# Pension Liabilities in the Czech Republic

**Zdeněk Skalák** [1] | *Czech Statistical Office, Prague, Czech Republic*
**Václav Rybáček** [2] | *Jan Evangelista Purkyne University, Usti nad Labem, Czech Republic*

***Abstract***

The pension liabilities drew a wide attention due to ageing of population, especially the liabilities originating in the operation of the unfunded scheme (pay-as-you-go). Changing demographic situation and the interest of users gave rise to a request on the provision of a new data aiming to provide a basis for analysis and the decision-making of policy-makers. The purpose of this paper is to present the calculations of the total pension liabilities for the Czech Republic which were first released by the Czech Statistical Office in 2018. Besides, the paper presents a sensitive analysis and also compares the final figures internationally.

***Keywords***

*Pension liabilities, pension systems, ageing of population*

***JEL code***

*H55, H75, H50*

## INTRODUCTION

Financial situation of pension systems in developed countries and a need for their reforms has currently become one of the topical issues. Demographic development over the last decades, namely an increasing proportion of retirees in the entire population, has necessitated a number of reform plans. In the field of statistics, this trend manifested itself into a request to compile relevant aggregates chiefly on the operation of the pay-as-you-go system (hereinafter: PAYG) which is commonly referred to as "the first pillar" and which is generally the dominant way how pension protection is institutionalized.

Request to deliver relevant data has been translated into a new table in the Eurostat´s Transmission program (so-called Table 29).[3] At the end of March 2018, the Czech Statistical Office (hereinafter CZSO) firstly released the total pension liabilities for the period ranging from 2011 to 2015. Although the Table 29 covers all pension liabilities including those of private pension schemes, this text is focused on the liabilities arising along with a system of the PAYG only. The reason is that while the liabilities of private pension schemes are explicitly recognized in business and national accounting, PAYG system´s liability must be calculated by statisticians themselves. We will thus present and discuss the way of calculation; then we compare the totals for the Czech Republic internationally as well as with other experimental calculations previously published in the Czech economic journals.

[1] Czech Statistical Office, Na padesátém 81, 100 82 Prague 10, Czech Republic. E-mail: zdenek.skalak@czso.cz.
[2] UJEP, Moskevská 54, Ústí nad Labem, Czech Republic. Also the Czech Statistical Office, Na padesátém 81, 100 82 Prague 10, Czech Republic. E-mail: vaclav.rybacek@czso.cz.
[3] The transmission program whose part is the Table 29 (Accrued-to-date pension entitlements in social insurance) specifies the nature and timeliness of data delivery within the framework of the European System of National and Regional Accounts.

The purpose of the data on pension liabilities is manifold. There is a difference in the treatment of funded and unfunded pension schemes (such as a PAYG system) in national accounts. Liabilities arising in the operation of the PAYG system are recorded off-balance only in the government accounts. This implies that a part of future government liabilities is not explicitly shown let alone to be a part of the general government debt. On the contrary, the funded schemes are recorded under the item AF.6[4] in national accounts adding to the national accounts aggregates.

Different recording of funded and unfunded schemes obviously poses an obstacle for the international comparability of the aggregates on pension liabilities (Bloch-Fall, 2015). Simply, the total amount of pension liabilities, as shown in the sector accounts, depends on the way how pension protection is organized in individual countries. This incomparability is supposedly overcome by introducing the supplementary table covering pension liabilities irrespective of their nature as funded or unfunded.

Furthermore, data on pension liabilities can also serve as an important input into decision-making process of policy-makers. An imbalance in the pension system, which is ideally supposed to be balanced, can create a pressure on the overall government revenues and expenditures. In other words, changes in tax legislation or expenditure cuts can become inevitable in the face of reoccurring imbalances in the pension system, i.e. especially when pension payments exceed pension contributions.

This brings us to an important aspect causing that aggregates discussed in this paper shall be read with great caution. In case of aggregates on the pension liabilities, we pay attention to the liability side only with no reference to the asset-side (Goebel, 2017). Simply, it can be hardly deduced from Table 29 whether the pension system is sustainable or not, because of missing information on revenues from contributions which will accrue to government in the future.[5] Table 29 thus offers only partial information on the financial soundness of the pension system.

## 1 BACKGROUND

The supplementary table was created in a situation which still poses fiscal challenges to authorities. We can only remind the trends of growing proportion of people at the retirement age creating pressure on the government expenditures, or decreasing share of economically active persons in the population bringing insufficient funds into the pension system. As the following table published in the Ageing report[6] demonstrates, the old-age dependency ratio (i.e. the age group of 65 and older to the age group of 15–64) will nearly double across the EU countries (increasing from the current 29.0% to 50.2%). In other words, during the reference period, the number of persons at the productive age per a person at the retirement age is expected to fall from four to two. In the Czech Republic, the expected changes in the coefficient are alarming, so the increase in the age group of 65+ from the current 18 to 28% in 2060 can create a strong need for interventions into the pension system.

Among the main causes of this trend, both declining birth rates and mortality rates leading to a prolonged life expectancy should be mentioned in particular. Gradually increasing life expectancy has a significant effect on the mortality tables which are an essential input into the calculations of pension liabilities. Technically speaking, the life expectancy represents the average period of time that a person of the age "x" may expect to live under the current immutable conditions. By 2060, this indicator is expected to increase in the Czech Republic to 85 years for men and 88 years for women.

[4] The item with the code AF.6 covers stock of insurance, pension and guarantee schemes.

[5] For interesting discussion on generational accounting calculating "lifetime net tax rates" for a given cohort, see Ruffing, de Water, Kogan (2014).

[6] The Ageing report for the European Population is published by the European Commission every three years. This document serves a platform for debates at the European level. Based on this document, the sustainability of public finance is assessed in the form of expenditures closely linked to demographic developments (retirement pensions, health care, education or unemployment benefits). It is also used to assess the impact of demographic developments on the labour market and potential economic growth.

**Table 1** Projection of population ageing expressed by the share of selected population groups, comparison between the EU and the Czech Republic, 2013–2060

| Age group | Year / Area | 2013 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0–14 | EU | 15.6 | 15.6 | 15.2 | 14.9 | 14.6 | 14.6 | 14.8 | 15.0 | 15.0 | 15.0 |
| | CZ | 15.3 | 16.0 | 15.3 | 14.7 | 14.3 | 14.7 | 15.3 | 15.8 | 15.7 | 15.4 |
| 15–64 | EU | 65.4 | 63.9 | 62.6 | 61.1 | 59.6 | 58.4 | 57.5 | 56.9 | 56.6 | 56.6 |
| | CZ | 66.6 | 63.8 | 63.3 | 63.0 | 62.7 | 60.6 | 58.0 | 56.7 | 56.2 | 56.4 |
| 65+ | EU | 19.0 | 20.5 | 22.2 | 24.1 | 25.8 | 27.0 | 27.7 | 28.2 | 28.4 | 28.4 |
| | CZ | 18.1 | 20.2 | 21.4 | 22.3 | 23.0 | 24.7 | 26.7 | 27.5 | 28.1 | 28.2 |

**Source:** Ageing Report 2015

Table 2 suggests that the Czech Republic has been slowly approaching the EU-levels in terms of life expectancy; moreover, this trend is expected to continue in the future. This holds for both life expectancy at birth and life expectancy at age 65. For the latter, the average life expectancy for men is expected to grow from nearly 16 years, as of today, to 21 years in 2060. In case of women, the projection counts with an increase on a similar proportion as for men, i.e. from 19.5 years to 24.5 years. It can be concluded that the Czech Republic, as well as other developed countries, has been going through the demographic changes which pose a risk to the PAYG system´s financial balance.

**Table 2** Life expectancy at birth and at age 65, EU and the Czech Republic, 2015–2060

| Life expectancy | Area | Year / Sex | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $E_0$ | EU | Men | 78 | 78.9 | 79.7 | 80.5 | 81.3 | 82.0 | 82.8 | 83.5 | 84.1 | 84.8 |
| | | Women | 83.4 | 84.1 | 84.8 | 85.5 | 86.1 | 86.8 | 87.4 | 88.0 | 88.5 | 89.1 |
| | CZ | Men | 75.5 | 76.5 | 77.4 | 78.3 | 79.2 | 80.1 | 80.9 | 81.7 | 82.5 | 83.3 |
| | | Women | 81.5 | 82.3 | 83.1 | 83.8 | 84.5 | 85.3 | 85.9 | 86.6 | 87.3 | 87.9 |
| $E_{65}$ | EU | Men | 17.9 | 18.4 | 18.9 | 19.5 | 20.0 | 20.5 | 21.0 | 21.5 | 22.0 | 22.4 |
| | | Women | 21.2 | 21.8 | 22.3 | 22.8 | 23.3 | 23.8 | 24.3 | 24.7 | 25.2 | 25.6 |
| | CZ | Men | 15.9 | 16.6 | 17.2 | 17.8 | 18.4 | 19.0 | 19.6 | 20.1 | 20.7 | 21.2 |
| | | Women | 19.4 | 20.0 | 20.6 | 21.2 | 21.8 | 22.4 | 22.9 | 23.5 | 24.0 | 24.5 |

**Source:** Ageing Report 2015

European countries thus clearly face a demographic trend which can bring about a chronicle imbalance to the pension system due to contrasting trends in a number of beneficiaries and contributors. This impacts mainly the un-funded systems where there are no individual pension plans which would make current retirement savings explicit. As a matter of fact, benefits currently payable are financed by social

contributions which are paid to the State by currently employed workers and theirs employers. This makes demographic situation very closely interlinked to the financial balance of unfunded pension system.

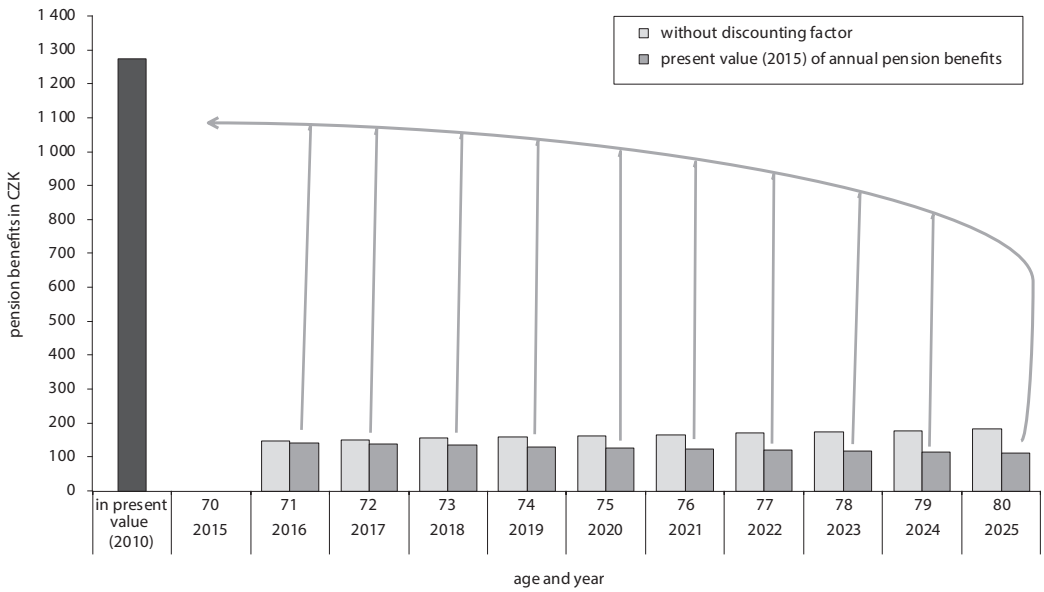
Before going into greater detail, it is worth making few more remarks on the nature of the PAYG system. It can be categorized into defined benefit schemes where the amount of benefits that participants receive at the retirement age is predefined by the law. Besides, the law stipulates the amount of compulsory contributions which applies to all economically active people of the age over 18 years who contributes a certain percentage of their income which is set regardless of level of the income. These funds are then distributed in the form of pensions to current pensioners by main actors.[7]

## 2 METHODOLOGY

In the methodological part of the paper, we will describe the way of calculation as well as assumptions which is essential to be aware of for an assessment of the explanatory power of aggregates.[8] Accepting some simplistic assumption regarding the future macroeconomic development is inevitable not only because these aggregates fall within the area of macroeconomic figures, but chiefly because we are dealing with projections reaching far into the future. One of the key issues which will be discussed in greater detail is the choice of relevant discount rate. To use a discount rate is an essential part of the calculation as the final aggregates are compared with nominal GDP for given period; future pensions must be thus presented in their current values.

As shown below, the final results are highly discount-rate-sensitive. From the households´ perspective, the discount factor reflects the time-value of money. Current payments are considered more valuable

**Figure 1** An example of a discount factor application




**Source:** Technical Compilation Guide for Pension Data in National Accounts

[7] In the Czech Republic, the following institutions are involved: the Ministry of Labour and Social Affairs, the Ministry of Justice, the Ministry of Interiors and the Ministry of Defence.

[8] The calculation of liabilities follows basic principles stipulated in the Technical Compilation Guide released by Eurostat and the European Central Bank (2011).

than future payments because of potential risks associated with future payment flows. This means that the discount factor is generally less than 1, i.e. the present is preferred to the future. In terms of the pension manager (the State), the discount factor is used to calculate the pension reserves currently required to finance future pension liabilities. The following chart shows a model example of pension liability for pensioners in 2015 at the current age of 70 who are expected to live for 80 years. Such a pensioner will be reimbursed a pension of 151 thousand CZK a year to 184 thousand CZK a year at the end of the period. These benefits will be reduced by the discount factor to arrive at their present value.

Discount factor thus significantly impacts the extent of pension liabilities. For the sake of our calculation, nominal discount rate of 5 percent was used in line with the recommendation of the Manual on Pension Liabilities. It is obvious that this assumption is very strong and it calls for the availability of alternative scenarios which are presented below. Besides, the future course of pensions will be, of course, directly affected by the performance of economy (translated into wage growth), amendments in the law (retirement age) or by development in the monetary sphere (rate of inflation). Due to these, it is necessary to incorporate further assumptions concerning the future macroeconomic conditions. These are the followings:

- Rate of inflation – it is defined as an increase in the general price level of goods and services in the economy over a certain period of time. According to the Act on Pension Valuation, they are adjusted annually, among other things, by the rate of inflation; therefore, this indicator is applied in the calculation of the liabilities of current pensioners. In the model, inflation rate of 2% is considered according to the CNB inflation target of 2015.
- Coefficient for adjusting the general assessment base – this indicator determined by the government regulation based on the growth of the average wage. All new types of pension are adjusted accordingly. We apply to the commitments of those generations that are not yet retired. Based on the average of this coefficient from 2008 to 2015.
- Real wage growth – future course of real wages, i.e. real value of monetary rewards of workers participating in the productions process, plays an important role as it serves as basis for the pension calculation. Since 2008, it is part of the annual valorisation of existing pensions to which one-third contributes. Real wage growth is assessed as the average in the period from 2008 to 2016.

Furthermore, as we will see below, assumptions regarding the future demographic situation must be incorporated. Concretely, the final values are directly influenced by the expected probability to be alive at the year x + 1, ongoing migration or the development of fertility rate which all already serve as an input into the compilation of demographic projection. As the demographic projection constitutes one of the key inputs into the calculation of pension liabilities, no further specific calculations are needed in this respect.[9]

Model of pension liabilities under the first pillar is based on the German Freiburg model – it is referred to as "The ADL model" (accrued-to-date liabilities), which represents the present value of the pensions to be paid in the future. ADLs measure the amount of money required by the pension system to meet its commitments in the theoretical case of closing down the system. In case of government- sponsored unfunded pension schemes, such a scenario is practically ruled out. Expressing the ADLs of the unfunded defined benefit schemes of government employees and social security schemes in terms of GDP gives an idea of the number of annual products a country would have to spend to meet its pension commitments.

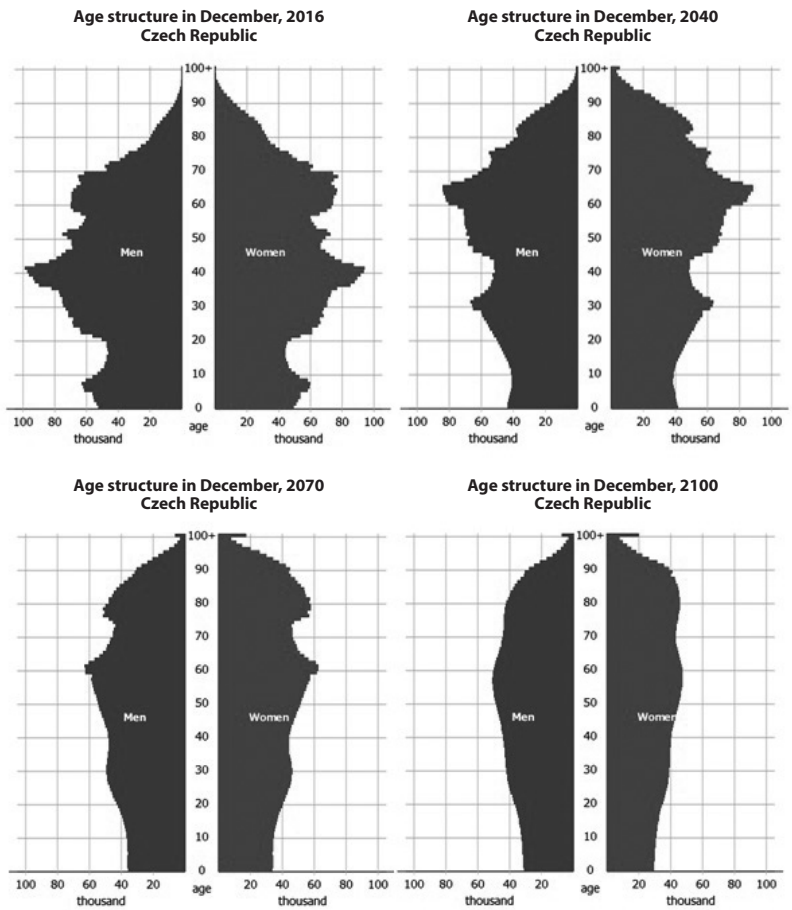
As already mentioned, modelling of commitments is only focused on the first pension pillar where these data are not captured in the national accounts system. The model calculates the liabilities of current and future pensioners, i.e. entitlements accrued to persons who have not yet reached retirement age, are counted in the final total of liabilities.

[9] The demographic projection as published by the CZSO in 2013 was incorporated into the calculation.

The model calculation itself consists of several basic steps. The very first thing is to acquire relevant primary data. To briefly recall, the model incorporates data on pensions which are structured by gender and age of beneficiaries. Relevant information is retrieved from the databases containing several types of pensions paid by the state institutions engaged in the pension protection (see footnote 7). Another key input already mentioned is the demographic projection as published by the CZSO.

The demographic projection is displayed in the following age pyramids population projection by 2100 (CZSO, 2013). There is a visible population ageing process as the age pyramid is increasingly changing into a regressive type of decreasing size of population. The least people are found in the child's component and most in the post-reproduction (or with reproduction at a similar level). The base of the chart is narrow and the sides are convex, which means that the number of newly born children is steadily decreasing and, in the longer term, the total population will decrease. In this case, the population is ageing and the economic burden on the entire population is increasing. Graphically, this state is represented by a significantly wider vertex.

**Picture 1** Age structure of the Czech Republic in selected years




**Source:** CZSO

As a further step, the average pension allowances for a single representative of each generation are determined. The purpose of the calculation is to find out the commitment the system brings to the annual cohort of the population. Once the average amount for each cohort is set, the number of people in each cohort (according to the projection) in the following years is multiplied by particular estimated average income (up to the age of 100 in old-age pensions - according to the population projection). After doing so, we will arrive at the amount of pension liabilities by individual generations. Formally, the estimation of the existing retirees' benefits is based on the following identity:

$$p_{b,k} = \frac{B_{b,k} \cdot M_{b,k}}{C_{b,k}} \quad \wedge \quad P_b = \sum_{k=b-D}^{b} p_{b,k} \cdot C_{b,k}\,, \tag{1}$$

where:

$p_{b,k}$ = the pension benefits in the base year b of the cohort born in $k$,
$B_{b,k}$ = average pension benefit of a certain age $x$,
$M_{b,k}$ = number of scheme retirees of a certain age $x$,
$C_{b,k}$ = cohort size of the overall population.

This identity suggests that the sum of age-specific individual pension benefits $p_{b,k}$ (in the base year $b$ of the cohort born in $k$) weighted by the cohort size $C_{b,k}$ should equal the corresponding overall aggregate pension expenditure, denoted by $P_b$.

It is necessary to consider the annual valorisation of pensions, i.e. adjustment of pensions according to the law amendments. In 2008–2017, this indicator was set as a sum of the rate of inflation in given year and one third of the real wage growth. Economic crisis in the year 2013 and 2014 was an exception from this rule as only one-third of the inflation rate was taken into account. Since 2018, half of real wage growth has been counted in as part of the valorisation. Based on these, we adjust the inflation rate and one third of wage growth which are discussed below. Formula (2) states that an individual already retired in base year $b$ receives the same pension in a specific year t as in the base year $b$, only corrected by the indexation $g$ of a pension in payment.

$$p_{t,k}^{exis} = p_{b,k}^{exis} (1+g)^{t-b}, \tag{2}$$

where:

$g$ = indexation, according to established rules.

The age-sex-specific pension profile for future new retirees, which is the basis for the estimation of accrued-to-date entitlements, is calculated by adjustments of existing retirees` benefits in the base year. A new retirees` benefit $p_{t,k}^{new}$ in a specific year $t$ of a cohort $k$ is developed by calculating the absolute change in the benefit of the existing retirees of the cohort $b - (t - k)$ (the cohort with the same age $(t - k)$ in the base year $b)$ to the cohort one year younger in the base year, namely $b - (t - 1 - k)$.

The following equation sums up the calculations of pension benefits for newly incoming beneficent in given future year $t$. The amount of future pensioners' allowances is then estimated from the current retirement benefits. The value of such benefit must be then adjusted by the coefficient of the general assessment base, according to which the newly awarded pensions are increased each year. The average of the last 8 years represents a value of 0.026 to 2015. In other words, the current claim shall be multiplied by the coefficient for each year remaining year before a beneficent reaches retirement age as shown in Formula (3).

$$p_{t,k}^{new} = \left[ p_{b,b-(t-k)}^{exis} - p_{b,b-(t-1-k)}^{exis} \right] \cdot (1+v)^{t-b}, \tag{3}$$

where:

$p^{new}_{t,k}$ = new retiree`s benefit in a specific year $t$ of a cohort $k$,
$p^{exis}_{b,b-(t-k)}$ = benefit of the existing retirees of the cohort $b - (t - k)$,
$p^{exis}_{b,b-(t-1-k)}$ = benefit of the existing retirees of the cohort one year younger,
$v$ = valorisation rate.

For generations not yet retired which do not meet the criteria of the minimum time of participation in the social insurance program, pension benefits is not considered in its full amount. In this case, the "lambda" factor is introduced which represents a reduced entitlement to future pension claims. To put an example of participants borne in the year 1980, we consider only 15 years of social insurance out of a total of 40 years. Then, the primary income of this generation is reduced by the share 15/40. The following years include the same pension adjusted for the revaluation of pensions. We will make all these adjustments for all generations over the age of 20 (with the exception of the orphan's pension we are considering from 0 to 26 years of age, who do not yet have a retired pension (up to the age of 67 when we no longer consider retirement).

Lastly, the accumulated future benefits of new retirees need to be calculated. Thus, for example, a 55 year old representative (in the base year) will have a certain probability of retiring at the age of 56, 57 and so on. Formally, this is done by cumulating year-by year $p^{new}_{t,k}$ according to the following equation. The accumulated age-sex-specific future pension benefits $p^{fut}_{t,k}$ of a retiree for a specific year $t$ of the cohort $k$ are defined as follows:

$$p^{fut}_{t,k} = p^{fut}_{t-1,k}(1+g) + \lambda_{t,k} \cdot p^{new}_{t,k} , \tag{4}$$

where:

$p^{fut}_{t,k}$ = future pension benefits of a retiree for a specific year $t$ of the cohort $k$,
$\lambda$ = lambda factor, which represents a reduced entitlement to future pension claims,
$p^{new}_{t,k}$ = the pension benefits for new retirees in the base year.

From this equation it follows that an average individual born in year $k$ receives a future benefit in year t (t>b) which consists of the accumulated pension payment one period earlier (t – 1) corrected by the pension indexation g plus the pension paid to new retirees in that year. Finally, the ADLs of the pension scheme are calculated by discounting and adding up the above projected pension benefits over the cohorts living in the base year as expressed by Formula (5).

$$ADL_b = \sum_{t=b}^{b+D} \sum_{k=b-D}^{b} \frac{\left(p^{exis}_{t,k} + p^{fut}_{t,k}\right)}{(1+r)^{t-b}} C_{t,k} , \tag{5}$$

where:

$ADLb$ = accrued-to-date liabilities of the base year $b$,
$r$ = discount factor.

This means that, in every period t, the pension benefits of the existing retirees ($p^{exis}_{t,k}$) and the pension rights accrued until the base year ($p^{fut}_{t,k}$) – which are both discounted by the factor $(1 + r)$ for every future year $(t – b)$ – are multiplied by the number of members of this age cohort $Ct, k$. This is done for each age group, beginning with those born in $k = b – D$, which goes back 100 years prior to the base year.

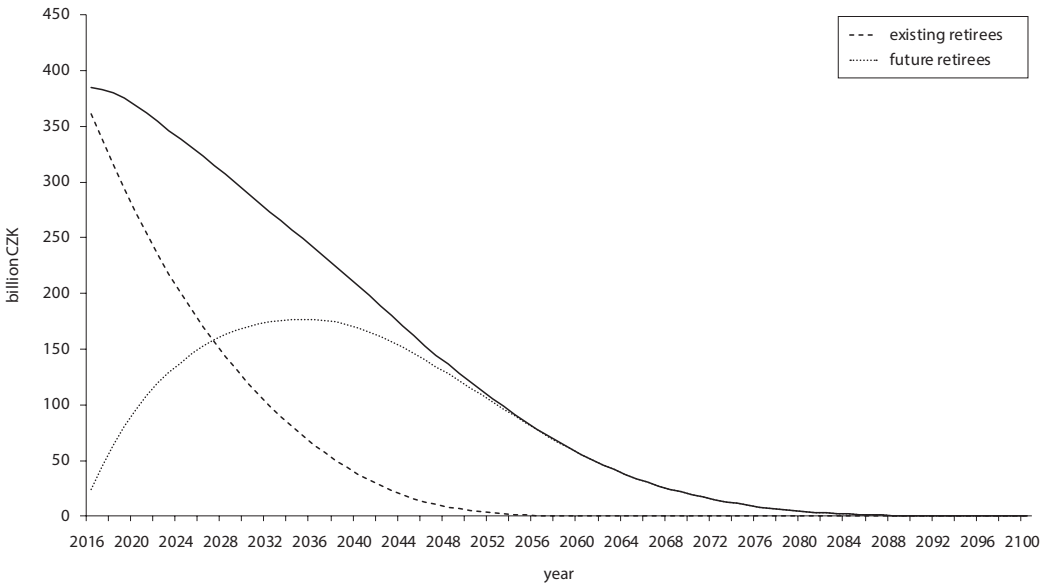
## 3 ANALYSIS

In this section, we will analyse the results obtained from the model just described. Figure 3 shows the comparison of pension liabilities arisen in the first pillar between the current and future pensioners as it was in 2015. The value of current pensioners' claims is approximately CZK 4.2 trillion amounting to 40 percent of all the pension liabilities. Most of the liabilities take the form of old-age pension claims

(84 percent). The number of expenditures falls over time due to a gradual decrease in the status of these cohorts and reaches a zero value by paying out the commitments to the last participant in the model (up to 100 years).

The claims of future pensioners who have not yet reached the age to benefit from the system offer a completely different picture. Due to a low lambda factor which determines the entitlements in the future, the liabilities are lower in the first years for the future pensioners as illustrated by the red line in Figure 2. As our analysis shows, the share of future retirees will peak around 2035 representing the balance between the most numerous generations retiring around this year and the high lambda coefficient. Similarly to the case of current pensioners, pension entitlements amounting to 82 percent takes the highest share in the total pension entitlements.

**Figure 2** Share of pension liabilities for current and future pensioners, the Czech Republic, 2015




**Source:** CZSO

Let´s take a look at the development of the total pension liabilities in terms of GDP which is shown in Table 3. Over the analysed period, pension liabilities grew by more than CZK 700 billion. Major part of the total amount takes the form of the liabilities of old-age pensions (more than 80 percent in all years), while the smallest share belongs to the orphan's pensions (8 percent). From the gender point of view, we can draw a fall in the value of men's disability pensions (by CZK 50 billion), while in the case of women this decrease reached only CZK 10 billion. In total, the share of pension liabilities from the first pillar stood at 230 percent of GDP at the end of 2015.

Although there was an increase in the value of pension liabilities over this period, it had been continuously decreasing if expressed in terms of GDP. This is chiefly due to a strong growth in nominal GDP, especially in 2014–2015. This trend may be expected to continue also in next years as the Czech economy was strongly growing in both years 2016 and 2017. To sum up, while the total value is nominally growing, its share on GDP went down due to high nominal growth of the Czech economy.

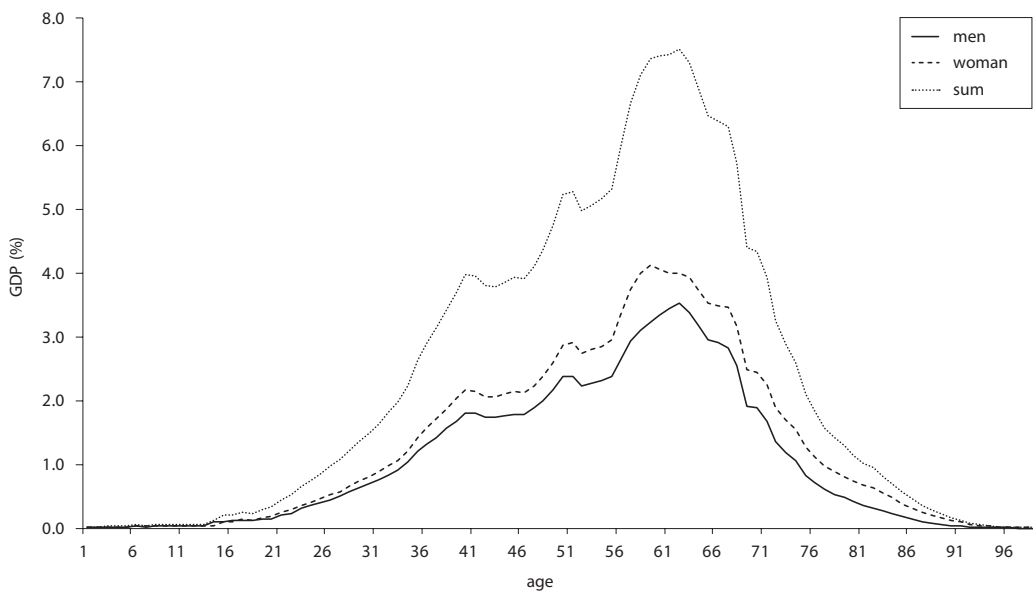
**Table 3** Pension liabilities of the first pillar by sex and type, the Czech Republic, 2011–2015, CZK mil, percentage of GDP

| Type of pension | Gender / Year | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| Survivor | Women | 699 | 744 | 745 | 735 | 704 |
| | Men | 110 | 122 | 125 | 126 | 125 |
| Disability | Women | 460 | 462 | 454 | 451 | 445 |
| | Men | 545 | 550 | 537 | 519 | 502 |
| Old age | Women | 4 368 | 4 492 | 4 548 | 4 627 | 4 706 |
| | Men | 3 626 | 3 843 | 3972 | 3 962 | 4 067 |
| **Total** | | 9 808 | 10 213 | 10 381 | 10 420 | 10 549 |
| **Percentage of GDP** | | 243 | 251 | 253 | 242 | 230 |

**Source:** CZSO

Pension liabilities can be, of course, analysed from many other perspectives. Let´s move on to the structure of liabilities by age and gender. As illustrated in Figure 3, the largest proportion of both male and female commitments falls into the age group of 60–64 years (approximately 20% of all commitments). Evidently, the amount of liability is growing over the working age for both men and women. Observable exceptions are the age groups from 41 to 45 which may be attributed to a lower number of people in these cohorts. From the age of 65, the amount is on declining path as the number of people in these

**Figure 3** Pension liabilities by age and sex, percentage of GDP, the Czech Republic, 2015




**Source:** CZSO

cohorts is decreasing. From the gender point of view, similar trends are observable. However, higher values are identifiable in all age groups compared to men, mainly due to larger sizes of generations in terms of number of people.

Let´s make a step beyond the headline figures. The values presented so far were based on the simplistic assumption on the 5-percent discount rate as requested by the Manual (Eurostat-ECB, 2011). Because the future conditions can change or a particular situation in individual countries can differ, statisticians are expected to provide the sensitivity analysis showing the alternative results at different level of discount rate. By doing so, we can better assess the extent of sensitivity, not least the importance of discount factor in the compilation process.

Table 4 summarizes the results of the sensitivity analysis for the Czech Republic.

**Table 4** Sensitive analysis, the Czech Republic, 2015

| Liabilities of the pay-as-you-go system | Discount rate 4% (nominal) | Discount rate 5% (nominal) | Discount rate 6% (nominal) |
|---|---|---|---|
| Closing stock of pension liabilities (CZK bn) | 12 693 | 10 549 | 8 928 |
| Level of pension entitlement as a share of GDP (%) | 276.2 | 229.5 | 194.3 |

**Source:** CZSO, own calculation

Not surprisingly, the lower discount rate used the higher share of pension entitlements on GDP is, as future payments take higher present values. Furthermore, we can see that the sensitivity on the discount rate is really significant. The total value for the lowest discount rate (4 percent) is by 82 percentage points higher than that for the 5 percent discount rate.

High volatility was found out also in other empirical studies dealing with this issue. For example, in the study made by Langhamrova, Sixta and Simkova (2016), the relative amount of pension liabilities for the year 2014 ranges from 679 percent of GDP (if 1-percent discount rate is used) to 230 percent of GDP for 5-percent discount rate)[10] depending on a particular discount rate. To compare the results of this study with the data published by the CZSO, only small differences can be found. Using identical assumption, i.e. 5 percent discount rate and 2 percent growth in wages, the officially published ratio is by 12 percentage points higher than that calculated in the study of Langhamrova, Sixta and Simkova.

## 4 INTERNATIONAL COMPARISON

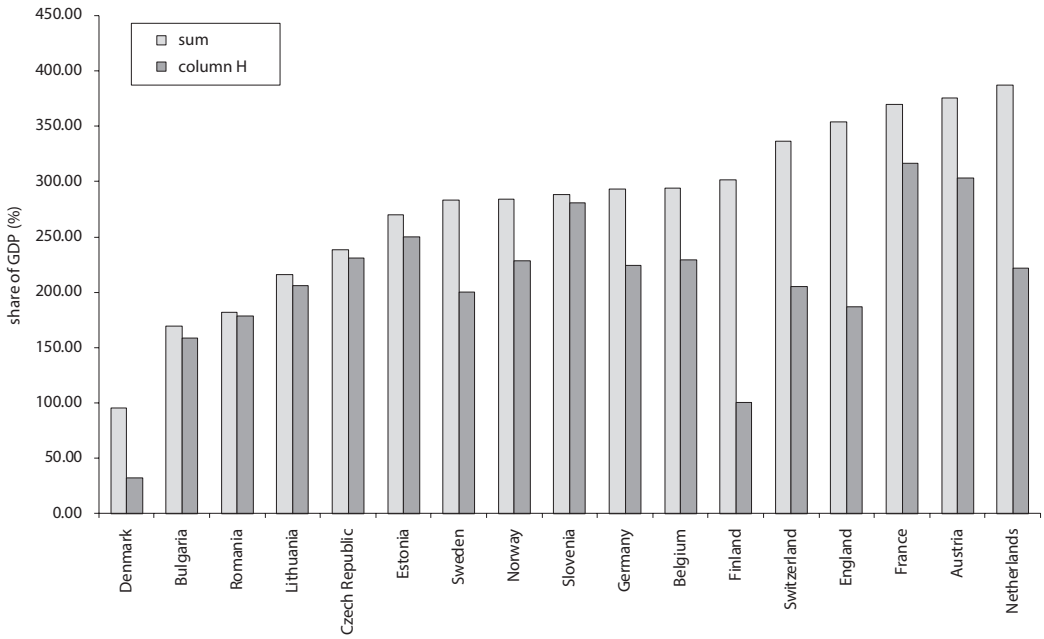
Finally, we will take a look at the pension liabilities in the international context. Figure 4 illustrates the role which the PAYG system (the column H in the Table 29)[11] plays in individual countries. The lowest shares were reported by Finland, Netherland or Denmark. On the other hand, the unfunded system dominates in Eastern Europe, i.e. in countries like Romania, Bulgaria or the Czech Republic where the share of the PAYG system reached almost 97 percent of all pension liabilities.

Let´s take a look at the PAYG system and its annual changes in Figure 5. In most cases, there are no large differences between year $t$ and $t + 1$. One of the reasons is that it is a long-term projection of an accumulated value of pensions in the base year that will be paid over coming decades. More substantial annual changes are thus mainly driven by economic cycle and the development in nominal GDP. This is exactly the case of the Czech Republic where the share decreased by 6 percentage points between the years 2014 and 2015.

[10] These values correspond to the assumption of 2-percent growth in wages as is the case of the calculation made by the CZSO

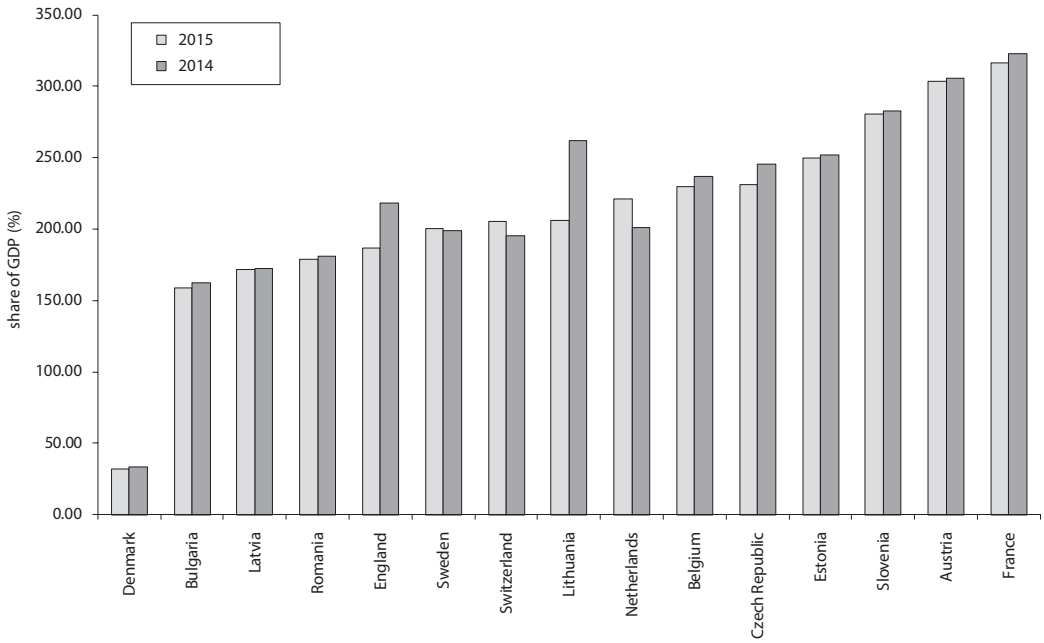
[11] Column H in the respective table concerns the social security pension schemes which are not an integral part of the core national accounts.

**Figure 4** The total amount of pension liabilities compared to Column H of Table 29 (2015)




**Source:** CZSO, Eurostat, own calculation

**Figure 5** Table 29 – Pension Entitlements in the column H, % of GDP (2014–2015)




**Source:** CZSO, Eurostat, own processing

In the first place, Figure 5 clearly reveals the extent of pension liabilities from the operation of the PAYG system (column H in Table 29) in individual countries. The 300-percent threshold in terms of GDP was exceeded in France and Austria. On the other hand, the lower value was reported by Denmark where, however, the funded scheme takes a larger share in pension protection as shown in Figure 5. For most of the countries, the share ranges between 150 percent and 250 percent of GDP. As we can draw on the table, the Czech Republic ranks among the countries with rather higher share of the PAYG system´s liability on GDP.

## CONCLUSION

As we have shown, the pension liabilities of the Czech Republic are primarily associated to the operation of the unfunded pension scheme (PAYG system, the first pillar). To quantify the corresponding liability, the Freiburg model ADL was used where the future households' claims are determined for the current base year. Using particular assumption on the macroeconomic and demographic development in the future, the pension liabilities from the operation of the first pillar in the Czech Republic reached 230 percent of GDP at the end of 2015.

As we have tried to show, the finals are highly sensitive to the choice of relevant discount rate. Discount rate of 4 percent, i.e. by 1 percentage point lower than that used for the headline figure calculation, would bring the pension liabilities up to 276 percent of GDP. The international comparison further revealed that the unfunded scheme played quite exceptionally major role in pension protection in the Czech Republic. However, the total shares in terms of GDP, capturing both funded and unfunded schemes, are not significantly different from other countries analysed in this paper.

Very finally, we can only reiterate that values on the pension liabilities do not themselves indicate on the sustainability of the pension system as the asset-side of the system is entirely left out. On the other hand, they can point to a potential risk for the government finance if future liabilities are not to be matched by corresponding payments of contributors. Thus, although pension liabilities are not a debt in a strict sense, because it does not originate in money borrowing, they clearly represent an obligation to future generation.

## *References*


BLOCH, D. AND FALL, F. *Government Debt Indicators: Understanding the Data.* Economic Department Working Papers No. 1228, OECD, 2015.

CZECH STATISTICAL OFFICE. *Main Economic Indicators* [online]. Prague: CZSO, 2017. <*https://www.czso.cz/csu/czso/hmu_cr*>.

CZECH STATISTICAL OFFICE. *Population projection of the Czech Republic until 2100* [online]. Prague: CZSO, 2013. <*https://www.czso.cz/csu/czso/projekce-obyvatelstva-ceske-republiky-do-roku-2100-n-fu4s64b8h4*>.

EUROSTAT, EUROPEAN CENTRAL BANK. *Technical compilation Guide for Pension Data in National accounts* [online]. Eurostat Methodologies and Working papers, 2011. <*https://www.ecb.europa.eu/pub/pdf/other/techn_comp_gd_pens_dt_nat_accts_201201en.pdf*>.

EUROSTAT. *European system of accounts* [online]. Publications Office of the European Union, 2013. <*http://ec.europa.eu/eurostat/documents/3859598/5925693/KS-02-13-269-EN.PDF/44cd9d01-bc64-40e5-bd40-d17df0c69334*>.

EUROSTAT. *The 2015 Ageing report: Economic and budgetary projections for the 28 EU Member States (2013–2060)* [online]. Publications Office of the European Union, 2015. <*http://ec.europa.eu/economy_finance/publications/european_economy/2015/pdf/ee3_en.pdf*>.

EUROSTAT. *Statistical Database* [online]. Eurostat, 2018. <*http://ec.europa.eu/eurostat/web/pensions/other-information*>.

GOEBEL, P. *A Primer on Government-Sponsored Pension Schemes in the National Accounts and Their Impact on the Interpretations of Government Debt Statistics.* Working Paper No. 81, OECD, 2017.

LANGHAMROVÁ, J., SIXTA, J., ŠIMKOVÁ, M. Penzijní závazky stárnoucí populace České republiky. *Politická ekonomie*, 2016, Vol. 64, No. 5, pp. 591–607. DOI: https://doi.org/10.18267/j.polek.1090.

MINISTRY OF SOCIAL AND LABOUR AFFAIRS. *Český důchodový systém* [online]. Prague, MoLSA, 2011. *<http://www.mpsv.cz/files/clanky/11969/Analyza.pdf >.*

RUFFING, K., VAN DE VATER, P., KOGAN, R. *"Generational Accounting" is Complex, Confusing, and Uninformative.* Washington, DC: Center on Budget and Policy Priorities, 2014.