

How to finance Belgian pensions in the future ?

The effects of progressive indexation on sustainability
and equality of the public pension system

Author: De Rudder Sander

Thesis Director: Hindriks Jean

Thesis Joint Director and Reader: Bosmans Kristof

Academic Year 2023-2024

In order to obtain the Double Degree

Master 120 en Sciences économiques, Orientation générale, Finalité
spécialisée (UCL/UNamur)

and

Master of Science in Economic Studies (Maastricht University)

Acknowledgments

Before starting this paper, I would like to express my gratitude to my thesis director, Jean Hindriks, former head of the Economic School of Louvain. His regular expertise and guidance on the subject have been the foundations of this work. I would also like to extend my appreciation to my Thesis Joint Director and Reader, Kristof Bosmans, associate professor at Maastricht University for his feedback and trust on the project.

Additionally, I want to show my gratefulness to the persons who coordinated the Double Degree Program between UCLouvain and Maastricht University. Thomas Meissner and Steffen Künn on the Dutch side and on the Belgian side, Catherine Maréchal and Vincent Vandenberghe. The combination of the two different learning approaches is a major asset of my educational background.

Furthermore, I extend my thanks to fellow master economics students who shared their feedback and insights from their own projects. Their input and discussions were very helpful.

Abstract

Ageing of the Belgian population exerts increasing pressure on the sustainability of the public pension system. In the context of the European Recovery and Resilience plan, Belgium must propose satisfactory reforms that answer the concerns of the European Commission about the sustainability of the Belgian public pension system. This paper explores empirically how implementing progressivity in pension indexation could help to improve the sustainability of the public pension system while decreasing inequalities. Overlapping generations simulations are developed to assess pension expenditures by 2050 and how progressive indexation can be used to control them. The results displayed by the projections suggest that indexation should be reduced to the minimum pension in order to reach the expense reduction target. Furthermore, the progressivity of indexation has promising implications for inequality reductions by limiting the increases in pension gaps. Finally, an ambitious policy of indexation that reconciles the concerns about the impact of indexation is proposed. Indexation of the minimum pension with respect to the wage index rather than to the price index provides for expenditure reductions at the same time it guarantees poverty alleviation.

Keywords : Population ageing, Pension expenditures, Inequality, Poverty alleviation

JEL-codes : H55, J32

Table of content

1	Introduction	1
2	Literature review.....	4
	2.1 Pension benefits indexation	5
	2.2 Different types of indices	5
	2.3 Flaws of consumer price index (CPI)	9
	2.4 Progressive indexation	10
3	Empirical method and data.....	13
	3.1 Model of the Belgian public pension scheme	13
	3.2 Empirical strategy	14
4	Predictions of the model	20
	4.1 Baseline scenario.....	20
	4.2 Progressive indexation	24
5	Conclusion and discussion.....	32
	Appendix	36
	Bibliography	38
	Official statement of original thesis	43
	Sustainable Development Goals (SDG) Statement	44

List of figures and tables

Table 1. Gross annual wage distribution per decile 2017-2021 (mean value per decile)	15
Table 2. Average wage growth and health index (2000-2021).....	17
Figure 1. Evolution of the dependency rate	20
Figure 2. Economic balance of pension scheme (wage growth = health index 0,0298).....	21
Figure 3. Evolution of Expenses/GDP ratio for different inflation scenarios (Wage growth=Health index)	22
Figure 4. Pension gaps increased by indexation (Health index = 0.0298).....	23
Table 3. Average growth rates per deciles (Health index = 0.0298)	23
Figure 5. Evolution of the rate of wage growth (Health index = 0.0298).....	24
Figure 6. Pension gaps: progressive indexation compared to baseline (Threshold sixth decile – Health index = 0.0298).....	25
Table 4. Recap of the results for the different scenarios (Wage growth = Health index)	26
Table 5. Benefit ratio and replacement rate for 2024 and 2050 cohorts (Baseline scenario – Wage growth = Health index = 0.0298)	27
Table 6. Benefit ratio and replacement rate for 2024 - 2050 cohorts (Indexation minimum pension – Wage growth = Health index = 0.0223)	27
Figure 7. Ratio expenditures/GDP for the different indexation techniques relative to the objective line (Health index = 0.0298)	28
Figure 8. Evolution of the balance of expenditures and contributions for different indexation techniques (Health index = 0.0298)	29
Figure 9. Pension benefits of the 2024 cohorts, for different indexation techniques (Health index = 0.0298)	30
Figure 10. Pension benefits of the 2050 cohorts, for different indexation techniques (Health index = 0.0298)	30
Table 7. Benefit ratio and replacement rate for 2024 and 2050 cohorts (Baseline scenario - Health index = 0.0298)	31
Table 8. Benefit ratio and replacement rate for 2024 and 2050 cohorts (Indexation of minimum pension to wage index - Health index = 0.0298)	31
Table 9. Recap of the results for the different scenarios (Wage growth $\neq$ Health index)	32
Figure 11. Evolution of the wage growth rate and the health index	37

1 Introduction

In recent years, many European countries have reformed their pension systems following contemporaneous concerns about ageing population threatening the long-term viability of public pensions. This issue was highlighted in the European Semester of 2019 which called for several countries to enact reforms. It provided recommendations that can be summarized in four points: implement comprehensive pension reforms to ensure the sustainability of pension systems, ensure that pension provides an adequate standard of living while reducing pension gaps and inequality, improve transparency about pension systems, and promote private pension savings (European Commission, 2019). Some countries were able to build promising reforms like Italy that adopted the “Quota 100 pension” which makes the pension system more flexible to the needs of different types of work which allows to enhance the sustainability of the system (Jessoula & Raitano, 2019) or France who merged 42 different pension schemes to increase transparency, and ultimately postpone the retirement age (Nossiter, 2019). While others are still yet to put satisfactory solutions on paper. This is the case of Belgium, which is particularly affected by the greying of its population. The 2021 Ageing report (European Commission, 2021b) expects the old-age dependency ratio¹ to go from around 32% to 53.3% between 2019 and 2070 and expenditures devoted to earning-related pensions to go from 9.7% of GDP to 13.5% of it in the same period. More than three-quarters of the increase is to happen during the first half of the period, calling for quick adjustment. These expenditures put huge pressure on the sustainability of public finances, in their long-term sustainability analysis, EC concludes that to stabilize the debt ratio, prolonged consolidation efforts representing 6.6 percentage points of GDP are required, with 1.6 percentage points coming from public spending on pensions (European Commission, 2019).

Since 2019, many things happened and impacted our economies, most notably the COVID-19 sanitary crisis which impacted economies worldwide, causing huge decreases in GDP and tax revenues, with a decrease of 6.3% of GDP in Belgium (OECD, 2021 & NBB, 2021)). To answer to this crisis, the European Union developed the largest stimulus package ever, NextGenerationEU, which is aimed at helping European economies to repair the economic and social damage caused by the pandemic (European Commission, 2021a). A major part of this package is the Recovery and Resilience Facility, 723.8 billion € to provide grants and loans to support reforms and investments for the EU member states. To benefit from this support, countries must prepare a Recovery and Resilience plan in which “Member States should provide a detailed explanation of how the

¹ Old – age dependency ratio = $\frac{\text{Population 65+}}{\text{Population 15–65}}$

challenges identified in the country-specific recommendations, in particular the 2019 and 2020 Semester cycles, are addressed by the proposed measures...” (Council of European Union, 2021). Part of the first recommendation for Belgium is to “continue reforms to ensure the fiscal sustainability of the long-term care and pension systems” and has been assessed to have limited progress as “measures to contain pension expenditures have been adopted but, despite these measures, the projected increase in pension expenditure is one of the largest in the EU (European Commission, 2018)”. (European Parliament, 2021). In that way, European recommendations that were non-binding became binding conditions in the context of the Recovery and Resilience Plan. In 2022, Belgium committed to propose an ambitious pension reform to answer to these conditions which aimed at improving social and financial sustainability, incentivizing to remain active on the labor market after reaching early retirement conditions, and increasing solidarity (European Semester, 2022). One year later, the European Commission is yet to send the money for the resilience plan to Belgium majorly due to an unsatisfying pension reform plan regarding long-term sustainability. Even if the money is eventually sent, it is expected that a part of it would be cut back due to failure to meet pension commitments, this loss is expected to be of at least 200 million euros (Le Soir, 2024). This situation leads us to think that other ways to improve the sustainability of the pension system could be used.

In their analysis, the National Bank of Belgium states that Belgium is expected to have the highest level of pension expenditure of the reference countries², more than 3 percentage points above the average in the eurozone. These higher predictions for pension spending are not due to a higher old-age dependency but rather to a higher benefit ratio and a worse labor market. Firstly, the benefit ratio³ in Belgium is close to the average in the eurozone but while it is projected to decrease for all countries between 2019 and 2070 due to approved reforms, this is not the case for Belgium. Second, the Belgian’s employment rate is lower than average, with especially a low share of older workers, and is expected to remain below it (Deroose et al., 2023). Reading this, we could believe that an appropriate answer would be to postpone the retirement age or reduce the possibility of early retirement to reduce public expenditures and increase participation in the labor market. Nevertheless, not all workers have equal opportunities to extend their careers, it could be due to poor health or arduous work (Andersen et. al., 2021). Those are generally employees with lower education and lower income who are also most exposed to involuntary job loss and are less able to adjust their retirement age, increasing employment at older ages would increase income inequality

² Which are Belgium’s neighbors: France, Germany, and the Netherlands, and two other high-debt countries: Spain and Italy.

³ Benefit ratio = $\frac{\text{average pension}}{\text{average wage}}$

through reinforcing health disparities (Johnson, 2018 & Etgeton, 2018). Eventually, these income inequalities will extend into retirement as pension benefits are partially defined by income. In conclusion, this solution could reinforce existing inequalities and act as a tax for low-income population and a subsidy to high-income because many low-income individuals would want to retire at the earliest age possible (Ayuso et. al, 2016). Furthermore, this solution benefits from decreasing political support as the cohort of individuals who are close to retirement and are less favorable to these policies is increasing through population ageing (Bello and Galasso, 2021). Finally, retirement earnings tests can be a costly way to reduce inequality because they discourage work at older ages (Andersen et al., 2021). But this article will not delve into this tradeoff between efficiency and equity as our sole focus is to decrease inequality and improve public pension system sustainability.

Indexation of public pension goals are to prevent losses in purchasing power, which is usually achieved through price or wage indexing, and allow pensioners to participate in rising living standard of the active population, which is normally achieved through wage indexing. These two mechanisms serve to maintain income security in old age and reduce poverty risks among the very old. Insufficient indexation leads to pension erosion, loss of purchasing power, and could lead pensioners with low initial pension benefits to poverty. While over-indexation could threaten public finances (Bańkowski et al., 2023) and could even lead to transfers from the poor to the rich, as the riches benefit from higher life expectancy (Creedy et al., 1993, Andersen and Jørgensen, 2024).

One can say that Belgium has a generous indexation rule, indexation is based on a 2% fixed threshold, meaning that every time the price index increases by 2%, pensions are instantly increased by 2% while the quasi totality of OECD countries apply fixed-frequency indexation, indexing once a year. This low fixed threshold led to 6 indexation episodes between September 2021 and May 2023, so an increase of 12.6% of pension benefits in nominal terms. This is associated with an increase in real terms of pension benefits, generating a deficit in pension finances (OECD, 2023). Furthermore, one could be afraid that price indexation overcompensated pensioners during this recent inflation surge. Pensioners may have been compensated twice for high energy prices, once via energy premium and a second time via price indexation. Also, price inflation may have been overestimated in countries like Belgium where many households have fixed price or regulated energy contracts. In its computation, the consumer price index accounts for how much an average household will pay for energy if they sign a new contract today. So, a temporary jump in energy prices is fully reflected in the index while it does not affect households with a fixed-price contract. In Belgium, the CPI indicates that energy was 81% more expensive in 2022 than in 2019, whereas

the average energy bill was estimated to be only 17% higher. Leading to an overestimation of CPI related to energy prices for an average household of 3.3% in 2022 (Peersman et al., 2023). Therefore, this combination of frequent adjustments and over-estimation of CPI ultimately contributes to the unsustainability of the pension system. Consequently, limiting indexation above certain thresholds reduces the weight of higher pensions in the cost of indexation while protecting lower-income pensioners.

In Europe, Austria, Italy, Greece, and Portugal already apply a lower indexation rate to pensions above a certain threshold to answer to the greying of population and inflation⁴ (OECD, 2022). Unfortunately, the impact of these policies is difficult to evaluate from a description of their rules and empirical work on them is scarce, they will be discussed in the next section. Nevertheless, we can argue that this type of reform could be effective in Belgium due to its socio-economic composition: high old-age ratio which is projected to increase, and a high benefit ratio.

The following article is aimed at testing empirically how different thresholds and reductions in indexation could reduce pension expenditures and pension gaps over time. The predictions provided by the simulations are that progressive indexation yields significant decreases in pension expenditures. Nevertheless, to reach sufficient levels, the threshold above which pensions are not subject to indexation must be very low or the reform should be accompanied by other policies. On the other hand, from an egalitarian perspective, progressive indexation gives encouraging results in terms of pension inequalities reduction and could even be used to provide for poverty alleviation.

The next section is a literature review presenting knowledge produced around this subject and identifying the gap in which this article will place itself. Section three will present the data and the empirical model used. In the fourth section, the predictions of our simulations are displayed. Finally, section five is a conclusion and discussion about the results and their policy implications.

2 Literature review

The scientific literature on the various indexing techniques is rather sparse. This is due to the fact that indexation rules have been often overlooked in the past, the interest of governments in this matter is quite recent (Brimblecombe, 2013). Nevertheless, today, most of the European countries have some form of pension indexation mechanism that depends on the structure and the design of their national pension system. Before delving into the specificities of different pension indexation

⁴ Descriptions of the indexation rules are in the appendix.

mechanisms we start by asking ourselves why pensions should be indexed and to which indices indexation should be linked.

2.1 Pension benefits indexation

Most researchers agree that indexing pensions is key because it prevents erosion of the real pension benefits. Otherwise, pensioners would face reductions of their pension values for which they could not compensate as it is too late for them to change work and savings decisions they made earlier (Whitehouse, 2009). This would have many negative outcomes such as lower economic growth due to lower purchasing power and higher inequality (Panizza, 2002). Indexation turns aside these issues while also preventing poverty and providing income and political stability. According to Weaver (1988), indexation rules transfer the determination of benefit levels of retirement from the political arena to the realm of the law. Adjustment of pension payments becomes a neutral element of the pension system and avoids recurrent debate. Nonetheless, it seems to be a consensus that pension payments should be indexed to insure pensions against inflation, counterarguments exist, automatic indexation could, for example, create a class of people that has nothing to gain from anti-inflation policies and would not support them (Wilson and Wilson, 1982). Also, automatic indexation limits flexibility in budgetary policy, in some cases, governments face budgetary constraints that make it challenging to afford regular increases in pension payments.

2.2 Different types of indices

These challenges depend on how pensions are indexed, and on the index used. There are two common ways to index pension benefits: wage indexation and price indexation. Wage indexation is on average more generous than price indexation as wages increase faster than prices due to economic growth (Disney and Johnson, 2001). Whitehouse (2009), compiled data from different OECD countries and compared price indexation to wage indexation from a microeconomic perspective and came to a basic trade-off between a lower starting benefit with real increases over time (wage indexation) or a higher initial pension without real increase (price indexation). He then uses four arguments in favor of price indexation. First, the marginal utility of income decreases with age, people are less capable of enjoying leisure activities and holidays when they age. Second is the rate of growth of earnings, if real wages are growing rapidly, pensioners may lose in terms of standards of living. In that case, an increase in real wage may be needed in the short-term but it is important that this policy does not become embedded in the pension system in the long run. Anyway, we observe low real-earnings growth in OECD countries nowadays. Third, indexation has

distributional consequences, it is well-documented that lower incomes are linked to lower life expectancy (Brown, 2000). A more generous indexation procedure would then redistribute from poor to rich. Last, wage indexation offers less flexibility for retirees to choose their own preferred consumption path. By offering higher starting pension benefits, price indexation gives the choice to individuals to save early in retirement in order to increase their consumption later, which is not the case with wage indexation. Pigott and Sane (2009) answered to the same question and concluded, by making simulations, that price indexation puts less pressure on governmental expenditures. Looking at this evidence, we can ask ourselves why we still observe countries using wage indexation rather than price indexation. Switching from wage to price indexation would have important consequences on labor incentives of the active workforce as developed by Jaag et al. (2007) in their simulations of different ambitious pension reforms for Austria, one of them being to switch from the actual wage indexation to price indexation. They found two direct effects of the switch. First, it would reduce the shadow price of pension entitlements, which can be defined as its opportunity cost. The fact that, with price indexation, the wage increases faster than the pension benefits a worker gets when he reaches pension age, associated with discounting, creates a disincentive to work longer and push for earlier retirement. The second effect is that the switch reduces the deficit in public expenditures and allows for a wage tax cut that will incentivize work. Their empirical analysis suggests that the first effect dominates, reducing participation rates for individuals between 60 and 70. On the other hand, as an indirect effect, the abolition of wage indexation stimulates effective labor demand for prime-age workers. Also, the decline in pension income relative to wage income is anticipated and leads to increases in private savings to ensure old-age living standards. Based on their modeling, these excess savings will lead to increased capital export and will reduce the net foreign debt of Austria by almost 4 percentage points. On the same matter, Sydney and Whitehouse (2009) went over the difference in potential impacts of price indexation compared to wage indexation in the United Kingdom which has a different setup. The British National Insurance System is based on two thresholds, the Lower Earning Limit and the Upper Earning Limit. The lower level at which contributions are paid on earning and the higher limit beyond which employee no longer pays contributions. Any income between these two limitations gives entitlements to earnings-related pension scheme and the minimum pension provided to everybody corresponds to the Lower Earning Limit. The authors use the thresholds to gauge the effects of price indexation and wage indexation. When earnings rise faster than prices, price indexation leads to a decrease in the real value of the limits, high-income workers contributing by a smaller proportion of their salary, favoring the richest and exacerbating existing income inequalities. Suggesting that the verges should be indexed regarding wages rather than

prices. Examining these thresholds is relevant as most countries have a ceiling beyond which high-income are not required to contribute on their entire earnings. Canada used price indexation for their ceiling in the past, leading to erosion of its value. In 2006, before switching to wage indexation, the ceiling was worth 96% of the average earnings (OECD, 2007).

Pension benefits are not the only characteristics of the pension scheme that can be indexed, as we have seen above, indexation also applies to the different thresholds specific to each country and can be applied to minimum wage (Tracy, 1976). To answer to longevity increases, some European countries now index the legal retirement age with respect to life expectancy. This type of reform minimizes the demographic and economic shocks on the financing of pension schemes whilst introducing a rationality justifying changes and avoiding regular political negotiations. Ayuso et al. (2021) developed empirical predictions for four member states that apply this indexation and anticipate flaws. For the Netherlands and Denmark, the policy goal being to achieve sustainability, each additional expected years of life will be devoted to work rather than to retirement, the period in retirement stays constant. Empirical analysis suggests that since the indexation mechanism uses period life expectancy rather than cohort life expectancy⁵, there is a significant deviation between the forecasted benefit duration and the target period in retirement. This generates an expected gap in 2050 of 1.40 and 1 years for the Netherlands and Denmark respectively. Translating into an explicit tax from current to future generations of 7% and 8.6% of pension wealth in an intergenerational actuarial fairness setting. In contrast, Portugal and Slovakia⁶ split the additional expected years of life between work and retirement, which is challenging for sustainability. By 2050, in Portugal, it will cost two more years per retiree if they are all to enjoy their extra years with leisure rather than work. Associated with forecasted pension benefits duration of 19.39 years for men and 23.91 years for women, in comparison to the Dutch benefit duration target of 14.5.

Besides linking retirement age with life expectancy, two other measures are commonly used to cope with changes in demographics: sustainability factor and automatic balancing mechanisms. The use of a sustainability factor was introduced for Spain in 2013, linking the starting pension benefits with remaining life expectancy at retirement age. Reducing the benefit level as life expectancy increases, neutralizing pressure from population ageing. Note that it provides for intergenerational fairness because although future retirees will enjoy lower starting pensions, they will receive their pensions for a longer period. This measure combined with the use of a reevaluation index adjusted to

⁵ Period life expectancy depicts expectation of remaining years of life at a given time, cohort life expectancy refers to a group of people and tracks them over time. Contrary to cohort life expectancy, when estimating the remaining years of life at 60, period life expectancy does not appropriately take into account the potential incoming increase in life expectancy (See Dattani, 2023).

⁶ In 2019, Slovakia voted a policy reversal and went for a fixed retirement age of 64.

variables such as revenue, expenditure, and number of pensions (PRI) rather than price inflation, is forecasted to lead to savings of 3.4 percentage points of GDP in pension expenditure in 2050 compared to a no-reform scenario (Ramos, 2014). On the other side of the coin, this measure is associated with major reductions in the real value of pensions, casting concerns regarding pension adequacy (Díaz-Saveedra, 2018).

Automatic balancing mechanisms are defined as: “a set of predetermined measures established by law to be applied immediately as required according to the solvency or sustainability indicator. Its purpose, through successive application, is to re-establish the financial equilibrium of PAYG pension systems with the aim of making those systems viable without the repeated intervention of the legislators” (Vidal-Meliá, 2009). This measure is used and yields quite good results from a solvency perspective, in Sweden in the context of a Pay-as-you-go defined contribution system. The automatic adjustment mechanism depends on a balance ratio⁷. When this ratio is above or equal to 1, pension benefits are indexed to wages. When the ratio is below 1, the automatic adjustment mechanism is activated, and pensions are indexed to the balance index which is the wage index multiplied by the balance ratio. The benefits are then adjusted to this balance index until they reach the level they would have been if they were to be indexed to wages during the adjustment period (Settergren, 2001). Notwithstanding, it is important to keep in mind that these reforms which perform well from a sustainability point of view, often generate concerns about the adequacy of pension systems. Digging further than the replacement rates, which is an insufficient measure of poverty alleviation⁸. Grech (2015) uses pension wealth to quantify the impact of reforms⁹. Using this measure of pension system adequacy, estimates suggest that the reforms have reduced the poverty alleviation function of state pension systems. We can also note that the impact of these changes is not gender neutral as women tend to live longer than men.

In a move towards less generous indexation, some countries went from indexation based on earnings to a mix of indices. In Greece, for example, annual indexation is now based 50% on the variation of GDP and 50% variation of CPI of the preceding year, but the variation in CPI may not be exceeded (Greece’s Annual Report on the Application of the European Code of Social Security, 2020).

⁷ *Balance ratio* = $\frac{\text{contribution assets} + \text{buffer fund}}{\text{pension liability}}$

⁸ From Grech (2015): “For instance, Italian women are supposed to have a net replacement rate which is 1.5 times that of German women, and yet the poverty rate among Italian women is 20% higher”.

⁹ Pension wealth is a “measure of the lifetime value of state pension benefits, computed as the discounted stream of future pension payments during retirement, weighted by the probability that the individual is still alive at a particular age”.

2.3 Flaws of consumer price index (CPI)

First, it is necessary to mention that Consumer Price Index, the base for almost every country using price indexation has some flaws that we should take into account. There exists suspicion that CPI has a tendency to overstate the increases in the cost of living. As seen, in the introduction with the price of electricity in Belgium, the simplicity of the CPI is also a weakness. In 1998, Deaton called for carefulness when using it to measure the cost of life as it is unable to correctly measure quality changes and does not correspond to well-defined cost-of-living indices. The Boskin Commission (2005) identified several biases of this estimate. Such as the substitution bias, the fixed basket of goods and services does not reflect consumers switching to cheaper goods when relative prices change. Combined with the other biases they detailed, an upward bias in the CPI of 1.1 percentage points per year was estimated. Also, an increase in the price of the fixed basket of goods does not impact everybody the same way, with bigger impacts on pensioners. In the UK, price inflation for pensioners in 2008 was 7.4% while it was 5.4% when accounting for the whole population. There are also intra-pensioners differences, inflation rate for the poorest was 9% compared to 6.1% for the richest pensioners (Leicester, O'Dea and Oldfield, 2008). Unfortunately, we have not yet found a satisfactory response to these concerns and CPI is used in most countries as it is easy to compute and yields overall satisfying results.

Reis (2005) proposed an answer to this long-criticized fixed basket approach of aggregating prices into a measure of the cost of living and the substitution bias associated with it. He developed a dynamic price index (DPI) that measures the cost of living for a consumer who lives for many periods and faces uncertainty. When comparing his index with the CPI in the US, although there is an overall correlation between the two indices, there are large differences over certain periods. For example, between 1994 and 2004, a retirement account grew by 24% according to CPI while DPI grew by 54%, a household with a retirement account indexed to DPI would have been substantially better off.

Despite these flaws, the Consumer Price Index offers overall a good picture of price variations of goods and services bought by a common household. Some countries use alternatives based on it, like Belgium which created a “smoothed health index” which is a CPI where tobacco, alcohol, and petrol products are excluded (Statbel, 2024a).

2.4 Progressive indexation

Difficulties finding suitable indexation mechanisms to answer to recent inflation surge call for new and alternative ways of indexing public pensions. Progressive indexation adds a new dimension to it by accounting for the individual level of pension benefits. It has the direct effect of reducing pension gaps and public expenditures at the same time.

Empirical research has been done about progressive indexation such as Bianchi et al. (2003) who reacted to the 1995 pension reform in Italy which incorporated the Amato and Dini laws¹⁰. Their main hypothesis tested was, in line with Pigott and Sane (2009), that indexation to wages rather than to prices of lower pensions can significantly reduce inequality and poverty by increasing the purchasing power of pensioners near the poverty threshold. After 20 Monte-Carlo replications, their results suggest that, in comparison with the new reform, indexation to wage of the lowest pension limits inequality increases and mitigates poverty. Moreover, this is associated with minor budgetary costs and negligible implications for the defined contribution system, reducing the need for vertical distribution taking place outside the defined contribution system. Additionally, when looking at gross cumulated wealth from wages and pensions, this measure provides more gain to women in relative terms. Putting more emphasis on the progressivity of these measures, Leombruni and Mosca (2014) provided backward simulations of work careers in Italy to assess among other things, the redistributive character of the system. The results provided by the modelling are the following, the intergenerational inequality caused by the transition from PAYG to Notional Defined Contribution regime could have been undone by a fine-tuning of the price-indexation scheme. Unfortunately, progressivity in indexation has been reduced over successive laws, leading the reforms to be regressive. The study also confirms the intuition that the higher the inflation, the higher the redistributive impact of progressive indexation. Which is a valuable insight in the contemporaneous context of high inflation. Eventually, Italian progressive indexation provided little inequality reduction as the threshold for having lower than price indexation is very high, pension earnings 135% superior to the average is needed to reach the threshold¹¹.

¹⁰ The first one increases the retirement age, lowers pension benefits, and modifies the indexation. The second one legislates the switch from an income-based system to a contribution-based system (including a transition phase to cope with the cost borne by the transitional generation having to finance both schemes (see Kotlikoff and Burns, 2005)) (IMF, 1997).

¹¹ For an individual with double average earnings, pension wealth is 1.5% (1%) lower for men (women) than with full price indexation (Whitehouse, 2009). For more information about pension wealth, see Queisser and Whitehouse (2006).

As mentioned above, Spain adopted a sustainability factor and a new index reducing the generosity of previous wage indexation. This combination of reforms upgraded massively the pension system sustainability. But concerns are that this reduction in real value of Spanish pensions could be so large¹² that it would not be politically sustainable in the future. On top of that, the reforms were not accompanied by safety nets or other retirement incomes to prevent the elders from falling into poverty. The minimum pension is evolving at the same rate as other pensions and is almost constant in real terms over time. To answer these worries, Díaz-Saveedra (2018) quantified the impacts of different reforms indexing Spanish pensions regarding to CPI. The analysis tends to favor a reform that would index disability and minimum pensions to prices rather than to the reevaluation index. This revalorization of disability and minimum pensions is important as they are those at higher risk of poverty and social exclusion. Also, compared to other alternatives, this indexation rule would entail significant welfare gains both for most of the households alive at the moment of this policy change and also for future cohorts. This reform would increase yearly pension expenditure by 0.9 percentage points necessitating an increase of 1.9 percentage points in the Spanish consumption tax to be compensated. Again, Díaz Saveedra underlines the issue of using price indexation instead of wage indexation for minimum pensions and their inability to prevent poverty. This study is encouraging in the context of this article, detailing that pension indexation policies favoring low-income pensioners can be welfare-increasing, alleviate poverty, reduce inequalities, and answer to intergenerational fairness while requiring low tax increases.

Besides scientific literature, we can draw upon reports from organizations like the OECD and other statistical offices, focusing on countries that implement progressive indexation. These reports help elucidate the shared characteristics of such systems and the outcomes they produce. However, it's crucial to approach inter-country comparisons with caution, recognizing the unique historical backgrounds, cultural nuances, and other factors inherent to each nation.

Portugal is a very interesting case to study as they have enacted many reforms to improve the financial sustainability of the pension system during past decades. Also, the Portuguese Republic is particularly impacted by the ageing of the population. By 2050, the old-age dependency ratio is projected to double, due to significant increases in life expectancy measures at 65, low fertility rates, and a net emigration level, especially young people leaving the country. These worries were big enough to motivate the OECD (2019) to process an in-depth analysis of the Portuguese pension systems in order to assess the system's capacity to provide adequate retirement income in a financially sustainable way. Portuguese pension indexation mechanism includes progressivity, this

¹² By 2070, the Sustainability Factor alone will have reduced the real yearly value of new Spanish pensions by 27.8 percentage points (Díaz-Saavedra, 2018).

could arguably have been motivated by income inequality levels which are the highest among OECD countries. Empirical proofs on the matter are scarce and insufficient to provide causality but we are yet to observe significant reductions in old-age income inequality as progressivity may not be aggressive enough¹³. Progressive indexation mechanisms are also applied in Greece and Austria. The Hellenic Republic case is complex to analyze, for some periods indexation was higher than price inflation for low pensions, and lower than inflation for the high ones. It was the case between 2001 and 2004 which resulted in increases in pension wealth of high earners to be 25% lower than for low earners. The Austria case is at least as complex to analyze due to ceilings imposed on pensionable pay, an OECD report computed the effect of progressive indexation ignoring the effect of the ceilings and estimated that the richest workers can expect a pension wealth 10% lower than the majority of pensioners (Whitehouse, 2009). Empirical simulations developed by this article could provide valuable comparisons.

To recapitulate, indexation of pension benefits fulfills the goals of poverty alleviation and purchasing power protection but can be budgetary constraining in context of ageing populations. Overall, price indexation is preferred over wage indexation, despite it may fail to reach poverty alleviation goal, as it is less costly and bestows advantages such as flexibility for pensioners and benefits being aligned with marginal utility from consumption decreasing with age. Indices used for price indexation often overstate inflation, which is maybe not a big issue in the context of poverty mitigation. But still, we shall take into account that inflation hits harder older and poorer individuals. To cope with demographic changes, other measures are used. Linking retirement age with life expectancy is a way to reach compensates for ageing population but reinstates the debates about how postponing retirement age reinforces existing income inequalities. Sustainability factor and automatic balancing mechanisms allow to reach sustainable pension systems but are associated with decreases in real value of pension and could ultimately lead to poverty. At last, progressive indexation mechanisms have been implemented in certain OECD countries grappling with an aging population with few small positive results that could be partly due to insufficiently aggressive thresholds. Therefore, in the following sections, empirical projections of progressive indexation with different types of thresholds and objective will be tested.

¹³ Indexation pension wealth of higher earners being around 4% lower than for the majority (Whitehouse, 2009).

3 Empirical method and data

3.1 Model of the Belgian public pension scheme

Before embarking on our simulations, it is essential to present the main lines of the Belgian pension system, which will be used to produce our projections. This model ignores all the special schemes, such as those for seamen and miners. We concentrate on employees and ignore civil servants and the self-employed, who contribute to different schemes than the one studied. Also, we make the assumptions that all workers in our analysis start working at 20 for a full career of 45 years without interruption and they either start or stop their career on the first day of the year. Consequently, we do not have to prorate their contributions or benefits and we have clearer computations.

To calculate the annual pension for an individual who has worked for 45 years and reached retirement, we consider the entire working period and follow these steps :

Notations :

- W_t : Annual gross wage during year t
- H_t : Health index evolution in year t
- T : Year of retirement

1. Adjustment for Salary Ceiling :

For each year worked, we compare the annual gross wage (W_t) to the salary ceiling¹⁴ for that year.

- If $W_t \geq \text{Salary ceiling}_t$, then $W_t = \text{Salary ceiling}_t$
- Otherwise, we retain W_t as it is.

2. Revalorization

To adjust for inflation, the annual gross wage is indexed using a revalorization coefficient.

This coefficient is calculated as follows :

$$\text{Revalorization coefficient}_t = (1 + H_{t+1}) * (1 + H_{t+2}) * \dots * (1 + H_T)$$

Thus, the revalorized annual gross wage for year t (RW_t) is :

$$RW_t = W_t * \text{Revalorization coefficient}_t$$

¹⁴ Salary ceilings are given by the federal service of pensions and are projected to increase with average wage growth for the periods not covered by administrative data.

3. Annualization and Calculation of pension rights :

The revalorized annual wage is divided by 45 and multiplied by 0.6, which is the target replacement rate. This yields the annual gross pension right.

$$P_t = \frac{RW_t}{45} * 0.6$$

After applying these steps to each year worked, we sum the individual pension rights to determine the annual gross pension benefits :

$$AP_T = \sum_{t=1}^N P_t$$

If the annual pension is below the minimum pension defined by the state, the pension is set to this minimum value. Thereafter, the annual pension benefit and the minimum pension are indexed each year according to the health index for the remainder of the individual's life.

Now that we have a clear picture of our model of the Belgian public pension mechanism, we can go further and develop projections.

3.2 Empirical strategy

In the following section, the framework used for the projections of different indexation mechanism is described. The foundation of our empirical strategy is to make by cohorts' projections of career and their time spent in pensions. Our basis for the simulations is the distribution of gross annual wage¹⁵ per decile for which we have administrative data for the period 1999-2021 (Statbel, 2023).

¹⁵ Gross annual wage includes only 12 months of salary, it does not include holiday pay, 13th month pay or any other bonus.

Here is for example the distribution for the period between 2017 and 2021 :

Deciles	2017	2018	2019	2020	2021
1	27132	27420	27540	28008	27636
2	30024	30612	31272	31800	31452
3	32436	33984	34200	34872	34488
4	34728	37116	38340	39000	38568
5	37680	40332	41832	42600	42084
6	40860	43668	45372	46248	45804
7	45444	48144	49188	50136	49596
8	52836	54312	56556	57648	57012
9	66528	66888	70632	71892	71064
10	100103	104135	107526	109506	108281

Table 1. Gross annual wage distribution per decile 2017-2021 (mean value per decile)
Source: Statbel

As we only have data for the period 1999-2021, we must make simulations for the years before 1999 and those after 2021. For the baseline model, we assume that wage growth is only determined by indexation and not by any other factor. Then wage growth is equal to the evolution of the health index for which we have data between 1995 and 2023 (Statbel, 2024a), we will project that it will take the mean value of the 20 years during the periods not covered. Therefore, projected wages are the following :

$$\text{Before 1999: } W_t = \frac{W_{t+1}}{1+H_{t+1}}$$

$$\text{After 2021: } W_t = W_{t-1}(1 + H_t)$$

By combining the administrative data and the artificially generated data on gross income per decile, we can simulate careers and pensions per decile for each cohort retiring between 2006, those who will get their last pension benefits in 2024 and 2094, those contributing for their first year in 2050. Doing so we have data on all the contributions of workers to the social security system and all the expenses related to pensions during the 2024-2050 period. Formally, for each year, we have some cohorts that get their pension benefits paid by other cohorts that are working. This is the Pay-As-You-Go system.

To cope with the fact that our data is by cohort, we will have to make some manipulations, we will take the year 2025 as an example to illustrate them. During the year 2025, there are individuals from the 2007 cohort that still have 0,45 years left to live (we use the life expectancy at 65) so they

still get pension benefits. Also, cohorts between 2008 and 2025 get their full pension benefits. In order to get the full expenditure, we sum up pension benefits for each cohort and then divide it by 18,45, giving us the average money spent on pensions that we multiply by the number of pensioners during that year. At the same time, agents from cohort 2026 to 2068 are working and financing the pensions. We take the distribution of gross wages in 2025 and multiply it by the number of workers active at that time. Then, we take 30% of this amount, which is the target contribution rate in effect in the country. In fine, we can compare the total expenses and total contributions to obtain the balance of the pension system.

This gives us a playing field on which various progressive indexation techniques can be tested. From the description of the Belgian public pension scheme, we learn that two components are subject to indexation. First, pension rights are indexed through the coefficient of revalorization and then pension benefits are indexed each year. The first stance of progressivity we introduce is to index only the rights and the benefits for the value of the sixth decile. In practice, each amount below or equal the one of the deciles 6 is indexed while everything above is not. Accordingly, for workers with wage above the sixth decile, the revalorized wage taken into account for the computation of their pension rights is :

$$RW_t = W_t \text{ of sixth decile} * \text{Revalorization coefficient}_t + (W_t - W_t \text{ of sixth decile})$$

Otherwise, it stays the same as in the baseline scenario.

In the same spirit, annual pension benefits (AP) higher than the mean value of the sixth decile are only indexed that way :

$$AP_t = AP_{t-1} \text{ of sixth decile} * (1 + H_t) + (AP_{t-1} - AP_{t-1} \text{ of sixth decile})$$

Next, more aggressive forms of progressive indexation are tested. With progressivity with respect to the fourth and the second deciles. Finally, in the most aggressive one, we index only the minimum pension. To do so, we have to artificially generate a minimum pension right for each year. To get the minimum pension right of the last year worked, we divide the minimum pension benefit for the first year of pension by 0,6, the replacement rate.

$$\text{Minimum right}_{T-1} = \frac{\frac{\text{Minimum pension}_T}{1 + H_T}}{0,6}$$

This amount is then adjusted backward each year using the health index.

Consequently, indexation of the pension rights takes this form :

$$RW_t = \text{Minimum right}_t * \text{Revalorization coefficient}_t + (W_t - \text{Minimum right}_t)$$

For individuals with a gross wage below the minimum wage, we only take the minimum right into account :

$$RW_t = \text{Minimum right}_t * \text{Revalorization coefficient}_t$$

Then for pension benefits :

$$AP_T = \text{Minimum pension}_t + (AP_{t-1} - \text{Minimum pension}_{t-1})$$

This very progressive approach to indexation allows the public pension scheme to fulfill its purpose of poverty alleviation while putting less pressure on public finances. Descriptive statistics of the baseline scenario and results of these various indexation techniques are presented in the following sections.

But before we dive into the figures, we would like to add complexity to our model about how wage growth is forecasted. In the first iteration of the model, we assumed that the evolution of wages was only determined by indexation. This simplification suits well our design but for the period for which we have administrative data about wages and health index, we observe that, on average, the health index explains about 72,2% of the wage increase. Above indexation, enhancement of productivity can explain the development of wages. Additionally, wage growth is unequal between deciles. Here is a table that compares the observed wage growth and health index during the 2000-2021 period :

Deciles	Average observed wage growth	Average Health index	Ratio
1	0,023	0,020	1,187
2	0,024	0,020	1,214
3	0,024	0,020	1,238
4	0,026	0,020	1,324
5	0,027	0,020	1,372
6	0,027	0,020	1,402
7	0,026	0,020	1,348
8	0,026	0,020	1,350
9	0,026	0,020	1,355
10	0,026	0,020	1,321

Table 2. Average wage growth and health index (2000-2021)

Source: Statbel and own calculations

We see that deciles at the bottom of the distribution tend to have lower growths and can be even lower than indexation during some periods, suggesting that inflation-adjusted wages have decreased during certain periods. To take this heterogeneity into consideration, we change our way of generating wage growth for the periods not covered. We do base ourselves on the ratio between the observed wage growth and health index during the period 2000-2021 and estimate that wage growth of year t for periods after 2021 is equal to the health index multiplied by the moving average of the ratio of wage growth on health index for the 20 last year before. For periods before 2000, we take the moving average of the 20 years after. Formally, this can be mathematically expressed as :

$$\text{Before 1999 : } W_t = H_t * \frac{1}{20} \sum_{i=t-19}^t \left(\frac{W_t}{H_t} \right)$$

$$\text{After 2021 : } W_t = H_t * \frac{1}{20} \sum_{i=t}^{t+19} \left(\frac{W_t}{H_t} \right)$$

This method yields convincing results¹⁶. Again, for certain periods wage growth of the low deciles can be below the health index, underlining the importance of fully indexing this part of the distribution. This method, regularly used in this type of projection, allows us to have growth levels that depend on their previous values. Further in the article, this method will also present the advantage of responding to changes in the projected health index. This new approach enables us to develop a new technique of progressive indexation that seems to reconcile the dilemma between indexation of pension benefits to the wage index that realizes its goal of poverty alleviation but puts high pressure on public finance and indexation with respect to the price index which gives less support to poorer parts of the distribution but imposes a smaller financial burden. We try the method of indexing minimum pension benefits to the wage index rather than to the health index while we do not index anything above them. It is true that in the introduction, it has been explained that the CPI was often over-estimated and could thus protect lower deciles from pension erosion. Nevertheless, the health index used to revalorize pensions does not account for increases in petrol products, alcohol, and tobacco which are major drivers of inflation. In 2024, tobacco products have a weight of 32.4% in the inflation, representing an increase of 0.4 p.p. (Statbel, 2024b). Besides, poorer individuals are more severely affected by inflation (Leicester, O'Dea and Oldfield, 2008).

¹⁶ We make a correction for the index jump of 2015 by applying the mean value of the health index on this period. Translated from Statbel (2024): “To achieve the 2% index jump (set in the loi relative à la promotion de l'emploi of 23 April 2015), the smoothed health index was temporarily frozen at its March 2015 level (equal to 100.66). The smoothed health index was then reduced by 2% from April 2015. As soon as the smoothed, reduced health index (also known as the reference index) rose again by 2%, or, in other words, when it exceeded the value of 100.66, the index freeze ceased. This was the case in April 2016”.

Therefore, the revalorization coefficient is calculated that way, with G_t being the average wage growth for period t :

$$\text{Revalorization coefficient}_t = (1 + G_{t+1}) * (1 + G_{t+2}) * ... * (1 + G_T)$$

Minimum pension rights are now computed and deflated using the wage index :

$$\text{Minimum right}_{T-1} = \frac{\frac{\text{Minimum pension}_T}{1 + G_T}}{0,6}$$

The replacement rate and benefit ratio for the generation retiring in 2024 and 2050 are used to represent the cost to pensioners. The difference between the 2050 replacement rate of the baseline scenario and that of the different indexation mechanisms will give us a picture of the impact that progressivity will have on the value of their pension rights. At the same time, a comparison of benefit ratios will give an idea of the impact of reduced indexation.

Making inflation projections is a perilous exercise. Especially during these recent years, where there has been a tendency to underestimate projected inflation. While it is true that these projection errors can be explained by health or geopolitical crises (Office for Budget Responsibility, 2023 and European Central Bank, 2022), we do not have a crystal ball to tell us that this won't happen again in the years to come. As making inflation projections is not in the scope of this article, we simply develop three different scenarios to cover multiple possible outcomes and to gauge the effects of progressive indexation depending on inflation rates, which will allow us to test the intuition that with higher inflation, the effects of progressivity are stronger. In the first one, the projected health index takes the mean value of the last 20 years: 2,223%. Then, to have a higher value we take the mean of only the last 5 years: 3,737%. Finally, we use the mean between these two values: 2.980 to have an in-between scenario.

The main benefit of our empirical strategy is that besides estimating the savings of different reforms, it allows to investigate the effects of our reforms inside generations. Now that our model has been defined, we present the predictions of our model, starting with some descriptive statistics of the baseline situation that let us have a clear picture of the initial state of the public pension scheme.

4 Predictions of the model

4.1 Baseline scenario

First, the issue that justifies this research and threatens the sustainability of our public pension systems. Ageing of the population results in the share of the population benefiting from pension allocations that grow faster than the number of workers who finance the system (Conseil supérieur des finances, 2022). This fraction is measured through the dependency rate. By 2050, the ratio will increase by 20% and reach levels unseen before.

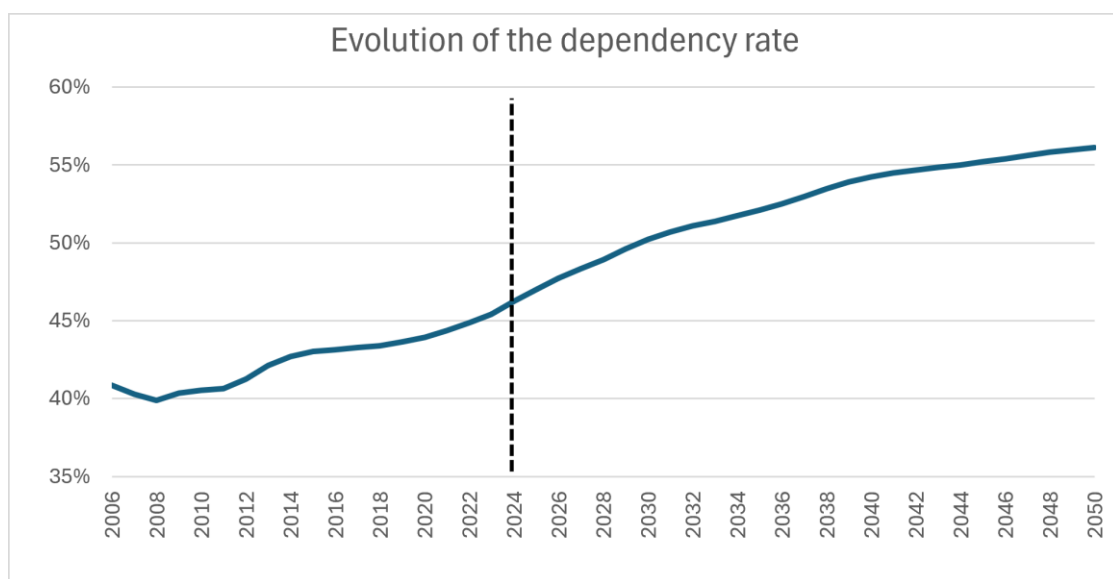


Figure 1. Evolution of the dependency rate
Source: own calculations

We observe a surging increase in the dependency rate, especially in the two next decades, with the dependency rate going from 46% to 54% as suggested by the National Bank of Belgium in their report (Deroose et al., 2023).

The next observation of our baseline scenario is that the pension system will be in deficit before 2050. This result is quite worrying as we are working with a model where there is no unemployment, long-term sickness, or any form of inactivity. In conclusion, even in a perfect situation where each individual works for 45 full years, the increasing charge of ageing is too big for the actual system to cope with. Hereby we present, the situation for the in-between inflation scenario of 2.98%¹⁷ and assume wage growth is equal to the health index. The system reaches deficit in 2038.

¹⁷ For each table, alternative scenarios have been computed and are available upon request.

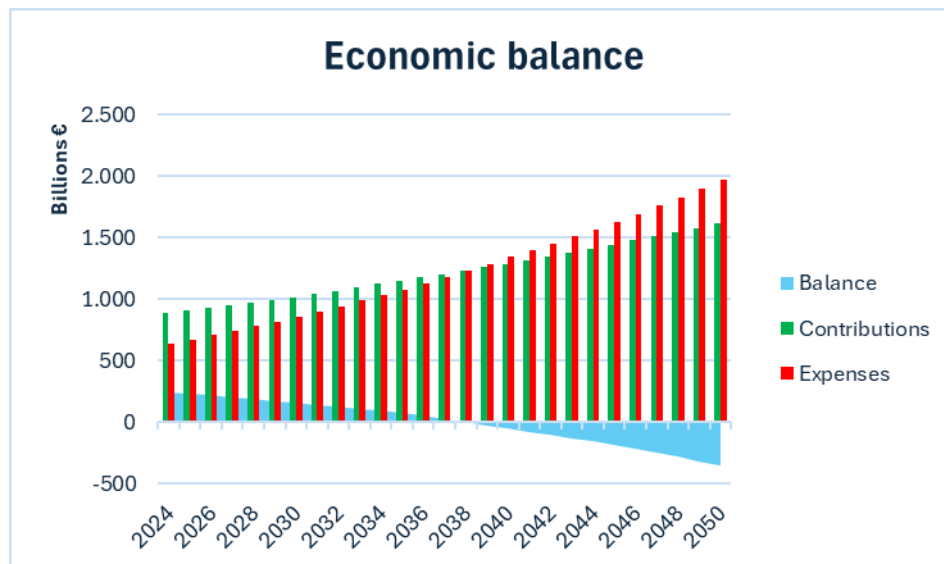


Figure 2. Economic balance of pension scheme (wage growth = health index 0,0298)
Source: Own calculations

We can note that, on average, wage growth has a positive impact on balance while higher inflation aggravates the impact of the shrinking workforce.

Then, to relate the increase in pension expenditures, we use the ratio of pension expenditure to GDP¹⁸. Our model forecasts an increase between 5.4 and 7 percentage points of this value depending on inflation and growth rate. A major part of this increase is driven by the dependency ratio as in the 2021 Ageing Report of OECD. We use as a target, the reduction of 1.6 percentage points needed to relax pressure on public finances of the European Commission. Thereafter, our policy target is to have a pension expense on GDP ratio 1.6 percentage points lower than it would be in 2050 for a scenario without reform.

¹⁸ For which we assume growth equal to salary growth for upcoming years.

Here is, the evolution of the ratio depending on the inflation rate :

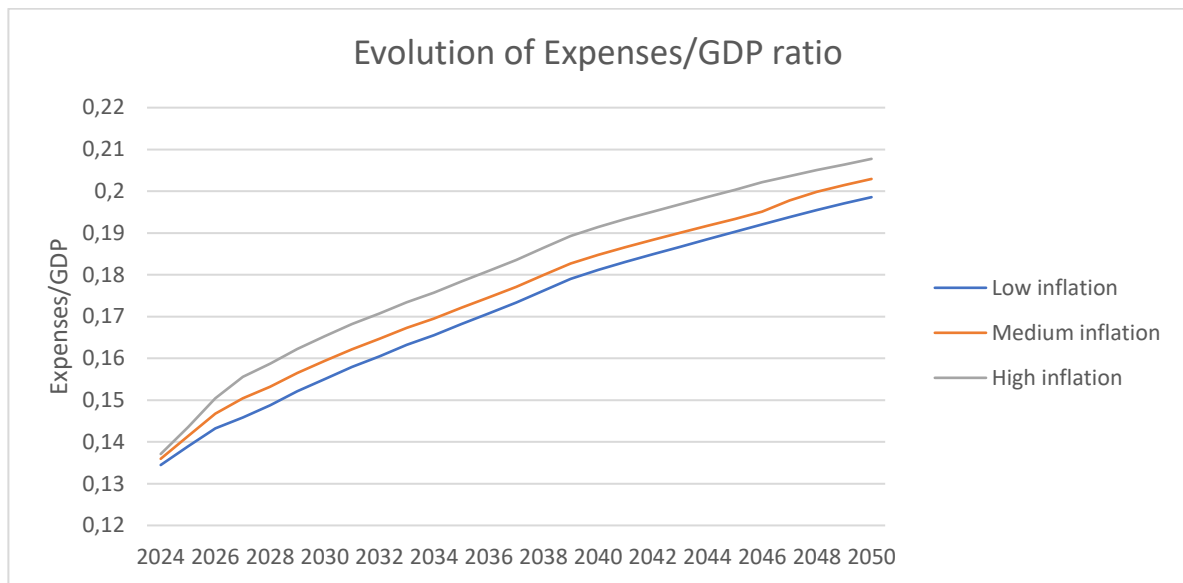


Figure 3. Evolution of Expenses/GDP ratio for different inflation scenarios (Wage growth=Health index)
Source: Own calculations

We see that today these ratios are about 13.5% in our model and are forecasted to reach levels around 20%. With obviously, higher inflation linked with higher levels of expenditures. In the next sub-section, our policies will be mainly evaluated regarding their ability to control this increase in expenses.

Besides that, the strength of progressive indexation relies on the fact it enhances the sustainability of the system. At the same time, it reduces pension inequalities which are aggravated by indexation. By applying the same indexation rate on each pension benefit, higher pensions increase way faster in nominal values than the smaller ones. For individuals starting their retirement in 2024, we compare the benefits of an average individual from the first decile to someone from the ninth decile. By doing the comparisons for projected inflations of 0.0223 and 0.377, we can observe that the pension gaps grow faster with higher levels of health index.

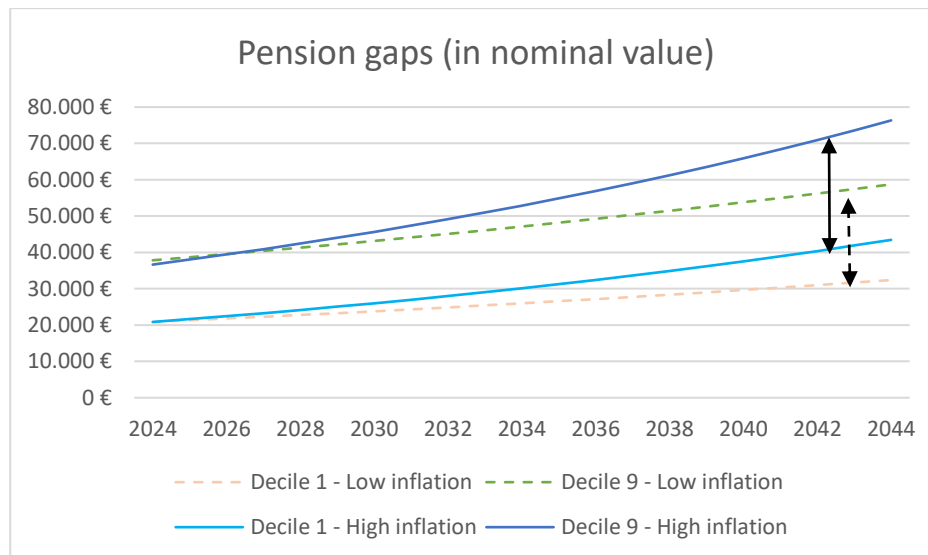


Figure 4. Pension gaps increased by indexation (Health index = 0.0298)
Source: Own calculations

We see increases in the gap between the two pensioners, with higher inflation associated with bigger widening.

The last parameter needed to be assessed before applying our progressivity is the growth of wages for the period not observed. As explained in the methodology, we use the relationship between wage growth and the health index for the period where we have administrative data that we expect to stay the same for future periods. In practice, it yields us, for a mid-inflation scenario, wage growth rates that are 1.214 times higher than the health index. Also, it has the strength of having different rates depending on the deciles, as we can see in this table of the average growth rates per decile between 2025 and 2050 :

Deciles	2.23	2.98	3.74
10	0,0201	0,0268	0,0335
20	0,0225	0,0300	0,0374
30	0,0239	0,0318	0,0398
40	0,0285	0,0380	0,0475
50	0,0305	0,0406	0,0508
60	0,0314	0,0419	0,0523
70	0,0288	0,0384	0,0480
80	0,0290	0,0386	0,0482
90	0,0294	0,0392	0,0489
100	0,0277	0,0369	0,0461
Average	0,0272	0,0362	0,0452

Table 3. Average growth rates per deciles (Health index = 0.0298)

Source: Own calculations

Interestingly, the evolution of salaries is sometimes below the indexation, underlining the importance of indexation and revalorization for poverty alleviation. For the first decile, during most periods, the rate is below the health index¹⁹ :

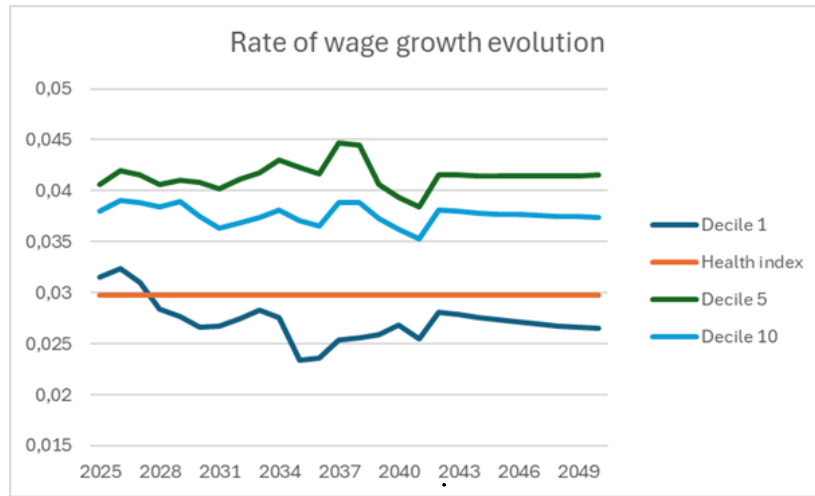


Figure 5. Evolution of the rate of wage growth (Health index = 0.0298)
Source: Own calculations

We do observe that the wages that grow the most are those in the middle of the distribution while those who grow less are those at the bottom of it, reinforcing inequalities.

Now that we have a clear picture of the starting point, we can quantify the effect of the progressivity of pension indexation. These effects will be measured through the indicators presented in this sub-section: the contribution/expenditure balance, the expenditure on GDP ratio, and finally the nominal gaps in pension benefits.

4.2 Progressive indexation

The presentation of our policy results is divided the following way. First, we will describe them under the assumption that wage growth is equal to the health index. Then, we will untie wage growth of the health index and allow it to take values over and under the health index depending on the year and the deciles, as defined in the empirical strategy. For each reform, we will use the three different scenarios of health index evolution: 2.23%, 3.98%, and 3.74% which will be referred to respectively as low inflation, medium inflation, and high inflation scenarios. Finally, we will make general observations on the results obtained.

Primo, for the scenario where wage increases are only due to indexation for the periods not covered by administrative data. We start with the softer version of our indexation progressivity²⁰ by indexing

¹⁹ A detailed explanation of why wage growth of the first decile is under the health index is in the appendix.

only the pension rights and benefits at the mean of the sixth decile. First, we can already denote that the year the expenditures will outweigh the contributions is postponed. For the low inflation scenario, the balance has a positive value in 2050 but the balance is leaning toward zero and will be negative if the demographic transition is not halted. For the medium and high scenario, deficit starts in 2040 and 2036 rather than 2038 and 2035 without reform. Further, this reform decreases the level of pension expenditures relative to GDP. We forecast the increase of this ratio by 2050 to be 0.59 p.p. smaller than the baseline for the lower health index, then 0.76, and 0.94 p.p. for the middle and high scenarios. Confirming the intuition that higher inflation levels reinforce the strength of progressivity. Nevertheless, results fall short with respect to the maximum increase target of 4.81 p.p. we set. Efforts to consolidate expenses between 1 and 0.6 p.p. are needed. Indeed, by limiting indexation to the same level for everyone above it, we cease the increases in nominal gaps for everyone above the threshold. There is no augmentation in pension differences between deciles above the fifth one and the increases are mitigated between low and top deciles. In 2050, the increases in pension gaps between the first and the ninth deciles are estimated to be 9374.01€, 14167.34, and 19932.95€ for the baseline scenarios. By applying progressivity, these amounts decrease respectively to 3686.04€, 5276.11€ and 7073.85€. Here we illustrate the attenuation of the pension gaps thanks to progressive indexation for the medium health index scenario. The benefits of the ninth decile are less indexed while those of the lower deciles stay unchanged.

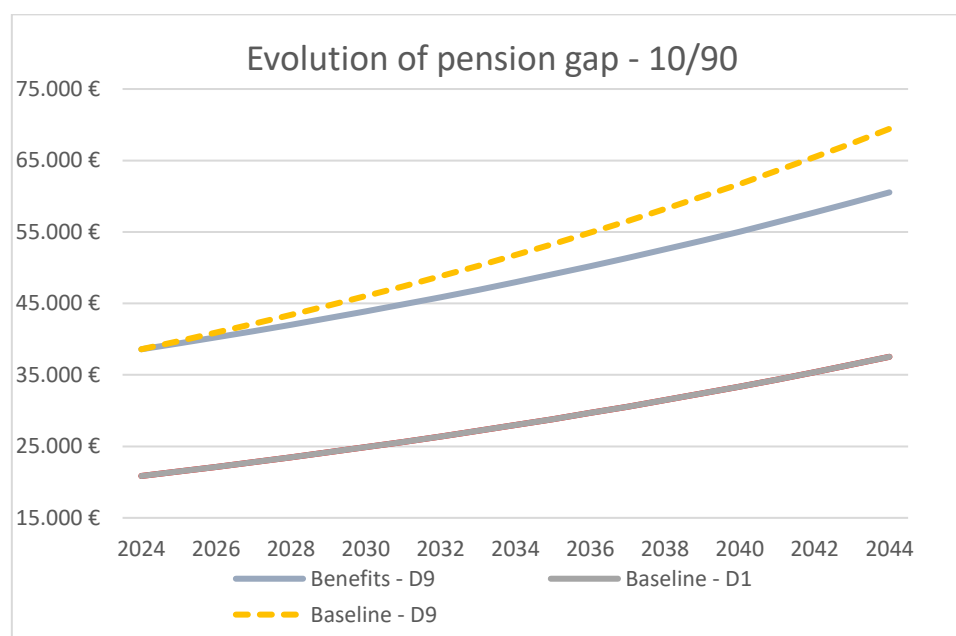


Figure 6. Pension gaps: progressive indexation compared to baseline (Threshold sixth decile – Health index = 0.0298)
Source: Own calculations

²⁰ Which is already more aggressive than the one used in Italy (Leombruni and Mosca, 2014).

This progressivity reform reduces the pension gaps created by indexation. Nevertheless, postponement of the deficit for only one year might not be very convincing, and it fails to reach the target set for each inflation scenario. Therefore, we try reforming with more aggressivity by setting the part of indexed pension rights and benefits to the mean level of the fourth and second deciles.

These more severe forms of progressivity obtain a higher postponement of the deficit year and decrease the total deficit in 2050 for the two inflation scenarios that present negative results. By lowering the thresholds above which pension benefits and rights are not indexed. We increase the share of people subject to them, but we also increase the charge on the people who were already impacted when the thresholds were higher. With lower limits, the amount above them, which loses in real value, increases. Therefore, the gains from lowering the threshold are still substantial. For a low inflation scenario, taking the second decile as the limit allows us to nearly reach the objective with a reduction of 1.49 p.p. The indexation of the fourth decile leads to a decrease of 0.99 p.p. For a projected health index of 2.98, indexation of the fourth decile yields a decrease of 1.27 p.p. While if we use the second decile, the target is reached with a reduction of 1.91 p.p. For the highest value of projected health index, a progressive indexation with the mean pension of the fourth is nearly already enough to reach the 1.6 p.p. reduction target. With a reduction of just 0.004 points below the target. Indexation of the second decile, permits to surpass this target with a reduction of the ratio by 2.33 p.p. The same mechanism applies to the pension gaps between individuals. The increases in the differences between the ninth and first decile are respectively 9374.01, 17092.97, and 19332.35 depending on the projected indexation. Progressivity of indexation to the fourth decile reduces these gap widenings to 1588.94, 2249.58, and 2982.62. Finally, if we index only the value of the second decile, the “bonus” given by indexation is the same for everyone above and the gaps are not boosted by indexation.

Lastly, the most budget-restrictive technique would be to index only the value of the minimum pension. Here is a table recapitulating the different values of our indicators depending on the type of indexation and the health index estimated for the uncovered periods.

Scenarios	First year of deficit			Expenditures/GDP			Pension gaps in 2044		
	0.0223	0.0298	0.0374	0.0223	0.0298	0.0374	0.0223	0.0298	0.0374
Health Index									
Baseline	2050	2038	2035	19.86%	20.29%	20,77%	26344.27	32877.96	38340.59
6th decile	-	2040	2036	19.26%	19,53%	19.83%	20657.04	23004.45	25481,49
4th decile	-	2041	2036	18.87%	19.03%	19.22%	19559.94	19977.92	21390.27
2nd decile	-	2043	2037	18.37%	18.39%	18.44%	16971	17728.34	18407.65
Pension min	-	2043	2037	18.16%	18.11%	18.10%	16971	17795.43	18407.65

Table 4. Recap of the results for the different scenarios (Wage growth = Health index)

Source: Own calculations

Our model predicts encouraging results for these reforms, with indexation reduced to the minimum pension allowing us to reach our financial target for every inflation scenario. Obviously, this would entail significant reductions in pension benefits, especially for the highest earners. We do use the replacement rate and the benefit ratio to have a picture of these reductions imposed on pensioners. Here we provide tables for the mid-inflation scenario with the baseline and the indexation of the minimum pension²¹ for the generations starting their pensions in 2024 and 2050.

BASE	2.98	BENEFIT	RATIO	REPLACEMENT	RATE
Deciles		2024	2050	2024	2050
1		1,494	1,645	0,656	0,666
2		1,335	1,523	0,577	0,614
3		1,290	1,521	0,552	0,612
4		1,289	1,514	0,534	0,604
5		1,287	1,511	0,525	0,602
6		1,285	1,511	0,521	0,601
7		1,287	1,515	0,532	0,605
8		1,286	1,515	0,532	0,606
9		1,141	1,380	0,472	0,552
10		0,744	0,905	0,310	0,362
Average		1,244	1,454	0,521	0,582

Table 5. Benefit ratio and replacement rate for 2024 and 2050 cohorts (Baseline scenario – Wage growth = Heath index = 0.0298)

Source: Own calculations

MIN	2.98	BENEFIT	RATIO	REPLACEMENT	RATE
Deciles		2024	2050	2024	2050
1		1,494	1,645	0,656	0,666
2		1,335	1,493	0,577	0,609
3		1,274	1,440	0,552	0,598
4		1,248	1,380	0,534	0,581
5		1,225	1,338	0,525	0,571
6		1,203	1,301	0,521	0,564
7		1,180	1,272	0,532	0,564
8		1,149	1,223	0,532	0,556
9		1,003	1,073	0,473	0,498
10		0,654	0,703	0,310	0,327
Average		1,176	1,287	0,521	0,553

Table 6. Benefit ratio and replacement rate for 2024 - 2050 cohorts (Indexation minimum pension – Wage growth = Heath index = 0.0223)

Source: Own calculations

The replacement rate measures the differences in the revalorization of earnings. That is why it stays the same for the 2024 generation. No modifications can be applied to their previous pension rights. For an individual in the middle of the distribution hitting retirement in 2050, the rate of replacement is decreased by 3 p.p. as his wages earned between 2024 and 2050 are subject to the alternative revalorization rule. Additionally, his benefit ratio is reduced from 1.511 to 1.338 due to the

²¹ The other tables are available upon request. As for the other results, the size of effects of progressive indexation is positively correlated with the evolution of the health index.

combination of a lower starting pension which is not totally indexed and lower indexation of benefits. Unquestionably, the bottom decile experiences no reduction as individuals from the first 10% of the distribution are, on average, below the minimum pension. As anticipated, the highest earners are those most impacted with a reduction of 20.2 p.p. of benefit ratio for the top earners of the 2050 cohorts. Intuitively, going further and for individuals starting their careers under the new indexation rule, the pension gaps will shrink even more.

We are now relaxing the assumption that wage growth will be at the same level as the health index. We are going to present the results on the same indicators as above. Starting with the indicator that states the first year the expenses are above contributions, can be interpreted as how well these measures control the growing expenses due to ageing of the population. For the low-inflation scenario, detaching wage growth from the health index brings the date of the deficit to 2047. While for the two other scenarios, it postpones it to 2040 and 2036. Then, progressivity with respect to the different thresholds used pushes it back even further and reduces the size of the deficit in 2050.

For our next measure of sustainability, the ratio of pension expenditure to GDP. By increasing growth rates, expenses increase but also the GDP. The national income grows faster than the expenses as only 60% of the wage increase is translated into expenses. Consequently, the ratios are lower than for the previous model but the size of the effects of progressive indexation are smaller. Nevertheless, our results are stable, with indexation to the level of the second decile needed to reach the target on time for a mid-inflation scenario.

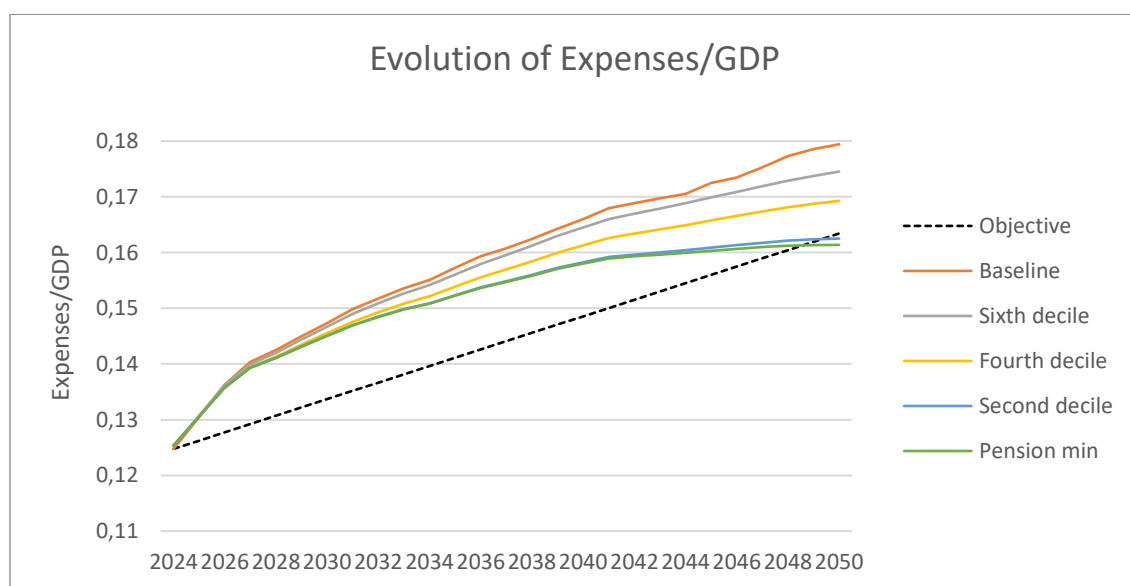


Figure 7. Ratio expenditures/GDP for the different indexation techniques relative to the objective line (Health index = 0.0298)
Source: Own calculations

The projections show how the impact of progressivity on expenses exponentially increases. Eventually, each progressive indexation technique may hit the target in a later period but indexation

to the second decile or minimum pension could even generate savings that could be used for different policies further increasing the sustainability of the system. The value of comparing the pension gaps for someone who stopped working in 2023 between the two iterations of the model is low because their career was not subject to the new indexation rules. Nevertheless, the pension gaps are a bit smaller, but it is due to the fact that the wages of workers before 2000 are decreased by a higher rate, resulting in lower pension benefits and thus lower gaps.

Indexation with respect to the average wage rather than the health index would in a higher revalorization but does not increase pension discrepancies. Clearly, this technique would yield lower expenditure reductions. We compare the balance with indexation with respect to the second decile which was the threshold needed to hit the 1.6 p.p. reduction of pension expenditures on GDP ratio which was targeted.

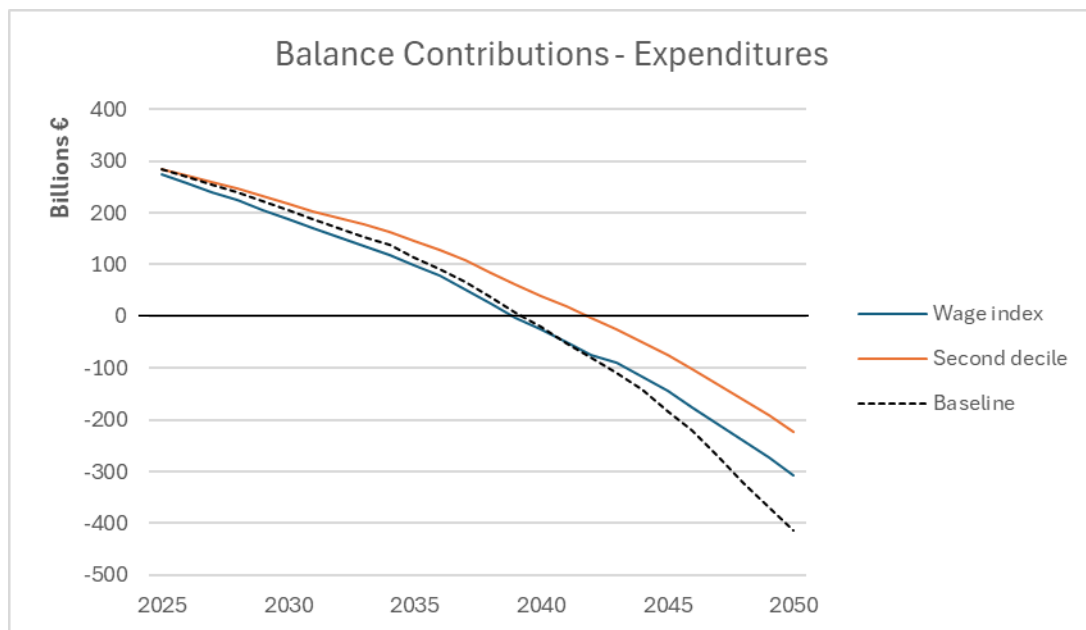


Figure 8. Evolution of the balance of expenditures and contributions for different indexation techniques (Health index = 0.0298)
Source: Own calculations

Unfortunately, this reform alone does not reach the reduction of Expenses/GDP ratio target by the EC. The reductions are respectively 0.79, 0.93, and 1.15 p.p. depending on the scenario. For individuals starting retirement in 2024, the baseline pension benefit with mid-inflation for someone in the first decile is 20862.51€ for the first year and reaches 37534.47€ for the last year. For someone of the ninth decile, the values are 37188.41€ and 53860.37€. With the indexation of the minimum pension benefits with respect to the wage index, the first decile will earn 20862.51€ for the first year and 43098.71€ for the last. The ninth decile earns now 37188.41€ and 59424.61€.

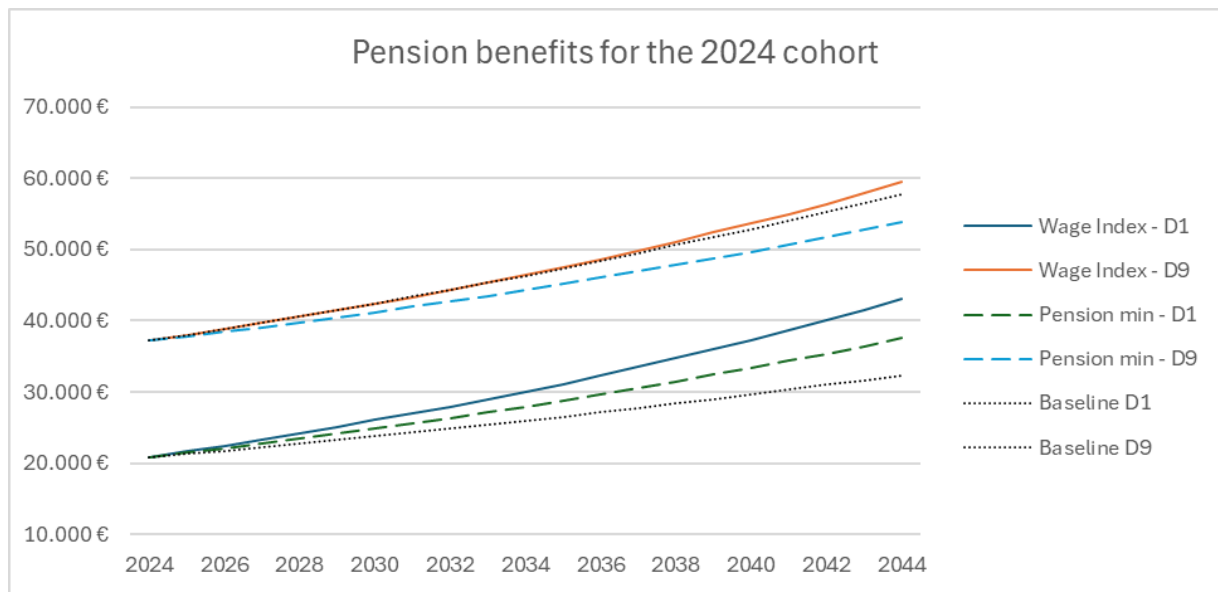


Figure 9. Pension benefits of the 2024 cohorts, for different indexation techniques (Health index = 0.0298)
Source: Own calculations

We see that both top and bottom deciles enjoy higher benefits. One could wonder how we reach decreases in expenses if pensioners earn more. This is due to the fact that we are looking at the 2024 cohort, for which the pension rights cannot be reevaluated. If we look, for example, at the 2050 cohort without reform, the mean benefits for the first decile are 43786.43€ in 2050 and 83542.92€ in 2072. For the ninth deciles, the values are 100737.40€ and 192203.40€, representing an increase of 108860€ of the gap in gross value. Applying our indexation rules, benefits for the bottom decile become 44766.11€ and 98969.96€ while those for the top decile are 92518.56€ and 146722.40€.

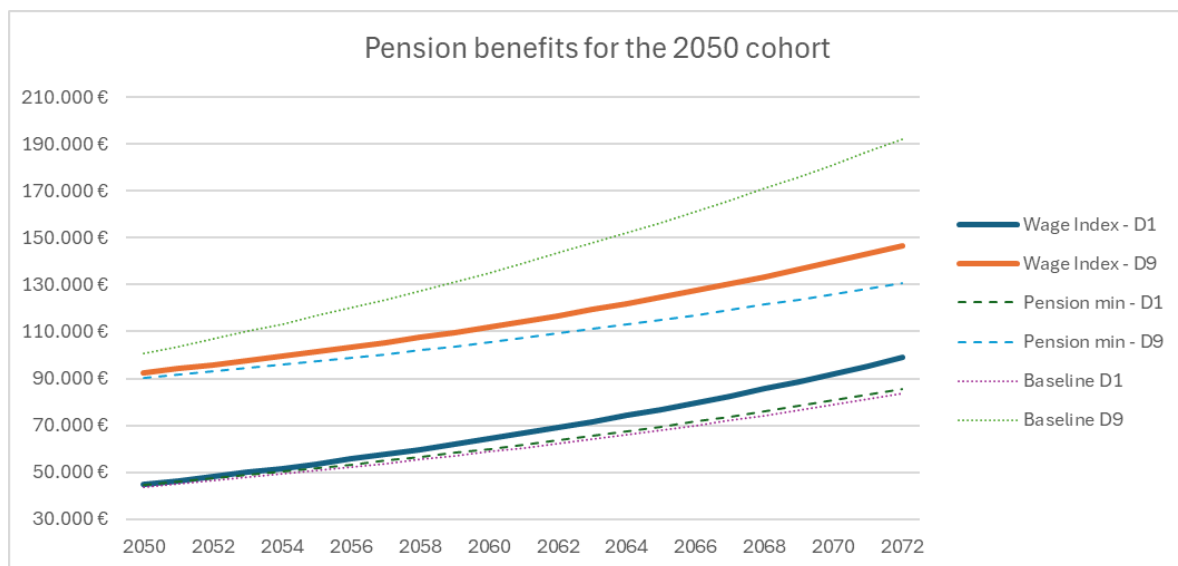


Figure 10. Pension benefits of the 2050 cohorts, for different indexation techniques (Health index = 0.0298)
Source: Own calculations

Note that the full effect of progressivity is not captured as the period between 2005 and 2024, the 19 years worked are not subject to the indexation rules. Nonetheless, it gives a clear picture of the

effects, limiting the galloping increase in the pensions of the top deciles while offering higher indexation to the bottom deciles. This allows the system to fully fulfill its mission of poverty alleviation while limiting total expenses. We can look at the benefit and replacement rates to analyze how redistributive the system is.

BASE	2.98	BENEFIT	RATIO	REPLACEMENT	RATE
Deciles		2024	2050	2024	2050
1		1,420	1,624	0,647	0,683
2		1,266	1,515	0,563	0,602
3		1,172	1,503	0,514	0,579
4		1,169	1,465	0,487	0,511
5		1,167	1,450	0,474	0,485
6		1,163	1,443	0,465	0,474
7		1,163	1,462	0,475	0,506
8		1,161	1,461	0,471	0,504
9		1,053	1,237	0,425	0,424
10		0,707	0,844	0,294	0,299
Average		1,144	1,401	0,482	0,507

Table 7. Benefit ratio and replacement rate for 2024 and 2050 cohorts (Baseline scenario - Heath index = 0.0298)

Source: Own calculations

The first observation is that the average replacement rate is different from the 60% target. For the first decile, we see that the average wage growth is below the health index. Therefore, their revalorized wages for the first years of their career are higher than their salary for the last period. The effect of the minimum pension adds up on top of that. For deciles with wage growth above the health index, the opposite happens and above it, the salary ceiling explains the lower replacement rate of the top decile.

Wage index	2.98	BENEFIT	RATIO	REPLACEMENT	RATE
Deciles		2024	2050	2024	2050
1		1,666	1,805	0,647	0,698
2		1,486	1,642	0,563	0,622
3		1,372	1,553	0,514	0,585
4		1,337	1,412	0,487	0,500
5		1,306	1,338	0,474	0,466
6		1,276	1,284	0,465	0,448
7		1,244	1,280	0,475	0,477
8		1,201	1,221	0,471	0,467
9		1,061	1,014	0,425	0,389
10		0,707	0,692	0,294	0,275
Average		1,266	1,324	0,482	0,493

Table 8. Benefit ratio and replacement rate for 2024 and 2050 cohorts (Indexation of minimum pension to wage index - Heath index = 0.0298)

Source: Own calculations

This reform would benefit from a democratic support as it increases the benefit ratio of the contemporaneous generations. For the generation hitting retirement in 2050, the three deciles at the bottom of the distribution would enjoy higher benefit ratios and replacement rates. By implementing the new indexation rule in 2025 and keeping the pension rights and benefits acquired before unaltered, the new mechanisms are slowly introduced on people already in the labor market. Each generation having to bear the costs and have the progressive indexation applied to their pension rights for one more year than the previous generation. The generation starting to work in 2025 will be the first fully impacted and the positive impacts of progressive indexation will be totally internalized in 2095, when this generation will have worked for 45 years and enjoyed 25 years of retirement.

Again, here is the table recapitulating the different outcomes of the measures :

Scenarios	First year of deficit			Expenditures/GDP			Pension gaps in 2044		
	0.0223	0.0298	0.0374	0.0223	0.0298	0.0374	0.0223	0.0298	0.0374
Health Index									
Baseline	2047	2040	2036	18.24%	17.94%	17.90%	26003.86	25343.98	32877.96
6th decile	2050	2040	2037	17.75%	17.45%	17.19%	19862.94	20560.95	21184.49
4th decile	-	2041	2037	17.34%	16.93%	16.56%	17909.32	17792.08	17503.70
2nd decile	-	2042	2038	16,81%	16.25%	15.75%	16750.97	16325.90	15784.99
Pension min	-	2043	2038	16.72%	16.14%	15.61%	16750.97	16325.90	15784.99
Wage index	-	2039	2036	17.45%	17.01%	16.75%	16750.97	16325.90	15813.70

Table 9. Recap of the results for the different scenarios (Wage growth ≠ Health index)
Source: Own calculations

In comparison with the prior model where the growth of income was bonded to the health index, higher growth has indeed a positive impact on the public finances. In conclusion, this in-between indexation mechanism could be used in combination in order to reach the 1.6. p.p. reduction of expenses. Classical measures such as increase in the rate of contribution and lengthening of the career could be applied as life expectancy at 65 will increase by more than 5 years by 2050 (European Commission, 2021b).

5 Conclusion and discussion

Increasing life expectancy is the result of human progress and the increases in quality of living. But combined with decreasing fertility rates, it creates a demographic transition where the share of pensioners increases faster than the one of workers. This results in increasing pressure on public finance. Like most European countries, Belgium is severely impacted and faces a structural deficit which is expected to rise further. The Belgian Kingdom is a poor performer and has been singled

out by the European Commission in its various reports on the subject and is now almost forced to reform its pension system to make it more sustainable so that it can benefit from funding under the European Resilience Plan. The most common measure adopted to address the sustainability issue is to raise the retirement age through ad hoc reforms or automatic indexation of the legal retirement age with respect to life expectancy. Nonetheless, it should not be the only solution considered as it increases existing inequalities. Next, to cope with the demographic transition, sustainability factors, and automatic balancing mechanisms are used in some countries. The sustainability factor consists of linking the revalorization of pensions to factors such as revenue, expenditure, or number of pensioners in to control the expenses. Automatic balancing mechanisms reduce the indexation of pension benefits to the value needed for the system to be sustainable. These two measures provide convincing reductions in pension expenditures but at the same time, they cause huge decreases in pension wealth and push the lower deciles of the distribution towards poverty. This generates concern about the political feasibility of these reforms. This analysis leads us to think about an alternative way of indexing pensions. Progressive indexation of pension rights and benefits allows to reduce the expenditures and pension gaps without reducing the wealth of the poorest. Also, it gives the possibility to use the threshold to target the part of the population that we want to protect from the decreases. Therefore, we create a model allowing us to make simulations for each cohort of workers reaching retirement age between 2024 and 2050.

The simulations for the baseline scenario of our projects a structural deficit with a negative balance for each inflation scenario being hit by 2050, increases between 5.4 and 7.1 percentage points of the pension expenditures to GDP ratio, and increases in pension gaps between nine and twenty thousand euros fueled by indexation. Depending on the inflation projections, rather aggressive thresholds must be applied to reach the targeted reduction in expenditure. This confirms the conclusion made on the analysis of the Portuguese progressive indexation case, that low thresholds are needed to reach sufficient reductions of the expenses. Nonetheless, progressive indexation can be used in combination with other reforms as it has a positive impact on equality. Finally, the last rule proposed, indexation of only the minimum pension but at the wage index rather than the price index yields very promising results, ticking all the boxes in terms of deficit and inequality reduction as suggested by Pigott and Sane (2009). On top of that, it provides for poverty alleviation which is not the case for the alternative solutions: postponement of retirement age, sustainability factor, and automatic balancing mechanism.

Still, this measure is very redistributive and will highly reduce the benefits of the richest. This might reduce their consumption levels or even create a disincentive to work for longer periods. This could

also have moral hazard effects on lower deciles by not incentivizing them to have savings and relying only on state pensions. Studies show a negative correlation between public pension benefits and private savings (Lachowska & Myck, 2018). Further, as it does not fully revalorize pension rights, wages at the end of the career are of bigger importance than the ones at the beginning, this mechanism might push individuals to delay the beginning of their career. But, on the other hand, it creates an incentive to work longer. Furthermore, authors like Whitehouse (2009) suggested that progressive indexation is nothing else than tokenism as it has only small effects on public finances and is “a poor substitute for a progressive benefit formula or a two-tier pension system with redistributive and earnings-related elements”. While it is true that the aggressive thresholds should be set to have sufficient decreases in expenditures, progressive indexation has effects other than cost reductions, it also prevents pension differentials from widening and could improve poverty alleviation. For the second criticism, as detailed by Baurin and Hindriks (2023), the added value of reforming the indexation rate rather than the acquisition rate is that the reform also applies to the whole of the population who are already retired rather than only to the future retirees. This is particularly advantageous in a context where this part of the population is very significant. Also, the projections of wage growth might potentially be inaccurate and have huge implications for the results. This justifies why a model where growth is fixed to indexation as a basic model that can be used for more detailed simulations is also presented. The contribution to literature of this thesis is that it combines insights from different researches on indexation and apply them on a model reproducing the public pension system of Belgium. The results may be used as a base for further investigation of the impacts of progressive indexation in different countries with similar public pension scheme.

Anyway, this article could encourage more research on this subject. Especially how progressive indexation mechanisms could be combined with other reforms decreasing pension expenditures. Also, theoretical analysis of behavioral impacts on individuals having less impact on their future pension benefits could provide an insightful understanding of the response of individuals to the policy change.

To conclude, we evaluate the proposed reforms with the four recommendations of the European Commission to answer to ageing of the population. First, implement comprehensive pension reforms to ensure the sustainability of pension systems. Progressive indexation does reduce the financial pressure caused by the pension system by reducing expenditures, the burden of these reductions is introduced progressively and is shared by workers and pensioners. Second, was to ensure that pension provides an adequate standard of living while reducing pension gaps. Indexation

with respect to wages increases the level of minimum pension benefits and does a better job of poverty alleviation than the current system. It slightly reduces pension gaps but more importantly, it prevents them from increasing over time as . The third guidance was to improve transparency about the pension system. With indexation of minimum pension, the state could communicate for each indexation episode on the amount that is going to be added to pension benefits, with the amount being the same for every pensioner. Last recommendation was to promote private pension savings. The reforms proposed do not directly promote private pension savings, but the reduction of pension benefits increases the incentive to raise savings and investments (Pereira et al., 2010). Also, part of the savings made with progressive indexation could be used to promote private pension savings and investments.

Appendix

1. Detailed description of the different progressive indexation in Austria, Italy, and Portugal (We recapitulate the descriptions presented by Whitehouse (2009).

Austria :

2022 pension indexation deviated from the initial price indexation of 1.8% for lower monthly pensions :

- 3% for pensions up to 1000€
 - declining from 3% to 1.8% for pensions between 1000 and 1300€
 - 1.8% for pensions above 1300€
- In 2023, they took total pension incomes into account and
- Indexed by 5.8% for total pension incomes up to 5670€ per month
 - For total pensions above this amount, pension increased by 328.86€ (5.8% of 5 670)

Italy :

In 2023-2024, only the lowest pensions will be fully indexed, following this scheme :

- up to 4 times INPS minimum: 100% prices
 - between 4 and 5 times INPS minimum: 85% prices
 - between 5 and 6 times INPS minimum: 53% prices
 - between 6 and 8 times INPS minimum: 47% prices
 - between 8 and 10 times INPS minimum: 37% prices
 - over 10 times INPS minimum: 32%
- (INPS being the minimum pension)

Portugal :

In 2021, total pensions up to 1.5 the Social Support Index (658.22€) were increased by 10€ above indexation.

In 2022, indexation of total pensions up to 2.5 time Social Support Index (1108€) at the beginning of the year was topped up to EUR 10, applied retroactively from January.

In January 2023, pensions were increased below regular indexation:

- Total pensions up to 2 times SSI (960.86€) were increased by 4.83%
- Between 2 and 6 times SSI by 4.49%
- Above 6 times SSI by 3.89%

In July 2023, all pensioners received an extraordinary increase of 3.57%

2. Explanation of the wage growth projection for the first decile

At first, it can be confusing to see wage growth below indexation as we would expect wages of those in the first 10% of the distribution to be indexed with minimum pension. Nonetheless, by observing the periods for which we have administrative data for the wages and health index, we observe a decreasing trend of wage growth. Especially during years of economic crisis such as 2021:

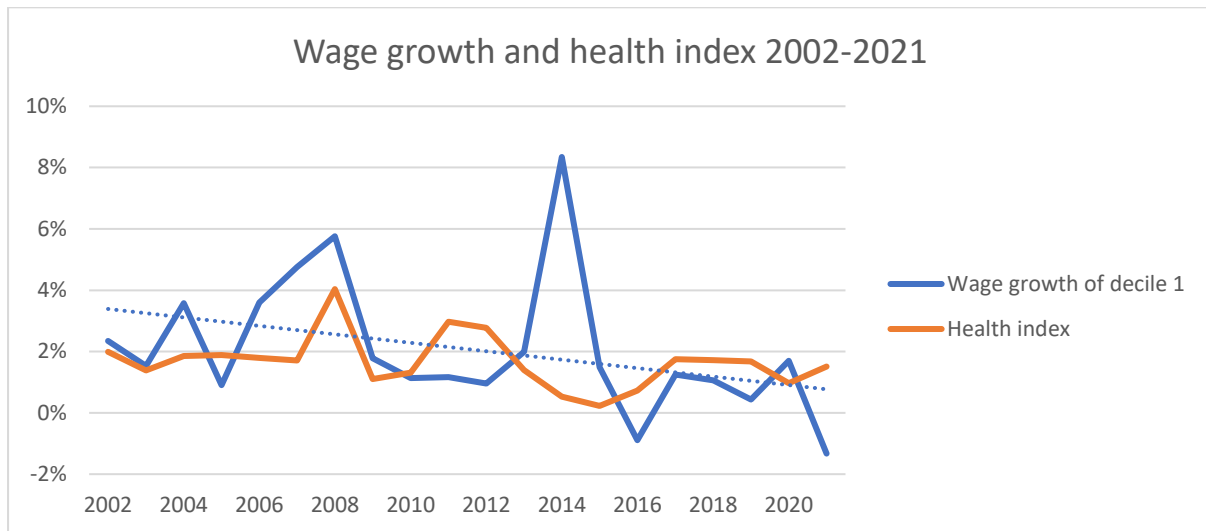


Figure 11. Evolution of the wage growth rate and the health index
Source: Statbel

By using a moving average to estimate the future growth, each year further, the weight of the last periods covered by administrative increases. And especially, these years, wage growth was lower than the health index. Our computation method reproduces this decreasing trend. Nonetheless, it can be supposed that the minimum salary being reevaluated by the health index will limit this decrease. Note that even if their wages are projected to be lower, they fall under the minimum pension in any case, so their pension benefits are not impacted by having growth below the health index. It does reduce the size of the contributions. Therefore, this causes a small underestimation of the effects of progressive indexation.

Bibliography

- Andersen, M. & Løchte J. (2024). The Distributional Implications of Pension Benefit Indexation. *CESifo Working Paper No. 10943*. <http://dx.doi.org/10.2139/ssrn.4723737>
- Ayuso, M., Bravo, J. & Holzmann, R. (2016). *On the Heterogeneity in Longevity among Socioeconomic Groups: Scope, Trends, and Implications for Earnings-Related Pension Schemes*. *IZA Discussion Paper No. 10060*. Retrieved from <https://EconPapers.repec.org/RePEc:iza:izadps:dp10060>
- Ayuso, M., Bravo, J., Holzmann, R. & Palmer, E. (2021). Automatic Indexation of the Pension Age to Life Expectancy: When Policy Design Matters. *Risks*, 9(5), 96. Retrieved from <https://doi.org/10.3390/risks905009>
- Baurin, A., & Hindriks, J. (2023). Intergenerational consequences of gradual pension reforms. *European Journal of Political Economy*, 78, 102336. <https://doi.org/10.1016/j.ejpoleco.2022.102336>
- Bańkowski, K., et al. (2023). The effects of high inflation on public finances in the euro area. *ECB Eurosystem Occasional Paper Series No 332*.
- Bello, P. & Galasso, V. (2021). The politics of ageing and retirement: Evidence from Swiss referenda. *Population Studies*, 75(1), 3-18. Retrieved from <https://EconPapers.repec.org/RePEc:taf:rpstxx:v:75:y:2021:i:1:p:3-18>
- Boskin Commission. (1994). *Towards a More Accurate Measure of the Cost of Living*. Final Report to the Senate Finance Committee from the Advisory Commission to Study the Consumer Price Index.
- Brimblecombe, S. (2013). A multivariate definition of adequacy: Challenges and opportunities. *International Social Security Review*, 66(3–4), 171–191.
- Brown, J. R. (2000). Differential Mortality and the Value of Individual Account Retirement Annuities. *Working Paper no. 7560, National Bureau of Economic Research*, Cambridge, MA.
- Bianchi, C., Romanelli, M. & Vagliasindi, P.(2003). Microsimulating the Evolution of Italian Pension Benefits: the Role of Retirement Choices and Lowest Pensions Indexing. *LABOUR*, 17(s1), 139-173.
- Conseil supérieur des Finances. (2022). *Comité d'étude sur le vieillissement: Rapport annuel 2022*. Retrieved from <https://conseilsuperieurdesfinances.be/fr/publication/comite-detude-sur-le-vieillissement-rapport-annuel-2022>

- Council of European Union. (2021). *Guidance to member states recovery and resilience plans*. European Commission. Retrieved from <https://data.consilium.europa.eu/doc/document/ST-5538-2021-INIT/en/pdf>
- Creedy, J., Disney, R. & Whitehouse, E. (1993). The Earnings-Related State Pension, Indexation and Differences in Lifetime Redistribution in the UK. *Review of Income and Wealth*, 39(3), 257-278.
- Dattani, S. (2023). *Period versus cohort measures: what's the difference?*. Published online at OurWorldInData.org. Retrieved from <https://ourworldindata.org/period-versus-cohort-measures-whats-the-difference>
- Deroose, M., Melyn, W., Stinglhamber, P. & Van Parys, S. (2023). Is public spending on pensions in Belgium sustainable? A comparison with other euro area countries. *Economic Review*, National Bank of Belgium.
- Disney, R. & Johnson, P. (2001). *Pension Systems and Retirement Incomes across OECD Countries*, Cheltenham, Northampton, MA: Edward Elgar.
- Díaz-Saavedra, J. (2020). The fiscal and welfare consequences of the price indexation of Spanish pensions. *Journal of Pension Economics and Finance*, 19, 163–184. <https://doi.org/10.1017/S147474721800032X>
- European Central Bank. (2022). *Why is inflation higher than expected?* Retrieved from https://www.ecb.europa.eu/press/economic-bulletin/focus/2022/html/ecb.ebbox202203_05~6d1fb8f5b0.en.html
- European Commission. (2018). *The 2018 Ageing Report: Economic and Budgetary Projections for the EU Member States (2016-2070)*. Directorate-General for Economic and Financial Affairs. Retrieved from https://economy-finance.ec.europa.eu/publications/2018-ageing-report-economic-and-budgetary-projections-eu-member-states-2016-2070_en
- European Commission. (2019). *2019 European Semester: Communication on Country Reports*. Retrieved from https://commission.europa.eu/document/download/4a3d6084-d84a-43af-a6a7-d17d8e6eae58_en?filename=2019-european-semester-communication-country-reports_en.pdf
- European Commission. (2021a). *The EU's 2021-2027 long-term budget and NextGenerationEU: facts and figures*. Publications Office of the European Union. Retrieved from <https://data.europa.eu/doi/10.2761/808559>
- European Commission. (2021b). *The 2021 ageing report: Economic & budgetary projections for the EU Member States (2019-2070)*. Publications Office. Retrieved from <https://data.europa.eu/doi/10.2765/84455>
- European Commission. (2022). *European Semester: Country Report - Belgium*. Retrieved from https://commission.europa.eu/document/download/c5d4a762-9123-45bf-bfbb-3528b5c3d788_en?filename=2022-european-semester-country-report-belgium_en.pdf

- European Commission, Directorate-General for Economic and Financial Affairs. (2019). *European economic forecast: Spring 2019*. Publications Office. Retrieved from <https://data.europa.eu/doi/10.2765/05897>
- European Parliament. (2021). *Country-Specific Recommendations for 2019, 2020 and 2021*. Retrieved from [https://www.europarl.europa.eu/RegData/etudes/STUD/2021/651391/IPOL_STU\(2021\)651391_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2021/651391/IPOL_STU(2021)651391_EN.pdf)
- Greece. (2020). *38th annual report on the application of the European Code of Social Security (Article 74 of the Code)*. Retrieved from <https://rm.coe.int/greece-reportart74-n-38-2020-website/1680a1856a>
- Grech, A. (2015). Evaluating the Possible Impact of Pension Reforms on Elderly Poverty in Europe. *Social Policy & Administration*, 49, 68-87. <https://doi.org/10.1111/spol.12084>
- Hohnerlein, E. (2019). Pension indexation for retirees revisited – Normative patterns and legal standards. *Global Social Policy*, 19(3), 246-265. <https://doi.org/10.1177/1468018119842028>
- Jaag, C. Y., Jaag, C. Y., Keuschnigg, C., & Keuschnigg, M. (2007). Pension Reform, Retirement and Life-Cycle Unemployment, *CESifo Working Paper No. 2163*. Retrieved from <https://ssrn.com/abstract=1070688>
- Jessoula, M. & Raitano, M. (2019). *A new path for Italian pensions*. ESPN. Flash Report 2019 - 11.
- Kotlikoff, L. & Burns, S. (2005). *The coming generational storm: What you need to know about America's economic future*. MIT press.
- Lachowska, M. & Myck, M. (2018). The Effect of Public Pension Wealth on Saving and Expenditure. *American Economic Journal: Economic Policy*, 10(3), 284–308. Retrieved from <https://www.jstor.org/stable/26529044>
- Le Soir. (2024). Relance: La Belgique n'a toujours pas reçu son premier versement. *Le Soir*. Retrieved from <https://www.lesoir.be/566367/article/2024-02-05/relance-la-belgique-na-toujours-pas-recu-son-premier-versement>
- Leicester, A., O'Dea, C., & Oldfield, Z. (2008). *The Inflation Experience of Older Households*. Institute for Fiscal Studies, London.
- Leombruni, R., & Mosca, M. (2014). The redistributive features of the Italian pension system: The importance of being neutral. *New Pathways in Microsimulation*, 109-128.
- NBB. (2021). The Belgian economy in the wake of the COVID-19 shock. *NBB Economic Review*. Retrieved from <https://www.nbb.be/fr/articles/leconomie-belge-au-lendemain-du-choc-de-la-crise-du-covid-19>
- Nossiter, A. (2019, December 23). Why France Is in the Streets. *The New York Times*. Retrieved from <https://www.nytimes.com/article/france-pension-strikes-macron-explainer.html>
- OECD. (2007). *Pensions at a Glance: Public Policies across OECD Countries*. OECD. Paris.

- OECD. (2019). OECD Reviews of Pension Systems: Portugal. *OECD Reviews of Pension Systems*. OECD Publishing. Paris. Retrieved from <https://doi.org/10.1787/9789264313736-en>.
- OECD. (2021). *The initial impact of COVID-19 on OECD tax revenues*. OECD Publishing. Paris. Retrieved from <https://doi.org/10.1787/6e87f932-en>
- OECD. (2022). *How inflation challenges pension*. OECD Publishing. Paris. Retrieved from <https://www.oecd.org/pensions/How-inflation-challenges-pensions.pdf>
- Office for Budget Responsibility. (2023). Why has recent inflation been stronger than we forecast? *Office for Budget Responsibility*. Retrieved from <https://obr.uk/box/why-has-recent-inflation-been-stronger-than-we-forecast/>
- Panizza, U. (2002). Income Inequality and Economic Growth: Evidence from American Data. *Journal of Economic Growth*, 7(1), 25-41. <https://doi.org/10.1023/A:1013414509803>
- Peersman, G., Schoors, K., & van den Heuvel, M. (2023). Hoezo energiecrisis? Analyse van de energiefactuur van 930.000 gezinnen. *Gentse Economische Inzichten*, 9. Retrieved from <https://www.ugent.be/eb/economics/en/research/gei/gei9>.
- Pereira, J., Karam, P., Muir, D. & Tuladhar, A. (2010). Macroeconomic Effects of Public Pension Reforms. Retrieved from . <https://EconPapers.repec.org/RePEc:imf:imfwpa:2010/297>
- Piggott, J. & Sane, R. (2009). *Indexing pensions*. Retrieved from <https://EconPapers.repec.org/RePEc:wbk:hdnspu:52445>
- Queisser, M. & Whitehouse, E. (2006). Neutral or Fair? Actuarial Concepts and Pension-System Design. *Social, Employment and Migration*. Working Paper No. 40, OECD. Paris.
- Reis, R (2005). A cost-of-living dynamic price index, with an application to indexing retirement accounts. *CEPR Discussion Paper No. 5394*. CEPR Press, Paris & London. Retrieved from <https://cepr.org/publications/dp5394>
- Ramos, R. (2014). The new revaluation and sustainability factor of the Spanish pension system. *Economic Bulletin, Banco de España*, issue JUL, 13-21.
- Settergren, O. (2001). The Automatic Balance Mechanism of the Swedish Pension System—A Non-Technical Introduction. *Wirtschaftspolitische Blätter*, 4.
- Statbel. (2023). Overview of Belgian wages and salaries. Retrieved from <https://statbel.fgov.be/en/themes/work-training/wages-and-labourcost/overview-belgian-wages-and-salaries#figures>
- Statbel. (2024a). *Health Index*. Retrieved from <https://statbel.fgov.be/en/themes/consumer-prices/health-index#documents>
- Statbel. (2024b). *Harmonised index of consumer prices (HICP)*. Retrieved from <https://statbel.fgov.be/en/themes/consumer-prices/harmonised-index-consumer-prices-hicp#:~:text=The%20largest%20upward%20effect%20on%20inflation%20was%20caused%20by%20natural,effect%20of%200.08%20percentage%20points>.

- Tracy, M. (1976). Maintaining value of social security benefits during inflation: Foreign experience. *Social Security Bulletin*, 39(11): 33–42.
- Vidal-Meliá, C., del Carmen Boado-Penas, M., & Settergren, O. (2009). Automatic Balance Mechanisms in Pay-As-You-Go Pension Systems. *The Geneva Papers on Risk and Insurance. Issues and Practice*, 34(2), 287–317. Retrieved from <http://www.jstor.org/stable/41953031>
- Weaver, R. K. (1988). *Automatic Government: The Politics of Indexation*. Brookings Institution, Washington, D.C.
- Whitehouse, E. (2009). Pensions, Purchasing-Power Risk, Inflation and Indexation. *OECD Social, Employment and Migration Working Papers* 77, OECD Publishing.
- Wilson, T., & Wilson, D. J. (1982). *The Political Economy of the Welfare State*. Allen and Unwin, London.

Official statement of original thesis

By signing this statement, I hereby acknowledge the submitted thesis (hereafter mentioned as “product”), titled:

How to finance Belgian pensions in the future ? The effects of progressive indexation on sustainability and equality of the public pension system

to be produced independently by me, without external help.

Wherever I paraphrase or cite literally, a reference to the original source (journal, book, report, internet, etc.) is given.

By signing this statement, I explicitly declare that I am aware of the fraud sanctions as stated in the Education and Examination Regulations (EERs) of the SBE.

Place: Louvain-La-Neuve

Date: 31st of May 2024

First and last name: Sander De Rudder

Study program: Master of Science in Economic Studies (University of Maastricht)

Course/skill: Writing a Master's Thesis Proposal: Economics (2223-EBS4035)

ID number: i332774

Signature: 

Sustainable Development Goals (SDG) Statement

Name De Rudder Sander
ID i6332774
Supervisor Jean Hindriks (UCLouvain)
Date 3rd June 2024

Through the research conducted for this master's thesis, I seek to contribute to one or more of the 17 SDG(s) set forth by the United Nations (<https://www.undp.org/sustainable-development-goals>).

Specifically:



SDG Code(s): 1 and 10

Explanation :

Through the research presented above, we contribute specifically to two of the Sustainable Development Goals. The first one is the reduction of inequalities, especially the limitation of the increase in gaps in terms of pension benefits that are widened by the classical indexation. By binding indexation to certain thresholds, the extra amount of pension benefits generated by indexation is the same for those above the threshold. Therefore, the pension gaps stay constant. Furthermore, the revalorization of minimum rights with respect to wage index rather than to price index increases the replacement rate of the poorer pensioners and reduces the ones of higher deciles of the population. Further reducing inequalities. The second one is about poverty alleviation, by targeting indexation to lower deciles we are able to push them further away from poverty. Especially with the indexation with respect to the wage index.