Master Thesis

THE HUNGARIAN PENSION SYSTEM: ANALYSIS AND A PENSION REFORM PROPOSAL

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ABSTRACT

The thesis aims to provide a pension reform proposal to the PAYG based Hungarian system that is inspired by the Danish system. Pension systems in general struggle with the problems of demographic changes among others in the 21st century. According to a recent study the Danish system, which functions as a multi-pillar system, is one of the bests globally. On the contrary, the Hungarian pension system operates in a PAYG system since 2011 again and faces severe sustainability and old-age poverty issues. Using the overlapping generations model by Diamond, effects and consequences of longevity and ageing population are discussed in both PAYG and funded systems, assuming favorable results for the latter one. Furthermore, the old-age poverty issue is investigated with the help of income inequality measures. The comparison of the systems and the two countries lead to a proposal incorporating the introduction of a mixed pension combining PAYG and funded schemes.

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Glossary of Terms and Abbreviations

PAYG	Pay-As-You-Go A pension system where pension benefits are financed from contributions paid by current workers.
DB	Defined Benefit A retirement plan where pension benefits are determined based on length of employment and salary levels.
DC	Defined Contribution A retirement plan where pension benefits are based on the value of contributions paid by each member.
Multi-pillar system	A pension system that incorporates public, occupational and voluntary personal pensions.
Funded pension	A system with enough assets to cover its liabilities. Contributions are invested to pay for future pension benefits.
Unfunded pension	A system with insufficient assets to pay its pension obligations. Pension benefits are directly paid from contributions.
Relative income poverty rate	The rate defines the share of people whose income is less than the poverty line. The poverty line is in general half the median disposable income in the total population.
Poverty gap	It determines the ratio by which the mean income of the por falls below the poverty line.
Gini coefficient	It is a measure of income distribution across the total population ranging from 0 (perfect equality) to 1 (perfect inequality).
P90/P10	It is an income inequality measure. It is the ratio of income at 90^{th} percentile to the one at 10^{th} percentile on the income distribution.

1. Introduction

The main idea of this thesis was given by a recent international ranking of pension systems, the Mercer Global Pension Index, where the Danish system acquired top position along with the Netherlands. (Mercer, 2019) Hungary was not included in the study, but it is known to have significant problems regarding its pension system like old-age poverty and sustainability issues among others. Demographic changes like population aging and increasing life expectancy are great challenges to the pension systems of the 21st century in general.

There is a tendency for countries moving from defined benefit (DB) to defined contributions (DC) pension schemes as longevity problems arise in many countries. Pension payouts in a DB scheme are calculated based on previous earnings and contributions and in a DC scheme pension benefits are determined by the accumulated asset value through private savings. Ortiz et al. (2018) presented that there have been 30 countries doing so in 3 decades, however some of them like Hungary decided to deviate later on. Hungary returned back to the DB system in 2011 after having functioned in the 3-pillar system recommended by the World Bank (Holzmann et al., 2008) for more than a decade. The previously called 2nd pillar, the mandatory private pension scheme was abolished, so the future payments for retirees come only from the state pension from the PAYG system and their voluntary pension savings since the reform. Even though the government is trying to make the voluntary private pension desirable by tax refunds, the state pension is still having a lot of pressure resulting from the demographic changes and their effect on the functioning of the PAYG system.

On the other hand, Denmark is proved to have a well-functioning multi-pillar pension system. According to Jensen, Pedersen and Foxman (2019b), its success lies among others in the reform that attached the retirement age to the continuously increasing life expectancy and the structural change of the system such that households' private savings have more importance. The defined contribution based 2nd pillar mitigates the negative effects of demographic changes, furthermore provides adequate pension benefits for all, yields high replacement rates and relatively low administrational costs. Jensen et al. (2019a)

complements the list for the above-average performance with good coverage and fiscal sustainability. The DC system results in better outcomes in many aspects compared to the DB.

The purpose of this thesis is to analyze a pension reform proposal, the option of moving from DB to DC system. More specifically to offer a pension policy option for Hungary inspired by and designed after the Danish system with the introduction of a mandatory fully funded pension scheme as a supplement to the current PAYG. The main goals of any pension systems are to provide the retired generation an adequate income and keeping the government's budget for state pension sustainable meanwhile overcoming the challenges of demographic changes. However, systems with different structures perform differently in many aspects. Designing a pension reform should aim at achieving improvements in these fields. The introduction of parametric reforms like increased contribution rates or decreased pension benefits put either the young or old generations in difficult situations so an alternative option is rather examined here, the structural change. Compared to parametric changes, a paradigmatic reform is supposed to share the costs and risks of the transition within the entire population, but at the end all generations are better off.

For the reform proposal to be reasonable, first it has to be shown whether a DC system is more resilient to demographic changes and should be preferred over the DB. The systems are compared in the terms of sustainability and redistributive features. As for the sustainability analysis, the OLG model by Diamond is used to investigate how well the DB and DC systems perform in the long run with the presence of the currently threatening demographic changes. The impact of longevity and ageing population is studied on long-run pension payouts in the two systems. As a matter of fact, ageing population is a consequence of the interplay of falling fertility rates and increasing life expectancy. The effects of longevity are discussed separately so ageing population always refers to the decline in fertility rates in this thesis representing the trend that the size of young cohort is always getting smaller than the old cohort. From previous researches the DC system is expected to bring better results, though Fanti and Gori (2011) proved that decreasing fertility is not necessarily inducing lower pension payouts in the long term. Additionally, Ediev (2014) argued that a population facing longevity issues might be better off with the PAYG system rather than a funded one. He explained that the working generation now will have a longer life expectancy at retirement than the pensioners

currently have which makes it easier and less costly to fund on the PAYG basis than to fund their own pensions in the future through a funded scheme.

After having elaborated on the intergenerational distribution with the help of the OLG model, the intragenerational distribution is examined using inequality measures. The poor redistributive feature of the system is reflected in poverty among the elderly, so it is important to look at the extent of old-age poverty in the population. The 2nd pillar schemes are earning-related, as a consequence they cannot contribute to income redistribution extensively. Since pension benefits are determined based on the previous wages and paid contributions, people who were threatened by poverty during their working age are at risk after retirement as well in a pension system that functions in a fully funded scheme. It is supposed to be the 1st pillar that ensures income redistribution. In a PAYG system money is redistributed from young workers to retired in the same period of time, but also redistributed from the better off to worse off. The minimum pension, that is independent of previous contributions, is supposed to protect the ones in need against old-age poverty. However, the amount of minimal pension has not changed in Hungary for a decade since it has no importance for the individual's pension calculation anymore.[1] As a result, the PAYG system is not maintaining its primary role anymore, the minimum pension ceased to exist as a safety net.

Adhering solely to the PAYG system in Hungary will cause sustainability issues in the coming decades as Bajkó, Maknics, Tóth and Vékás (2015) predicted as well. They expressed their worries regarding a default in the system in the future that will put a threat on the living standards of the elderly. The Danish system also is in need of changes, but Jensen, Hansen and Stephensen (2016) recommended it as a role model for other countries. They believe that the Danish model could inspire others for improvements and provide a guidance on the design of a reform agenda. In this thought, introducing or re-introducing a funded 2nd pillar could help sustainability issues and mitigate intragenerational poverty that Hungary faces now. The possibilities of this step are elaborated on later in this thesis.

The rest of the thesis is structured as follows. Chapter 2 provides a general insight in the literature. In Chapter 3 the evolution and characteristics are discussed of both the Hungarian

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[1] https://www.penzcentrum.hu/nyugdij/ennyi-lesz-jovore-az-oregsegi-nyugdijminimum-ennek-magyarok-tizezrei-latjak-karat.1086581.html

and the Danish pension systems, along with the effects of demographic changes. Chapter 4 depicts the OLG model and presents results for the effect of demographic changes on sustainability in both PAYG and funded system. The problem of old-age poverty is discussed in Chapter 5. Chapter 6 examines the reform proposal of a mixed system of combining PAYG and funded schemes. Finally, Chapter 7 concludes the paper.

2. Literature Review

For any country that is determined to thrive and develop economically, it is essential have a well-functioning social security system that includes the pension system as well. A pension system is performing properly if fiscal sustainability and fair pension payouts are ensured even under the threat of demographic changes. The World Bank (1994) involved itself in assessing pension systems and came up with a reform proposal including key principles ad concepts for a paradigmatic change. The recommended and introduced multi-pillar system incorporating privatization has been adapted by many countries including Hungary in the late 1990s.

After a bit more than a decade, this decision was changed and a re-reform took place. The Hungarian National Bank's assessment concluded that the multi-pillar system is not sustainable as the unexpectedly huge increase in the net implicit liabilities reflected it. (Orbán and Palotai, 2005) Other reasons for the re-reform are discussed in Chapter 3. The International Monetary Fund (2010) however had advised against it. Hungary was one of the countries who implemented the World Bank's proposal in the most successful ways according to IMF's assessment.[2] At that time Hungary was characterized with a relatively stable situation even though the 2008 recession hardly hit the economy. The government was under pressure to meet the EU's target for fiscal deficit[3], but the measures taken in order to reach the objective were criticized by the IMF as well among others. The transfer of assets from the 2nd pillar into the 1st raised concerns regarding transparency, liquidity and queried the

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[2] https://www.imf.org/en/News/Articles/2015/09/28/04/52/mcs102510

[3] https://ec.europa.eu/eurostat/statistics-explained/index.php/Government_finance_statistics#Introduction

preservation of economic growth. They argued that instead of improving the economic situation of the country, the reform rather hindered it.

Furthermore, the method of implementation seriously undermined the confidence of the population as they were not clearly informed about the reimbursement procedure. The amount of contributions were redirected back to the 1st pillar, but the pension funds had been accumulating their returns and extra voluntary payments as well on top of the mandatory ones. The confidence issue is further elaborated in Chapter 3. Simonovits (2011) criticized the reform as well that he summarized in a very expressive way as "a fine example of how not to make a pension reform". He shared the IMF's worry as well about the use of nationalized assets from pension funds. The concern was that they will be used for an immediate reduction in government deficit, but no reform of the system will be executed and funded apart from that. The undemocratic way of implementation further added to the untrustworthiness of the government mentioned by Szikra (2018). The whole process happened so rapidly that the ruling government did not consult with anyone, neither did they leave time for authorities or experts to provide a professional feedback or recommendations on it.

Nearly a decade later, the OECD (2019a) raises concerns regarding both sustainability, old-age poverty and transparency. Projection by the European Commission (2018) contributed to the OECD's research showing that along with the increasing old-age dependency ratio pension contributions will fall. In the period until 2070, first the public pension expenditure is expected to decrease slightly, but then it reaches an approximately 3 percentage point rise at the end which is substantially higher than the EU average.

The same projections for Denmark depict a more favorable situation by far. Denmark is one of the few countries that is predicted to have continuously decreasing trend. Even a slight increase at the end of the projection horizon leaves the public pension expenditures at a way lower level than it was at the time of the projection. It leads to a nearly 2 percentage point decrease in total for the entire horizon of approximately 50 years. The European Commission's latest assessment described Denmark with sound public finances partly owing to the recent pension system changes like linking the retirement age to increasing life expectancy.[4] The occupational scheme is playing an essential role in contributing to both the sustainability of the entire pension system, ensuring adequate living standards for the elderly

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[4] https://ec.europa.eu/info/sites/info/files/2020-european_semester_country-report-denmark_en.pdf

and keeping the system robust to population ageing. The European Commission (2018a) nevertheless raises concerns regarding the coverage and saving disincentives. The occupational scheme includes all full-time workers, but others like self-employed cannot participate in it and the interaction of public and private pension has an impact on retirement decision for low income people. It additionally proposes increasing the transparency of the system. The OECD (2019b) also mentions the issue with high contribution rates that makes households exposed to financial risks. Higher the contribution rate, higher the savings accumulated by pension funds and also higher the probability that an unexpected change in the underlying price or interest rate occurs in the future negatively affecting the value of savings. It nevertheless emphasizes the necessary existence and contribution of the occupational schemes to the pension system to keep it resilient to population ageing. According to OECD projections, the gross pension replacement rate in Denmark, taking into account the public and the private scheme together, could reach nearly 90% by 2070 even under the threat of demographic changes. The robust system is not perfect though as Andersen (2015) and Jensen et al. (2019a) mentioned it as well and is need of alterations. One of the most important challenges they discussed arises from the interaction between public and private schemes that is crucial for maintaining savings incentives for retirement and thus lifetime consumption smoothing. The so-called “toxic combined taxation” had rather an adverse effect on savings behavior and the government tried to mitigate this disincentive impact through the introduction of high tax relief on contributions among others. The IMF (2019) report emphasized the importance of further changes to the system in order to keep the system fiscally viable. Reforms like increasing retirement age linked to increasing life expectancy, and increased contribution deductions support that objective.

There are other forms of pension systems as well all around the world, some performing better than others, but the IMF (2014) and Holzmann and Hinz (2005) define the primary objectives of a pension system in general as consumption smoothing, adequacy, poverty relief, redistribution and sustainability. The different schemes take different approaches to achieve these goals, but a pension reform has to aim at an improvement in these fields. They claim that a pension reform must be based on a holistic approach that secures economic growth without distortions as future pensions depend on future output as well.

The next chapter focuses on the two pension systems, the Hungarian and the Danish that do not share many similarities. It elaborates on the specific characteristics that makes them

so different, what changes they went through over time and how they integrate the main objectives a pension system should regard.

3. Overview of pension systems

This chapter presents the characteristics and evolution of the Hungarian and Danish pension systems over the last years. It puts emphasis on the weaknesses and challenges of the Hungarian PAYG system and highlights the strength of the Danish multi-pillar system.

3.1 The Hungarian pension system

Pension benefits have been existing in Hungary for about almost a century, but the thesis is not covering the entire period. It rather discusses the recent changes since 1998 including both the introduction and abolition of the three-pillar system along with its motives, problems and consequences. Furthermore, it goes more detailed into demographic challenges of the system as longevity and ageing population.

First of all, the situation of the pension system is presented since 1998 along with depicting the path towards the reform in 2011. The Hungarian pension system was first reformed in 1998 based on the recommendation of the World Bank (1994) introducing the three-pillar system with the goal to boost long-term sustainability. (Simonovits, 1999) The main initiatives for a reform were the demographic changes, also Szikra (2017) mentions additional problems as the lack of transparency and indexation in the system as well as the huge differences in pension among different cohorts retiring the following years. Furthermore, people didn't tend to have individual savings which means that the main income they could count on in retirement years was only the pension provided by the state. In order to reduce the burden on the state budget, more sources of pension income had to be introduced. The reformed system was set up in order to provide a way for avoiding old-age poverty and boosting economic development at the same time.

The three-pillar pension system seemed to provide a solution for the issues mentioned above. The 1st pillar, the earnings-related public system was characterized by defined-benefit operated on a pay-as-you-go (PAYG) basis, meaning that the current pension payouts were covered from the current incoming contributions through payroll taxes. The second pillar, that was introduced for the first time with the 1998 reform in Hungary, incorporated the mandatory private pension, where contributions were collected by pension funds on individual accounts. Funds invested in capital markets and yields from these investments provided additional sources of income for retirement years. While in the case of the first two pillars contributions were collected directly or indirectly by the state, the third pillar, the voluntary private pension was completely independent of it. It was a DC fully funded scheme.

At the time of the introduction, the employers' contribution accounted for 24% of net salaries that was paid to the 1st pillar, however the 7% of net salary, the employees' contribution was split into two due to the reform. 6% was transferred into the private pension funds and the remaining 1% was further enriching the public system. (Szikra, 2017) By that, the actual contributions paid to the 1st pillar were cut, but that was not the only issue the new three-pillar system suffered from. Even the ongoing political situation remorated the successful stabilization of the new system. Right after the introduction, the opposition (who is the ruling party during 2011 reform and in 2020 as well) got into power during the next election, who openly disagreed with the reform for three-pillar system and was also not willing to proceed with the previously planned improvements like raising the contribution rates. Continuing with the improvement steps was crucial for the successful integration and functioning of the newly installed system. It was only 4 years later, with a new government again that these improvements were executed. (Simonovits, 2009)

That 4-year gap with the absence of sufficient improvements could have contributed also to the problems that arose over time. The second pillar was expected to provide a sufficient amount of private pension so that it eases the burden on the public system. Nevertheless, a review was conducted a few years later among the private pension funds because they were criticized for not having met the expectation regarding returns and had huge amounts of administrative costs. (Mesa-Lago, 2014) Simonovits (2009) explained this with the structure of the system. According to him, the costs were not driven down due to the high concentration in the market as five big funds owned approximately 80% of the capital. The funds were expected to spend 4-5% on operational costs, to the contrary the

reality was rather above 10%. Besides the costs being too high, the returns were too low since most of the capital was kept in low-risk government securities. (Szikra, 2017)

Furthermore, it reduced the coverage for the 1st pillar as the bigger part of the employees' contribution was not paid to the state directly anymore and this transition cost resulted in a huge deficit. By 2009 it reached 1,4% of the GDP highly exceeding the planned 1% and the expectations for the future were not favorable either. The government was under great pressure as meeting the Maastricht criteria regarding government deficit and debt[5] became problematic. Furthermore, the GDP suffered a negative shock due to the crisis in 2008 as well. An exemption was granted for meeting the requirements until 2010 for countries going through the pension reform saying that the transition costs can be ignored for the deficit calculation. The problem was not solved though, only the immediate threat was alleviated. According to prediction by Monostori (2009) and (2016), the dependency ratio was expected to more than double up to 48,3% until 2050 which shows an even faster increase than the EU average and further up to 53.4% by 2070. If these expectations became true, that would make the pension expenditures to account for 20% of the GDP.

These numbers regarding government deficit, dependency ratio and pension funds' costs predicted serious challenges for the short- and long-term sustainability of the system so the need arose for a new reform. Although the general solution to sustainability issues was the multi-pillar system which is supposed to decrease the burden on the publicly funded 1st pillar, Hungary made a decision against this idea. The fact that the private pension funds didn't perform well enough, but it divided the employees' contribution, made it harder and harder to sustain the 1st pillar as well so a decision was made to leave the three-pillar system. (Szikra, 2018)

Hungary was not the only country reaching this decision. As a matter of fact, Ortiz et al. (2018) considered the privatization process unsuccessful as 60% of the countries that privatized fully or partially decided to reverse it later on. Despite the advantages offered by the multi-pillar system, these cases demonstrate unexpectedly high administrative costs along with low benefits and the exposure to market risk raised doubtfulness in people about their future pension incomes.

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[5] https://www.ecb.europa.eu/ecb/orga/escb/html/convergence-criteria.en.html

The decision became urgent when the temporary exemption from the EU regarding deficit calculation was not prolonged after 2010 and the aftermath of the 2008 crisis was still acute. A new law was passed in 2011, according to which a new two-pillar system was established with the elimination of the previous second pillar. Without the mandatory private pension, the future pensions depend on the PAYG payouts of the 1st pillar which face several difficulties and the voluntary savings that individuals put aside from their taxed incomes. The new law was criticized a lot by individuals and was controversial from the public but mainly due to the lack of information and probably the way of implementation. (Simonovits, 2011; Szikra, 2017; Ádám and Simonovits, 2019) The incomplete knowledge about the proper definition of the private pension caused confusion to many people. In 1998, when the second pillar was introduced, that was not an additional pension contribution in a sense that employees didn't pay more than before but the amount they paid was divided now, to the state and to the private pension funds. People believed and considered the private pension contributions as their own money that is dependent from the state. Especially for the reason that it was kept on individual accounts, they could follow all the payments, costs and returns from statements they regularly received. However technically that money still belonged to the state. In legal terms it was just a rearrangement of pension contributions from the state.

The re-reform introduced in 2011 was a complex and controversial process. The central goal was to stabilize the system on short-medium term, also to reduce the increased national debt that was caused by the existence of private pension. In 2010, the private pension funds could count more than 3 million members with 3000 billion HUF of assets. Approximately half of it was kept in bonds meaning that transferring them back to the state simply worked as reducing the national debt, namely by 10%. (Ádám and Simonovits, 2019) This makes it obvious why was it so tempting for the government. As the first step in November 2010, the mandatory membership of the private pension was abolished, new entrants of the labor force were not obligated to join anymore. From this point in time, the whole amount of the employee contribution had to be paid to the state, there was no share paid to the private pension funds. This transfer was announced to be temporary for 14 months in the first place, but it stayed permanent at the end. People were still allowed to stay members if they preferred to, but they couldn't keep paying their mandatory employee contributions to their own individual accounts. They had approximately 2 months to decide

on that and declare on staying, otherwise they were automatically transferred. Thus, the second pillar turned into a completely voluntary option.

In December 2010, a new law was declared stating that all those individuals who decided to stay members in a private pension fund even after the temporary period of 14 months and are not willing to pay all their pension contribution to the state, would be deprived of their right for receiving state pension when they retire. This law was withdrawn later on, but it helped to accelerate the process. There was a general disappointment already among people since they believed that the government confiscated their money from the private funds, but it still sounded better than not getting any state pension for the rest of their life. People who chose to leave private pensions were promised individual accounts also after transferring their money back to the state that could be inherited as well, which sounded reassuring, but this was never accomplished. Also, it would have been impossible to achieve that with the prevailing conditions since there are no individual accounts in system that functions on a PAYG basis. That would have required the restructuring of the system.

As a supplement, the employer contribution was renamed to pension tax. This step was needed in order to justify the state's threat about denying state pension and to avoid impeachment for social rights' violation. (Ádám and Simonovits, 2019) When it is defined as a form of tax, there is no obligation for providing anything in return for the contributions so the employers can be forced to pay their part but the government is not forced to pay the pensions later on. The bribing strategy turned out to be very successful as by the end of January 2011, 97% of the members decided to leave private pension funds and that meant an additional 3000 billion HUF for state pension.[6] As no individual accounts were established, that whole amount was poured into the PAYG system and used for fixing the central budget. More precisely, almost 70% of assets were used to reduce debt.

The most common misunderstanding from the population arose at this point. People were upset as they believed the state took away their own pension savings and made it disappear raising confidence issues. What happened in reality is that the pension contribution belonged to the state even when it was collected by private pension funds previously, so by redirecting that money back to the state pension, the state technically didn't do anything inappropriate. It had the right to deal with the amount of the contributions as it wished and

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[6] https://nyugdijmaskeppen.hu/magannyugdijpenztar-manyup/

all the accumulated returns, additional payments were transferred back to the leaving members. Other new regulations were introduced for private pension funds as well mainly regarding their clientele, trying to make their survival harder and harder. As a result, in 2020 there are only 4 still operating private pension funds, but the number of their members halved since the introduction of the reform.[7] Along with the nationalization of the private pension, further changes were accomplished that Szikra (2017) described as the "profile cleansing" of the system. As an additional, almost all early retirement options were abolished, disability pension was removed from public pension, the minimum pension was kept frozen, and it still is since then, and price indexation was introduced.

The second half of this section gives insight into the current functioning and challenges of the Hungarian pension system. As of 2019, every fifth person in Hungary received pension, the benefits accounting for 8.9% of GDP. (KSH, 2019) Every citizen is entitled to it as soon as they reach retirement age and have a certain period of time registered in service. There is an exception for women allowing them to retire once they completed 40 years of service even if they haven't reached the retirement age yet. It is allowed for them to count periods with child raising-related benefits as part of the 40 years.(OECD, 2017a) This was the only early retirement possibility that survived the 2011 reform, all the other like for armed forces or hazardous jobs were abolished. There are several forms of pension-like benefits, like disability allowance, widow's pension, orphans' benefit but this research takes into account only the old age pension.

The calculation of the pension benefits is conducted in a Bismarckian-type earnings-related method where contributions are closely linked to benefits. There are two main requirements a person has to meet to be eligible for old-age pension: reaching retirement age and minimum 20 years in service. (Emberi Erőforrások Minisztériuma Központi Ügyfélszolgálati Iroda, 2019) There is a so-called Pillar 0, a minimum pension benefit of 28.500 HUF monthly that serves as a lower bound for those who meet the eligibility requirements for full pension.[8] It was supposed to ensure that even people who have reached retirement age and have had only low-paying jobs for the two decades could count on a sufficient amount pension benefit that prevents them from poverty. Nonetheless, this amount has not been

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[7] https://nyugdijmaskeppen.hu/magannyugdijpenztar-manyup/

[8] Country Fiche on Pension Hungary

increased for more than 10 years now. The reasoning behind it is that it has no significant importance anymore regarding the pension benefit calculation. It is still used however for determining a list of other social subsidies as maternity leave and allowances, child protection allowances and certain health insurance benefits among others. In the current settings, increasing the pension minimum would threaten the central budget through all the social subsidies, but it would not affect considerably the pension system itself. There are only a very few number of people who receive only this amount of benefit, though the exact number is not published by the government.[9] With the current, earnings-related calculation method the majority of retired people get a much higher benefit. The average salary and the length of service are used in order to determine the amount of pension benefit an individual is entitled to. Regarding the first term, the average of all salaries since 1988 that contributed to social security system are taken into account. The salaries are used in net terms, net of taxes and contributions, and valorized. Furthermore, digression is carried out meaning that for average salaries between 372.000 and 421.000 HUF, 90% of it can be taken into account, and for average salaries higher than 421.000 HUF, 80% of it can be used as a base for pension calculation. The length of service is used as a scale to determine the percentage of the previously estimated average salary. As of 2020, if the mandatory 20 years of service is completed, 53% of the average income can be received as pension. In case the service period is longer than that, the pension benefit is proportionally higher as well. For a service of 25-36 years, the benefit increases by 1% for every year and by 2% for every year in the case of 40 years service. [10]

From the revenue side point of view of the public system, the employer contributions, or since 2011 the so-called social tax accounts for 17.5% of gross income meanwhile the employees' contribution increased to 10% of income.[11] The social tax is expected to be further reduced by 2 ppt. for the second half of 2020.[12]

The Hungarian Central Statistical Office sets the average pension payout to 126.723 HUF (350 €) monthly in 2019.[13] The replacement rate is less than 52% and it has been decreasing in the past 6 years. The indexation of the system is one of the reasons for the

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[9] https://www.napi.hu/magyar_gazdasag/nyugdij-nyugdijas-orban-viktor-kormany.670941.html
[10] https://ado.hu/tb-nyugdij/az-oregsegi-nyugdij-osszegenek-szamitasa-2020-ban/
[11] https://ado.hu/tb-nyugdij/2020-julius-1-tol-hatalyba-lepo-uj-tb-szabalyok-i-resz/
[12] https://www.nav.gov.hu/nav/segitseg_rendkivuli_helyzetben/Csokken_a_szocialis_h20200427.html
[13] https://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_fsp001.html

increasing gap between average wages and pensions. Pensions are indexed to consumer price index, so they do not follow the growth of wage. This can cause huge differences in benefits for subsequent groups of retiring people.

Furthermore, a substantial income gap has been shown between the poorest and richest pensioners. Here being poor or rich only refers to the amount of monthly pension benefits they are entitled to. Nearly 60% of the 2 million retired people receive a smaller benefit than the average representing the disproportional problem in the system. Furthermore, 3.6% of pensioners obtain a pension that is even less than half of the average, which is completely insufficient for proper living standards, meanwhile a monthly benefit that is more than twice the average is granted to 2.7% of retired population. [14] This problem refers to intragenerational distribution issues, that will be covered more in depth in Chapter 5.

The remaining part of this section elaborates on the challenges and weaknesses of the current pension system. As the 2011 reform reversed the system into a two-pillar system, pensioners' income depends only on the public pension and the voluntary private savings and the system faces similar sustainability issues as before 1998. The main problem of the 1st pillar arises from demographic changes like longevity or increasing old-age dependency ratio, and the fact that it needs to keep the balance between incoming contributions and paid-out pensions. However Augusztinovics (1999) argues that the demographic changes alone are not responsible for the fall of the pension system, but economic factors, like employment rate are to blame as well.

The increasing life expectancy results in a longer period of payments for the system. According to the latest data, life expectancy at birth is 73.8 years for male and 80.7 years for

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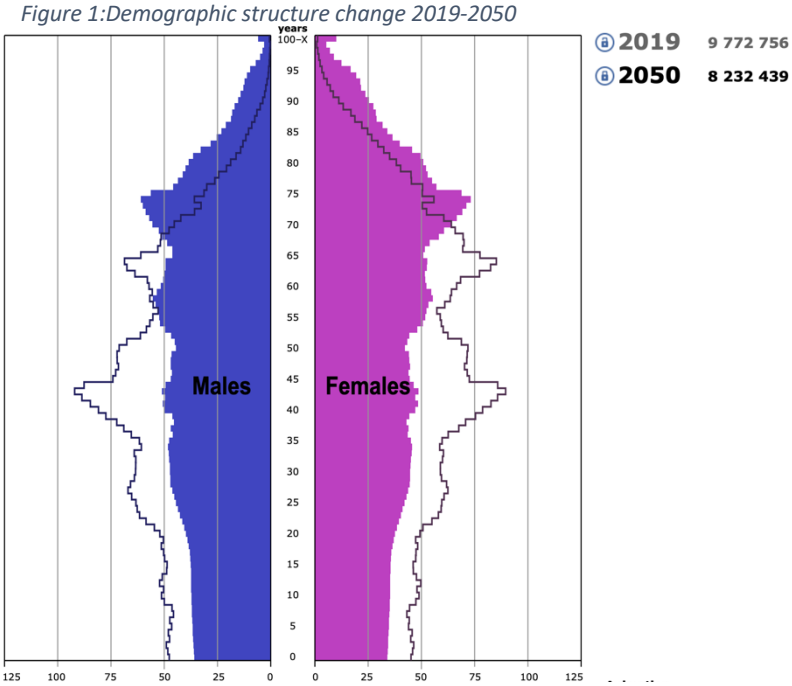
[14] https://hvg.hu/gazdasag/20200902_73_ezer_torpenyugdijas_el_Magyarorszagon

Figure 1:Demographic structure change 2019-2050



Source: https://www.ksh.hu/interaktiv/korfak/orszag_en.html

females in 2020 [15] and it is continuously increasing. The retirement age is 64.5 years for both genders in the same year currently, though women have the option of early retirement after completing 40 years of service which changes their average retirement age to 61.2 years. (KSH, 2019) Also, the demographic structure of population is changing in an unfavorable way for pension systems with the increasing number of people reaching retirement age. The pension system will probably experience the hardest time in the coming decade when the entire baby-boom generation is retiring. Figure 1 shows the predicted change in age structure between 2019 (line) and 2050 (colored) illustrated by the Hungarian Central Statistical Office. The structure of the subsequent generations after the baby-boomers doesn't show huge excesses anymore, nevertheless the pyramid still takes a constrictive shape describing an ageing and decreasing population.

The other side of the ageing population issue apart from longevity is the decreasing fertility. Lower birth rates result in a smaller number of workers that are going to pay contributions which is threatening the maintenance of the pension system balance. However, there are researches that discuss a contradictory view saying that decreasing fertility is not necessarily a threatening factor. One of these was the paper by Cipriani (2013) who explained it through a quantity-to-quality shift in child investment. He discussed that fertility is decreasing because parents rather prefer to invest in human capital, in the children's education. With higher education, they can expect to have higher future salaries which is

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[15] https://www.worldometers.info/demographics/hungary-demographics/#life-exp

going to raise the contributions as well. A drawback in this picture is the brain drain, the migration of educated human capital. Due to longer education, there is a delay in the payment for contributions and when the new graduates decide to move away, they will pay those higher contributions to another country's pension budget. Also Fanti and Gori (2011) agrees that falling birth rates do not necessarily cause a fall in pension benefits, moreover it can even increase it if the pension tax rate and child rearing costs are high enough.

The burden on the PAYG system could not be abolished but could be at least scaled down if there was an alternative source of pension income too. However, the lack of voluntary saving is characterizing the general behavior in the population. There was a huge decrease in how much people trust any pension funds with the reform. It is a general belief or rather fear that the government can take away any savings any time so people do not see the motives for any savings in funds. This problem arose mainly from the lack of information, people did not have proper knowledge about what was happening during the 2011 reform. On the other hand, it also became very clear that the government can and will do anything to achieve its goals, even if it includes bribing providing profound reasons for untrustworthiness.[16] A recent research concluded that approximately 40% of the people are not saving individually for pension years at all.[17] Either for the reason that they are not able to or they simply are not interested in it, the result is still shocking knowing that the average age of the participants was 40 years. Even though the government made steps in the form of tax deductions to incentivize people to start saving, it seems that the unreliability towards the government is still dominating. It could nonetheless ease the burden on public pension budget, if the voluntary savings would account for some ratio of old-age income.

All of the above-mentioned issues put a high burden on the system as less money is collected that needs to be distributed to more people. There are several recommendations for curing these problems though none of them are proved to be perfect solutions. On one hand, parametric reforms are suggested by adjusting parameters like the payroll taxation, the amount of pension benefits or the retirement age. Increasing the amount of the pension contributions would boost the revenue side for the state, or similarly decreasing the pension payouts causes a fall on the expense side. The purchasing power of the Hungarian pension

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[16] https://nyugdijmaskeppen.hu/onkentes-nyugdijpenztar-onyp/

[17] https://bankmonitor.hu/cikk/ellentmondasosan-gondolkodnak-nyugdijas-eveikrol-a-magyarok-es-te/

payout was already belonging to the lowest group within Europe, so further lowering it would have an unfavorable and even crucial change in many pensioners' life.[18] The effect of raising the retirement age works in two ways. The longer individuals are kept in the labor market, the longer is the period they have to pay contributions and the shorter is the period they get pensions. According to a study from 2018, the retirement age should be extended by 7 years in order to make the system sustainable keeping every other factor fixed, though that would result in the highest retirement age globally. [19] That change does not seem to be feasible at all, also for the reason that people can't be expected to work until the age of 71 when the average life expectancy for men is only 2 years longer. Besides parametric reforms, another option is shifting to partially or fully funded systems. Hungary did an attempt for this in 1998 and then moved away from it later, however a number of studies prove it to be well-functioning and to be preferred over the defined benefit system.

The sustainability of the system is not the only concern. Owing to the indexation, the gap between average salaries and pensions grows bigger and bigger as the pension raise is tied to the inflation and thus independent of the change in average salary. The gap almost doubled within the past 5 years, so by 2019 the average pension benefit is by 43% less than the average salary.[20] It raises concern for the old-age poverty issue. Not only the purchasing power of the pensioners suffers from it, but it also causes huge differences for the new retirees compared to the old ones and it hits the hardest the oldest group of people. Even though the gross replacement rate for Hungary is not the worst on a European scale as Figure 2 shows it, in the list for comparing the purchasing power of pensions, Hungary took a less favorable position as mentioned earlier. The purchasing power of Hungarian pension benefits in 2017 was less than half of the Danish and even less than half of the EU average.[21] Eurostat conducted a research regarding deprivation of societies in 2017 where Hungary did not perform well either. For many people it is normal to have enough income to have a safe and warm home, to pay the bills, to eat nutritious food, have a car, phone, these and some other factors are considered to be desirable as for proper living conditions. Severe deprivation is defined as not being able to afford at least four of the nine items essential for a proper

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[18] http://www.ksh.hu/docs/hun/xftp/idoszaki/regiok/orsz/nyugdij/nyugdij17.pdf

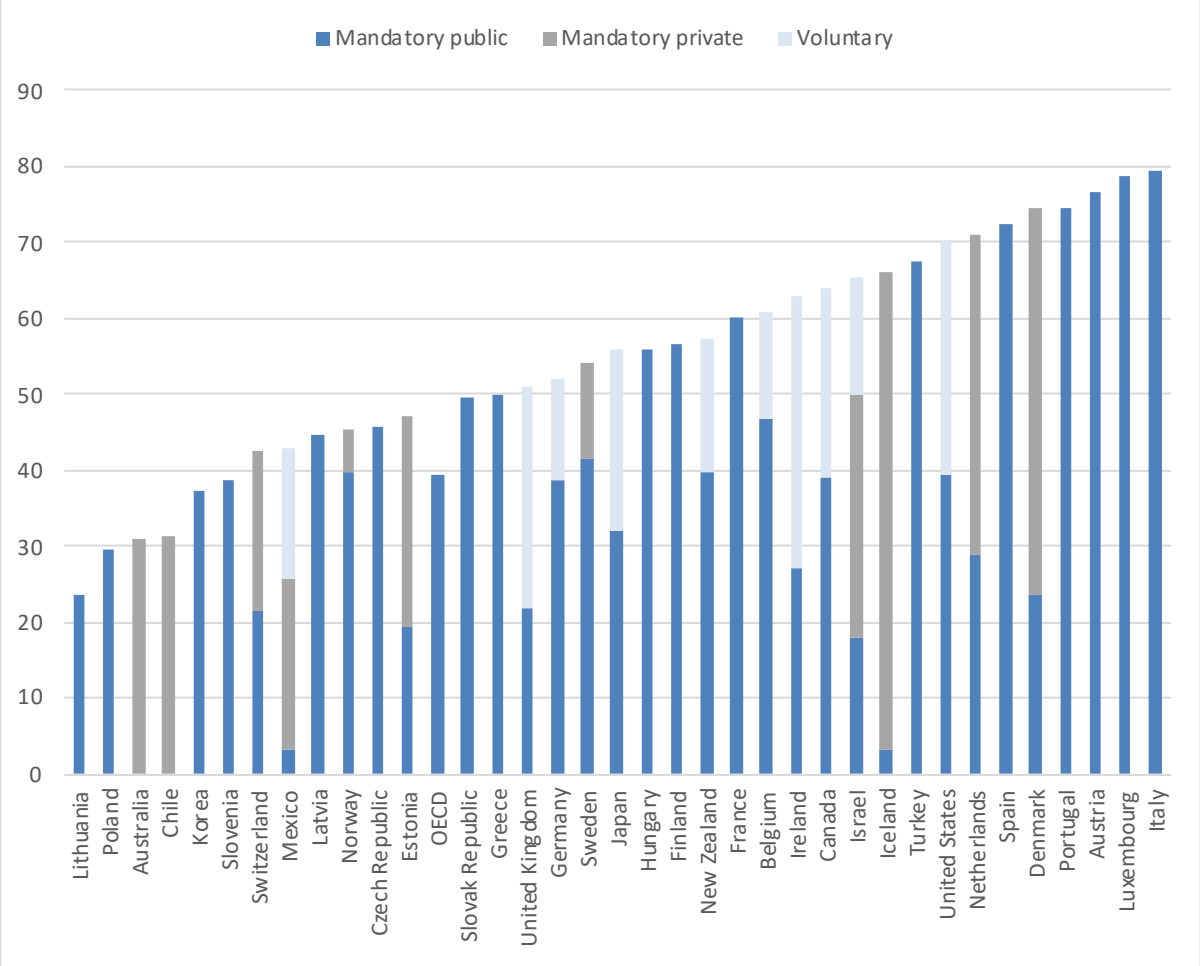
[19] https://szendreiadam.hu/nyugdij/magyar-nyugdijrendszer/

[20] https://bankmonitor.hu/cikk/nagyon-lemaradtak-a-nyugdijak-a-berekhez-viszonyitva/

[21] https://mfor.hu/cikkek/szemelyes_penzugyek/minden-11-forintbol-egy-a-nyugdijasoke.html

standard of life from the list by Eurostat. Looking at the entire population, Hungary takes a high-ranking place with 14.5% way exceeding the EU average however it shows a declining trend in the recent years.[22] The situation is similar for the elderly above 65 years, the 9.4% is worse than the average in EU.[23] It is clear that the current system has problems with providing adequate income with a good coverage in the total population.

Figure 2:Gross pension replacement rates from different pension schemes



Source: (OECD, 2019d)

The main challenges of the Hungarian pension system have been discussed. The next section turns to the Danish system to show that a pension system can thrive too and not only survive.

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[22] https://bbj.hu/analysis/hungary-among-eu-countries-with-highest-poverty-rates_148538

[23]https://www.napi.hu/magyar_gazdasag/idoskori_szegenyseg_ujabb_szomoru_teny_derult_ki_a_magyar_nyugdijasokrol.671698.html

3.2 The Danish pension system

The previous section discussed the main issues of a PAYG based pension system, like in Hungary. Discovering that the DB type pension has many weaknesses, other pension systems are proven to be more efficient. According to the 2019 Mercer Global Pension Index, the Danish and the Dutch pension systems are rated as the best globally, both functioning in a multi-pillar system. The index calculation that is used for the ranking takes into account the adequacy, the sustainability and the integrity of the pension systems. (Mercer, 2019)

The Danish pension system has three pillars providing a better chance for retirees to obtain a proper pension benefit and relief for the burden on the state budget. The 1st pillar covers the DB type state pension, running on a PAYG basis, that provides minimum pension benefit for the entire population.(OECD, 2019c) The public pension is conditional on the residence in Denmark and is indexed to wages, that ensures fairness between previous and new retirees. The supplementary labor market pension, so-called ATP also belongs to the 1st pillar, though it is a DC scheme. Contributions to ATP are deducted from all wages and transfer incomes, so participation is mandatory. The second, and additional pillar compared to the Hungarian system, includes the earnings-related or occupational pension schemes. It has a relatively long history starting from around 1990. The establishment and the decision making up until now are both connected to the so-called social partners, that is an organization of employees' and employers' representatives. The main advantage of the existence of social partners is that the functioning of the occupational scheme is exempt to some degree from risks arising from politics and public finances. However, communication and collaboration with the government is essential when it comes to pension issues or reforms. The participation is mandatory and the main goal of it is consumption smoothing to provide an additional benefit in order to minimize the difference between living standards in working and retired age. The pension benefit depends on working income and years, so individuals having paid higher paid contributions obtain higher pensions, so their consumption opportunities do not have to alter significantly.[24] This pillar is funded in a manner that the mandatory contributions paid by employers and employees are collected on individual accounts and invested by pension funds and other financial institutions and that is used in

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[24] Torben: Robustness of the Danish Pension System

retirement age to cover the pension benefits of the same person. It is the second pillar that mainly distinguishes the multi-pillar system from the PAYG system. The second pillar can be interpreted as the safety net that secures both inter- and intragenerational redistribution and thus strengthens cohesion in the society. (Forsikring & Pension, 2012) In 2020, 4 employees out of 5 pay a contribution that is at least a 12% of monthly salary to the second pillar.[25] Lastly, the third pillar describes the voluntary private pension insurance, however (Jensen, Lassila, et al., 2019) queries the importance of it as the pension benefits from the first 2 pillars are relatively high.

Further strength of the system are listed by Jensen, Lassila, et al. (2019) such as good coverage, low inequality among pensioners, limited administration costs and high replacement rates. The DC characteristic helps to ease the burden on public finances both through improving financial sustainability and through redistribution. In the case of the second pillar, individuals are self-financing, their own savings are paid out as pension benefits. This gives more room for the society to take care of the poor ones, the ones in need. However, they also express their worries regarding the legitimacy and the flexibility in the system. Having the social partners in charge of the occupational schemes reduces the exposure to political risks, but on the downside, legitimacy issues might occur in case of a process with decreasing unionization.

The multi-pillar pension systems are facing similar demographic changes and challenges as discussed in the previous chapter. At the same time, the structural differences in the pension systems provide the opportunity for different approaches and methods to overcome these challenges. As a result of having an ageing population, the OECD (2017b) revealed an increasing old-age dependency ratio. Though the situation seems more favorable than the OECD average, it is still expected to grow up to 45% by 2050. The longevity problem was mitigated in 2006 by linking the retirement age to the life expectancy trying to incentivize people to stay in the labor market as long as possible.

As a result, individuals either have to postpone retirement or they retire early on the cost of lower pension payouts. The current retirement age is 65 years in 2020, but it is increasing up to 68 in the coming 10 years. Not only the demographic projections provide a

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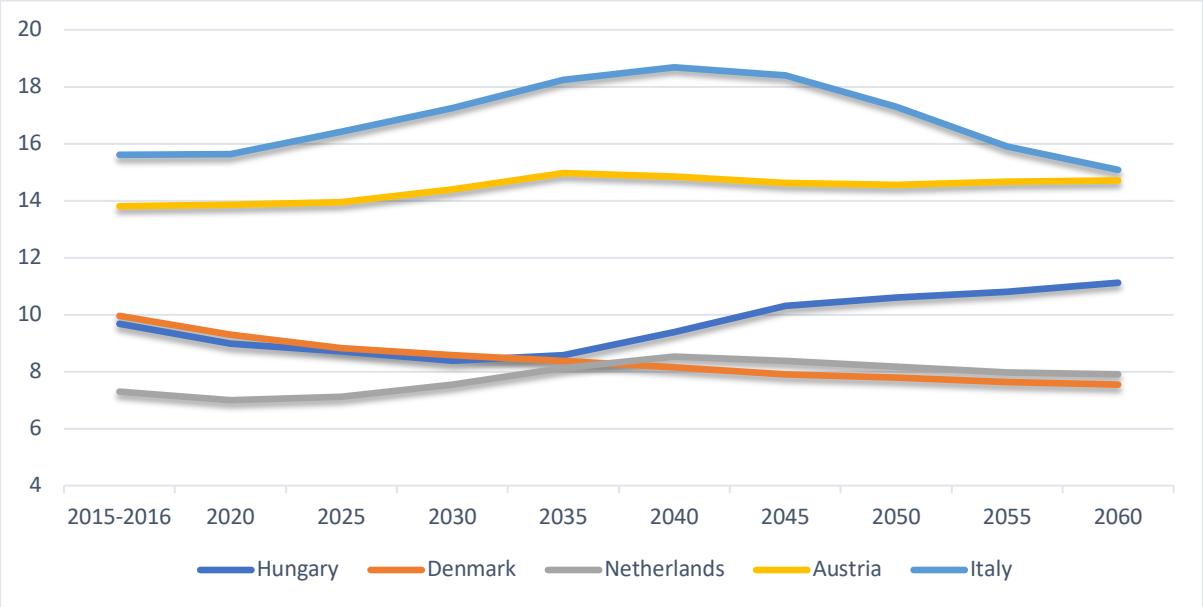
[25] https://www.forsikringogpension.dk/en/press-releases/why-does-the-danish-pension-system-rate-so-high-on-the-mercer-index/

reassuring picture, but so do the expectations regarding pension budget. Figure 3 depicts the public pension expenditures as a share of GDP from a horizon until 2060. Denmark is supposed to achieve one of the lowest ratios among the OECD countries in the next 50 years. It is not proper to draw conclusions based on 5 countries, but there seems to be two convergence points on Figure 3 illustrating the differences between DB and multi-pillar systems. Denmark and the Netherlands are assumed to continuously lower their public pension expenditures below 8% by 2060, however Austria, Hungary and Italy will all achieve a higher ratio than 11%.

Figure 3: Projections on public pension expenditures as a share of GDP



Source: (OECD, 2019d)

Chapter 3 gave insight into the Hungarian and the Danish pension systems that function in different structures. The central point of the Hungarian description was the re-reform in 2011, when the system returned back to two-pillar system by destroying the mandatory private pension pillar. Concerns regarding sustainability of the system and the ability to provide adequate pension for all retired people was discussed from literature. There is an increasing pressure from the demographic changes, especially in the coming few decades, when the baby-boomer generations retire, but the budget projections show that the proportion of GDP spent on public pensions is not going to progress in the later decades

either. It is a more complex issue. On the other hand, Denmark seems to show a successful operation of the three-pillar system. It is not a perfect system, but the strengths are outweighing the disadvantages. Similar demographic changes are going to affect the system in the future, but steps have been taken already to diminish the effects of increasing dependency ratio for example and the projections for sustainability are promising as well. In spite of the ageing population, the expenditures for public pension as a share of GDP are expected to further decrease which also reflects the maturing of the three-pillar system. Returning back to Figure 2, the interplay of mandatory public, mandatory private and voluntary schemes can be observed. The mixed system in Denmark provides a high replacement ratio, but it is clear that no robust conclusions can be drawn on the correlation between replacement ratio and pension system structure. Mandatory private and voluntary schemes are absent in many of the countries.

Chapter 4 and 5 are executing a more profound comparison. Chapter 4 aims at analyzing the sustainability of a PAYG and a fully funded system in an OLG model. And later on, Chapter 5 will discuss the old-age poverty issue looking at poverty and income inequality measures.

4. The model

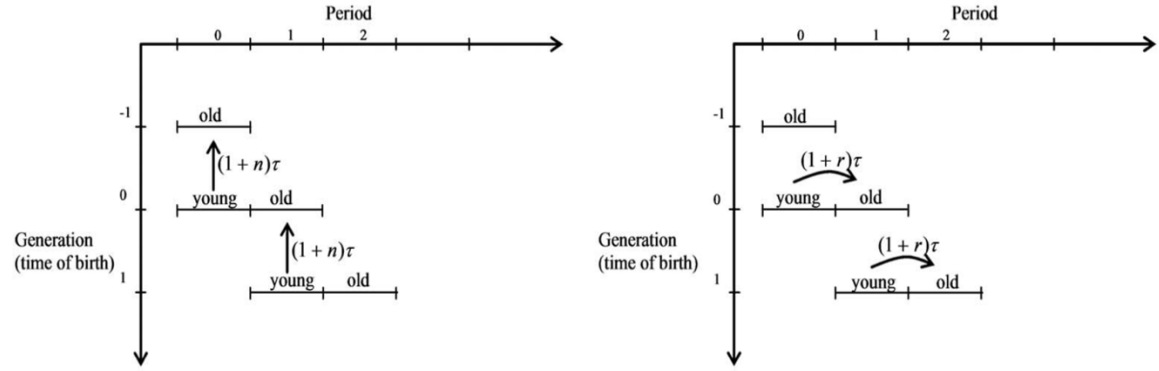
In the previous chapter the evolution and characteristics were examined of the DB system in Hungary and the combined system of DB and DC schemes in Denmark. The next chapter seeks to assess the effects of longevity and decreasing fertility on the viability of the PAYG and the fully funded pension systems. This assessment is conducted using the overlapping-generations (OLG) model by Diamond (1965). The model is widely used for macroeconomic researches analyzing several issues from taxation, educational policies to designing social security finances like pensions. The OLG model is built on an economy that consists of households, firms and the government and studies the distribution of income and wealth across time. It provides a framework for analyzing life-cycle behavior and dynamic implications of the intertemporal choices of individuals. It captures the interaction of several generations living together at the same time in an economy and the consumption-smoothing motives for saving.

The OLG model has been used in numerous papers for assessments regarding pension systems. Fanti and Gori (2008) studied the impact of longevity on pension budget in both exogenous and endogenous fertility settings and concluded with a contradictive result to what they expected beforehand. They showed that increasing life expectancy does not necessarily have a negative effect on the viability of the system. In another study, Fanti and Gori (2011) found positive relationship for longevity and pension benefits in case the capital's production share is high enough.

This thesis considers two different types of pension systems for sustainability assessment. On one hand, the unfunded PAYG pension is analyzed that characterizes Hungary because it has no mandatory private saving scheme. On the other hand, the viability of the fully funded system is assessed which exists in Denmark as part of the multi-pillar system. Figure 4 depicts the main difference of the two systems that is important for the model setup. In an unfunded system the pension benefits to the retirees are funded by the instantaneous contributions from the young of the same period as it is shown on the left-hand side of the Figure 4. On the contrary, the right-hand side explains that the retirees' pensions are paid out from the payroll taxes they had been paying during their working age. These contributions and their returns finance the future pensions, thus explaining the funded feature of the system. In an unfunded system assets travel between generation in the same period of time, meanwhile a funded system leaves assets for the same people but transfers it through time. Due to this difference the unfunded PAYG system is more threatened by demographic changes and there is a higher chance for having deficit that oppresses the government.

As Figure 4 shows it as well there are two generations living together in each time period. For simplicity the period for children is not considered even though every representative individual goes through that phase. Children are assumed not to make any decisions that regard this model, but they live according to their parents' decisions. However, raising children is assumed to be costly. Consequently, individuals are either part of the young generation or the old.

Figure 4: Difference between PAYG (left) and funded system (right)



Source: (Groth, 2016)

OLG model allows for assessing long-term effects of demographic changes. The two challenges included in this chapter are longevity and ageing population or more specifically decreasing fertility. Longevity defines longer expected lifetime and enters the model with π, representing the probability of survival. Consequently, individuals die with probability *(1-π)* before reaching retirement age, thus they never enter the old cohort and never receive pension. As for the population ageing, it is the consequence of both decreasing fertility and increasing life expectancy, but this chapter refers only to the fertility aspect of it. This issue covers the fact that fertility falls so the young, tax paying cohort is getting continuously smaller than the old, retired cohort. As a result, the population is shrinking. This problem is captured in the model by *n* where *n<1*.

Chapter 4 continues with presenting the OLG model for the PAYG pension system and for the fully funded system in Section 4.1 and 4.2 respectively. Section 4.3 demonstrates results from comparisons.

4.1 OLG model for PAYG

For the OLG model analysis, equations were taken and rearranged from Fanti and Gori (2008, 2011) to include both demographic changes and the setting was reflected to the fully funded systems as well.

Individuals

Each representative individual lives for two periods, hence the overlapping generations term. The number of young people in period *t* is N_t that grows at a constant rate *n*. (n>0) During the first period of their lives, individuals born at time *t* supply one unit of labor in the labor market and receive wage (w_t) for it. At this stage, they spend their wage on consumption (c_t), savings for old age (s_t) and a fraction (τ_t) of the wage is transferred to the government as a lumpsum tax. Fertility is exogenous, but having children is assumed to be costly and the child rearing cost (*x*) further extends the model. Thus, the budget constraint for the young generations looks like the following:

$$c_t = w_t(1 - \tau - xn) - s_t \,. \tag{1}$$

When reaching the second period of their lives, individuals don't participate in the labor market anymore. At time *t+1*, they live off their accumulated savings, the interests accrued at rate (R_{t+1}) and the pension benefits from the government (p_{t+1}). Pensioners are assumed to consume everything before they die and there are no bequests. Furthermore, the budget constraint here differs from the first period due to the certainty of life as well. Individuals survive to old age with probability π. The budget constraint of old generation looks as follows:

$$c_{t+1} = \frac{1}{\pi}(1 + R_{t+1})s_t + p_{t+1} \,. \tag{2}$$

Preferences of an individual are illustrated with the lifetime utility function. The aim is to maximize lifetime utility by choosing how much to save at time *t*:

$$\max_{s_t} U_t = ln(c_t) + \beta\pi ln(c_{t+1}) \,, \tag{3}$$

subject to the intertemporal budget constraint:

$$c_t + \frac{\pi}{1 + R_{t+1}}(c_{t+1} - p_{t+1}) = w_t(1 - \tau - xn) \tag{4}$$

where $\beta > 0$ is the impatience discount factor.

Taking first order conditions, the optimal saving function is derived such that:

$$s^*_{t,PAYG} = \frac{\beta w_t(1-\tau-xn)}{\frac{1}{\pi}+\beta} - \frac{p_{t+1}}{\left(\frac{1}{\pi}+\beta\right)(1+R_{t+1})} \ . \tag{5}$$

Equation (5) shows that individual savings are decreasing in taxes and increasing in interest rate as expected.

Firms

Firms are assumed to be identical and they use physical capital and labor for production. Labor input requires wages to be paid and physical capital is accompanied with a rental rate. The production function is described by a standard, constant-returns-to-scale Cobb-Douglas production function:

$$Y_t = AF(K_t^{\alpha}, L_t^{1-\alpha}), \tag{6}$$

where *A>0* denotes factor productivity, *K* stands for the aggregate capital stock and *L* for the aggregate employment. α determines the capital's share of output such that $0 < \alpha < 1$.

Firms aim at maximizing their profits, so the problem they face is given by:

$$\max_{K_t, L_t} \ AF(K_t^{\alpha}, L_t^{1-\alpha}) - w_t L_t - r_t K_t \ . \tag{7}$$

The results of solving the first order conditions show that wage and capital return are equal to their marginal products of labor and capital respectively.

$$w_t = (1-\alpha)A(k_t)^{\alpha} \tag{8}$$

$$r_t = \alpha \, A(k_t)^{\alpha-1} - 1 \tag{9}$$

Both wage and rent are expressed as functions of k_t, that is defined in per-capita terms. $(k_t = \frac{K_t}{N_t})$

Government

In this setup, the government serves as a social planner. It balances the social security system and by that the welfare of current and future generations. It covers its expenses of pension benefits from payroll labor income taxes. The PAYG system does not require any asset accumulation, the expenses are offset from contributions within the same time period. PAYG systems function either on Bismarckian or Beveridgian principle. In a Bismarckian scheme the benefits are defined as a replacement rate on past wages. Due to this close link between wages and pensions, there is no room for redistribution is the system. (CESifo, 2008) The Beveridgian system rather provides flat-rate benefits allowing more redistribution in the population. Maintaining the balance of the pension benefit expenditures on one side and the incoming tax receipts on the other is the government's task. Its budget constraint looks the following:

$$p_{t+1} = \frac{1}{\pi}\tau_{t+1}w_{t+1}n + b, \tag{10}$$

where b represents the deficit or surplus of the system that can originate from the unfunded feature of the system.
Substituting this constraint into the optimal saving function (5) gives:

$$s^*_{t,PAYG} = \frac{\beta w_t(1-\tau-xn)}{\frac{1}{\pi}+\beta} - \frac{\frac{1}{\pi}\tau_{t+1}w_{t+1}n + b}{\left(\frac{1}{\pi}+\beta\right)(1+R_{t+1})}\,. \tag{11}$$

Equilibrium

Equilibrium is reached when aggregate demand equals aggregate supply. In the OLG setting it translates into the equivalence of savings and investments. The market clearing condition is

$$nk_{t+1} = s_t \,. \tag{12}$$

It implies that productive capital originates from the savings of the young generation from the previous period. The dynamics of the capital is determined by the market clearing condition (12), the optimal saving function (5) and the wage rate (8).

$$k_{t+1,PAYG} = \frac{\pi\beta(1-\alpha)\alpha A(1-\tau-xn)}{n\big((1+\pi\beta)\alpha+\tau(1-\alpha)\big)}k_t^{\alpha} \tag{13}$$

In the long run, the economy reaches its equilibrium. The steady- state implies that $k_{t+1} = k_t = k^*$ which defines the long-run capital stock as:

$$k^*_{PAYG}(\pi,n) = \left(\frac{\pi\beta(1-\alpha)\alpha A(1-\tau-xn)}{n\big(\alpha(1+\pi\beta)+\tau(1-\alpha)\big)}\right)^{\frac{1}{1-\alpha}} . \tag{14}$$

From equation (14) it can be seen that the long-run capital stock per capita is increasing in longevity (π) but higher fertility rate (n) results in smaller k^*, so population ageing increases the steady-state value of capital stock. For these to hold, $k^*(\pi,n)$ has to be positive which requires $n < \frac{(1-\tau)}{x}$.

At last, the value of steady-state pension is found by combining the wage rate (8), the government's budget constraint (10) and steady-state per capita capital stock (14). In order to make presumptions about the increasing life expectancy's effect on pensions in the long run, the generic form is used as a help to see the sign of the derivative.

Fanti and Gori (2008) form the generic function of longevity as:

$$p^* = p^*\left(\pi, w^*\big(k^*(\pi)\big)\right) \tag{15}$$

The total derivative the generic form is:

$$\frac{\partial p^*}{\partial \pi} = \underbrace{\frac{\partial p^*}{\partial \pi}}_{-} + \underbrace{\frac{\partial p^*}{\partial w^*}\frac{\partial w^*}{\partial k^*}\frac{\partial k^*}{\partial \pi}}_{+} \tag{16}$$

The total effect is characterized by two counterbalancing forces, a negative direct and a positive indirect effect. The direct effect stands for the fact, that if life expectancy increases

there will be more pensioners which results in lower pension benefits. However, equation (14) showed that the per capita capital stock is increasing in longevity which, through increasing wage rate, results in a positive indirect effect. The total influence depends on which effect is the more dominant.

In order to see which effect prevails at the end, combining equations (8), (10) and (14) forms the steady-state pension:

$$p^*_{PAYG}(\pi, n) = \frac{\tau(1-\alpha)A}{\pi}\left(\frac{\pi\beta(1-\alpha)\alpha A(1-\tau-xn)}{\big((1+\pi\beta)\alpha+\tau(1-\alpha)\big)}\right)^{\frac{\alpha}{1-\alpha}} n^{\frac{1-2\alpha}{1-\alpha}} \tag{17}$$

From equation (17), the impact of longevity on pension depends on the capital's share in production. If it is sufficiently small ($\alpha < 0{,}5$), then the direct effect dominates and pension benefits are decreasing in longevity but it is increasing in case of a sufficiently high share. For moderate values of α, there exists however a pension maximizing longevity rate. Proof for the derivation is provided by (Fanti and Gori, 2008).

As the next step, the impact of ageing population on pensions is conducted in a similar way. First, examining the generic function shows again that the final effect of falling fertility depends on the dominance of either the direct or indirect effects.

$$p^* = p^*\Big(n, w^*\big(k^*(n)\big)\Big) \tag{18}$$

$$\frac{\partial p^*}{\partial n} = \underbrace{\frac{\partial p^*}{\partial n}}_{+} + \underbrace{\frac{\partial p^*}{\partial w^*}\frac{\partial w^*}{\partial k^*}\frac{\partial k^*}{\partial n}}_{-} \tag{19}$$

Conversely, the signs are different in this case. The negative indirect effect is derived from negative effect on per capita capital stock, thus on wage rate as well. On the other hand, due to falling fertility the smaller the contribution paying young cohort, the smaller the pensions benefits, accounting for the positive direct effect. (Fanti and Gori, 2011) (Economiche, 2009)

From Equation (17) the ageing population's impact on long-run pension is dependent on the value of α as well. Here, a sufficiently high capital share ($0{,}5 < \alpha < 1$) ensures that steady-state pensions increase due to falling fertility. For small values of capital share $0 < \alpha < 0{,}5$

the direction of the impact is not clear, it can be either positive or negative depending on the tax rate and the child rearing costs. If the output elasticity of capital is low, there exists a pension maximizing number of children.

Contrary to presumptions, the demographic changes are not necessarily threatening factors for PAYG pension system according to these results. Longevity and ageing population can either cause the long-run pensions to fall or rise depending on other factors like the capital's share in production, child rearing costs or contribution rates.

4.2 OLG model for fully funded system

Taking into account the previously mentioned demographic challenges a pension system can face, a fully funded system is believed to be more feasible and sustainable. As pension benefits are not funded from the same period's taxes, but taken out from the individual's account, the distorted age structure of the population is not putting an extra burden on the state budget. However, the close link of contributions and benefits does not leave much room for intra-generational redistribution.

The aim of this section is to demonstrate the impact of longevity (π) and ageing population (n) on pensions in the case of a fully funded scheme. The structure of the OLG model is very similar to the previous section, equations (1)–(9) apply for the funded system as well. In a funded system the collected contributions from the young are invested and returned in the next period, so the government's budget constraint looks as:

$$p_{t+1} = \frac{1}{\pi}(1 + R_{t+1})\tau_t w_t \tag{20}$$

The new pension budget changes the optimal savings function looks to:

$$s^*_{t,FF} = \frac{\beta w_t(1 - \tau_t - xn)}{\frac{1}{\pi} + \beta} - \frac{\frac{1}{\pi}(1 + R_{t+1})\tau_t w_t}{\left(\frac{1}{\pi} + \beta\right)(1 + R_{t+1})} \tag{21}$$

Thus, the combing equations (8), (12) and (21) gives capital stock's dynamics for the funded system as:

$$k_{t+1,FF} = \frac{(1 - \alpha)A(\beta\pi(1 - \tau_t - xn) - \tau_t)}{(1 + \pi\beta)n}\, k_t^{\alpha} \tag{22}$$

The equilibrium value of per capita capital from equation (22) is:

$$k_{FF}^{*}(n) = \left(\frac{(1-\alpha)A(\beta\pi(1-\tau_t-xn)-\tau_t)}{(1+\pi\beta)n}\right)^{\frac{1}{1-\alpha}} \tag{23}$$

Equation (23) reveals that demographic changes have the same effect on the steady-state per capita capital stock in a fully funded system and in the PAYG. Falling fertility causes the long-run capital stock to increase and it is increasing in longevity.

Finally, the steady-state pension in a funded system is given by equations (8), (20) and (23).

$$p_{FF}^{*} = (1+R_{t+1})\frac{\tau_t(1-\alpha)A}{\pi}\left(\frac{(1-\alpha)A\beta\pi(1-\tau_t-xn)-\tau_t}{(1+\pi\beta)n}\right)^{\frac{\alpha}{1-\alpha}}$$

In contrast with the presumption that a fully funded system is performing way better than a PAYG in the presence of demographic changes, the two systems provide similar results.

4.3 Results from OLG

Section 4.1 and 4.2 have examined the effects of falling fertility and longevity on pensions in a PAYG and a fully funded scheme respectively. Section 4.3 here aims at concluding the effects and provide a comparison of the ways these pensions schemes are hit by demographic challenges in the 21st century.

Ageing population is discussed in this model through the falling fertility or decreasing *n*. Due to decreasing fertility, the size of the young generation is always getting smaller than size of the old generation, which means that the contributions paid by the state are collected from fewer workers and have to be distributed to more pensioners. PAYG pensions are expected to be decreasing in *n* and a fully funded scheme is expected to be more robust to changes in fertility. In contrast with the presumptions, the ageing of the population can result in higher pension on the long-term in the PAYG system, in case the capital's share in high enough.

Since the results are not unambiguous, there is no clear and wise choice between the two systems. Rather a combination of the two systems seem to provide the best outcome where they can counterbalance and complement each other. However, the optimal portfolio has to be designed carefully. Chapter 6 discusses the proposition of a mixed system combining PAYG and funded schemes. But first the issue of old-age poverty is discussed in Chapter 5.

5. Old age poverty

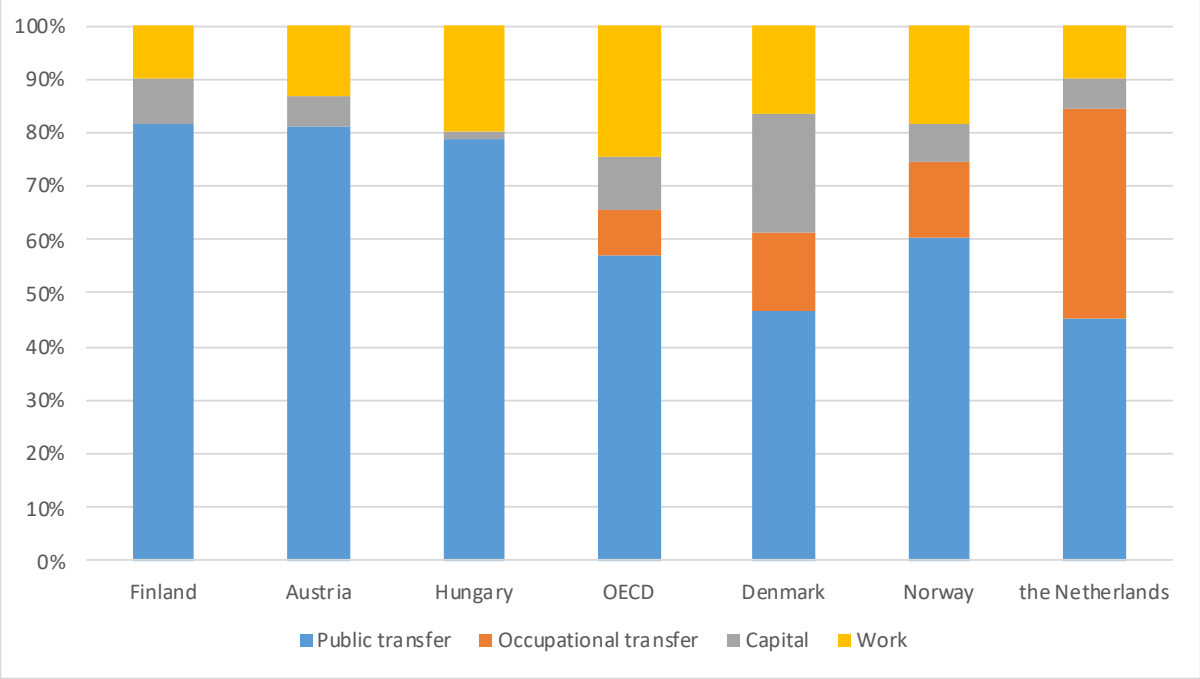
The two main goals of the pension systems have been mentioned earlier. Keeping the system sustainable that ensures consumption smoothing has been discussed with the OLG model in the chapter before. The other aim is income redistribution in order to avoid old-age poverty. Poverty reflects the quality of life in the population, whether a person can afford to maintain a standard of living. Public pensions have been introduced initially to achieve that objective. In the absence of it, a high ratio of pensioners would need to work even at old ages, especially previous low-wage earners as they did not have the opportunity to put aside an adequate amount of savings for old age. However, by time people are more likely to face health issues or even disabilities that might keep them away from the labor market. The public pension aims to ensure a safety net for the entire society. This aim is achieved successfully if it provides both good coverage and adequate benefits, so it also reaches the ones in need through redistribution from better off to worse off individuals.

To illustrate the financial situation of old generations in a population, OECD, (2019c) proposes a number of indicators. The relative income poverty and poverty depth measures give a picture about the economic situation of pensioners also compared to the population and income inequality is depicted with the Gini coefficient and percentile ratio. These measures help to investigate the issue whether poverty and old age are correlated. Comparing the inequality measures among both the old generation and the entire population across countries does not give a straightforward answer. Based on these indicators, it is also not clear whether the PAYG system is fulfilling its redistributive objective as it should in Hungary. As it was discussed before, the occupational scheme of multi-pillar systems in its original form lacks the ability to transfer money from the better off to worse off people, as a

consequence countries that have substantial private savings should face more severe old-age poverty issues compared to countries functioning solely with PAYG system. The indicators from OECD do not support this presumption.

Before starting to analyze the first measure, the income and the composition of income for older people is examined. With only a very few exception among the OECD countries, retired people have lower average incomes than the population that futher decreases with age. This is the case especially in countries where instead of wage growth, pension are indexed to the consumer price index like in Hungary. It causes huge inequalites among pensioners retiring in subsequent years. The primary comparison of Hungary and Denmark regarding old-age poverty is extended by Austria, Finland, Norway and the Netherlands as Figure 5 shows. Austria and Finland have no mandatory occupational pension schemes, just like Hungary and the Netherlands functions in a very similar system to Denmark, also being in the race for the best pension system in the world.

Figure 5: Income sources of older people, 2016 or latest available year



Source: OECD (2019d)

Countries without multi-pillar pension systems are characterized with extremely low capital and high public transfer share. Compared to Denmark and the Netherlands, the income from work accounts for a smaller proportion of income for the elderly. As Figure 5 shows, when occupational schemes provide income for individuals, it does not only result in smaller public

pension proportion, but also smaller ratio for income from work. The share of occupational transfer is the highest by far in the Netherlands, and so is the capital's share in Denmark.

5.1 Poverty measures

First, the relative income poverty is presented that denotes the proporton of elderly living on an income below a given poverty threshold. The indicator is sensitive to the poverty line. The poverty threshold used by OECD (2019c) is 50% of the median of households' disposable income, similarly the Hungarian Central Statistical Office (HCSO) and the European Commission sets it equal to 60% of the income.[26] Table 1 shows the OECD's version of the relative income poverty rates by age and gender for the most recent years available. It displays the OECD average and also the average of the European subset of the OECD countries. The dataset reveals that both Denmark and Hungary perform far below the OECD and the EU subset average, that are 13,5% and 10,6% respectively. As a matter of fact, Denmark has the second lowest poverty rate in the sample, only 3% of the all elderly people acquire less income than half the median. Income poverty among people aged over 65 is lower than for the whole population in more than half of the countries, meaning that people are at higher risk of poverty during their working years than after retirement. Furthemore, women are more likely to become income poor. Reasons for it can be lower wages, thus lower contributions and longer life expectancy. Relative income poverty seems to be increasing with age, though the opposite is true for Hungary. In general people aged over 75 are exposed to higher risk of poverty than those aged between 66 and 75. All indicators with age and gender groups for Hungary are lower than the OECD and EU subset averages, but higher than for Denmark.

The main objective of the public pension should be redistribution in order to mitigate the old-age poverty problem. Figure 5 and Table 1 rather show the opposite. Austria, Finland and Hungary with no mandatory occupational schemes all have higher incidence of poverty among people aged over 65, 8,7%, 6,3% and 5,2% respectively compared to Denmark, Norway and the Netherlands that have an average less than 3,5%.

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[26] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_statistics_on_income_and_living_conditions_(EU-SILC)_methodology_-_monetary_poverty_of_elderly_people#Description

Table 1: Income poverty rates by age and gender for 2016 or latest year

	Older people (aged over 65)					Total population		Older people (aged over 65)					Total population
	All	By age		By gender				All	By age		By gender		
		Age 66-75	Aged over 75	Men	Women				Age 66-75	Aged over 75	Men	Women	
Australia	23,2	19,5	28,7	21,2	24,8	12,1	Korea	43,8	35,5	55,9	37,1	49,0	17,4
Austria	8,7	9,0	8,5	5,9	11,0	9,8	Latvia	32,7	25,6	40,8	20,0	38,8	16,8
Belgium	8,2	8,0	8,4	7,0	9,1	9,7	Lithuania	25,1	21,7	29,2	13,4	31,0	16,9
Canada	12,2	10,9	14,3	9,3	14,7	12,1	Luxembourg	7,7	8,9	5,4	6,3	8,9	11,1
Chile	17,6	17,7	17,4	17,6	17,5	16,5	Mexico	24,7	22,5	28,2	23,3	25,9	16,6
Czech Republic	4,5	4,1	5,4	1,4	6,9	5,6	Netherlands	3,1	2,0	4,9	2,8	3,5	8,3
Denmark	3,0	2,0	4,5	2,1	3,7	5,8	New Zealand	10,6	7,7	15,2	6,6	14,0	10,9
Estonia	35,7	29,3	43,0	21,4	42,8	15,7	Norway	4,3	2,4	7,3	2,1	6,2	8,4
Finland	6,3	3,7	10,0	4,6	7,6	6,3	Poland	9,3	10,1	8,2	5,5	11,8	10,3
France	3,4	2,8	4,1	2,6	3,9	8,3	Portugal	9,5	7,8	11,3	7,2	11,1	12,5
Germany	9,6	8,9	9,4	7,4	10,6	10,4	Slovak Republic	4,3	3,6	5,7	2,6	5,5	8,5
Greece	7,8	7,6	7,9	6,4	8,8	14,4	Slovenia	12,3	10,5	15,0	6,8	16,3	8,7
Hungary	5,2	5,9	4,3	4,8	5,5	7,8	Spain	9,4	8,7	10,1	7,8	10,6	15,5
Iceland	2,8	2,4	3,5	1,7	3,9	5,4	Sweden	11,3	7,9	16,5	7,3	14,8	9,3
Ireland	6,0	4,9	7,6	5,8	6,1	9,2	Switzerland	19,5	15,5	25,0	17,0	21,6	9,1
Israel	19,9	17,3	23,8	16,2	23,0	17,9	Turkey	17,0	14,3	21,0	14,9	18,5	17,2
Italy	10,3	10,0	10,6	7,9	12,1	13,7	United Kingdom	15,3	12,1	19,7	12,5	17,7	11,9
Japan	19,6	16,7	22,9	16,2	22,3	15,7	United States	23,1	19,7	28,3	19,6	25,9	17,8
							OECD	**13,5**	**11,6**	**16,2**	**10,3**	**15,7**	**11,8**
							EU - OECD	**10,6**	**9,1**	**12,6**	**7,3**	**12,7**	**10,3**

Source: OECD Income Distribution Database, http://www.oecd.org/social/income-distribution-database.htm

The relative income poverty measure depends on the threshold, so altering the poverty line yields a different outcome. The HCSO uses the 60% threshold for the at-risk-of-poverty rate, as the European Commission calls it. Increasing the poverty line to 60% of the national equivalized median income more than doubles the relative income poverty rate. The gender inequality holds in the Hungarian dataset as well, also the difference is increasing over time.[27] Looking at the current values is not giving a full picture on the situation, it is also important to consider how these values have been changing over time. Figure 3 displays the evolution of at-risk-of-poverty rate of 6 countries from 2010 until the nowadays. In case the pension system structure in general had an effect on old-age poverty, countries with similar systems should follows a similar path. Figure 6 is not supporting this idea. Denmark and the Netherlands both have large occupational schemes, nevertheless their relative poverty rates have opposite trends. Meanwhile Denmark has oppressed the proportion of poor among the elderly to its minimum in the horizon, the Netherlands experiences a growing incidence of poverty, similarly to Hungary. In 2010, at the time of the re-reform in Hungary it had the second lowest rate in the OECD countries accounting for only 4%, but during the past decade

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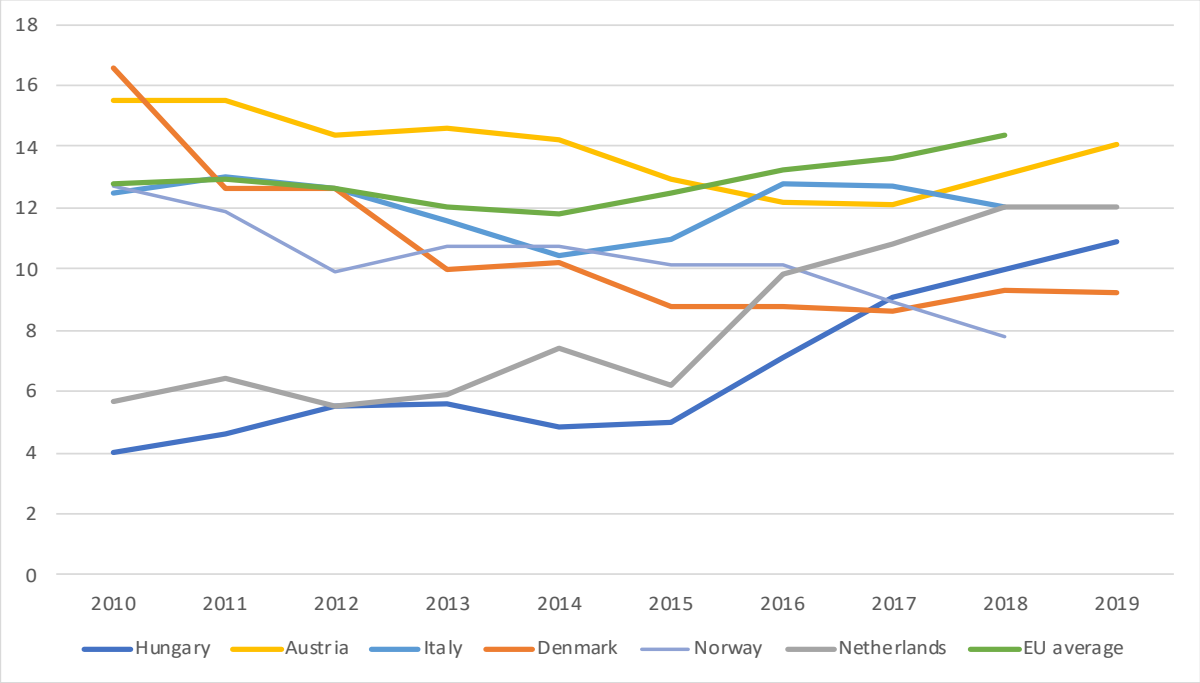
[27] https://www.ksh.hu/docs/eng/xstadat/xstadat_annual/i_zaa007.html#

it managed to reach a rather middle position in the list. The relative fast increase since 2013 is especially worrying because for the same time horizon, the rate for the entire population has been showing a falling trend. From HSCO data on at-risk-of-poverty, it can be seen that poverty has been shifted from the young and adult generations to the old in the past couple of years. It seems that increasing the public pension budget by the 2nd pillar's abolishemnt rather caused bigger problems for the elderly, instead of solving the income inequqality and adequate pension issues. However, rather the opposite happened in most of the OECD countries, Denmark and Norway accounting for one of the biggest changes.

Figure 6: At-risk-of-poverty rate for pensioners (60% of median income)

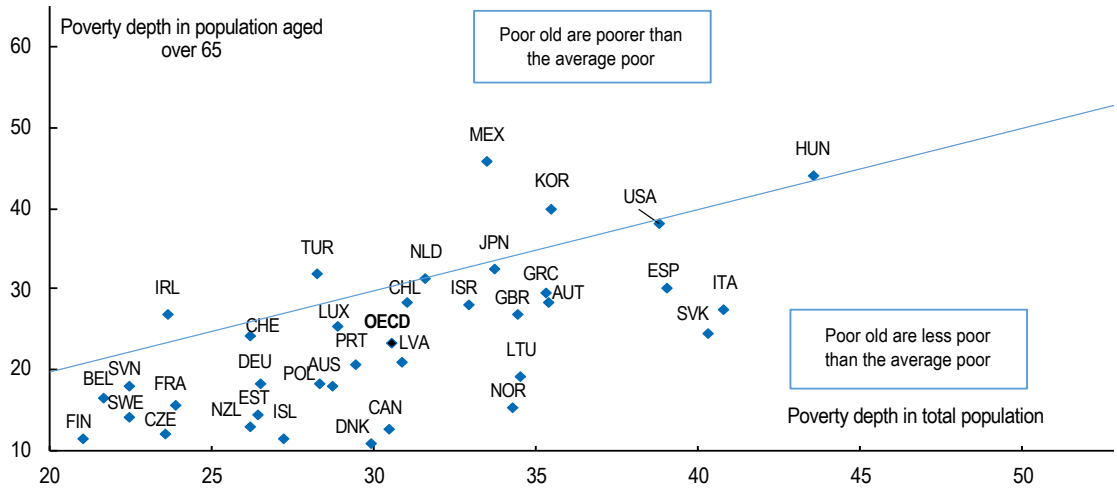


Source:EU-SILC survey,
https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tespn100&plugin=1

The other indicator for describing the economic situation of pensioners in this thesis is the poverty gap. It takes into account the previously mentoined poverty line and measures the difference of the average income of the poor from the threshold. (OECD, 2019d) research reveals tremendous differences between the countries using the 50% of median income as the threshold. Figure 7 illustrates the poverty depth of the elderly and the whole population as well using the most recent data available. The two extremities for the old-age group are actually represented by Hungary and Denmark. Hungary has an outstading position on figure exceeding 40% , meanwhile Denrmark accounts for approximately 10%. Thses numbers mean

that the average income of those who are poor euqal to 44% of the poverty line, that is half the median of total disposable income of all aged over 65. For most of the countries, that are positioned below the poverty line in Figure 7, the poverty gap is smaller for the elderly than for the entire population. Hungary stands very close to the line, which means that the poverty gap for the entire population is also extremely high.

Figure 7: Income poverty depth for older and total population, 2016 or latest data



Source: (OECD, 2019d)

5.2 Income inequality measures

The second part of this chapter discusses income inequality in countries using Gini coefficient and S80/S20 indicator. Both of them measure the distributional feature of the system and as a matter of fact due to the high correlation, their results are quite similar. (OECD, 2019d) The higher the number, the greater is the level of inequality in the country and for the pensioners it means the extent of the variation of the pension payouts. The Gini coefficient illustrates income distribution in the total population, meanwhile the percentile ratio shows the relationship between incomes on the extremities of the whole distribution. The percentile ratio reveals from Table 2 that people at the 90th percentile of the income distribution have 3,3 times higher incomes than those at the 10th percentile. For most of the OECD countries it is true, that the income inequality is higher for the total population than for

those aged over 65, which could be the reason of a well- functioning PAYG system. Yet Hungary achieved higher numbers representing poorer performance than Denmark again

Table 2: Income inequality of older and total population, 2016 or latest date

	Gini		P90-P10 ratio			Gini		P90-P10 ratio	
	Aged over 65	Total Population	Aged over 65	Total Population		Aged over 65	Total Population	Aged over 65	Total Population
Australia	0,325	0,330	3,1	4,3	Korea	0,419	0,355	7,0	5,8
Austria	0,262	0,284	3,3	3,5	Latvia	0,342	0,346	4,1	5,3
Belgium	0,222	0,266	2,6	3,3	Lithuania	0,340	0,378	4,0	5,8
Canada	0,291	0,310	3,5	4,1	Luxembourg	0,285	0,304	3,7	4,0
Chile	0,441	0,460	6,6	7,2	Mexico	0,500	0,458	9,5	6,7
Czech Republic	0,185	0,253	2,2	3,0	Netherlands	0,235	0,285	2,4	3,4
Denmark	0,233	0,261	2,3	2,9	New Zealand	0,354	0,349	3,8	4,3
Estonia	0,283	0,314	3,2	4,7	Norway	0,225	0,262	2,6	3,1
Finland	0,233	0,266	2,7	3,1	Poland	0,250	0,284	3,1	3,7
France	0,273	0,291	3,0	3,4	Portugal	0,346	0,331	4,3	4,5
Germany	0,260	0,294	3,2	3,8	Slovak Republic	0,202	0,241	2,4	3,1
Greece	0,279	0,333	3,3	4,7	Slovenia	0,252	0,244	3,2	3,1
Hungary	0,254	0,282	2,8	3,3	Spain	0,300	0,341	3,7	5,3
Iceland	0,271	0,255	2,8	3,0	Sweden	0,296	0,282	3,1	3,3
Ireland	0,284	0,309	3,2	3,8	Switzerland	0,298	0,296	3,9	3,6
Israel	0,357	0,344	5,6	5,4	Turkey	0,376	0,404	5,0	5,7
Italy	0,307	0,328	3,8	4,5	United Kingdom	0,336	0,357	3,9	4,3
Japan	0,351	0,339	5,0	5,2	United States	0,411	0,390	6,9	6,2
					OECD	**0,302**	**0,317**	**4,0**	**4,3**

Source: OECD Income Distribution Database, Key Indicators http://www.oecd.org/social/income-distribution-database.htm

5.3 Results from poverty and inequality measures

Sections 5.1 and 5.2 examined the old-age poverty issue using indicators like relative poverty rate, poverty gap, Gini coefficient and P90/P10. The 1st pillar of the pension system is expected to take the bigger part in income redistribution in order to suppress poverty and inequality among pensioners. Based on this statement, Hungary should have had better outcomes compared to Denmark as 80% of Hungarian pensioners' income is covered by the public pension, way higher ratio then for Danes. Nevertheless, Denmark functioning in a multi-pillar system including mandatory private pension showed more favorable results with all the measures discussed here. The most salient difference appeared with the poverty gap, the two countries in focus represented the highest and the lowest number among all the OECD countries. Furthermore, the relative poverty rate for elderly more than doubled during

the past 10 years in Hungary. Poverty measures thus showed that the reform of 2011 in Hungary might have improved fiscal indicators, but it definitely has not alleviated the old-age poverty issue, rather made it worse. Conclusions from this chapter are that the structure of the pension systems is not necessarily influencing old-age poverty in a way that was expected. This statement is based on purely on these four measures and the comparison of mainly 6 countries, so there is room for further analysis on what way and what extent does the pension system affect the poverty and inequality measures. There also might be country-specific characteristics that have not been included here but can distort the results.

6. Proposal of the mixed pension system

Advantages and disadvantages of PAYG and funded schemes have been discussed and compared in the previous chapters in terms of sustainability and old-age poverty. It is shown that both DB and DC systems would have difficulties functioning alone and fulfilling every objective that is required from a pension system. Therefore, the idea is rather to consider a mixed system as the ideal pension system. The combination of PAYG and funded schemes could be a promising option for a reform proposal. The different systems try to accomplish the targets of the pension system in different approaches, both having weaknesses in the process to success. Complementing each other's gaps due to the combination could be prosperous for the future of pension systems.

Pension reforms have always been on the agenda, but due to the differences it is impossible to design one good system that is available to every country. This thesis considers following the recommendations of Jensen et al. (2016) that the Danish example with occupational schemes could be used as a guideline for pension reforms. Stevens, Majcen and Patxot (2019) define policy recommendations on how the supplementary 2nd pillar could improve the system overall. They urge to investigate on the gaps in the existing system, to discover the challenges and to improve the interplay between public and supplementary schemes. PAYG has the ability to mitigate old-age poverty and poverty gaps through intra-generational redistribution, however an occupational scheme can be more efficient in maintaining the living standards of pensioners after retirement. As a consequence, the

Hungarian system with PAYG plan should not be so far behind Denmark regarding poverty measures as it was showed in Chapter 5. As a conclusion, the PAYG system is in need of changes as well in order to improve the economic situation of elderly in Hungary.

The pension reform proposal for the Hungarian system formulated in this thesis incorporates the implementation of a funded DC pension system as a supplement to the existing PAYG. Thus, Hungary would function again in a multi-pillar system. The role of the additional pillar is to provide relief for the state pension budget in the long-term and improvements on the elderly generation's financial situation can be achieved through parametric changes in the PAYG. The first part of this chapter discusses the benefits of the introduction of a 2nd pillar and also problems that may arise with it. Later on, a framework is provided for the privatization of the PAYG pillar.

First of all, extending the existing pension system with an additional pillar has many advantages. The World Bank has already recommended the conversion to the multi-pillar system in 1994 that was implemented by many countries. (World Bank, 1994) About a decade later, the system was extended with two more pillars. The so-called zero pillar was introduced to ensure a pension minimum and the fourth pillar intended to provide financial and non-financial aid e.g. housing or health care access. (Holzmann and Hinz, 2005b) The reason for further extending the system is explained with diversification of risks. Each pillar has its own objective and also its own risks that can be financial market or political risk or risk of poverty among others. One thing is common, that the risks have to be managed. Just like in a portfolio, the pension system that incorporates multiple pillars can more effectively optimize the pensions through diversification.

According to Holzmann and Hinz (2005b), a supplementary 2nd pillar can be beneficial through increasing output, managing population ageing and enhancing individual welfare. First of all, the second pillar has the possibility to enhance national savings due to funding and thus to boost financial markets and the close link between contributions and benefits in a DC system lowers labor market distortions. Regarding population ageing, the funded feature mitigates the transfer of burden across generations. Longer life expectancy means a longer period of pension benefits, but this has to be covered from their own contributions. Funding also ensures more flexibility between work and leisure in retirement years and provides the

option of international risk diversification as ageing population is not deterministic in every country. Holzmann and Hinz (2005b) claim that funding increases individual welfare through higher flexibility with retirement options and through decreasing the exposure to political risk. However, the 2011 reform in Hungary was the unambiguous example for the opposite. An additional advantage of the multi-pillar system is the higher credibility compared the PAYG. As long as the demographic changes do not take a positive turn, the PAYG system will never be sustainable. The system will need parametric adjustments from time to time which reflect lower level of credibility.

In summary, the privatization of the PAYG can be beneficial in many aspects, but it is also accompanied with additional costs like transition costs or financial risks. Financial risk regards the assets managed by pension funds, but population has to bear some of the costs too. In the process of the transition from one system to the other, there will be an initial period where the current workers should be financing both the current pension benefits and their own future pensions too. This is the transition costs for exchanging implicit pension debt to explicit. It is impossible for the working generation to finance both, so it is the government's task to seek an additional source of income. Moving towards the multi-pillar system also includes parametric reforms in the PAYG system in general. The reduction of implicit pension debt can be achieved through postponing the retirement age or decreasing the pension payouts, one affecting the working generation and the other the pensioners.

All in all, possible benefits and costs have to be thoroughly assessed in order to prepare the right design. Holzmann and Hinz (2005a) recommended conducting a cost-benefit analysis that considers country-specific characteristics and the current institutional and political environment of the system. The analysis can provide guidelines on the implementation of the 2nd pillar.

The second part of the chapter presents a framework for the introduction of the 2nd pillar. DC pension schemes are becoming more widely used all over the world, accounting for smaller or bigger parts in the multi-pillar systems. The way of implementation for new countries is crucial for the success of the process. Therefore, OECD (2013) provides a framework for the proper design of a DC system. First of all, it is essential to establish coherence between accumulation and decumulation periods and with the entire pension system as well. Secondly, people should be incentivized for long-term participation and

paying high contribution rates even if participation is mandatory or voluntary. A voluntary scheme has to offer additional motivations for savings in general though tax incentives. The design of investment strategies has to be given thorough consideration ranging from a reliable default option to a variety of available options for different risk profiles. Clear and effective communication gives incentives for members to stay.

The same primary objectives should be considered for a reform proposal as for pension systems. According to Holzmann and Hinz (2005), these are adequacy, sustainability and robustness. They also highlight the reform's support and contribution to economic growth, as pension benefits are claims for future payment that depends on future economic conditions. A list of criteria was recommended by them in order to help the design of a reform proposal and to make them feasible. The first is regarding the objectives mentioned above. A well-designed reform should achieve improvement and progress in the main objectives. Secondly, the success of the reform can be threatened if the macro and fiscal environment is not ready to assist it at an adequate level. Projections should be carefully evaluated taking into account nearly all changes and shocks that can influence the environment. Furthermore, the successful interplay of public and private schemes and the commitment of government are also essential requirements. It usually takes time before reforms fully mature and the profits from it can be attained. Therefore, the commitment of the government has to be both credible and long-term.

The main goal of the reform proposal is to secure sustainability and diminish old-age poverty as it had severe problems in many aspects that were discussed in previous chapters. More importantly to decrease the poverty gap so increasing the average income of those pensioners that are below the poverty line. The Hungarian system has serious poverty issues, more severe than Denmark, given that the income share of public pension is much higher. The conclusion is that the introduction of a 2nd pillar would not be enough alone, the improvement of the 1st pillar is urgent as well. The success of the reform lies in the proper design. Lindeman et al. (2000) provides a list of factors that should be considered as size, participation requirements, role of government, organization, administration and so on.

The first step is to determine the optimal size of the pillar expressed in payroll taxes. To find the optimal size, both expected benefits and economic constraints should be weighed. According to Lindeman et al. (2000), the range of initial rates was between 4% and 10%

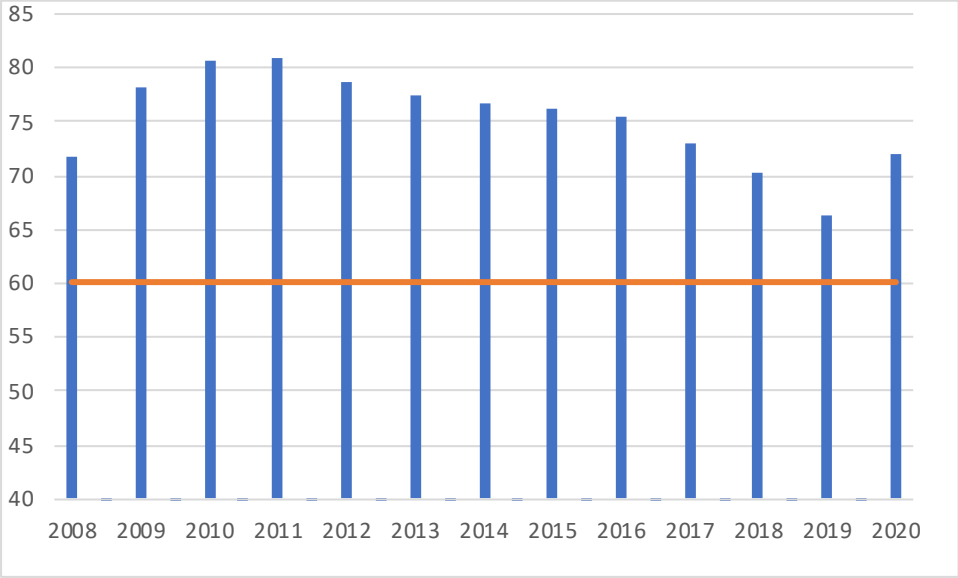
among countries that have a 2nd pillar. The lower bound is defined by cost effectiveness and the upper bound usually by transitions costs. The transition costs are a crucial part of the cost-benefit analysis for the design. At the beginning of the transitional period, workers should pay for two pensions, to finance the current pension benefits and their future pensions. This would pose an impossibly huge burden on the current generation. The other option is for the government to find an additional source of income. Transition costs can be alleviated in case of a phasing-in implementation compared to an immediate step. It can extend burdens over a longer horizon, effecting more generations. It has been done previously in Hungary, but the government decided not to continue with the improvement of the system. Phasing-in can start at a relatively low level, even lower than 4%, and it should be increased following the designed path for it.

Another important aspect that requires careful design is the financing. In case of a transfer from PAYG to funded system, the most problematic period is the initial period where the current working population should be financing both the current pensioners' payouts and also their own future pensions. However, this is impossible to carry out. Implicit pension debt thereby turns into explicit debt. It is straightforward that there is an initial period in the case of an immediate and phasing-in implementation as well where the benefits from the parametric changes in PAYG system are not sufficient to cover all expenses. These reforms have their limits as retirement age cannot be increased excessively from one year to another, also pension benefits cannot be decreased to a substantially lower level, since poverty measures among the elderly are already giving worrying results.

The government has the tools of acquiring extra capital either through increasing taxes or higher indebtedness. Debt and tax financing have different capacities for sharing the burden in the population. Imposing higher taxes without doubt regards the current working generations, meanwhile increasing the government debt allows to share the burden over a longer period of time even though it is usually accompanied with expenditure cuts. Thus, it still is the current population being affected the most but the disadvantageous impact is somewhat diminished. Lindeman et al. (2000) presented that the implementation of a contribution rate of 8% of wage would account for 2,5-3,2% of GDP in the first years. Government debt raising is a sensitive area, because it can easily skyrocket due to uncareful planning and shocks to the economy. Figure 8 illustrates that the Hungarian government has managed to produce a continuously decreasing gross debt as a share of GDP since the 2011

reform, it still has not managed to accomplish the Maastricht criteria and get below 60%. Events in 2020, like COVID-19 pandemic and its shrinking impact on economy have however raised the ratio above 71% by the middle of the year and it is expected to further increase until the end of 2020.[28] According to the worst case scenario prediction, it could even reach 80% of GDP which would put Hungary back at the 2011 level swiping away all debt reducing effort of the past decade.[29] Also the budget deficit gives reasons for worrying. Even though Hungary managed to keep if below 3% of GDP since the reform[30], expectations are less favorable. Partly due to the pandemic, it can reach up to 4,5%-6% by the end of 2020.[31] If the pandemic is to blame for these numbers, then due to the unpredictability it is hard to make assumptions whether the government can afford higher indebtedness for the sake of a 2nd pillar in the pension system at the moment.

Figure 8: Government debt as share of GDP, Hungary



Source: Eurostat, https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=teina225&plugin=1

Another factor that needs to be discussed is the participation requirements. As a funded system needs a much longer horizon to mature, participation requirements have to

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[28] https://www.portfolio.hu/gazdasag/20200817/beutott-a-valsag-nagyot-ugrott-hirtelen-magyarorszag-adossaga-445104

[29] https://www.portfolio.hu/gazdasag/20200814/megszolaltak-a-hitelminositok-fajdalmas-lesz-a-valsag-magyarorszagnak-de-leminosites-nem-fenyeget-444982

[30] https://countryeconomy.com/deficit/hungary

[31] https://think.ing.com/snaps/hungary-coronavirus-widens-the-deficit-further-may2020/

be flexible. For those people who are close to retirement, it is most likely not worth the share their contributions anymore, because the returns from DC plan will not cover the lower public pensions. As a solution, the participation requirement cannot be a standardized solution for the whole population. The option of no changes should be available for those who are retiring in the close future. For those under 30, the mandatory enrolment would ensure that by the time they retire, the returns from private pensions are adequate. For the generations aged 30-50 the participation should be voluntary. This voluntary feature would mitigate the transitional costs as well making the initiation smoother. (Chlon, Góra and Rutkowki, 1999) The incentive for voluntary enrolment would possibly be ambiguous by the Hungarian population due to the absence of credibility of the government. The nationalization of the 2nd pillar in 2011 was not considered to be a democratic process and dissatisfaction arose in the population. Partly due to that reason, voluntary private savings are not common either in Hungary until nowadays. The voluntary enrolment in a system would not motivate people. Some mandatory elements have to be introduced.

A reform of the introduction of an additional 2nd pillar has to include parametric changes in the existing pillar as well. Even if there is a supplementary pension, the PAYG still has to intend to stay sustainable and adequate. A popular parametric change is the increasing retirement age. In Denmark, it has been linked to the increasing life expectancy. As longevity is one of the demographic elements that threaten sustainability, it seems to be a wise choice. By postponing the retirement, increases in taxes and decreases in pensions can be avoided. The goal is to keep people in the labor market as long as possible, but health issues are more likely to occur with age which might make it unreasonable. Exceptions for hazardous and physically intensive jobs should be established. These have been abolished in Hungary in 2011, but the rising retirement ages will require a debate on the early-retirement option sooner or later. Other possibilities for parametric changes are the alteration of the benefit calculation or indexation. (Lindeman et al., 2000) The indexation of pension benefits was changed to consumer price index instead of wage growth in Hungary. Indexation is important as it protects benefits from eroding over time. However, in case of a relatively high wage growth the gap between wages and pensions can widen, as it has been happening lately. The problem of income inequality is further deepened by this gap.

Returning back the multi-pillar system should be considered by Hungary through the introduction of a mandatory private 2nd pillar and parametric reforms in the existing system. Even though the initial phase requires thorough planning along with huge funding that is not accessible yet, the long-term sustainability is expected to be achieved from the interplay of funded and unfunded schemes. The crucial points of the initial period can be diminished by a phasing-in process instead of an immediate implementation in full size and allowing voluntary participation for some cohorts of the population. Parametric changes like linking the retirement age to longevity and wage indexation could contribute to the common goals regarding adequacy, sustainability and robustness.

7. Concluding remarks

The thesis aimed at providing an assessment about the Hungarian pension system regarding its ability to remain sustainable and to diminish old-age poverty. The assessment was completed with a comparison with Denmark as one of the best pension systems in the world. Income inequality measures showed that Hungary is having severe poverty problems, especially among the elderly. This was rather unexpected, since the Hungarian system functions on PAYG principle and one of the strengths of this type of system should be redistribution across and within generations. For the reason that the current system does not seem to fulfil its main objective, the need for a pension reform appeared. The thesis explored the option of the implementation of a supplementary 2nd pillar to the existing PAYG system, therefore Hungary could function in a multi-pillar system like Denmark.

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