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The Role of Supplementary Retirement Savings in Reducing the Pension Gap in Poland

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Abstract: The main aim of the study is to identify the size of the pension gap in Poland and to estimate the level of supplementary savings needed to cover it. The issue of pension system income adequacy is first discussed, and the forecasted and targeted levels of replacement rates in Poland are indicated. Next, the basic parameters determining the pension gap are defined and the size of the gap is analyzed. The amount of savings needed to cover the pension gap is then computed. How changes in the values of particular parameters influence the amount of monthly savings needed to cover the individual pension gap is discussed. As a result of the studies, it was determined that the size of the future pension gap for the average worker in Poland is ca. 15-25% of his salary. To cover this gap, it is necessary to contribute additional funds to one's retirement savings during the course of a professional career. Finally, the multitude of assumptions involved and the long horizon of the calculations make it impossible to precisely determine the amount of monthly savings needed to finance the pension gap.

Keywords: pension system adequacy, replacement rate, pension gap, supplementary retirement savings

JEL codes: J32, H55, E21, D31

1. Introduction

Recently in Poland there has been a lively debate on the condition of the pension system. In addition to the problems in how Open Pension Funds function, (Łuszczyk 2015; Jakubowski 2015; Trippner 2015), changes of the statutory retirement age (Benio 2014; Szczepański 2016) and advisability of maintaining pension privileges for various social and occupational groups (Grodzicki 2012;

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Lechowicz and Łuszczyk 2014), one of the most frequently raised issues is the pension system's third pillar (Kawalec at al. 2014; Rutecka 2015a; Jedynak 2016b, Jedynak 2016c). There are two main reasons it is scrutinized. First, replacement rates from the base (i.e. obligatory) part of the pension scheme are forecast to be low. Second, Poles have a very low level of supplementary retirement savings. Together these factors will result in future pensioners' incomes being lower than expected and desired. A number of studies have taken up issues of future replacement rates (Szumlicz 2009; Jabłonowski and Muller 2013; Góra and Rutecka 2013; OECD 2015), Poles' participation in the third pillar (Ostrowska-Dankiewicz and Pieńkowska-Kamieniecka 2013; Rutecka 2014, Trębska 2014) and the desired shape of the supplementary pension scheme (Kawalec at al. 2014; Rutecka 2014). Hardly anybody, however, raises the emerging pension gap and the level of additional savings needed to cover it. The following question should therefore be asked: *How much should one save during his or her professional career to ensure the future pension gap is covered*? The two main objectives of this study should help to make that determination. They are, first, to identify the size of the pension gap in Poland and, second, to estimate the level of additional savings required to cover it.

2. Background – Adequate Retirement Income and the Pension Gap

Depending on the point of view, the pension system is defined as:

- In the microeconomic approach – a tool for smoothing consumption in a life cycle (Barr and Diamond 2014: 51) or a tool for allocating income during the lifetime (Góra 2003: 32).
- In the macroeconomic approach – a method of dividing current GDP between the working generation and the generation that preceded it, now made up of pensioners (Góra 2003: 19).

Taking the microeconomic approach, Góra (2003: 37) and Szczepański (2014a: 734) maintain that the primary objective of the pension system is to provide its participants with income in retirement. Barr and Diamond (2014: 37), referring to the macroeconomic perspective, note that the purposes of the pension system also include supporting the poorest members of society, redistributing income and implementing other economic and social objectives, such as economic growth and pro-family policy. Chybalski (2016: 16-17) takes into account both perspectives and points out its two

main purposes: to smooth the consum and divide GDP. To these he adds other social goals including protecting against longevity risk and preventing the elderly from sliding into poverty.

Further in-depth analysis of the different objectives of the pension system leads to the conclusion that some of them, particularly those related to the microeconomic viewpoint, are the basis for determining a wider group of targets that can be called the income adequacy of the pension system or pension adequacy. This objective is supplemented by economic goals which guarantee its implementation, i.e. the efficiency and financial stability of the pension system. As Chybalski (2016: 17) comments "an inefficient and financially unstable system in the long term cannot ensure adequate pensions"[1].

Pension system income adequacy means that the payment from this system ensures that pensioners are able to maintain their previous standard of living after retirement (OECD 2013: 61). In a broader sense, pension adequacy also prevents social exclusion of the elderly, promotes solidarity between generations and protects against gender-based retirement benefit discrimination (European Commission 2003: 23-39). While the subject literature reveals little controversy concerning the definition of pension adequacy, there is a good deal surrounding the measuring of pension system adequacy.

In the literature, there are two basic approaches to measuring pension adequacy: the income approach and the consumption approach. The first is based on measuring retirement income and its relation to earnings during one's career. In the consumption approach, adequacy is measured relative to household expenses before and after retirement. There are also the one-dimensional and multi-dimensional approach to the problem of pension adequacy. The one-dimensional frame concentrates mainly on measuring income (or consumption) allocating over the course of a lifetime, while the multi-dimensional frame takes into account other factors, especially protecting the elderly from falling into poverty (Chybalski 2016: 23-25).

Bearing in mind the many controversies surrounding the measurement of pension system income adequacy, the starting point for the further analyses will be the results of those studies in which the authors applied a one-dimensional frame with a simple replacement rate as a measure of adequacy. Regardless of its limitations and restrictions, this measure still remains the most important and most frequently used indicator of pension system adequacy (Biggs and Springstead

[1] The issues of pension system efficiency and stability are beyond the scope of this paper and will not be analyzed here in any greater depth.

2008). Significant advantages of using the replacement rate include the fact that interpreting it is relatively simple and straightforward and the results obtained by different researchers are easy to compare because researchers use this model so widely, and there is a plethora of results that are readily available.'.

Accepting the replacement rate as a measure of pension system adequacy raises the question of its optimal amount. In the light of Modigliani and Brumberg's (1954) life cycle income hypothesis and Friedman's (1957) permanent income hypothesis, it may be stated that the optimal target replacement rate level is the one at which retirement incomes enable one to maintain the standard of living at a level similar to that achieved during one's career. Unfortunately, in practice it is extremely difficult to determine exactly what the target replacement rate should be. This is due mainly to complications in determining what the future needs of retirees will be. Obviously those needs are derived from the wealth of the society in which they live, but there are many other factors involved, including the range of the services provided by the state (Mercer, CFA 2016; Aviva 2016).

Table 1. The target replacement rate

Source	Targeted replacement rate	Additional remarks
Mercer, CFA (2016)	65-80%	
OECD (2015)	70%	
Munnell et al. 2014)	67-80%	targeted replacement rate depends on household's wealth
Whitehouse (2014)	50-60%	
MacDonald and Moore (2011)	70-80%	
Schieber (2004)	70%	
Greninger at al (2000)	70-89%	the average level is 74%
World Bank (1994)	60%	counted as a percent of gross average lifetime wages for middle-income households
Myers (1993)*	70-75%	calculations for average wage worker
MOP (1952)	>40%	minimum replacement rate that protects against entering poverty risk
(Szczepański 2016)	40%	
(Góra, Rutecka 2013)	60%	

*Cited after Biggs and Springstead (2008).
Source: the author.

Results of theoretical analyses and empirical studies show that for the majority of pensioners, the optimal target replacement rate is between 60% and 80% (see Table 1). A replacement rate below 60% will lead to the inability to maintain the standard of living achieved during one's career. On the other hand, a replacement rate above 80% means that the savings rate was too high and consumption is not equalized over the course of the life cycle.

The expected future replacement rate in the Polish pension system has been the subject of comprehensive analysis in numerous studies. UNFE (2001) forecasts done soon after the country's pension system was reformed in 1999 assumed the replacement rate for women retiring in 2035 would be approximately 38-44%, and for men reaching retirement age in 2040 approximately 56-69%. According to Szumlicz's (2009) calculations, in an optimistic scenario, women retiring in 2039 will receive a pension equal to 43% of their final salary, and the respective figure for men retiring in 2044 will be 63%. In turn, the European Commission (EC 2015) predicts that the replacement rate in Poland's public pension scheme in 2050 will come in at 31,2%. Results obtained by Jabłonowski and Muller (2013) suggest that in 2040, the replacement rate for women will be 37%, and for men 40%. Góra and Rutecka (2013) computed that, assuming a retirement age of 60 years, in 2050, the average replacement rate in Poland will be 34,2%. According to the newest OECD (2015) forecasts, the average earning worker in Poland retiring in 2049 will obtain a replacement rate of 52,8%. According to a recent study done by Aviva (2016), the average replacement rate in Poland in 2047 will be approximately 37%.

Even a rough juxtaposition of demands formulated with regard to the target replacement rate values with the forecasted replacement rates from the public pension system in Poland reveals a significant discrepancy between the two values. Formally, the difference between the target (expected) and the actual replacement rate is defined as the pension gap (OECD 2011, Aviva 2016). As a rule, a thus understood pension gap is presented as a percentage, though it could of course also be presented as a specific amount of money, one equal to the discounted (as of the day of one's retirement) value of the future payments, which provide coverage of the difference between the desired level of retirement income and its actual level obtained from the public pension scheme. To distinguish between these two ways of understanding the pension gap in this study, I will henceforth use the terms "pension gap" and "individual pension gap".

3.Methodology

The first step in calculating the size of the individual pension gap in Poland was to estimate the size of the gap for the average worker (see equation 1). To do so, I subtracted the replacement rate guaranteed by the basic pension system (RR_B) from the target replacement rate (RR_T). Taking into account the considerations from Section 2, in my base scenario I assumed that target replacement rate should be 70%. As the actual replacement rate from the base pension system I took the rate projected by the OECD in their most recent forecasts (52,8%). In the next stage of research both of these assumptions are rejected.

$$PGAP = RR_T - RR_B \quad (1)$$

Then, to obtain the value of the monthly individual pension gap in the first month of retirement ($PGAP_t$) I multiplied the difference received from the above equation by the last remuneration (R_0) (see equation 2). The values of consecutive monthly pension gaps I computed similarly, but with the additional assumption that pension benefits in subsequent months should grow at the same rate as the average salary does. In the base scenario I assumed that the average saver starts saving at age 25 and retires after 40 years at the age of 65[2]. The initial salary is 4000 PLN gross. After Berk and others (2013), I established the growth rate of salary (g) at 2.3% per year.

$$PGAP_1 = (RR_T - RR_B) \times R_0 \quad (2)$$

In the next phase of the research I discounted the consecutive monthly pension gap values for the average saver for the day when he would retire and summed up (see equation 3.).

$$PGAP_T = PGAP_1 \times R_0 \times \left(1 + q\,\frac{1-q^m}{1-q}\right); \quad (3)$$

$$\mathrm{q} = \frac{1+r_d}{1+g}$$

Thus the value of $PGAP_T$ represents the amount of money that should be saved before retirement to fully cover the individual pension gap. Bearing in mind the need to minimise the investment risk during the saver's retirement, I established the discount rate (r_d)[3] similarly to Berk and others (2013) at 0.5% per annum. Moreover, for both the discount rate and the rate of growth of pension

[2] In the this study, for simplicity, I assumed that the retirement age and the end of the savings accumulating period and the age at which the consumption of savings begin are the same.
[3] Please note that this rate should correspond to the technical interest rate used in the actuarial calculations in annuities.

benefits, I adopted monthly capitalization. In discounting I used the average further life expectancy (m) from the 2016 Communication of the President of the CSO in Poland, which was computed jointly for women and men (GUS 2016).

In the next step, the previously computed total individual pension gap was spread over a series of monthly payments, which savers should accumulate before retiring. I assumed that the amount of monthly savings will grow proportionally to the wage growth at the rate of g and the accumulated savings will be invested at a constant rate during the whole period at a rate of r. In the base scenario, the value of r was set at 2.5% per annum, meeting the assumption of secure and stable investment of one's retirement savings. I further assumed that the number of monthly savings is equal to the length of the saver's career in months. Hence, the amount of the first monthly saving was calculated with this formula:

$$S_{m_1} = \frac{PGAP_T \times (r - g)}{(1 + r)^n - (1 + g)^n} \tag{4}$$

I would emphasise at this point that the methodology presented here is based on several assumptions about the value of the parameters in equations (3) and (4). A necessary complement to the analyses in this study is therefore to examine how changes in the values of particular parameters influence the amount of monthly savings needed to cover the individual pension gap (S_{m_1}). Base on equation (4), we could say that S_{m_1} is a function of four variables: $PGAP_T$, n, r and g. From equations (2) and (3) we can infer that $PGAP_T$ is a function of $PGAP$, W_1, m, r_d and g. Finally, it can be concluded that:

$$S_{m_1} = f(PGAP_1, R_1, m, n, r, r_d, g) \tag{5}$$

The values of m and n in the above equation are mutually correlated. This means that the longer the saving period (n), the shorter the period of consumption savings (m) will be. Detailed results of the analyses in which different values of $PGAP, m, n, r, r_d$ and g were considered are presented in the next section. A similar analysis could also be carried out for different values of R_0. It seems, however, that taking into account the different levels of R_0 makes little sense, since in the model both $PGAP_T$ and S_{m_1} depend on that parameter proportionally. So, if one wants to obtain results for different levels of starting remuneration, it is enough to multiply the results presented in this study by the appropriate factor.

4.Results

In the base scenario, the size of the individual pension gap calculated according to formula (3) is 438 019 PLN. This is the amount a 25-year-old earning 4000 PLN gross, and beginning to save for retirement, has to accumulate to fully cover the pension gap in retirement. Considering the time value of money (discount rate r = 2.5%), this amount is equivalent to 163 132 PLN in today's money. If this pension gap is to be financed throughout one's career in the form of monthly payments that rise during the accumulation period at an average rate of g = 2.3% per year, then the first installment should be 350.35 PLN.

As noted earlier, the applied methodology and parameters of the model used to calculate the individual pension gap in Poland and the monthly savings needed to cover it are based on a number of assumptions. I therefore analyzed, in the next stage of the study, how changes in each parameter affect the final results.

I first examined how different retirement ages (i.e. the age when the accumulation phase ends and the consumption of savings begins) influence the amount of savings needed to cover the pension gap. Given the difficulties in estimating the target replacement rate for an individual and the discrepancies in the forecasted size of the future replacement rate in Poland, in addition to the base level pension gap (17,2%), three others were used—14%, 20%, and 23%. I also computed the amount of savings that cover the one-percentage pension gap (see Table 2).

Table 1. Retirement age and the size of pension gap (PLN)

Retirement age (years)	Number of months spent saving	Pension gap				
		1% (PLN)	14% (PLN)	17,3% (PLN)	20% (PLN)	23% (PLN)
60	420	28 229	395 205	**485 537**	564 578	649 265
61	432	27 694	387 722	**476 344**	553 888	636 972
62	444	27 136	379 910	**466 747**	542 729	624 139
63	456	26 595	372 327	**457 430**	531 896	611 680
64	468	26 029	364 407	**447 700**	520 582	598 669
65	480	25 466	356 527	**438 019**	509 324	585 723
66	492	24 892	348 494	**428 149**	497 848	572 525
67	504	24 293	340 108	**417 846**	485 868	558 748
68	516	23 697	331 756	**407 585**	473 937	545 027
69	528	23 089	323 240	**397 123**	461 771	531 037
70	540	22 468	314 556	**386 455**	449 366	516 771

Source: the author.

According to equation (3), the size of the pension gap expressed in monetary units is directly proportional to the size of the pension gap expressed in percentage points. Hence, the amount of money needed to finance the pension gap of certain size is always a assumptiple of the amount calculated for a one-percentage point pension gap. Furthermore, since the pension is by definition a lifetime benefit, it should be clear that the higher the age at which one retires, the less monthly savings will be required to finance the pension gap. Analyses show that putting off retirement by a year reduces the amount required to cover every 1% of the pension gap of approximately 535-621 PLN.

However, the formula used to determine the size of the pension gap leaves it dependent on the value of one's final salary (see equation 2), which, in accordance with the previous assumption, grows at a constant rate of *g*. The size of the pension gap presented for different retirement age values thus does not represent the same level of needs satisfaction, but the same rate of replacement of the final salary. As a reference point for calculating the pension gap for different retirement ages, if we take the remuneration received at the age of 60, then putting off retirement for a year reduces the amount required to cover every 1% of the pension gap of approximately 917-1157 PLN (see Table 3.)

Table 3. Retirement age and the size of the pension gap (in PLN) – without an increase in remuneration (PLN)

Retirement age (years)	Lenght of saving (months)	Pension gap				
		1% (PLN)			1% (PLN)	
60	420	28 229	395 205	485 537	564 578	649 265
61	432	27 072	379 005	465 634	541 435	622 651
62	444	25 930	363 020	445 995	518 599	596 389
63	456	24 841	347 774	427 266	496 820	571 343
64	468	23 766	332 724	408 775	475 320	546 618
65	480	22 729	318 210	390 944	454 586	522 774
66	492	21 718	304 047	373 544	434 353	499 506
67	504	20 719	290 059	356 359	414 370	476 526
68	516	19 755	276 575	339 792	395 107	454 374
69	528	18 816	263 417	323 627	376 310	432 757
70	540	17 898	250 577	307 852	357 968	411 663

Source: the author.

In the next stage of the research I analysed the level of initial monthly savings that would enable one to accumulate the capital needed to cover the four different pension gaps shown in Table 1.

Table 2. The initial monthly savings and the age, pension gap and length of the savings period (PLN)

Age	Scenario	Pension gap			
		14%	17,3%	20%	23%
60	A (40 years)	407	500	582	669
	B (30 years)	725	890	1035	1191
	C (20 years)	1535	1886	2193	2522
61	A (40 years)	379	466	542	623
	B (30 years)	668	820	954	1097
	C (20 years)	1379	1694	1970	2265
62	A (40 years)	353	434	504	580
	B (30 years)	615	755	878	1010
	C (20 years)	1241	1525	1773	2039
63	A (40 years)	329	404	470	540
	B (30 years)	567	697	810	932
	C (20 years)	1122	1378	1602	1843
64	A (40 years)	306	376	437	503
	B (30 years)	523	643	748	860
	C (20 years)	1015	1248	1451	1668
65	A (40 years)	285	350	407	468
	B (30 years)	483	594	690	794
	C (20 years)	921	1132	1316	1514
66	A (40 years)	265	326	379	436
	B (30 years)	446	548	638	733
	C (20 years)	837	1029	1196	1376
67	A (40 years)	247	303	353	406
	B (30 years)	412	506	589	677
	C (20 years)	762	936	1088	1251
68	A (40 years)	230	282	328	377
	B (30 years)	380	467	543	625
	C (20 years)	694	852	991	1140
69	A (40 years)	214	262	305	351
	B (30 years)	351	432	502	577
	C (20 years)	632	777	904	1039
70	A (40 years)	198	244	283	326
	B (30 years)	324	398	463	533
	C (20 years)	577	709	824	948

Source: the author.

To make the study more comprehensive, I analyzed three scenarios differing by length of savings period. Scenario A is the same as the base scenario – the consumption phase begins following a 40-year saving period. In scenario B, I assumed a 30-year savings period and in scenario C, 20 years (see Table 4.)

The values in the table are relatively high. In the base scenario (40 years of saving, retirement age – 65, pension gap 17,2%, initial gross remuneration 4000 PLN), the amount of monthly savings needed to cover the pension gap is 350 PLN, or 8,75% of the gross salary. Depending on the scenario, the age at which one begins saving and the size of the pension gap, this value varies between 4,95% and 63,05% of gross remuneration. It should also be noted that, in addition to the values presented in table 4, saver must also contribute 9.76% of their gross salary (with another 9.76% paid by the employer) to participate in the public pension scheme.

Obviously, the amount of savings needed to cover the pension gap depends on the age of one's retirement: the later it is, the lower the amount will be. Similarly, a longer period of saving will of course also drive down the amount needed. However, the extent of the differences in the values of savings caused by changes during one's period of professional activity and the saving period are certainly worth emphasising. For example, for the 17,2% pension gap and forty-year saving period, the initial amount of savings required to retire at 60 years of age is more than double the corresponding value for those who retire at 70. In turn, for 65 years, shortening the saving period from 40 years to 20 results in a more than threefold increase of the initial monthly savings required to cover the pension gap. Given the level of savings needed to cover the pension gap and salaries in Poland, the vast majority of Polish households will struggle to finance it. Thus the influence of the length of saving period, together with the number of years worked, on the amount of monthly payments needed to cover the pension gap should be emphasised.

The size of the pension gap expected also has an important influence on the amount of monthly savings. In the scenarios examined here, the average difference between the initial monthly savings that provide pension gap coverage of 14% and 23% was approximately 64%. Hence, taking into account 1) that pension gap forecasts are highly uncertain, and 2) that the diversity of individual preferences in terms of consumption in the life cycle individualizes the size of the pension gap, an alternative way of presenting the values of monthly savings needed to cover the pension gap is advisable.

In this approach I computed the initial value of monthly payments which allows the replacement rate to be raised by 1% (with fixed assumptions as to the other parameters of the model) (see Table 5). This approach leaves the decision on the final size of the retirement savings to savers. It should be assumed that this decision will be determined by the expected size of the individual pension gap and the level of the replacement rate desired and will depend on the level of current incomes and expenses.

Table 3. Monthly savings needed to cover the one-percentage pension gap (PLN)

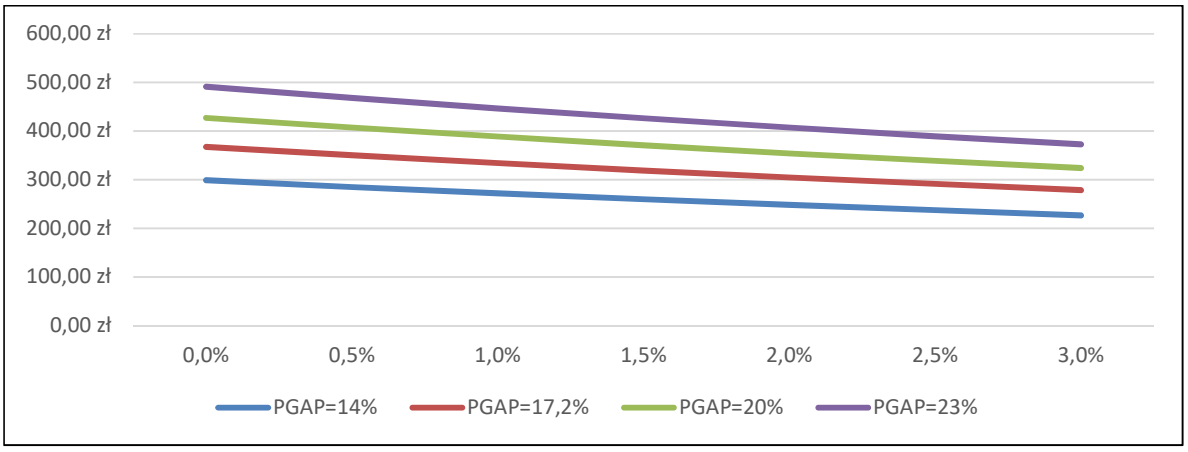
Retirement age	Replacement rate calculated for increasing salary			Constant replacement rate for salary of 60-year-old saver		
	A (40 years)	B (30 years)	C (20 years)	A (40 years)	B (30 years)	C (20 years)
60	29,1	51,8	109,7	29,1	51,8	109,7
61	27,1	47,7	98,5	26,5	46,6	96,3
62	25,2	43,9	88,7	24,1	42,0	84,7
63	23,5	40,5	80,1	21,9	37,9	74,8
64	21,9	37,4	72,5	20,0	34,1	66,2
65	20,4	34,5	65,8	18,2	30,8	58,7
66	19,0	31,9	59,8	16,5	27,8	52,2
67	17,6	29,4	54,4	15,0	25,1	46,4
68	16,4	27,2	49,6	13,7	22,7	41,3
69	15,3	25,1	45,2	12,4	20,4	36,8
70	14,2	23,2	41,2	11,3	18,4	32,8

Source: the author.

In the final stage of the research, I analyzed the impact of the changes in the values of selected parameters in the model described by equations (3) and (4), which determines the amount of monthly savings needed to cover the pension gap (S_{m_1}).

The technical interest rate (r_d) represents the efficiency with which previously accumulated savings are invested throughout the entire consumption period. According to equation (3), r_d directly influences the size of the pension gap ($PGAP_t$), and therefore also the final magnitude of S_{m_1}. Note that this relationship is inversely proportional (Figure 1).

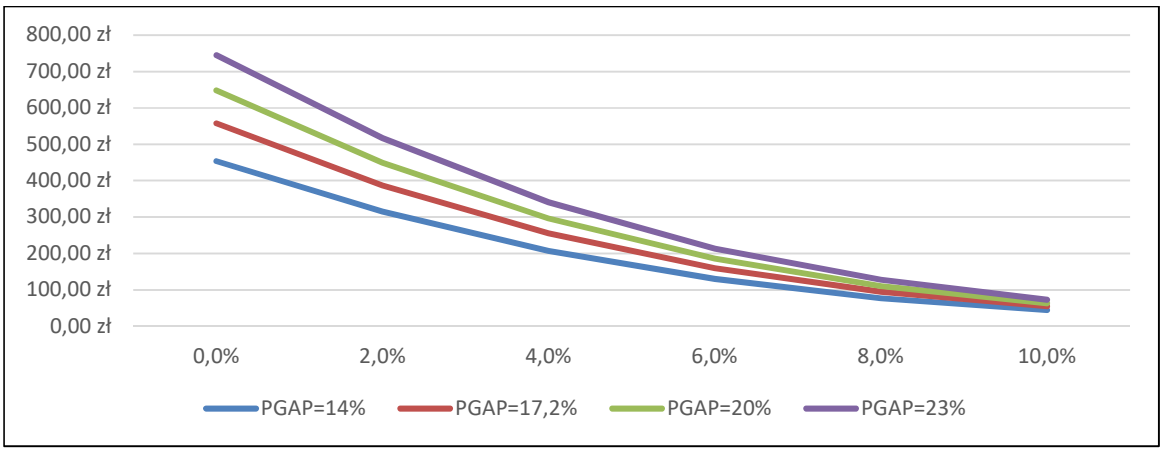
Figure 1. The monthly savings needed to cover the pension gap and the technical interest rate (r_d)



The calculations are based on assumptions of the base scenario.
Source: the author.

The market rate of return *r* reflects the rate of return on the assets invested to finance the pension gap during the period of savings accumulation (that is, while the saver is working). So, changes in values of *r* do not directly affect the size of the pension gap (equation 3) but have an influence on the amount of monthly savings needed to finance it. As a rule, the higher the rate r, the lower the amount of single monthly savings required (Figure 2).

Figure 2. The monthly savings needed to cover the pension gap and the market rate of return (r)

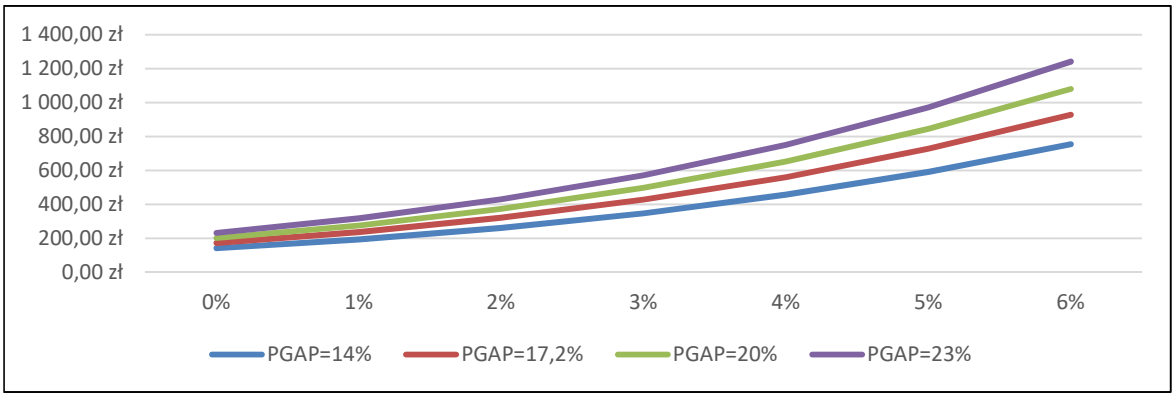


The calculations are based on assumptions of the base scenario.
Source: the author.

From the saver's point of view, it is most desirable to reap the highest possible rate of return in each phase of financing the pension gap. This means that the saver should want to maximize both r and r_d. However, the rate of return is a reward for risk taken and the higher rate of return is always accompanied by a higher risk of failure in getting it. Thus, in long-term retirement savings, due to their function, savings portfolios with a moderate rate of return are preferred.

The salary growth rate (g) affects both the size of the pension gap ($PGAP_T$) and the amount of monthly savings needed to cover it (S_{m_1}). The final outcome of these two relations demonstrates that the higher the salary growth rate becomes, the higher the amount of monthly savings allocated to finance the pension gap (Figure 3). Analysis in absolute values may lead, however, to misleading conclusions. That is because, at first, the higher salary growth rate increases the remuneration used to compute the replacement rate and the pension gap (see equation 2). Therefore, along with the increase in the salary growth rate, the level of satisfying one's needs when retired rises alongside the amount of monthly savings.

Figure 3. The monthly savings needed to cover the pension gap and the salary growth rate (g)



The calculations are based on assumptions of the base scenario.
Source: the author.

5. Conclusion

One of the greatest challenges facing contemporary pension systems is to guarantee pension adequacy. Adequacy means providing pension benefits to maintain the standard of living retirees had when they were working. While not without drawbacks and limitations, the most frequently used measure of pension system income adequacy is the replacement rate. For Poland, the results

of the majority of empirical studies clearly indicate that future replacement rates will be substantially below expected values. The difference between expected and actual replacement rates has brought about a pension gap estimated for the average worker at ca. 15-25% of his or her salary. To cover the pension gap, it is necessary to accumulate supplementary pension savings throughout one's career (Aviva 2016). At present, given the socio-economic pension systems prevailing conditions, only additional savings will enable the proper smoothing of consumption across the lifetime cycle.

The analyses done for this study prove that precisely determining the future pension gap and the savings needed to cover it is a complex undertaking. This is in part due to doubts surrounding the target replacement rate and the accuracy of actual replacement rate forecasts. Moreover, the model used to calculate the individual pension gap and the monthly savings needed to cover it requires a number of assumptions regarding the length of professional activity and estimated time of retirement, the market's rate of return, technical interest rate and salary growth rate, to name a few.

The model has the following limitations:

- It assumes savings are accumulated throughout one's career and does not take into account gaps in employment and other periods when saving sufficiently is not possible.
- It assumes the consumption of savings is constant throughout retirement. In fact, demand for pension income is different in various periods of retirement (see eg. Rutecka 2015b; Jedynak 2016b).
- The assumed levels of the market's rate of return and the technical interest rate are appropriate to current market conditions. However, in the long-term perspective it is impossible to predict how they will change.
- In practice, the salary growth rate depends on an individual's career path, not general wage growth.

Moreover, the majority of the parameters analysed are based on forecasts formulated on the basis of current market conditions and may be biased.

Given these limitations, I have attempted to determine the actual value of the pension gap and the amount of monthly savings required to cover it. The calculations do not, however, determine how much one should additionally save over the course of a career to ensure the future

pension gap is covered. Due to the multitude of assumptions, providing a specific value appears impossible. However, all conclusions on the impact of changes in the parameters on the size of the pension gap and the amount of monthly savings necessary to cover it remain valid. Moreover, the length of the savings' accumulation period and the age at which one retires have a crucial impact on the amount of the savings needed to cover the pension gap. Since the age at which one ends one's professional career may be adjusted, it can be adapted to suits one's individual preferences.

In view of the research, some practical conclusions for Poland's pension policy can be drawn. First, there is a need to educate society about the pension system. Particularly important issues are the rules governing participation in the base pension scheme, expected values of future pension benefits, the predicted size of the individual pension gap and the need to fund it. Second, it is necessary to build a comprehensive supplementary pension scheme which would effectively encourage voluntary saving for retirement (Szczepański 2014b; Kawalec at al. 2015). Third, the ongoing political debate on the official retirement age and the rules for acquiring pension rights should take into account the enormous influence of the length of both one's career and retirement (Jedynak 2016a).

This research may contribute to further, in-depth analyses. In addition to issues related to the methods of determining the values of the adopted model's parameters, interesting problems that could be taken up include the following: determining the size of target replacement rate in Poland; defining an alternative to the replacement rate measures of pension system adequacy; verifying whether the current level of salaries allows for additional savings; searching for methods beyond additional savings to finance the pension gap (eg. reverse mortgages). Poles' awareness of the pension gap and whether educational campaigns conducted to date have brought about any meaningful results are also issues worth examining.

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Rola dodatkowych oszczędności emerytalnych w zmniejszaniu luki emerytalnej

Streszczenie

Głównym celem opracowania jest identyfikacja rozmiarów luki emerytalnej w Polsce oraz określenie poziomu dodatkowych oszczędności niezbędnych do jej pokrycia. W toku postępowania badawczego w pierwszej kolejności omówiono kwestię adekwatności dochodowej systemów emerytalnych oraz określono prognozowany oraz pożądany poziom stóp zastąpienia w Polsce. Następnie zdefiniowano podstawowe parametry wpływające na rozmiary luki emerytalnej oraz przeprowadzono analizę jej rozmiarów. W kolejnym etapie badania obliczono rozmiary oszczędności niezbędnych do pokrycia luki emerytalnej oraz przeanalizowano jak na tę wielkość wpłynie zmiana wartości poszczególnych parametrów modelu. W rezultacie przeprowadzonych badań stwierdzono, że rozmiary przyszłej luki emerytalnej dla przeciętnego pracownika w Polsce wynosić będą ok. 15-25%, a pokrycie tej luki wymaga gromadzenia dodatkowych oszczędności emerytalnych w okresie aktywności zawodowej. Odnotowano również, że mnogość założeń oraz długi horyzont czasowy uniemożliwiają precyzyjne ustalenie wysokości miesięcznych oszczędności niezbędnych do sfinansowania luki emerytalnej.

***Słowa kluczowe**:* Adekwatność systemu emerytalnego, stopa zastąpienia, luka emerytalna, dodatkowe oszczędności emerytalne