here as a complementary illustration of what might be the evolution of the GPG "if".

4.1. The Alternative Configurations Envisaged

The "constant scenario" (also referred to as CO) keeps labour market participation, unemployment rates as well as other characteristics of the employed and of the not working or inactive population at their 2021 levels. The constant scenario serves to put the BASE scenario, based on the AWG projections into relief : what would the evolution of the GPG look like if labour market behaviour of women and men would remain unchanged from 2021 on, instead of converging in some respects ?

Alternatively, the "equalised scenarios" set key socio-economic values in projection equal for women and men, since 2021 on unless (sooner if) otherwise mentioned here below. The equality scenario reveals how quickly the GPG would decline if several labour market differences between women and men would disappear overnight. Those scenarios are cumulative. A first one (EQ1) is equalizing women and men at the extensive margin, that is the activity, unemployment and then employment rates (including share of civil servants, other wage earners, hence self-employed), but here since 2017 already. The second (EQ2) is enlarging the cope of equalization at the intensive margin, that is the share of part-time workers and hours worked (per year). The last one (EQ3) is equalizing, on top, the wage/hour. All those equalizing actions are done by sub-groups identical to those mentioned in the BASE scenario, out of wage/hour that are determined based on class of age AWG ([15-24], [25-54], [55-74]) and distinguished between self-employed and wage earners.

The *Table 4* is summarizing main hypotheses set up in those scenarios. This can be related to the *Table 2* for the BASE scenario.

We emphasize that these scenarios have an analytical purpose : they do not represent policy options and do not necessarily correspond to plausible socio-economic developments (out of maybe CO). As evoked earlier, in the microsimulation model MiDAS_LU as in the real world, the prospective development of the GPG is a function of 1) the gender differential in currently observed pension benefits; 2) the gender differentials in previous labour market behaviour of currently active people, and 3) the gender differentials in prospective labour market environment of currently active people, as well as of future (new entrants) ones. The variant scenarios to be discussed in this *Section* affect the latter aspect, that is the prospective labour market sphere. The effects of the first two sets of variables take a long time to wear off, as current cohorts of pensioners and active people are replaced by new ones. Therefore, the variant scenarios tell us more about what would be the world going through if gender differences in forward-looking dimensions were not considered anymore, leaving sole uneven impact of backward-looking determinants that cannot be changed so easily anyway (see *Section 2* for more comments), provided that we would decide to (and could) do it immediately. They can also can help us understanding better the impact of a series of future factors on the rate of decline of the GPG indicator.

***Table 4* : MiDAS_LU 2020 – Long term Aggregates**

Hypotheses in Variant scenarios

<table>
<tr><th rowspan="2">Drivers</th><th colspan="4">Variant scenarios : Hypotheses about the Evolution on the longer run</th></tr>
<tr><th>Constant Scenario (CO)</th><th>Equalizing scenario 1 (EQ1)</th><th>Equalizing scenario 2 (EQ2)</th><th>Equalizing scenario 3 (EQ3)</th></tr>
<tr><td>Population</td><td colspan="4">Idem BASE scenario (see Table HHH)</td></tr>
<tr><td>Participation (Working)</td><td>Constant shares since 2021 on</td><td colspan="3">Equalized for Women and Men (*)</td></tr>
<tr><td>Status, out of retirement</td><td>Constant shares since 2021 on</td><td colspan="3">Proportions equalized for Women and Men</td></tr>
<tr><td>Part-time / Full-time Work</td><td>Constant shares (cf. BASE scenario)</td><td>cf. BASE scenario</td><td colspan="2">Equalized for Women and Men</td></tr>
<tr><td>Hours worked (per year)</td><td>cf. BASE scenario</td><td>cf. BASE scenario</td><td colspan="2">Equalized for Women and Men</td></tr>
<tr><td>Hourly Wage</td><td colspan="3">cf. BASE scenario</td><td>Equalized for Women and Men, by Class_Age_AWG and Self-employed/Wage earners</td></tr>
<tr><td>Retirement</td><td colspan="4">cf. BASE scenario</td></tr>
</table>

(*) If equalized, by / and based on same sub-groups as in BASE scenario (see *Table 2*), unless otherwise mentioned

It is underlined also that the equalizing scenarios are changing both men and women environments. For example, EQ1 is decreasing employment rates for men and vice versa for women, imposing to both groups the general gender average.

4.2. The GPG under Variants

The *Graph 9* is showing outcomes for GPG under the various scenarios. The main message of these scenarios is that the GPG, compared to the Reference scenario, changes rather slowly, because at any moment, those differences are governed by sole forward-looking drivers that leave their marks progressively only (see *Section 3* for more details).

More specifically, the impact of a CO scenario is revealed quite limited. It seems that AWG hypotheses, maintaining some gender differences (see the hypotheses behind the BASE scenario, *Table 2*), do not play so much on the GPG compared to a status quo situation. The *Graph 9* also shows that the scenarios equalizing men and women on the labour market at the extensive and intensive margins (mainly employment rates, share in part-time workers and hours worked per year), are progressively bringing mean pensions closer, hence a decrease in the GPG by 0.023 for EQ1 and an additional 0.033 for EQ2, to be compared to a level of 0.101 in the BASE scenario. Finally, an equality in hourly wages (the pay gap was 0.015 in 2020), is lowering the GPG by an additional 0.054, which is sufficient to generate an overall negative wage gap (-0.001 in 2050) !

All in all, the difference in GPG in 2050, between the BASE and EQ3 scenarios, is generated for about 1/4 through EQ1 (extensive margin), about 1/3 on top through EQ2 (intensive margin) and a little less than 1/2 through EQ3 (wage/hour), which leaves a negative GPG (favourable to women) in 2050.

Regarding EQ3, still, we go deeper in the study and replicate in *Table 5* the impact analysis done for the BASE scenario in *Table 3*. Note that outcomes for 2020 differ slightly from those in Table 2 because some parameters diverge already since 2017 in EQ3 (see introductory lines in the present *Section*). Do not forget either that so-called standard populations targeted by the GPG are not identical between CO and EQ3 scenarios.

We can see from Table 3 that the main remarkable changes compared to the BASE scenario are the factor $\frac{\%\text{surv}_{\text{pension}}}{\%\text{old}_{\text{age}_{\text{pension}}}} * \frac{\text{Mean(survivor pension)}}{\text{Mean(old age pension)}}$ for men, which is now 0.057 in 2050 (0.048 in BASE), yet still having a limited role on GPG, and mainly the ratio of old-age pensions between women and men, $R_{\text{old\_pension}}$, which is 0.83 (0.73 in BASE). All in all, this is sufficient to impact the GPG by -0.28 between 2020 and 2050, driving this indicator to negative values.

Table 5 **: The Change in GPG from 2020 to 2050 in EQ3 scenario**

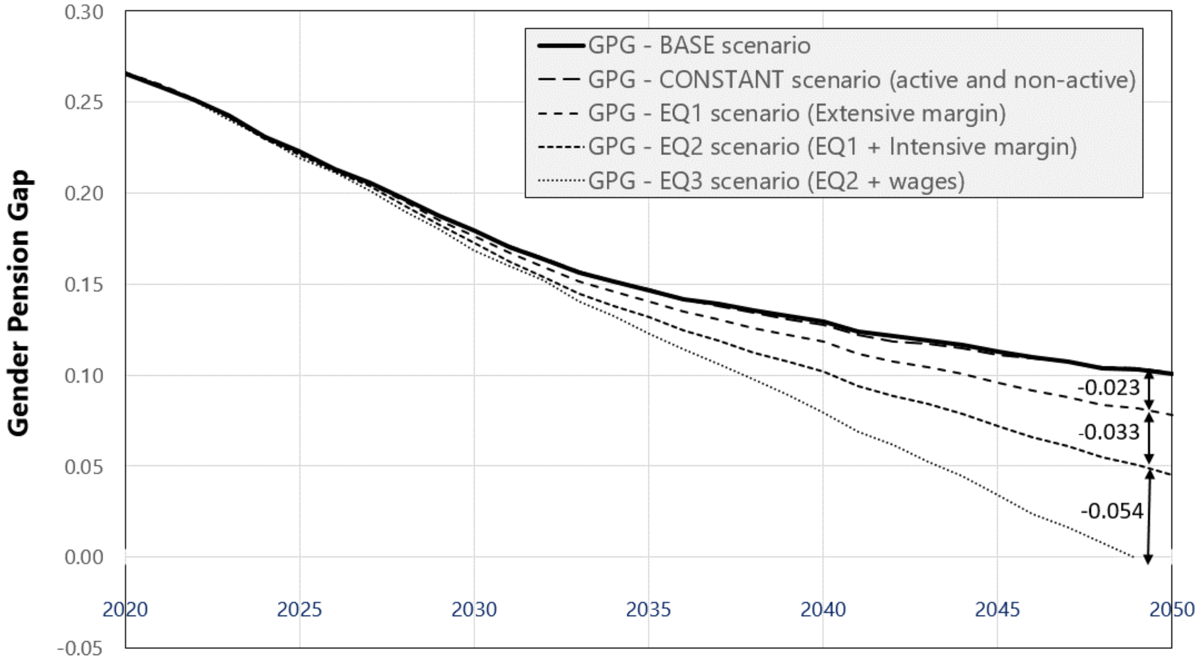
Impact analysis of factors involving old-age and survivor determinants

	FACTORS	Impact on GPG if an increase, out of R (*then via R alone [*]*)	EQ3 scenario 2020	EQ3 scenario 2050	**Absolute change in GPG** if one Factor goes from its 2020-value to the 2050 one (*and proxy of **1st derivative** = change in GPG / change in Factor Mean_Surv/Mean_Old_age*)
WOMEN					
%(survival_pension > 0, in "standard population" [**]) * Mean (survival_pension, if >0 in standard)	(1)	- (=)	0.749	0.816	
%(old_age_pension > 0, in standard population) * Mean (old_age_pension, if >0 in standard) [***]	(2)	+ (-) ⇒ ?	1.000	2.914	(6)
⇒ Mean(survival_pension) / Mean (old_age_pension), in standard population	SO_{2050}_W = (1)/(2)	-	0.749	0.280	**0.20**
			(7)	(8)	*(-.42)*
MEN					=(6)/[(8)-(7)]
%(survival_pension > 0, in standard population) * Mean (survival_pension, if >0 in standard)	(3)	+ (=)	0.030	0.200	
%(old_age_pension > 0, in standard population) * Mean (old_age_pension, if >0 in standard)	(4)	- (+) ⇒ ?	2.354	3.496	
⇒ Mean(survival_pension) / Mean (old_age_pension), in standard population	SO_{2050}_M = (3)/(4)	+	0.013	0.057	**0.03**
					(.69)
WOMEN versus MEN, old_age_pension					
$R_{old\_pension}$	(5)	- (+) ⇒ -	0.42	0.83	**-0.71**
					(-1.73)
Standard Gender Pension Gap (GPG)			**0.27**	**-0.01**	**-0.28**

[*] It a positive impact on $R_{old\_pension}$, this implies a negative impulse for GPG, hence "-" mentioned here if so
[**] Age > 64 and receiving any pension : old_age (including disability) or survival
[***] The computations on R and GPG are neutral to the monetary basis retained
⇒ this Factor (for women in 2020) chosen as the common reference base

Source : MiDAS_LU 2020, version 2400, 22 Mar 2021

***Graph 9* : The GPG under BASE and Variant Scenarios**



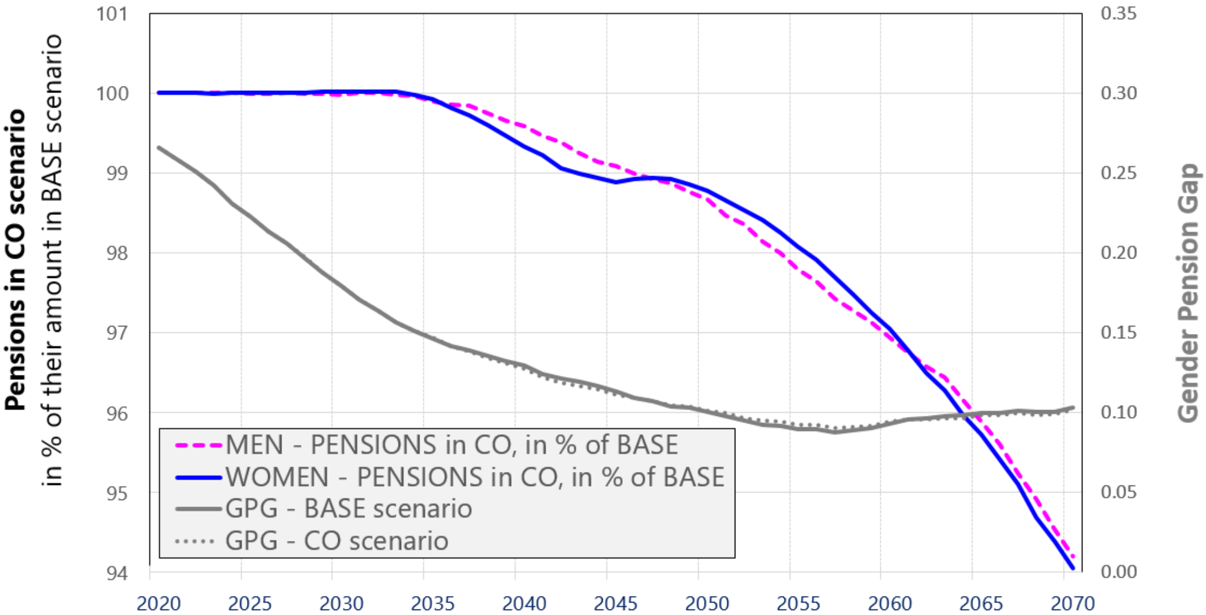
Source : MiDAS_LU 2020 - Versions 2000-2400 - 22 Mar 2021

4.3. Pensions under Variants

However, it is worth to underline that the *evolution* of the GPG is far from telling the whole story and may hide changes in each part of the ratio that are quite significant.

***Graph 10* : The GPG and Pensions in Constant Scenario in % of their level in BASE Scenario**

The pensions are on average per year for usual standard population (pension > 0 and age 65+)



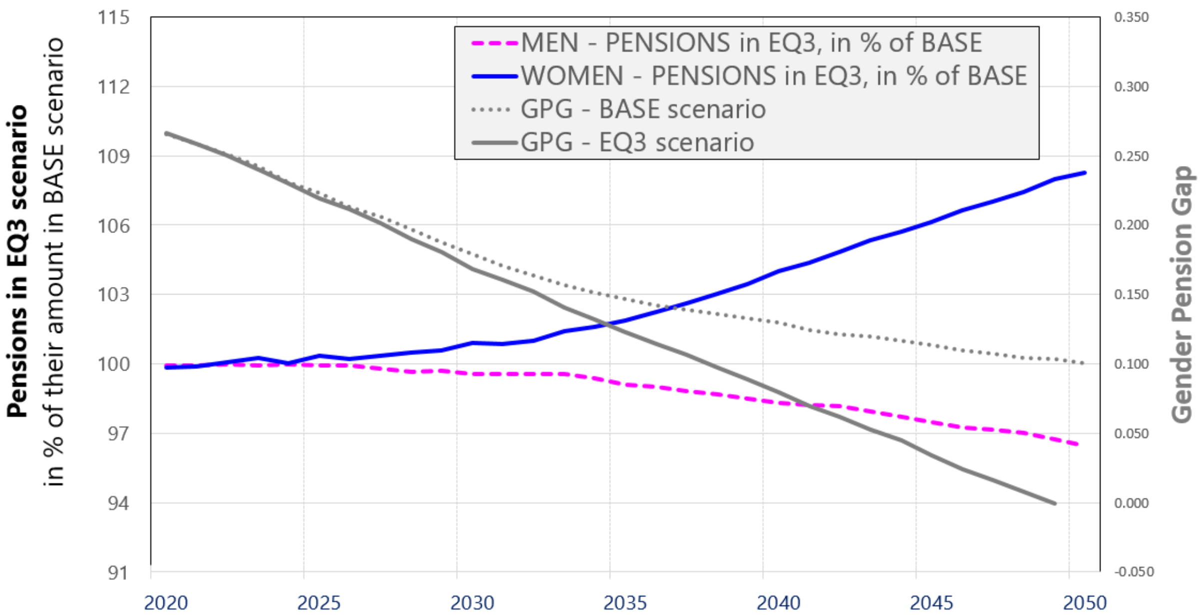
Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

For example, the *Graph 10* shows that despite the GPG in CO scenario remaining close to the BASE one throughout the longer period, pensions become indeed lower in CO scenario, mainly due to an employment rate stable in the CO scenario, whereas it was increasing for both women and men in the BASE scenario (see *Graph 2*). The wage profiles are depressed compared to the BASE scenario, but remain close each other (in proportion of what is observed in BASE scenario for each year), which explains the somewhat invariant GPG from BASE to CO scenarios. Note that we represent a longer period in *Graph 9* than usual in order to validate better our statement, given that little happens here before 2050 with pension relative levels.

Alternatively, the same representation for BASE versus the third equalizing scenario EQ3 shows in *Graph 11* pensions depressed in comparison to the BASE scenario for men, augmented for women. This naturally results from the equalization procedure which is sending all persons to the mean, hence "at the expense" of men and in favour of women.

Graph 11 **: The GPG and Pensions in EQ3 Scenario in % of their level in BASE Scenario**

The pensions are on average per year for usual standard population (pension > 0 and age 65+)



Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

5. Conclusions

In this report, part of the MIGAPE project, we analyse mainly the Gender Pension Gap (GPG) in Luxembourg for the times coming, more specifically the period 2020-2050. The GPG is one minus the ratio between the average pension of women and that of men. In its standard format, the GPG involves that part of the population aged 65 or more and receiving at least one positive amount among old-age (including disability) and survivor pensions.

The analysis is done based on a dynamic microsimulation model, MiDAS_LU 2020 for Luxembourg. MiDAS_LU is an update of a former one set up in 2015 and part of the MIGAPE project was devoted to the upgrade of this old version. We are at date undertaking the validation of the model, a process which is known to be long and will be prolonged ahead the MIGAPE project, on top of continuously implying additional changes while proceeding. As usual, a modelling exercise is embedding a series of hypotheses and sometimes *ad hoc* choices that classically aim at simplifying a complex reality, hopefully while taking sufficiently into account the essential dimensions. Both the novelty of MiDAS_LU 2020 and those modelling constraints should keep us aware still that the outcomes generated should be checked and explained further and represent only a description of a possible future consistent with the ingredients entered, including hypotheses and relations embedded.

In particular, our long run simulation rests here on hypotheses about future conditions at the demographic level, on the labor market and in terms of policy rules. Regarding the first two items, we stick basically to the Working Group on Ageing Populations and Sustainability (AWG) 2018 projections, involving to some extent the EUROSTAT population projections. Those projections are completed by experts in Luxembourg (IGSS) and we follow those indications as well, under our sole responsibility. An upgrade to the recent AWG 2021 projections (European Commission, 2020) is to come later.

The AWG projections imply, among other aspects, an increase in employment rates both for women and men, maintaining a gap at that level over the long run (9% of difference in 2020, 7% in 2050). They also take into account the increase in survival probabilities and some difference with that respect based on gender. Those two aspects are of main importance as soon as gender gaps are at stake, given that they keep "active" differences from the beginning, at least in our so-called BASE scenario. At the intensive margin, we also consider differences observed nowadays (for example, hours worked per year, on average, and share of part-time workers) as largely maintained in the long run. The same prevails for wages per hour that are set evolving on average as the productivity of labour provided by the AWG projections and that are identical for men and women, what limits the possibilities of convergence through simulations.

However, those hypotheses, past careers and present pensions result, through simulation of the BASE scenario just evoked, in a standard GPG which is decreasing with time, from 0.27 in 2020 to 0.10 in 2050. This qualitative result is observed in other countries participating in MIGAPE project as well. The curve shows a lower slope for younger generations (aged between 65 and 74).

Obviously, the picture shown through the standard GPG is not telling the whole story. We might need measures of the extent to which beneficiaries (and especially women) have their own independent access to pension system benefits. This is done while including zero pensions in the GPG : the population covered is now all residents aged 65 or more, whatever benefitting from a pension or not. The standard

GPG (excluding the residents with 0-values for total pension benefits) and this new indicator including zero-values are related each other by the Gender Coverage Gap (GCG), which is one minus the ratio between the percentage of women receiving a positive amount and the same index for men. Thanks to higher employment rates (mainly) and their implications on future pensions, the (positive) GCG is decreasing, from 0.20 in 2020 to 0.11 in 2050. This makes the GPG including zeros, greater than its counter-part without zeros, becoming closer the latter through time : going from 0.41 in 2020 to 0.20 in 2050, whereas the GPG excluding 0s is passing from 0.27 to 0.10, the initial difference of 0.14 in 2020 becomes 0.10 in 2050.

If considering survivors' benefits as derived rights not in relation with the survivors' own working life, we might want to disentangle those benefits from "direct" ones (old-age or disability). This is also done in the present report. Survivor pensions benefitting more often (women live longer) and at a higher level (resulting from partner's pension or rights, which are higher if coming from men) to women, excluding them from the indicator obviously penalizes women, which drives the GPG from 0.41 in 2020 down to 0.22 in 2050 (again 0.27 and 0.10 respectively).

Thanks to those developments, we show that the main factor pushing the standard GPG downwards through time is the ratio between women and men of the old-age pension served on average, when targeting the whole standard covered population. This ratio is passing from 0.43 in 2020 to 0.73 in 2050, to the benefit of women, however not sufficient to balance the figures and drive the GPG to 0.

Moreover, the GPG measured at the mean of pension benefits distribution provides a rather targeted view of pension differences between men and women, which does not necessarily provide a fully adequate perception of the pension gender differences. Il might happen that women deviates differently from men all along the income curve, compared to the what is observed around the means. Therefore, we analyze also in the present report indicators when comparing other statistics than the mean, namely here the percentiles 25 (P25), 50 (median) and 75 of the pension income distributions. It is shown that the GPG curves when considering P25 and P50 are higher than the "mean" curve, showing more inequalities between men and women on this side of the pension income curves. On the contrary, the GPG based on P75 is revealed quite similar to the "mean" one.

Finally, we examine several variant scenarios compared to the BASE one. One of them (CO) keeps labour market participation, unemployment rates as well as other characteristics of the employed and of the not working or inactive population at their 2021 levels. The others (EQ1 to EQ3, cumulative) set key socio-economic values in projection equal for women and men, since a given year and by steps regarding the parameters considered : at the extensive margin, at the intensive margin and at the level of wage/hour worked.

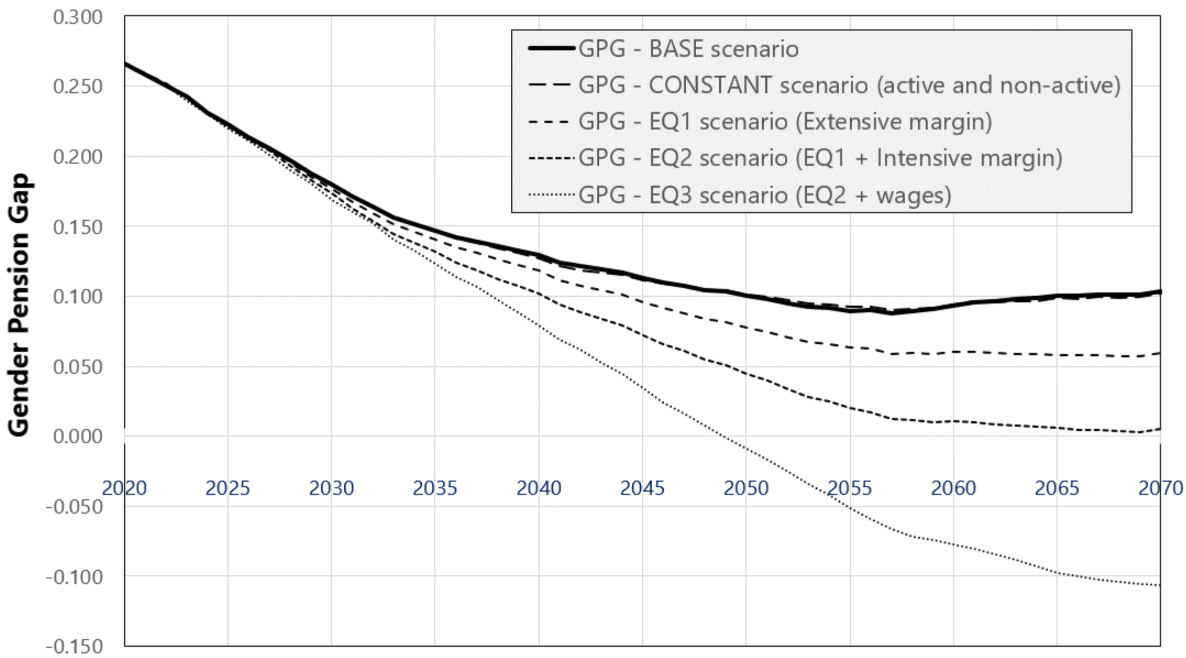
The CO scenario does not change so much to the GPG in the BASE scenario. Nevertheless, it is shown that the underlying implications are not minor. This invariant environment, less favourable to women than the BASE scenario, lead to lower pensions for women and higher for men, compared to the BASE scenario, keeping the GPG broadly unchanged when comparing both scenarios.

On the contrary, the EQ1-3 scenarios, more favourable to women, imply a diminution of the GPG, compared to the BASE scenario, even down to a negative value (-0.001) for the indicator in 2050 if the ultimate EQ3. The difference in GPG in 2050, between the BASE and EQ3 scenarios, is generated for about 1/4 through EQ1 (extensive margin), about 1/3 on top through EQ2 (intensive margin) and a little less than 1/2 through EQ3 (wage/hour). This change, still and logically, is generated at the expense of men, in terms of pensions served on average compared to the BASE scenario, and benefit to women.

Most outcomes discussed in the present report are concentrating on the period 2020-2050. Indeed and given the nature of the modelling exercise, and many possible sensitivity analyses not done here yet, we preferred to limit our horizon of analysis. However, we may want to know more about the years after. In order to address this question, we just show in *Graph 12* results for the longer period, considering all scenarios envisaged in the present report. We will not discuss the curves but would like to underline here a kind of stabilization over the long run… given the hypotheses and MiDAS_LU components !

Graph 12 **: The Gender Pension Gap up to 2070**

Standard approach : all pensions considered (old-age, Invalidity and Survivor) – All scenarios

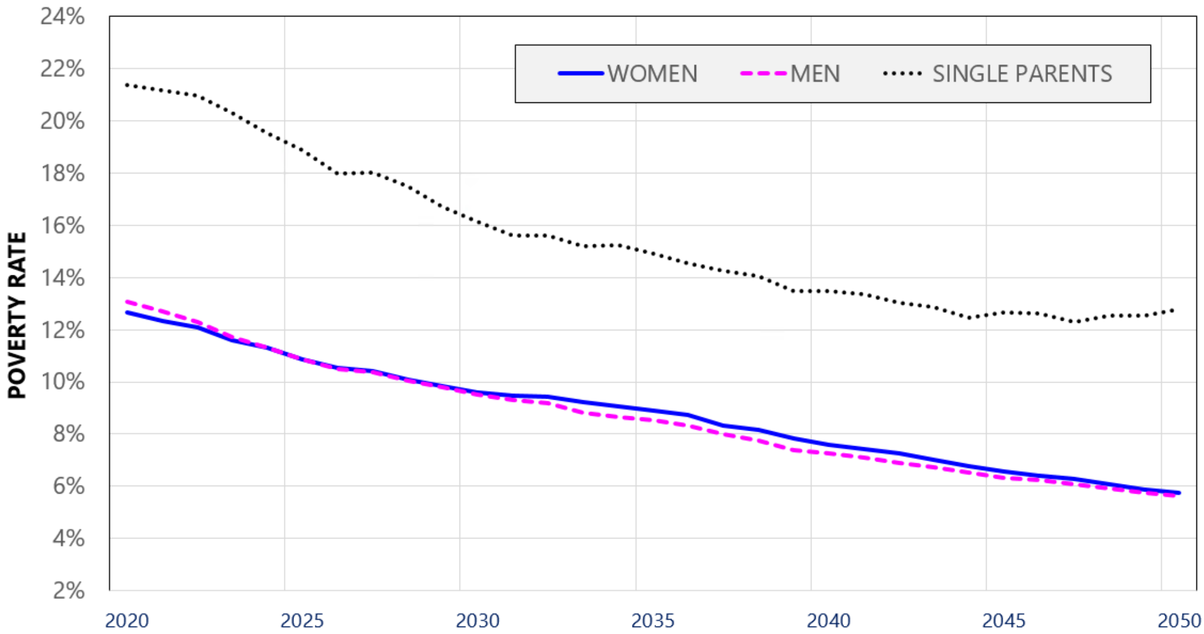


Source : MiDAS_LU 2020 - Versions 2000-2400 - 22 Mar 2021

But a model like MiDAS_LU is providing much more information than the one we emphasized here in conformity with MIGAPE expectations. Starting from the full representation of the Luxembourg population, involving all residents, at the demographic and working levels and on the long run, and adding up policy rules, we can, on the one hand, go deeply into details and try to understand better drivers an relations that may have generated a specific outcome. The task is not often easy and might even be impossible for certain considerations, but the information created thanks to the simulation (a picture of the residents population, year after year) gives a starter for that. On the other hand, we can generate all kinds of indicators, specifically inequality indicators, of interest for assessing for example the implications of the demographic ageing, migrations or policy changes.

The *Graph 13* gives an overview of the latter possibilities. We represent the poverty rates as derived from MiDAS_LU for the long run. The standard poverty rate is telling which percentage of the population benefits from an equivalent income lower than 60% of the median of incomes[11]. Poverty rates appear to be close for men and women. However and obviously, while going deeper in the population and details, it appears the specific sub-groups are facing a less favorable situation than others, like here-represented the single-parent households (a vast majority of which[12] being headed by a mother) with a poverty rate about twice that of the population one. However, we can observe a continuous tendency to a lowering of those poverty rates, probably (we have still to explore this assumption, which will drive us ahead MIGAPE) partly explained by the increase in employment rates that is serving a higher share of the population with more primary income close to the median.

Graph 13 **: Something about the Adequacy of Pensions – Poverty Rates**



Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

The *Graph 14* is telling something different from poverty rates. We are now concentrating on the whole distribution of incomes for deriving the classical GINI coefficient. This is an inequality index, with a value between 0 and 1, increasing if inequalities in equivalent income become greater ("0" would indicate a perfect equality, the same income for all). Again, the tendency for inequalities seem to be a progressive reduction, with the Gini going from 0.33 in 2020 to 0.29 in 2050. Another view on general inequalities is given by the inter-quintile ratio S80/S20 that is focusing on the first and last quintiles of the same distribution of equivalent income. Here-again, a progressive reduction if observed.

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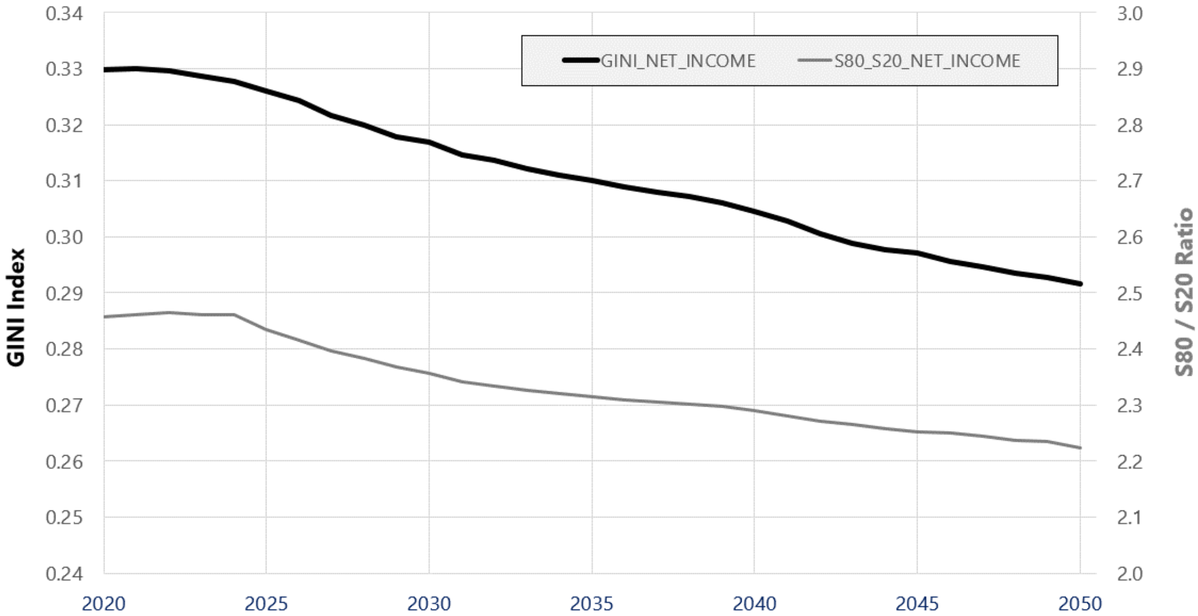
11 The equivalent income is built from "real" household net total income while taking into account economies of scale and then attributing to each household member a weight corresponding to its composition (following the OECD modified scale, "1" is the weight given to 1st adult in the household, "0.5" is attributed to each supplementary adult and "0.3" to each child). Finally, the same equivalent income, as fixed at the household level, is attributed to each member of the household.

12 91% in 2020 (MiDAS_LU 2020, 22 Mar 2021, simulation outcomes).

Graph 14 **: Something about the Adequacy of Pensions - Inequality Indices**



Source : MiDAS_LU 2020 - Version 2000 - 22 Mar 2021

We will conclude by a general statement. We are perfectly aware that the GPG is certainly a part only of the whole picture regarding gender inequalities, what was illustrated sometimes in this report. Our developments aim uniquely at providing some additional information, in particular about future possible evolutions. We wanted also to show that tools are now available, that can help in enriching the debate and thinking about the "why", ahead the "what", moreover in quantitative terms, completing a necessary qualitative approach, and considering sub-groups or distributions, on top of averages. The reduction of the GPG over the long run, if happening, is certainly also the result of long-lasting multi-dimensional efforts to reduce inequalities between women and men. But obviously, those achievements and expected evolutions are neither for sure nor for ever, if even considered as sufficient. Our developments will help, hopefully, in feeding the debate and reinforcing promising evolutions.

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