

# COMPARATIVE ANALYSIS OF LONG-TERM SUSTAINABILITY OF EU PENSION SYSTEMS: SOME IMPLICATIONS FOR CZECH REPUBLIC

Lenka Lakotová – Eva Zamrazilová

---

## Abstract

This paper deals with the long-term sustainability of pension systems in EU countries with special focus on the position of the Czech Republic. First, brief description of pension systems using different combination of pillars in individual EU countries is presented serving as a background for further analysis. The evaluation of a synthetic S2 indicator is analysed within the context of population ageing phenomenon characterized by the old-age dependency ratio. Moreover, the indicators of public pension expenditure ratios and gross replacement rates are taken into account. The design of pension systems in EU countries is then analysed, with respect to these factors. The findings show, that there obviously exists a link between population ageing and unsustainability of pension systems, however, there are exceptions in both directions. In spite of relatively favourable demographic projections, there may be found pension systems assessed as unsustainable in the EU area. On the other hand, it is obvious that some European countries will be able to cope with the demographic challenge successfully. This analysis may serve not only as a tool, how to explore experience from other EU countries to make domestic pension system more resilient, but also as a warning which ways should not be followed.

**Key words:** pension system, sustainability of public finance, population ageing

**JEL Code:** J11, H68, H55

---

## Introduction

The economies of most European (EU) countries will be challenged by the problem of population ageing in the future caused by low fertility rate and/or prolonged life expectancy. This demographic development will most likely have a negative impact on public finances and there is a risk of fiscal unsustainability for many European countries. This has been already stated by Afonso (2005) or Eckefeldt et. al. (2014) and situation has not improved since then (European Commission, 2018b). The need for some pre-funding strategy to create

budgetary room for financing ageing costs in advance was already mentioned by Langenus (2006). However, this was mostly either ignored or impossible due to the impact of financial crisis and would thus require important consolidation efforts for most EU countries in the years to come. Anyway, it is still valid that for some countries, significant budgetary surpluses in the coming years would be inevitable, if the challenge of ageing population ageing should be coped with. A very strong argument for adopting some plausible strategy in advance is an even distribution of the fiscal burden across generations. Langenus (2006) proves convincingly that forward looking strategies generally imply a more even distribution of the fiscal burden across generations than more gradual adjustment strategies.

Ageing costs are usually referred to as health care costs, long-term care costs, or pension costs. As pension cost seem to be most significant challenge in the coming decades, further analysis will be focused on evaluation of long-term sustainability of pension systems in EU countries. In those, which will be assessed as unsustainable, some kind of reforms will have to be adopted sooner or later. The aim of this paper is to find some common best practices derived from the countries where population ageing represents a serious challenge, however, the pension systems are assessed as being able to cope with it. At the same time, it should not be forgotten that reforms must always take into account the particular circumstances of the country<sup>1</sup>.

## **1 Pension systems in EU**

Pension systems consist of pension pillars, which are made up of a pension plan (or more plans). Pension plans can be characterized by different elements according to classifications of pension systems. There is quite an agreement among experts that a multi pillars pension system diversifies risks better (e.g. Disney, 1999). Currently, most EU countries do not rely solely on a single pension plan but create a pension system consisting of pension plans of different characteristics in order to diversify the risks posed specifically by each type of pension plan. Thus, pension systems are constructed as multi pillars pension systems.

The pension plan can be of the type DB, DC, hybrid or NDC. In DB (defined benefit) pension plan type pension benefits are computed using a formula that considers several factors, such as length of employment and salary history. On the contrary, for the pension plans of the DC (defined contribution) type, the amount of the contribution (of employees, employers or both) is defined, while the amount of pension benefit varies based on the return

---

<sup>1</sup> E.g. the mentality of citizens, cultural characteristics of society, economic, political and historical background.

on investment. Hybrid type of pension plan is combination of DB and DC types. The amount of benefits in some of the countries are based on the number of points earned for a work career. The number of points earned is then multiplied by the value of the pension point, which undergoes regular valorization. NDC (notional non-financial defined contribution) systems are designed to be similar to a defined contribution plan where the pension benefit depends on contributions and return on investment. However, these accounts are only hypothetical, and the rate of return is determined by the government (not determined by the profitability of investments in the capital markets). Participation in a pension plan can be either mandatory or voluntary. It can also be quasi-mandatory participation. In such a case, the obligation of participation is usually given by collective agreements. Furthermore, a distinction can be made between PAYG (pay-as-you-go) financing and funded pension plan financing. In PAYG schemes, the contributions currently paid to the pension plans are used to finance current pension benefits of the current retirees. Conversely, in a funded pension plan each person contributes to its individual personal pension account. According to a study by Schieber and Shoven (1996), a PAYG pension plan can be described as follows:

$$t \cdot NW \cdot W = NB \cdot B \quad (1)$$

where  $t$  is the income tax rate,  $NW$  is the number of working persons,  $W$  is the average wage of contributing persons,  $NB$  is the number of recipients of benefits, and  $B$  is the amount of the benefit. It is evident from equation (1), that this equality should be fulfilled to keep pension system sustainable.

Table 1 summarizes pension system schemes in all EU countries. The first pillar of all the pension systems of EU countries operates to some extent on the PAYG principle and is mandatory. In Austria, Belgium, Croatia, Czech Republic, Finland, Greece, Hungary, Slovakia and Spain the pension system is based primarily on the PAYG financing in the first pillar. Croatia, Cyprus, Germany, Romania and Slovakia use points for calculation of pension benefits. The advantage of a point system is that by adjusting the value of a pension point, it can respond to economic and demographic changes, contributing to the sustainability of the pension system. Italy, Latvia, Poland and Sweden use NDC systems. The advantage of this plan is the direct relationship between the amount of benefit and the person's contributions, so the pension plan is personalized. The second pillar varies considerably between EU countries. In Czech Republic, Hungary and Malta there is no second pillar and in Poland, the second pillar is being phased out. In some of the countries the second pillar consists of two or more plans designed specifically for the self-employed, certain professions, etc. Participation in

Denmark, The Netherlands and Sweden is quasi-mandatory. The third pillar usually takes a form of tax allowance or otherwise advantaged individual accounts or insurance, and participation is voluntary and plans are of DC type.

**Tab. 1: Summary of pension system schemes in EU 28 countries**

Country	I. Pillar Characteristic		II. Pillar		III. Pillar Characteristic		
			Characteristic	Participation			
<b>Austria</b>	✓	DB, PAYG	✓	DB, DC, funded	voluntary	✓	DB, DC
<b>Belgium</b>	✓	DB, PAYG	✓	DC, funded	mandatory, voluntary	✓	DC
<b>Bulgaria</b>	✓	DB, PAYG	✓	DC, funded	mandatory, voluntary	✓	DC
<b>Croatia</b>	✓	points, DB, PAYG	✓	DC, funded	mandatory	✓	DC, DB
<b>Cyprus</b>	✓	Points	✓	DC, DB, PAYG/funded	mandatory, voluntary	✓	DC
<b>Czech Republic</b>	✓	DB, PAYG	X			✓	DC
<b>Denmark</b>	✓	taxes, DB, PAYG	✓	DC, funded	mandatory, quasi- mandatory	✓	DC
<b>Estonia</b>	✓	DB, PAYG	✓	DC, funded	mandatory	✓	DC
<b>Finland</b>	✓	DB, partly funded, PAYG	✓	DB	voluntary	✓	DC
<b>France</b>	✓	DB, PAYG	✓	points, DB, PAYG	mandatory	✓	DC
<b>Germany</b>	✓	points, PAYG	✓	DC, funded	voluntary	✓	DC
<b>Greece</b>	✓	flat rate, DB, NDC, PAYG	✓	DC	voluntary	✓	DC
<b>Hungary</b>	✓	DB, PAYG	X			✓	DC
<b>Ireland</b>	✓	flat rate, DB, PAYG	✓	DC, DB, DC/DB hybrid	voluntary	✓	DC
<b>Italy</b>	✓	NDC, PAYG	✓	DC, funded	voluntary	✓	DC
<b>Latvia</b>	✓	NDC, PAYG	✓	DC, funded	mandatory	✓	DC
<b>Lithuania</b>	✓	DB, PAYG	✓	DC, funded	voluntary	✓	DC
<b>Luxembourg</b>	✓	DB, PAYG	✓	DC	voluntary	✓	DC
<b>Malta</b>	✓	flat rate, DB	X			✓	DC
<b>Netherlands</b>	✓	DB, PAYG	✓	DB, DC, hybrid, funded	quasi-mandatory	✓	DC
<b>Poland</b>	✓	NDC, PAYG	?	DC	voluntary	✓	DC
<b>Portugal</b>	✓	DB, PAYG	✓	DC, funded	voluntary	✓	DC
<b>Romania</b>	✓	points, PAYG	✓	DC, funded	mandatory	✓	DC
<b>Slovakia</b>	✓	points, DB, PAYG	✓	DC	voluntary	✓	DC
<b>Slovenia</b>	✓	DB, PAYG	✓	DC	mandatory, additional voluntary	✓	DC
<b>Spain</b>	✓	DB, PAYG	✓	DC, hybrid, funded	voluntary	✓	DC
<b>Sweden</b>	✓	NDC, DB, DC, PAYG	✓	DB, DC, funded	quasi-mandatory	✓	DC
<b>United Kingdom</b>	✓	DB	✓	DC, DB	voluntary	✓	DC, DB, hybrid

Note: If the pension system contains the certain pillar it is signed by ✓, bold ✓ indicates high significance of the pillar. Shaded area indicates insignificance of the pillar.

Source: Own elaboration and European Commission 2018a

## 2 Comparison of long-term sustainability of EU pension systems

This part of the paper is focused on the analysis of sustainability of EU pension systems in the long run. In this analysis the fiscal sustainability will be evaluated by forward-looking approach specifically by synthetic indicator. Forward-looking approaches analyse the future development of public finances based upon the currently available information enriched by demographic and macroeconomic projections. Age structure of the population combined with demographic forecast is the key factor to project government deficit and debt dynamics over a long time period. Synthetic indicators measure adjustment effort required to reach a certain sustainable debt ratio at a given point in the future. (Langenus, 2006)

As a tool for further analysis, synthetic indicator  $S_2$  will be used. This indicator is an essential tool for analysing long-term fiscal sustainability, suggested by the European Commission being used also as the core indicator in the Fiscal Sustainability Reports produced annually by the European Commission. (European commission 2018b) The  $S_2$  indicator represents the amount by which the state budget would have to be adjusted to ensure long-term fiscal sustainability or in other words, the amount of the adjustment to the current structural primary balance<sup>2</sup> needed to achieve a stable debt-to-GDP ratio over an infinite horizon. The formula for calculation is described in Equation (2).

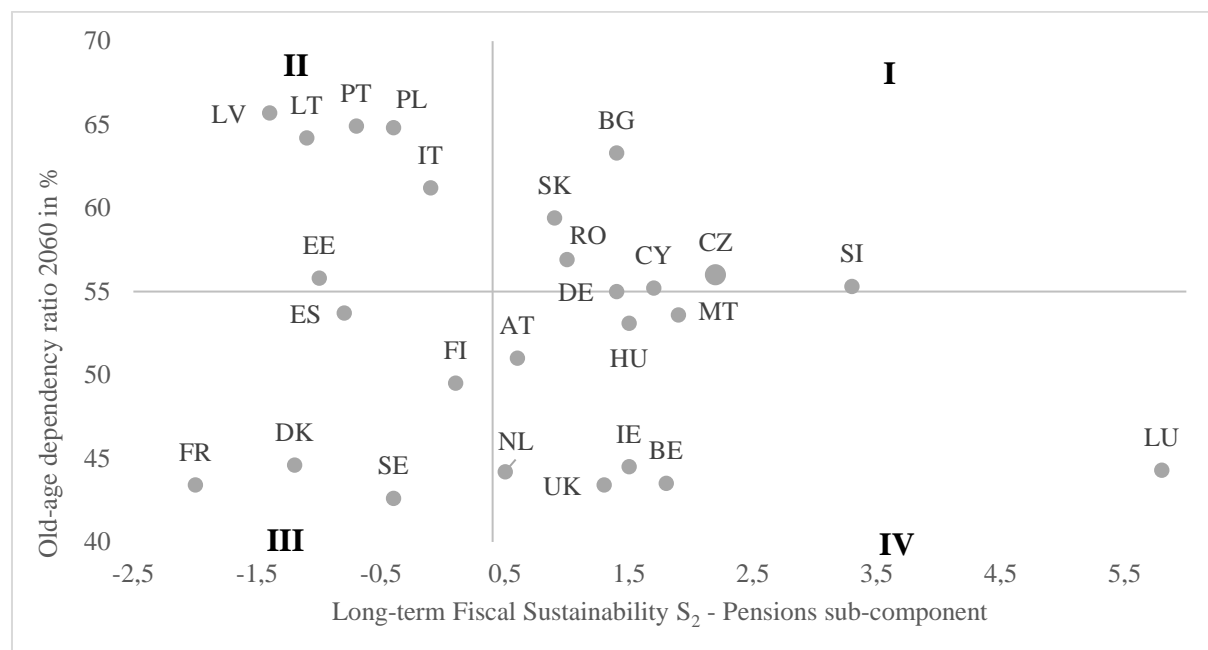
$$S_2 = \underbrace{rD_{t_0} - SPB_{t_0} - \sum_{i=t_0+1}^{\infty} \left( \frac{\Delta PI_i + CC_i}{\alpha_{t_0;i}} \right)}_A + \underbrace{\sum_{i=t_0+1}^{\infty} \left( \frac{\Delta A_i}{\alpha_{t_0;i}} \right)}_B \quad (2)$$

where  $r$  is the differential between nominal interest rate and nominal GDP growth rate,  $D$  is debt to GDP ratio,  $SPB$  is structural primary balance,  $PI$  is property income,  $CC$  is cyclical component and  $\alpha$  is discount factor. The element  $A$  represents the initial budget position, i.e. the gap to reach the debt-stabilizing level of primary balance, and part of equation  $B$  represents the additional adjustment required in relation to the cost of ageing. The change in ageing costs is marked with  $\Delta A$ .  $A$  consists of pension, health, long-term care and other ageing costs. Pension costs are relevant to this analysis (for more details see European Commission 2018b, p. 158-160.) The relationship of the  $S_2$  pension sub-component with old-age dependency ratio as an indicator of demographic development and with public pension expenditure will be analysed. The sustainability of pension systems will be also set in a context of the pension system design (a brief description in Table 1).

<sup>2</sup> Structural primary balance is the primary budget balance that would exist given current tax and expenditures laws if there were no output gap - the primary budget balance adjusted for the effects of the business cycle.

Figure 1 indicates distribution of EU countries into four quadrants according to the population ageing, represented by the projection of old-age dependency ratio<sup>3</sup>, and to the sustainability of pension system, represented by S<sub>2</sub> pension sub-component. The limit for low risk value of the S<sub>2</sub> pension sub-component is set to 0.4 as in Fiscal sustainability report 2018 and a limit for the lower values of old-age dependency ratio is set to 55 %.

**Fig. 1: Projected old-age dependency ratio in relation to S<sub>2</sub> pensions sub-component**



Source: Own elaboration and European Commission 2018c; EUROSTAT 2019

The most undesirable situation is in the quadrant I where the combination of high risk of long-term unsustainability of a pension system and high old-age dependency ratio occurs. This quadrant includes countries that are expected to face extreme population ageing in the future, but whose pension systems are not sufficiently prepared to cope with this burden. Such countries are Slovenia, Czech Republic, Cyprus, Bulgaria, Slovakia, Romania and Germany. Czech Republic, Germany and Slovakia have their pension system based primarily on PAYG financing. Slovakia and Romania are near the 0.4 borderline. Both of these countries have funded second pillar. Romania has low gross public pension replacement rate. Cyprus and Bulgaria have relatively high gross public pension replacement rate. (see Figure 2)

On the contrary, the quadrant II is the combination of low risk of long-term unsustainability of pension system despite a high old-age dependency ratio. This quadrant thus includes countries that are expected to face extreme population ageing, but their pension

<sup>3</sup> The ratio between people aged 65 years and more and people aged 15-64 years.

systems will remain sustainable in a long-run. Therefore, these pension systems can inspire countries in the quadrant I with their solution of the population ageing. Among the countries in the quadrant II are the Baltic states (Latvia, Lithuania, Estonia), Portugal, Poland and Italy. Latvia, Poland and Italy implemented NDC system. Estonia, Latvia, Lithuania, Italy and Portugal have funded second pillar. In Portugal is also projected a decrease in public pension expenditure due to substantial reforms implemented in pension system area.

The lowest risk situation is represented by quadrant III. Countries in this quadrant dispose with a low risk of long-term unsustainability of pension system and a low projected old-age dependency ratio. Such countries are the North countries (Sweden, Finland, Denmark), Spain and France. Less serious problem of population ageing is combined with reformed pension system in the North countries like Sweden, Finland and Denmark. Sweden uses NDC system, funded occupational second pillar, in Finland the first pillar is partly funded, and in Denmark is low gross public pension replacement rate and funded second pillar (see Figure 2). In Spain is projected fall in public pension expenditures, however, the reversal of recent pension reforms would worsen  $S_2$  pension sub-component in the future. France have increased compulsory contributory period which will further increase in line with life expectancy.

In the quadrant IV is the combination of high risk of long-term unsustainability of pension system and low old-age dependency ratio. Such country is Luxembourg, Belgium, Ireland, United Kingdom, Hungary, Austria, Netherlands and Malta. Austria and Netherlands have reformed their pension system, improvements in the sustainability of their pension systems are observable by comparing the previous values of  $S_2$  pension sub-component with the current values, which are significantly reduced. The second pillar was cancelled in Hungary in 2011, which probably led to a significant deterioration in the sustainability assessment of its pension system. In Luxembourg, Belgium and Malta is projected a large increase (8.9 and 3 percentage points of GDP respectively) of pension expenditure. Austria and Luxembourg belong to countries with the highest gross public pension replacement rate.

Based on the classification above, it is obvious that ageing of population is not fundamentally connected with pension systems unsustainability as there exist countries with pension systems expected to work well in the future despite ageing population (quadrant II). On the other hand, there are countries challenged by unsustainability of pension systems even though their demographic outlook is quite favourable (quadrant IV). There is quite an agreement in literature (see e.g. Aaron, 1966; Disney, 1999) that in case of population ageing, it is appropriate to at least partially limit PAYG based funding and to implement at least a partially funded plan. However, it should be borne in mind that reforms of a pension system

and the transition from PAYG to funded financing are considerably costly and can lead to a widening of the public debt (Barr, 2006). This was the case of, for example, Hungary and some other East European countries. However, the countries that maintained the funded pillar remained in quadrant II, while Hungary moved to risk quadrant IV.

**Fig. 2: Public pension expenditures in % of GDP in 2015 in relation to gross public pension replacement rate as a ratio of gross pre-retirement earnings in 2016**



Note: Missing values of public pension expenditure for Croatia, Romania, Bulgaria and Cyprus.

Source: Own elaboration and OECD 2017a, OECD 2017b

## Conclusion

Our analysis has confirmed that the problem with sustainability of pension systems is common for almost all of the EU countries with only few exceptions, for example Sweden, Finland or Denmark, where problems of pension system unsustainability seem less likely. In our opinion, the problem will be worst in countries with a combination of an ageing population with a generous pay-as-you-go pension system. Mainly because of the population ageing, some countries have begun to reform their pension systems to make them more effective and resilient to demographic challenge in the long run. Reforms often consist of limiting pay-as-you-go (PAYG) pension schemes and replace or supplement them with fully or at least partially funded schemes. It could be either personal or occupational scheme.

If a decision is made that the PAYG should remain the main financing principle, basically three measures may be considered to improve the sustainability of the system - to increase the contribution rate and/or other taxes, reduce replacement ratio, increase retirement age. Different combination of these individual measures would probably be the outcome, however their counterproductive potential effects on economic growth (in case of increasing



taxes) or social problems (in case of reducing replacement ratio) should be borne in mind as well. If the government decides to allow the replacement rate to decline, it is essential to implement incentives to increase savings in other pillars in sufficient advance. Retirement age increase is definitely not an unlimited measure, as the full health life period does not keep pace with total life expectancy. In the Czech Republic the unlimited increase in the statutory retirement age (2 months per year) has been abolished in 2017. There was introduced a revision mechanism for setting retirement age, “capping” retirement age to 65 years.<sup>4</sup>

As the Czech Republic was identified to be one of the most rapidly ageing EU countries threatened by unsustainable pension system in the long run, the sooner the pension system will be reformed the better. In ageing societies, the phenomenon of so-called median voter gains on importance. With increasing old-age dependency ratio the size of the population that is financially supported will be increasing as well. After the median voter will be a retired person, there can be expected a jump in both taxation and social transfers' rates, similarly as expected by Razin et. al. (2002). We also come to a similar conclusion to Bongaarts (2004) that today's workers will have to save more, work longer, retire later, receive a lower retirement pension and will likely to pay higher taxes – if there is no change of pension system adopted in the near future in the Czech Republic. As there no EU country with NDC account was assessed as unsustainable, the introduction of NDC accounts could be a way how to improve the sustainability of the pension system of the Czech Republic.

## References

- Aaron, H. (1966). The social insurance paradox. *Canadian Journal of Economics and Political Science/Revue canadienne de economiques et science politique*, 32(3), 371-374.
- Afonso, A. (2005). Fiscal sustainability: The unpleasant European case. *FinanzArchiv: Public Finance Analysis*, 61(1), 19-44.
- Barr, N. (2006). Pensions: overview of the issues. *Oxford review of economic policy*, 22(1), 1-14.
- Bongaarts, J. (2004). Population aging and the rising cost of public pensions. *Population and Development Review*, 30(1), 1-23.
- Disney, R. (1999). Notional accounts as a pension reform strategy: An evaluation. Social Protection, World Bank.

---

<sup>4</sup> According to the current wording of Act No. 203/2017 Coll., a revision mechanism for setting the retirement age according to the development of life expectancy will be introduced in the Czech Republic. The aim should be for the person on average to spend a quarter of the total life in retirement.

- Eckefeldt, P., Schwierz, C., Giamboni, L., Aarnout, M., & Carone, G. (2014). Identifying fiscal sustainability challenges in the areas of pension, health care and long-term care policies-European Commission. *Occasional Papers 201*. Brussels. *European Economy*.
- European Commission. (2018a). The 2018 pension adequacy report. Current and future income adequacy in old age in the EU. Volume II, *Country profiles*. Brussels. PDF. 288pp. doi: 10.2767/653851
- European Commission. (2018b). Fiscal Sustainability Report 2018. *Institutional Paper 094*. January 2019. Brussels. PDF. 212pp. (vol. 1). doi: 10.2765/435292.
- European Commission. (2018c). Fiscal Sustainability Report 2018. *Institutional Paper 094*. January 2019. Brussels. PDF. 176pp. (vol. 2). doi: 10.2765/014340.
- Eurostat. (2019). Population and social conditions. Population projections. Population projections at national level (2015-2080). (proj\_15ndbims). (2019, February 5). Retrieved April 15, 2019, from <https://ec.europa.eu/eurostat/data>
- Langenus, G. (2006). Fiscal sustainability indicators and policy design in the face of aging. *National Bank of Belgium Working Paper*, (102).
- OECD Statistics. (2017a). Social Expenditure - Aggregated data. Public. Old age. Cash benefits. Old age – Pension. Retrieved April 15, 2019, from <https://stats.oecd.org>
- OECD Statistics. (2017b). Pension at a glance. Funded Pensions Indicators. Gross replacement rate. (2017, December 5). Retrieved April 15, 2019, from <https://stats.oecd.org/>
- Razin, A., Sadka, E., & Swagel, P. (2002). The aging population and the size of the welfare state. *Journal of Political Economy*, 110(4), 900-918.
- Schieber, S. J., & Shoven, J. B. (1996). Social security reform: Around the world in 80 ways. *The American Economic Review*, 86(2), 373-377.

## Contact

Lenka Lakotová

University of Economics, Prague

W. Churchill Sq. 1938/4, 130 67 Prague 3, Czech Republic

xlakl00@vse.cz

Eva Zamrazilová

University of Economics, Prague

W. Churchill Sq. 1938/4

eva.zamrazilova@unrr.cz