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INSURANCE AGAINST LONGEVITY RISK IN A PENSION SYSTEM THE CASE STUDY OF POLAND*

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K e y w o r d s: longevity risk, life expectancy, public and additional pension systems.

A b s t r a c t

Life expectancy has been rapidly increasing and remains uncertain in all OECD countries, including Poland. One of the many economic and social consequences of this process is the increase of the longevity risk in social security systems. This article focuses on the issues of managing longevity risk in the pension system in Poland, in particular – the construction of public and supplementary pension systems and its ability to adapt to the challenges associated with longevity risk. Particular attention has been paid to the analysis of public structures and supplementary pension schemes in the phase of payment of benefits (decumulation).

The research work, of which the results are presented in the article, is based on literature studies, comparative analysis, statistical analysis; as well as descriptive and explanatory methods. Also, a model of the two stages of pension risk created by T. Szumlicz has been used.

The author argues that both the public pension systems as well as the supplementary pension schemes in Poland do not secure adequate protection against the risk of longevity. While in the public retirement system, the aggregate longevity risk exists, and the participants of additional pension systems are exposed to individual longevity risk. The limitation of these risks requires significant structural changes both in the public and in the additional pension schemes in Poland.

UBEZPIECZENIE OD RYZYKA DŁUGOWIECZNOŚCI W SYSTEMIE EMERYTALNYM NA PRZYKŁADZIE POLSKI

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S ł o w a k l u c z o w e: ryzyko długowieczności (ryzyko dłuższej niż oczekiwano długości życia), dalsza oczekiwana długość życia, publiczny i dodatkowe systemy emerytalne.

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Abstrakt

Średnia długość życia gwałtownie wzrasta, lecz tempo wzrostu pozostaje niepewne we wszystkich krajach OECD, w tym w Polsce. Jednym z wielu gospodarczych i społecznych skutków tego procesu jest wzrost ryzyka długowieczności w systemach zabezpieczenia społecznego. W artykule skupiono się na kwestiach zarządzania ryzykiem długowieczności w systemie emerytalnym w Polsce, w szczególności na wpływie konstrukcji publicznych i dodatkowych systemów emerytalnych na zarządzanie ryzykiem długowieczności.

W badaniach, których rezultaty przedstawiono w artykule, zastosowano metodę literaturową, metodę badań porównawczych, a także metody opisu i wyjaśniania. Wykorzystano też model dwóch faz ryzyka emerytalnego opracowany przez T. Szumlicza.

Na podstawnie przeprowadzonych analiz stwierdzono, że zarówno konstrukcja publicznego systemu emerytalnego, jak i dodatkowych programów emerytalnych w Polsce nie zapewnia odpowiedniej ochrony przed ryzykiem długowieczności. Podczas gdy w publicznym systemie emerytalnym istnieje łączne ryzyko długowieczności (ryzyko błędnego oszacowania dalszej długości życia dla danej kohorty demograficznej osób osiągających ustawowy wiek emerytalny), uczestnicy dodatkowych systemów emerytalnych są narażeni na indywidualne ryzyko długowieczności. Ograniczenie tego ryzyka wymaga znacznych zmian strukturalnych, zarówno w publicznych, jak i w dodatkowych systemach emerytalnych w Polsce.

Introduction: longevity risk in a pension system – a model approach

Continued progress in living conditions and health standards has increased the average life expectancy in all OECD countries, including Poland (see Tab. 1). Life expectancy at birth now exceeds 79 years on average across the OECD. The 25 years between 1983 and 2008 saw an average rise in life expectancy of about six years (*Society at a Glance* 2011). Taking into consideration the longer perspective, ANATOLIN (2007, p. 3) states that „the length of time that people are expected to live in most OECD countries has increased by 25 to 30 years in the last century". The Max Planck Institute for Demographic Research (MPDR) reports on the remarkably stable increase in life expectancy since 1840. A summary aggregate statistic (defined as the highest life expectancy of all countries in a given year) has been increasing steadily every decade by about 2.5 years for women and 2.2 years for men (VAUPEL 2011, 2002, ZELENKO 2014, p. 36).

Table 1

Life expectancy in Poland and OECD countries

Life expectancy at birth* in 2008 or latest year		Rise of life expectancy between 1983 and 2008	
OECD (average)	Poland	OECD (average)	Poland
79.3	75.6	6.0	4.5

* Life expectancy is defined as the average number of years that a person could be expected to live if he or she experienced the age-specific mortality rates prevalent in a given country in a particular year. It does not include the effect of any future decline in age-specific mortality rates.
Source: OECD Publishing, Paris (www.oecd.org/health/healthdata), and OECD Income Distribution and Poverty Database (www.oecd.org/els/social/inequality), access: 15.10.2015.

The increase of life expectancy in Poland is even more impressive when we take into consideration a longer period. For example, an expected period of life for men born in 1950 was 56.1 years and for women 61.7. The life expectancy for men born in 2014 is already 73.1 years and for women 81.1 years (see Fig. 1).

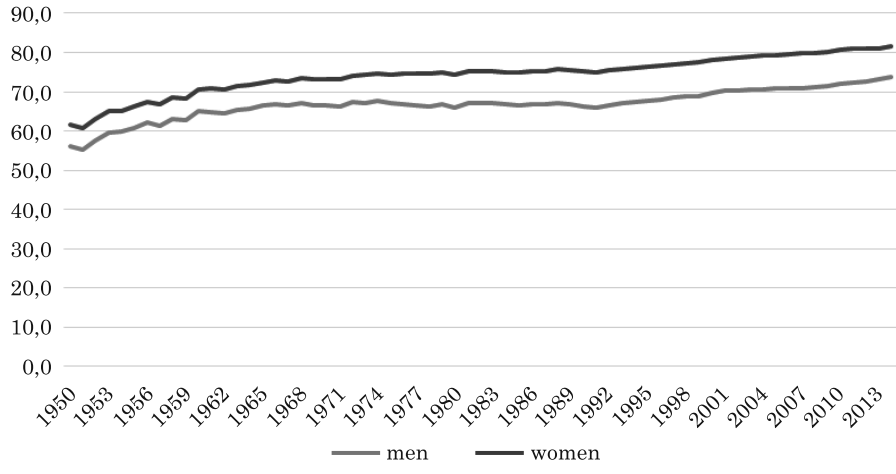
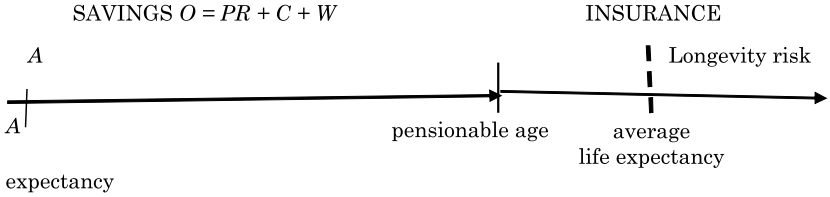


Fig. 1. Life expectancy by sex in Poland in urban and rural areas from 1950–2013
Source: *Life Expectancy*. 2015.

A basis for further consideration is the proper definition of longevity risk, which is not the same as the demographic risk related to the aging of the population. However, improvements in the mortality rate and life expectancy are uncertain and the outcomes of future life expectancy pose many kinds of threats to social security systems as well as for individuals. In each demographic cohort there are people living longer than expected. From the point of view of pension economics, this basically positive phenomenon is connected also with certain risks (ANATOLIN 2007, p. 3), such as the risk of outliving one's pension savings – the **individual longevity risk**. Inaccurate estimation of life expectancy can undermine the sustainability of a pension scheme (the risk addressed to the pension provider – public or private) or negatively influence the wealth of pension benefits (risk addressed to pensioners). This kind of risk is called the **aggregate longevity risk** (the trend risk). It consists of the fact that in a given cohort, the average life expectancy will be longer than expected and predicted in statistical forecasts. In other words, it is the risk of incorrect estimates of future trends in the mortality rate. Together, both specific and aggregate longevity risks form the **total longevity risk** (BLAKE, BORROWS 2001, p. 340, BLAKE 2006, REJDA 2001, PITACCO, DENUIT, HABERMAN, OLIVIERI 2009).

The risk of longevity, which refers to the phase of paying out pension benefits (pension capital decumulation) affects both public pension systems as well as the supplementary pension schemes (occupational or individual pension schemes). The degree of vulnerability of a pension system to longevity risk depends on its structure, especially on the methods of calculating benefits (pension formula), and the pension benefit method of payment. In order to manage longevity risk, it is particularly important to properly define the risks of old age covered by pension security. In Polish literature this is aptly illustrated by a model of pension risk by Tadeusz Szumlicz (see Fig. 2).



A – adoption of occupational activity
O – total retirement savings
$PR + C + W$ – the possible forms of retirement savings (pension rights + pension capital + wealth)

Fig. 2. Two stages of pension risk – a model by Tadeusz Szumlicz
Source: own study based on SZUMLICZ (2005, p. 242).

Using this model approach for the risk of old age, the longevity risk can be placed in an individual's third cycle of life. Considering unitary and individual terms (microeconomic level), the risk of old age in the first phase (accumulation) lies in the fact that a person does not gather sufficient retirement savings, and in the second phase (from the age of retirement until the end of the average life expectancy) that the accumulated savings provide too little income. In the third phase, for people living longer than expected, in addition to the risk of low income (e.g. low level of pension benefits offered by the public pension system) there still exists the risk of partial or total exhaustion of additional accumulated resources (e.g. in an individual or occupational pension plan, in other forms of savings, etc.); namely the implementation of individual longevity risk (see Fig. 2).

The design of the Polish pension system

Since the comprehensive and systemic reform introduced in 1999, the Polish pension system for employees and the self-employed has consisted of three pillars (see Tab. 2). The first pillar refers to a mandatory notional defined

contribution account (NDC) scheme (JAROCIŃSKA et al. 2014, p. 21–22). The total pension contribution rate amounts to 19.52% of gross wages (pillar 1 + pillar 2). The contributions (premiums) are financed equally by both employer and employee. 16.60% of pension contributions are transferred to pillar 1 (being written down on the individual accounts and sub-accounts of those insured) and 2.92% goes to open pension funds (pillar 2), if the insured person is a member of an OFE (Open Pension Fund). If not, the entire 19.52% is transferred to the first pillar (RUTECKA 2014, p. 130).

Table 2

The architecture (design) of the three pillar Polish pension system

Pillar 1	Pillar 2	Pillar 3
Mandatory	Mandatory/Voluntary*	Voluntary
PAYG	Funded	Funded
Basic pension benefit	Basic pension benefit	Additional/Complementary Pension benefit
Notional Defined Contribution (NDC)	Defined Contribution (DC)	Defined Contribution (DC)
Managed by public institution: Social Insurance Institution (ZUS)	Privately managed: Open pension funds (OFEs) managed by Pension Fund Societies (PFSs)	Privately managed: Individual and group (occupational) pension savings managed by different financial institutions

* Open Pension Funds (OFEs) were introduced in 1999 and have been obligatory since 1999. As of 1 April, 2014 they are voluntary. The role of the second pillar has been marginalized.
Source: own elaboration.

The notional interest rate is defined as 100 percent of the growth of the real covered wage bill, and no less than the price of inflation. The second pillar is a voluntary funded defined contribution (FDC) scheme. Contributions paid into the second pillar are indexed with the rate of return on pension fund investments.

One of its main objectives in the economic dimension was the division of risk between the financial market and the labor market by introducing a three-pillar structure, and in particular the second capital funded pillar and private pension funds (called „OFE") operating within it (GÓRA 2003).

After retirement (in the decumulation phase of a pension system), pension benefits are indexed annually by inflation with at least 20 percent of the real average wage growth.

The pension formula is to a large extent similar to the first and the second pillar. Benefits are equal to the accumulated capital from contributions (plus indexation) divided by life expectancy obtained from the observed unisex period mortality tables. Mortality tables are recalculated by the Polish Central Statistical Office (GUS) every year.

The third pillar consists of voluntary, additional private pension plans:

– the occupational pension schemes („pracownicze program emerytalne", PPE),

– individual retirement accounts („indywidualne konta emerytalne", IKE)

– and individual retirement saving accounts („indywidualne konta zabezpieczenia emerytalnego", IKZE).

Tax incentives for additional pension savings are rather poor. The occupational pension schemes (PPE) cover only 2.3% of the labor force in Poland. Both forms of individual pension schemes are: IKE – 5.2% and IKZE 3.2% of the working age population, respectively (RUTECKA et al. 2014, p. 6).

Two recent reforms (introduced from 2011 to 2014) will have a further impact on pension income in Poland. The first reform has shifted a part of the contributions from the mandatory FDC to the NDC system since 2011, but assumes that the benefit formula will be very similar. If the rates of return in the FDC and NDC systems during the accumulation phase differ, this may influence future pension incomes. The second reform will have a more important impact: the retirement age has been raised gradually to 67 for both men and women as of 2013. Men will reach the new retirement age by 2020, and women by 2040[1].

The new legislation that came into force in February 2014 made the second pillar voluntary, i.e. an insured person can pay the entire old-age pension contribution (19.2%) to the first pillar only. The decision can be reversed every two years (JAROCIŃSKA et al. 2014, pp. 21–22).

Longevity risk in the Polish pension system

While the first pillar (PAYG) is in the accumulation (savings) phase, the pension system is more sensitive to the risk of demographics which increases with the aging of the population, and the funded pillar is subject to different (demographically non-correlated) kinds of risk (including investment risk). However, the diversification of pension risk in the Polish pension system was not to be applied only to the phase of its consumption (decumulation), which carries the risk of longevity. Both PAYG and the funded pillar are not immune to aggregate longevity risk in the pay-out phase of the pension system.

According to the initial assumptions of the pension reform of 1999, the payment of benefits from capital accumulated in the second pillar of the

[1] The new Polish president Andrzej Duda promised in his election campaign in 2015 to restore the previously existing statutory retirement age (65 for men and 60 for women). Making this change under the rule of the Law and Justice party in 2016 is quite likely. It would be another significant change in the rules of the pension reforms introduced in Poland.

pension system was to be dealt with by pension institutes (created especially for this purpose), which would not only pay benefits under the second pillar but also multiply the accumulated capital and invest it in low risk financial instruments. However, such pension institutes never came into existence. For the last 15 years, the pension reform has not been completed, because there has been no legislation regarding the payment of pensions from the second pillar. Only recently has the legislation been enacted (Ustawa z 6 grudnia 2013 r. o zmianie...) that will finally regulate this important issue. The payment of the total pension funds accumulated in the first and second pillar will be provided by the Social Insurance Institution (ZUS). A lifetime pension (annuity) remains the only available product.

In order to justify the recent changes in the public pension system, former government experts explicitly informed the public that only the state is able to take on demographic risks, including longevity risk, by stating that „the only entity able to deal with the demographic risk is the state. Thus, the issue of payment of benefits accumulated in private pension funds should also be linked to the interests of public finances" (MLSP, 2013, p. 5). However, the examples of insurance companies that pay annuities and have already developed a method of spreading risk within the insurance community, demonstrates that the state monopoly with regards to the payment of pensions, although still present in most countries, does not need to be the only acceptable solution.

Merging pension payments from the first and the second pillar in one state institution (ZUS) does not eliminate the aggregate longevity risk. We can analyze it using an example based on real data.

Example no. 1

A 53 year old participant of a public pension system in Poland, who started work in 1982 and paid pension contributions at 1.5% of an average salary, received in 2013 information from the Social Insurance Institution (ZUS) about the pension rights registered on his individual retirement account (the 1st pillar) through the end of 2012:

Valorized initial capital[2]	525,014 PLN
Valorized pension contributions	178,172 PLN
Contributions cataloged on a subaccount[3]	18,095 PLN

[2] Capital pension rights transferred from the old pension system, which was in force in Poland until 1999.

[3] The subaccount was created after the reduction of pension contributions transferred to OFE in 2011. Generally it can be treated as a part of the first pillar (PAYG), but its valorization method is a bit more generous.

Total pension rights (based on paid contributions in the 1st PAYG pillar of the public pension scheme) are 721,281 PLN

The same participant of the pension scheme gathered 93,556 PLN on his second individual pension account (2nd pillar) in an open pension fund (OFE) – since the introduction of pension reform from the 1st January 1999 until December 31st, 2012.

So his pension capital (pension rights registered in the 1st PAYG pillar and pension savings invested in the capital market and registered in a form of units of the given OFE pension) is found to equal the following:
721,281 PLN + 93,556 PLN = 814,837 PLN

Pension formula:
Total pension capital / expected time of future life in months (for a given demographic cohort)

A hypothetical amount of pension paid at the age of 67 out of the 1st PAYG pillar:
721,281 PLN / 195.7 months of expected life for this demographic cohort[4] = 3,685.6 PLN.

A hypothetical amount of pension paid at the age of 67 out of the 2nd funded pillar (OFE):
Total pension savings/ expected amount of future life in months (for a given demographic cohort)
93,556 PLN /195.7 months of expected life for this demographic cohort = 478 PLN

A hypothetical total amount of the old-age pension paid at the age of 67 out of the 1st PAYG and the 2nd funded pillar:
3,685.6 PLN + 478 PLN = 4,163.6 PLN, that is **approx. 4,164 PLN**

If the chosen cohort of participants of pension systems lived longer than expected on average, for example 220 months instead of 195.7, the Social Insurance Institution (ZUS) would be obliged to pay 4,164 PLN pension benefits 24 month longer. **It would cost an additional 99,936 PLN** (for one participant of this cohort in the public pension scheme). This is an example of the materialization of the aggregate longevity risk.

[4] Own calculation based on *Life Expeetancy*..., 2012, p. 80.

This calculation is based on the following assumptions:

1. The statutory retirement age in Poland will be extended for this cohort of male participants of the pension scheme until the age of 67. Otherwise, of course, the pension capital (accumulated in the 1st and second pillar) would be lower, as well as the capital of hypothetical pensions. It would reduce the aggregate longevity risk (for ZUS) and at the same time cause increased individual aggregate risk for participants (lower old-age pensions from the public pension scheme must be complemented with additional, voluntary pension savings) if this additional pension savings were not sufficient. If that were the case, the individual longevity risk – the risk of outliving individual, personal pension savings – would materialize.
2. For the analyzed cohort, no more contributions to the public compulsory pension system would be paid until the statutory retirement age.

At the level of social security in the current Polish pension system, the individual longevity risk – assuming ownership of a reasonably long period of contribution – does not exist. Pensions are paid by the state until death – in the form of a life annuity. The elimination of individual longevity in the public (base) pension system does not eliminate the aggregate longevity risk, which must be covered by the Social Insurance Institution and by the State which is responsible for paying pension benefits out of the obligatory public pension scheme. As a consequence of rising living standards and advances in medicine, in conjunction with a declining birth rate and increasing migration (in the case of Poland, after joining the EU about 1.5 mln Polish citizens have migrated to other EU Member States to find better jobs and living conditions), the increasing life expectancy in Poland is a very serious challenge for the public pension system financed (after the reduction of the funded part of the system since 2011) mainly by the PAYG method. From the point of view of ZUS (and public finances) the risk of incorrect estimates of the life expectancy trend (the aggregate longevity risk) lies in the fact that the given demographic cohort would live longer than the forecast provided annually by the Central Statistical Office (GUS). Since the pension reform in 1999, the amount of pension benefit in Poland has been calculated by dividing the accumulated pension capital (pension obligations) by the expected number of months of life for the given demographic cohort. The 1999 introduction of the defined contribution formula does not provide automatic financial stability and does not protect against the risk of longevity. If a certain demographic cohort lives longer than predicted, the aggregate longevity risk must be covered by the Social Insurance Institution (ZUS).

To a large extent, longevity risk affecting the people in a given year of beneficiaries (the demographic cohort) reduces the risk of a shorter than

expected life span of other retirees receiving pensions. It is known that in every age group there are people living shorter than the average life expectancy, as well as those living longer than expected. It is difficult to assume that these two groups will always balance one another. Nevertheless, the risk of longevity cannot be completely eliminated, and the State (directly or indirectly) must take responsibility for the elderly, for whom the benefits of the public pension system are often the main or the sole source of income. Not even a single part of the longevity risk in the public pension system in Poland is offset by any financial instrument (such as longevity SWAPS or longevity bonds). The Polish capital market does not offer such longevity hedging. Very few insurance companies operating in Poland offer insurance with life annuity payments, and none of them are ready to take the risk from the public pension system (for example in the form of a longevity SWAP).

The subject of the aggregate longevity risk is neither broadly discussed in the Polish scientific literature nor in the praxis of the public pension provider (the Social Insurance Institution). On the contrary, the most serious political discussions concern the restoration of the statutory retirement age (65 for men and 60 for women) in force as of 2014, and so the withdrawal of the recently introduced reform would provide a gradual equalization of the retirement age for men and women to 67 years. Of course, the shortening of the statutory retirement age only increases the aggregate longevity risk and the general risk for public finance in Poland.

As for the additional voluntary pension systems functioning under the third voluntary pillar, there are no products offered in the form of a retirement annuity, neither in the system of group savings for additional pension in the workplace (occupational pension systems – PPE, available since 1999), nor in individual systems (individual retirement accounts – IKE, operating since 2004, or individual retirement savings accounts – IKZE, since 2011 onwards). Legal regulations on occupational pension plans (Ustawa z 20 kwietnia 2004 r. o indywidualnych... art. 42), IKE and IKZE (Ustawa z 20 kwietnia 2004 r. o indywidualnych... art. 34), provide that the payment of money may take place at once or in installments after a retiree reaches the age of 60 (occupational pension plans or individual retirement accounts) or 65 years (in individual accounts of retirement security). Any payment of installments will last until the depletion of savings that has accumulated in occupational pension plans, IRA or in individual accounts of retirement security, and will not be in the form of benefits payable for life. There is a quite realistic scenario, where a person saving for retirement will receive an additional one-time payment at the age of 60 or 65 years of age, and by living unusually long, this person will deplete their additional funds. Therefore, in the last phase of life his or her standard of

living (based solely on funding from the public pension system) will be significantly lower. Such a structure of payments from the third pillar of the pension system in Poland does not protect against longevity risk.

Conclusions and recommendations

The public pension system in Poland is sensitive to longevity risk and this exposure is likely to increase in the near future (in 10–20 years time) as well as in the longer foreseeable horizon (until 2050). The reduction of the funded pillar in the public pension scheme since 2011 and a retreat to the pension system prior to 1999 is based almost exclusively on the PAYG financing method. This has caused a significant increase in longevity risk and an increase in the risks of damage to the long-term sustainability of the pension system. The anticipated withdrawal from the extension and equalization of the statutory retirement age for men and women in the public pension system in Poland would increase the aggregate longevity risk and the systemic risk of the entire pension system in Poland – in both the short and the long term.

The purpose of the payment of benefits should be to ensure an optimal standard of living for beneficiaries continuing through the duration of their life. The right solution to this problem requires the development of an algorithm and parameters to determine the optimal value of benefits. Actuarial risk is associated with the adoption of poorly estimated parameters (e.g. longer life expectancy in terms of months for a given demographic age group as the basis for the calculation of benefits in the new pension system). When pension payments are realized directly from the accumulated capital, a pensioner begins to bear the risk. Above the minimum guaranteed by the state, the level of benefits is determined by the amount of capital held and by a legally defined algorithm for determining the scope of the provision. The adoption of the algorithm, which in the sphere of assumptions departs from reality, can provide two kinds of results.

The too slow decumulation of capital in the population reduces the beneficiaries' level of consumption and causes the transfer of non-consumed pension capital to the next generation. On the other hand, a too high payout level may conclude with prematurely depleted capital and result in the realization of longevity risk. The problem then is a decline in living standards of pensioners and a burden for the state, due to minimal guaranteed pension payments.

Therefore, the necessary missing link in the pension system is to create an institution of national actuary, which will be properly prepared for the precise forecasting of demographic trends and the appropriate calculation of base pension benefits on the basis of further life expectancy. This will enable the more effective management of both demographic and longevity risks.

Additional pension systems (occupational pension systems – PPE, individual retirement accounts – IKE, individual retirement saving accounts – IKZE) do not protect the savers against longevity risk as they do not offer life annuities. In many countries, a widely used solution is to buy an annuity at the starting point of the withdrawal of accumulated additional pension capital. However, in Poland life insurance with perpetuity payments is very poorly developed, and its availability is limited. As there are no additional systems in Poland with defined benefits, such as the occupational pension systems in Western Europe or the U.S., aggregate longevity risk does not affect those employers who offer pension schemes.

The general conclusion that can be drawn from the analysis of the public and supplementary pension schemes in Poland is that: **both the public pension system, as well as any supplementary pension schemes in Poland, do not secure adequate protection against the risk of longevity**. While in the public (the base) retirement system the aggregate longevity risk exists, the participants of additional pension systems are exposed to individual longevity risk.

The limitation of these risks requires significant structural changes both in the public and in the additional pension schemes in Poland. Changes in the public pension system (including the introduction of the institution of the state actuary, the possible use of derivatives allowing for the transfer of part of longevity risk to private institutions such as life insurance companies) should minimize the aggregate longevity risk. The introduction of compulsory conversion of savings accumulated in additional pension systems into a stream of annuity payments should reduce the individual risk for participant longevity in such systems.

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