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INTERGENERATIONAL FAIRNESS: A MACRO AND MICRO PERSPECTIVE

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Abstract
This theoretical paper seeks to develop the general concept of intergenerational fairness at the macro and micro scale which could be a background for further empirical analyses in this field, including especially some quantitative studies. First, the micro-scale and macro-scale definitions of generation are explained, and the concept of intergenerational fairness is discussed. Then we develop two perspectives from which intergenerational fairness can be considered. The first one is that of an economy (a macro approach) the other is that of a family (a micro approach). In the case of an economy the government’s policy matters since it determines the intergenerational transfers today and their impact on the future. This means that contemporary intergenerational distribution of incomes or resources crucially affects such a distribution in the future. In the case of a family, its structure and the strength of family ties play a dominant role. We also show that intergenerational relations on the macro and micro level are not independent. The impact of transfers on the macro level on transfers on the micro level is, however, more direct and stronger than the other way around.
Keywords: equity, intergenerational fairness, justice, transfers, welfare.
JEL codes: D60, D63, J10.

1. Introduction
The process of ageing populations over the developed world, especially in Europe and the United States, raises many questions concerning intergenerational fairness perceived in the context of equity, equality or justice. Although these concepts are differently perceived in the literature, there are no doubts that generational relations are an issue worth analyzing both on the macro as well as at the micro scale. In the case of the macro scale, intergenerational fairness can be intuitively perceived as fair relations between different generations of the population of
a given country, or even at a global scale (especially with the reference to climate change). In the case of the micro scale, intuition suggests that the object in which different generations are compared in terms of fairness is a family or a household. This theoretical paper seeks to develop the general concept of intergenerational fairness at the macro and micro scale which could be a background for further empirical analyses in this field, including especially some quantitative studies. First, we define the generation at a macro and micro scale. Second, we attempt to develop the concept of intergenerational fairness at the scale of an economy, then at the scale of a family. Additionally, some possible interactions between the macro and micro levels in the context of intergenerational fairness are discussed. The paper ends with some summarizing conclusions.

2. Generations and intergenerational fairness

The concept of a generation is much simpler and intuitively perceived at the microscale. On this level, generations are within a family or, in more economic terms, within a household (however, these two notions are not synonyms, family is a broader concept than a household – a given family may consists of more than one household). In such a case, a family can consist of people playing different roles which results mainly from their age. Therefore, the household members are divided into children, parents, grandparents or even great-grandparents (see e.g. Papworth and Corlett 2014). In such an approach, these groups overlap and children become parents, parents become grandparents, new children are born etc. As a result, people change the roles in a family. First they are educated, then they work and, at the last stage, they retire. These roles determine the directions of possible transfers distributed within a family and the sources of utility in economic terms.

The concept of generation is much more complex at the macro scale. It is not as easy to transfer the different groups from a micro scale (i.e. from a family) to a macro scale. The first reason for this is that some people have children and others do not. Second, people born in the same year or at quite close moments in time, even if they have children, may have them at quite different ages. For instance, two couples of adults, born in 1970, have one child each; however, in the case of the first couple a child was born in 1990, and in the case of the second couple a child was born in 2015. As a result, the child of the first couple may become a parent and play a quite different role in society as compared to the child of the second family in which case the child would be in the education period at the same time. As a consequence, at a macro scale a generation is not perceived in the context of the role played within a household but more with reference to the time criterion. In such an approach, generations may be perceived from a chronological-temporal and chronological-intertemporal perspective. The chronological-temporal perspective refers to different age groups of a given population (usually of a given country). This perspective is usually highly consistent with the division of population into generations on the basis of social group criterion. In a chronological-intertemporal approach, a generation is defined as the population alive today which means that a generation consists of all
the people living in a given period of time. These people can be divided into different age- or social groups (see Tremmel 2014). One can conclude that a chronological-intertemporal perspective includes a chronological-temporal one, since a generation living in a given period of time (chronological-intertemporal perspective) consists of subsets which are generations in age- or social group terms (the chronological-temporal perspective).

In our subsequent considerations, we will perceive a generation within a family (micro scale) in terms of the role played (children, parents, grandparents, etc.). In the case of the macro scale, a generation will be defined in the context of social groups, which also means different roles played in society or an economy (young people are educated, adult people work, and old people retire). Such a division is quite consistent with that based on age groups. Referring to statistical terms (see e.g. OECD terminology), the young population includes people aged 0-15, the working age population includes people aged 15-64, and the elderly population includes people aged 65 and over.

Intergenerational fairness is a very complex term. It is linked to the general idea of justice in intergenerational terms, which refers to both equality and equity. Equity refers to the needs that must be met to enjoy full, healthy lives. Equality is a quite different notion and refers giving people the same things they need to enjoy full, healthy lives. “The equality of a distribution of income or wealth is basically a matter of fact and is, therefore, basically objective. The equity of the same distribution is basically a matter of ethical judgment and is, therefore, basically subjective” (Bronfenbrenner 1973). In this paper, we focus on the economic meaning of intergenerational fairness. In such a view, fairness perceived through the prism of justice or equity refers generally to taxation and welfare policy (Summers and Smith 2014). Equity between different generations living in a given period of time accounts for equal respect, opportunities and comparative living standards. Moreover, in the long term, equity also refers to future generations. This means that it also takes into account generations not yet born or children when they become adult or adult when they become old. Such an approach refers to the prospects a given generation has for the future (Piachaud et al. 2009).

A narrow concept of intergenerational fairness is based on transfers between different social (or age) groups both within a society and within a family. In the case of a society, public transfers are considered, which includes public debt inherited by younger generations and taxes or pensions to be paid by different age groups. In the case of a family, private transfers are possible and they refer to some burdens of carrying for young and older persons or to support improving life prospects (Piachaud et al. 2009). In a broader context, intergenerational fairness refers also to future prospects. We will try to combine these two approaches in our perception of intergenerational fairness since today’s transfers can be perceived as future’s perspectives. In our view, intergenerational fairness means such relations between different age (or social) groups which do not discriminate against any age group in terms of its present and future living situation. Obviously, the equity of these relations is determined by present economic, political or demographical conditioning (e.g. wars affect such relation dramatically since it
changes priorities, ageing populations also affects the distribution of incomes or resources across generations). These relations refer to both present transfers (today) and their impact on prospects (future) since intergenerational fairness cannot be measured only through the prism of the contemporary situation. It requires reference to the foreseeable future. This reference to the foreseeable future can be achieved by the use of today’s transfers as a predictor of future prospects (tomorrow’s situation). Another important aspect refers to the fairness between today’s age groups (contemporary generations) and future age groups (future generations).

Fair intergenerational transfers today and fair intergenerational transfers in the future do not automatically mean a fair distribution of incomes and resources between today and the future. This results from the fact that the division of incomes or resources today determines future GDP, which actually means that the way we divide GDP today (between consumption and investments) affects the GDP that will be divided in the future. Pensions are a great example, since they can be funded only through the division of current GDP. That is why future GDP is crucial for pension systems (Barr and Diamond 2006). As a result, not only will the future generation be responsible for the product generated “tomorrow” but today’s generation also plays an important role.

The government creating a welfare policy can affect the directions and magnitude of the intergenerational transfers through the division of current GDP at the macro scale first of all, but also at the micro scale indirectly. This impact of the macro scale on the micro can result from the directions of transfers made by the government (within a family the direction can be adverse to mitigate e.g. an intergenerational unfairness created at the macro scale) or can be stimulated more indirectly (e.g. through an ineffective child care policy and shortage of kindergartens which may cause the involvement of grandparents to look after children to enable adults to work). Therefore, an important question is what type of transfers can be identified on the macro and micro level and, whether the level of intergenerational fairness at a macro scale affects transfers in the micro scale, or vice versa. Since we assume an economic perspective in the paper, we will perceive a transfer as a result of some rules set to share incomes (GDP), resources, the environment (climate), knowledge and skills. Such a transfer can be of a material or non-material nature. The former includes e.g. pensions, spending on education, healthcare, financial support within a family, and bequests. The latter includes e.g. time or attention (through the time consumed by care for children or parents). The role of non-material transfers can be also very important since e.g. they can enable adults to keep working while they have children if grandparents devote their time and attention to providing care for grandchildren see e.g. (Hagestad and Herlofson 2007).

3. A macro perspective

A macro perspective, from which the policy of intergenerational transfers is implemented, is reflected by the social or welfare state policy which can be fair or just towards different generations or discriminate against one generation in
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favour of another. Such discrimination can have short as well as long term consequences. For instance, if today’s children and young are discriminated against through low spending on education and high spending on pensions caused by the greater political power of adults as a significant electorate, this will have its consequences also in the future through lower knowledge and skills, and as a result, lower human capital and lower labour production. Moreover, the competitiveness of those young people on the international labour market would be lower as well. So, the problem from a macroeconomic perspective refers to the current GDP division between consumption and saving, which determines capital accumulation and investment. As emphasized by Besley (2001), if generations living today do not care about consumption of future generations or younger age groups (depending on the view of a generation: temporal or intertemporal), they underaccumulate as compared to the long term path (or path chosen by a dynasty providing that agents care about their heirs which means that an economy works as an infinitely lived consumer).

Taking the production factors into account, one can analyse the impact of current GDP division between consumption and savings on growth, which subsequently determines the future GDP from which the consumption of future generations as well as further capital accumulation will be funded. We will focus on two production factors: capital and labour. In terms of capital, we will refer mainly to physical capital, whereas in the case of labour we will focus on its input to production which is determined by the labour supply and productivity. In such a view, the magnitude of future physical capital is determined by saving and its transformation into investment, whereas labour input is affected by the labour supply and human capital (see e.g. Besley 2001). Below, we discuss how the government implementing socio-economic policy can affect these growth factors to maintain intergenerational fairness in terms of prospects for future generations. Long-term savings are mainly accumulated within a pension system. Agents at working age save for the period when they will no longer be able to work or will consume leisure after they achieve retirement age. This way they smooth their consumption over the life cycle, since the sacrifice part of current consumption to consume in the future. However, regardless of the pension system (funded or unfunded, defined benefit or defined contribution) pension benefits are financed through the division of current GDP. For today’s workers, future GDP is crucial since their pensions will be funded through division of this GDP between generations. Savings, if transformed into investments, affect GDP growth and, therefore, impact future pension benefits. What if today’s workers undersave for pensions? This can be caused by two main factors. The first is the GDP division discriminating against the current working generation in favour of current pensioners (spending on pensions is relatively high as compared to the population of pensioners or to average salary). The other is a huge propensity to consume of current workers, since they much prefer current consumption over future consumption. Such undersaving for pensions in a libertarian state (e.g. Nozick state) would result in very low pension benefits, probably under the poverty threshold. However, in the case of welfare states, especially more social ones, old
people with low pensions would be supported by the generation of workers through appropriate social policy implemented by the government. This way today’s workers can overpay current pensioners. This would be the result of undersaving in the past which decreased the potential GDP growth. Moreover, such a situation would affect negatively the future GDP, since today’s spending on pensions increases the share of GDP distributed for consumption instead of education (human capital development) or remuneration of labour (which decreases the working generation incomes and savings). Thus, the government may stimulate savings in two main ways. The first is a fair distribution of GDP between the working generation and the generation of pensioners, since workers’ incomes impact their propensity to save. Moreover, according to the life cycle model, the working generation saves for wealth accumulation, whereas the old generation decumulates the wealth. The other way is taxation of savings or other incentives supporting e.g. capital accumulation in voluntary pension schemes. The second factor in physical capital accumulation is investments. The two following aspects of the transformation of savings into investments are crucial. First, is this transformation immediate and of a one-to-one ratio? Second, what is the structure of the investments, which means, what are the savings allocated in? As for the first aspect, the transformation of domestic savings into domestic investments in the era of globalization should account for capital flows. This determines the equilibrium between domestic savings and investments. Feldstein and Horioka (1980) in their seminal work compared two views of the impact of capital mobility on the transformation of domestic savings into domestic investments. The first view was that in the case of perfect world capital mobility, the link between domestic savings and investments is very weak or does not even exist. The other view was that in the case of some institutional constraints in international capital mobility, the relation between domestic saving and investment should be significant. They conclude that the second view is better supported by statistical data. Nevertheless, a temporary imbalance between domestic savings and investments is possible, as proved e.g. by Petreska and Mojsoska-Blazevski (2013) on the example of transition economies, including Central and Eastern European countries. So matching investments to saving needs time. Barriers to capital mobility are still characteristic for some post-communist countries which implemented significant pension reforms in the 1990s, involving inter alia compulsory participation in privately-managed pension funds. However, these funds were limited in their foreign investments and obliged to allocate a significant part of assets in domestic government bonds. This is the result of the government policy which is aimed at increasing the capital accumulation in a given country instead e.g. of geographical diversification of future pensioners’ assets allocation. However, in the case of transition economies, whose main problem is shortage of capital, such a strategy is justified. The second aspect is what the savings are invested in, which refers to the structure of investments. This is also crucial for future GDP divided between generations since present tax incentives or other public subsidies (which are the result of the current GDP division) can stimulate investments in innovations, which create a qualitative
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development of enterprises and of the whole economy. For instance, European funds in Poland are mainly dedicated to firms’ investments with a high level of innovation. Firms which realize mainly replacement investments generally do not have the chance to be supported by European funds. Moreover, some studies demonstrate that firms investing in innovations support socio-economic growth, which means that innovations support not only economic growth but also societal development in the long run, also in terms of ecology or the environment people live in (Ahlstrom 2010; Doran and Ryan 2012). As a result, the distribution of savings between innovative and non-innovative investments is crucial for the prospects for the young age groups or more generally, for future generations.

The government can stimulate household savings and investment by private firms, however it can also make public investments. This is the question of public spending distribution between consumption (pensions, social benefits) and widely perceived investments (infrastructure, education, healthcare, R&D). Spending on pensions or other social benefits can result from clear rules and be even actuarially balanced, which actually means fairness in intergenerational terms. A given generation is paid pension benefits which results from its previous contributions (to a pension system) adjusted by a rate of return. However, this rate of return has to be strongly linked to GDP growth (in the case of unfunded schemes) or is directly the result of returns on financial markets (in the case of funded schemes). A problem arises if pensions are overpaid, since then a given generation receives benefits that exceed the amounts resulting from an actuarial balance. In such a case, redistribution from younger to older is at work, which means that the working generation or youth generation is discriminated against. This discrimination may be reflected not only by a tax wedge but also by lower investments in infrastructure, education, healthcare or R&D. This could result in lower GDP growth, since all these factors affect production capabilities of enterprises.

The other production factor under consideration in this paper is labour. Labour input to the product can be changed into two ways: through the labour supply and labour productivity. The first is a global problem today, since the labour supply is determined by demographic conditions. These can be changed (at least theoretically) by government policy in the long term through fertility stimulation. However, some important adjustments of social policy facing the problem of ageing population are also possible in the short term. People live longer and stay healthy longer, which means are able to work longer. This should be reflected in the effective retirement age and, if necessary, in the pensionable age. It should be emphasized that a real goal for keeping pension systems sustainable in the long run is increasing the effective age of retirement. Pensionable age is only one tool to achieve this goal. This is a crucial issue for intergenerational fairness, since in the case when extending life expectancy is not reflected by a longer duration of working life, the relative time spent on retirement increases as compared to the time of economic activity. This means that young people have to overpay their parents. One can say that defined contribution schemes, which are actuarially balanced, solve this problem. However, this is utopian, since in such a case a given
part of the pensioner subpopulation is unable to accumulate wealth enabling payment of benefits higher than the poverty threshold. As a result, such pensioners are paid additional social benefits which are funded by the working generation. That is why the problem of a slow increase in the effective retirement age as compared to increasing life expectancy is so very important. Unfortunately, this has remained unsolved in many countries since the 1970s and 1980s, when the policy of full employment were realized and turned out to be ineffective in reducing youth unemployment through early retirement programmes offered to the elderly, especially in Continental Europe (Chybalski and Marcinkiewicz 2014; Gruber et al. 2009; Jousten et al. 2010; Kalwij et al. 2010). The problem of increasing the statutory retirement age to stimulate a longer duration of working life is justified by economics and demography but it is difficult to solve due to political conditioning, especially when the subpopulation of pensioners increases and imposes its political significance as a social group. Another way to increase labour input to production is by stimulating labour productivity. This can be achieved through investments in technologies that make labour more effective, or through investments in human capital which is an important factor in innovations. Thus, an effective retirement age acts twofold. First, through the labour supply, second through the division of current GDP between consumption (pensions) and investments (including not only infrastructure or physical capital, but also education, R&D and healthcare which stimulate labour productivity).

To summarize, a macro perspective of the government’s policy in terms of intergenerational relations, which should aim at keeping it fair and just, policy makers have a range of tools that affect the intergenerational contract. This is observed at the macro level directly through e.g. public budget spending and intergenerational transfers between different age groups, or more indirectly through differences in taxation of different age groups, retirement age or pension privileges. However, government activity at the macro level may cause a reaction at the micro level, since households may take policy makers’ decisions into account when making their own decisions about savings, retirement, transfers within a family etc.

4. A micro perspective

As mentioned above, intergenerational fairness at the macro level refers to transfers of different kinds from one generation to another perceived as relatively distant age cohorts consisting of unrelated agents. When it comes to the micro level, family relations are involved. One can define intergenerational transfers at the micro level as transfers within one family, which consists of related members. That is why the family structure and the strength of family ties play the crucial role i.e. they determine the willingness and ability of particular members to provide support (transfers) from one generation to another.

Taking a closer look at the demographic dimension allows us to appreciate how some trends bring the family closer and away from the function of providing social coverage. The demographic panorama is changing over time, and this includes:
1) Aging of the population as an effect of the extending of life expectancy. With the improvement in the living conditions of the elderly (economic, health, physical, psychological, etc.) we live longer and experience a longer duration of coexistence between generations, although this is not linked to co-residence. Advanced age and health conditions are often the elements that disturb the future of the family. There are more and more dependent elderly, more people living alone, fewer children in general and more economically active daughters. Growing up in a family will be difficult in the near future. The strength and frequency of exchanges and family solidarity between generations is an asset in the family that largely guarantees social coverage that is not found in the precarious network of social services.

2) Change in reproductive patterns. Since the late 1970’s, in Europe the number of births has progressively fallen until, at the end of the 90s, it was just over a half of those born twenty years ago. What seems to be taking hold as a future trend is that women better control their fertility, having fewer children (especially second and third children) and delaying the birth of the first child.

3) Changes in the behaviour of couples. There is a different attitude towards marriage. People marry less and at later ages, especially in the case of women, in whose biographies marriage and children are competing to a greater extent with education and paid work. This situation of delay and reduction in the frequency of marriage and fertility has been common especially for women born in the 1960’s and later. Such attitudes and patterns are typical for the younger generations of this century observed in the European environment. Among the transformations that affect family relationships which are acquiring greater relevance and social significance, the breakdown of the couple relationship by separation or divorce is more common.

The aforementioned changes have heavily influenced the typical model of the family. Other social norms have emerged that reduce the significance of the nuclear family as the main family model. This is also associated with the transformation of family relationships. Likewise, the important changes in the area of family relationships have also led to changes in the way that the family gives support to its dependent members, and that fact raises huge questions about the future of assistance. Relations between generations have been affected; however this has not always meant a weakening of intergenerational relations (Segalen 1981). The current demographic conditions have led to an increase in relations between generations never seen in the past (Gomila 2005). The relationship between grandparents and grandchildren, and even between great-grandparents and great-grandchildren, has given way to a kind of interaction between generations much more frequent than it had been only two generations ago, simply due to the fact that the fraction of the children born at the beginning of the 20th century, knowing their grandparents and living or maintaining a relationship with them, was much smaller than in the case of those of the 21st century.

As pointed out by Saraceno (2008) on the basis of a literature review, the downwards financial transfers within a family are more frequent than upward
ones. This means that parents tend to support their children financially more often than (middle-aged) children support their ageing parents. This can be considered a result of the described above changes in the family structure, as well as the fact, that in welfare states the society provides for older agents through the pension system, social assistance and health care.

The economic transfers – or, in a narrower meaning, the financial ones – from one generation to another, can be considered from the perspective of the division of income between consumption and savings. The downward transfers, i.e. from the older generation to the younger one, are naturally reflected in the economic dependence of children on their parents. Parents provide for children while they are unable to have their own income, and this is the basic form of economic support. But satisfying current consumption needs is not the only area of downward transfers. The second is savings. Parents limit their own consumption and save to support their children in the future, also when the children are fully able to provide for themselves. In the body of literature, both theoretical and empirical, two main saving motives can be distinguished in regard to this issue: bequest and children’s educational needs. One of the first works that identifies the bequest motive (among eight basic saving motives) is the seminal study by Keynes (1936). This kind of motivation is also included in the theoretical models that at the micro level explain agents’ consumption and saving behaviour. As discussed by Wärneryd (1999), the bequest motive is a major theoretical modification of the standard life cycle hypothesis (LCH) developed by Modigliani and Brumberg (1954) and Ando and Modigliani (1963). Several empirical studies also prove that older (retired) agents demonstrate a propensity to save, even higher than in the case of younger (working-age) generation, which is inconsistent with the standard form of LCH (Alessie et al. 1999; Belke et al. 2015; van Ooijen et al. 2015). This phenomenon can be explained by the need to transfer assets (wealth) to the next generation within a family. However, this kind of intergenerational transfer seems to depend on household income. Schmidt-Hebbel and Serven (1997) conclude that for more affluent households, bequest is common, whereas for less affluent ones it is a luxury good. As pointed out by Hagestad and Herlofson (2007), transfers often go down the generation line deeper than one generation at once. On the basis of a review of the previous literature, they notice that bequest is common, i.e. by agents in their 50’s, who tend to pass it on immediately, partly or in full, to their children in their 20’s who are in a greater financial need to pay for education, housing, or for child care. The second, also very important saving goal that directly involves intergenerational transfers, is saving for children’s future needs, mostly education. This is distinguished in other widely known classification of saving motives, developed by Katona (1975), together with saving for emergencies, retirement and other goals. Its relevance is also proved by the empirical studies conducted at the micro level. For example, Yao, Wang, Weagley and Liao (2011) compares Chinese and US households in terms of their saving motivation. Their findings suggest that Chinese are more likely to save for children’s education than Americans, which can be explained both by cultural and economic premises. First, Chinese influenced by
Confucianism highly value education, and second, as a result of economic reforms in China shifting considerably education costs from the state to households. A very important question is what, if any, the interactions between micro and macro level of transfers are. One can identify the possible mutual interactions of two kinds:

- the impact of the intergenerational transfers at the micro level on the transfers, thus fairness, at the macro level,

- the effects of the transfers at the macro level on the transfers at the micro level.

In the current literature, there is a discussion whether state involvement in the welfare of the elderly impacts the involvement of the family in the care for older members; however, this refers to all kinds of transfers including non-material support. This issue is often referenced to as the substitution thesis or crowding-out hypothesis (see Hagestad and Herlofson 2007). The findings are mixed. However, as discussed in (Nauck et al. 2009) the empirical studies in majority tend to support the view that the economic transfers at the aggregated (state) level reflected in the extended social assistance rather complement intergenerational solidarity within the family, than reduce it. A somewhat different perspective is studied by Kohli (1999). His findings imply that public and private transfers interact in such a way that public pension benefits are channelled through family transfers to younger generations.

The impact of micro level transfers on macro level transfers seems to be less direct, than the other way around. The generosity of welfare states towards the elderly and children is determined in a great part by the welfare state model implemented, and as discussed in (van Oorschot et al. 2008) welfare state models have strong cultural foundations, which have roots inter alia in family relationships. However, some more specific implications of the financial private transfers for the transfers at the society level can also be distinguished. For example, as stated by Sturm (1983) transfers at the family level in the form of a bequest – but only under the condition of a growing population or growing productivity – lead to greater national savings. This implies that the next generation will benefit from this in the future.

5. Summary

Between the concept of intergenerational fairness as seen from the macro perspective and as seen from the micro perspective, some analogies can be found. First, it is about the division of working-age generation income between consumption and savings. Both can be further divided between three generations: dependent children, parents (the working-age population) and grandparents (the elderly population). Second, fairness, regardless whether it is perceived as equity or equality, in both perspectives is not limited to the present balance of transfers between two particular generations but requires a longitudinal approach for its assessment. For example, at the micro level the fact that the older members of the family, who provided for their children while they were young, do not receive economic support from them at the old age, does not imply intergenerational unfairness. To have a complete picture of this phenomenon, the previous transfers
towards older members received while they were young from their parents should also be taken into consideration. Transfers are the main channels that intergenerational fairness is realized through. But the transfers at the micro scale are not necessarily reflected straightforwardly in the transfers at the macro scale. At the family (micro) level, as pointed out above, downward transfers are more common, i.e. the ones flowing from the working-age parents to the underaged children, than the upward transfers towards the older grandparents. However, at the society (macro) level much more support is given to the elderly. Gál, Vanhuysse and Varghad (2018) note that this can be perceived as an unjustified discrepancy, since investment in children is more desirable from an economic point of view, which can be related to the notion of “social investment”. They argue that “Europe is a continent of elderly-oriented welfare states and strongly child-oriented parents”. Nonetheless, one can state that while at the macro level the working age generation is a net contributor of social transfers, at the micro level this is not so obvious when the transfers in a form of bequests are considered. In both cases, only the role of the children’s generations as net beneficiaries of the transfers is unquestionable. However, the above refers only to transfers at a given moment of time, which do not fully determine intergenerational fairness, since this notion is associated with a wider time perspective.

The concept of intergenerational fairness perceived through the long-term balance of transfers between generations is analysed mainly at the macro scale. Previous literature refers to the issue whether the development of pension and health care programs for the elderly compensates for their economic effort previously made to other generations, e.g. their contribution to the development of public education (see Becker and Murphy 1988; Bommier et al. 2010; Preston 1984). However, similar transfers that include a wider time perspective are very difficult to analyse at the micro scale. Transformations of family structure and family ties do not facilitate such analyses. Thus, one can identify a cognitive gap with regard to this issue. Longitudinal empirical studies of the intergenerational fairness at the family level, preceded by the development of some adequate measurement methods, can be regarded as a challenge for future research.

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References

Intergenerational fairness: a macro and micro perspective


THE MULTIDIMENSIONALITY OF INTERGENERATIONAL FAIRNESS: SOME CONCEPTUAL ISSUES

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Abstract
In this paper we try to identify the most important dimensions of intergenerational fairness perceived mainly through the prism of economics. To achieve this goal, we first identify a methodological and empirical gap in a multidimensional approach to the measurement and evaluation of intergenerational fairness. Then, we indicate and characterize the most important and obvious dimensions of intergenerational fairness. Since we are aware of the limitation that it is probably impossible to identify all the economic and social aspects in which intergenerational relations are reflected, we focus on those which are most addressed in the literature and can be measured or evaluated. These are: pensions, incomes, taxation and public debt, education, the labour market and healthcare. We can conclude that all these dimensions are closely related one to each other. Moreover, all of them are closely linked to the life cycle theory. An important feature of intergenerational relations is their time inertia, which means that present relations (e.g. distribution of GDP between generations) determine future relations. We also see some other important aspects of intergenerational fairness that were not discussed in our paper (natural resources, housing, migration). These can constitute the subject of further conceptual developments.

Keywords: equity, intergenerational fairness, justice, transfers, welfare.

JEL codes: D60, D63, J10.

1. Introduction
The deteriorating demographics in the developed world have raised many questions concerning the relations between generations living today (a chronological-temporal approach to defining generations, perceived as different age- or social groups living today) or between generation living today and generations that will live in the future (a chronological-intertemporal approach, see Tremmel 2014). These relations touch on many different aspects of economic and social life on the micro- (family, household), macro (economy, country) or even global (the world) level. In this paper, we try to identify the most important dimensions
of these relations in the context of intergenerational fairness perceived mainly through the prism of economics. To achieve this goal, we first identify a methodological and empirical gap in a multidimensional approach to the measurement and evaluation of intergenerational fairness. Then, we indicate and characterize the most important and obvious dimensions of intergenerational fairness. We are aware of the limitation that it is probably impossible to identify all the economic and social aspects in which intergenerational relations are reflected. Therefore, we focus on those which are most addressed in the literature and can be measured or evaluated. The paper ends with summary conclusion, also including directions for possible further empirical research in the field of intergenerational fairness. It should also be emphasized that the perspective we take in our considerations is the possibility to apply all the dimensions discussed in further research aiming at some cross-country comparisons in terms of multidimensional intergenerational fairness. This could contribute to the search for more effective welfare policies promoting intergenerational fairness instead of preferring (or discriminating against) selected generations.

2. Different approaches to intergenerational fairness: a literature review

The literature study supports the thesis that a multidimensional approach to intergenerational fairness is rather rarely addressed by investigators. This results from the fact that the majority of researchers focus on one very important dimension of intergenerational fairness, disregarding other dimensions. Such dimensions are first of all pensions and natural environment, sometimes healthcare, taxes, public debt, the labour market or education. Moreover, a one-dimensional approach is very often accompanied by a one-country approach. This means that a given country is investigated usually in terms of one or a few given dimensions of intergenerational fairness, while comparative cross-country studies of a multidimensional nature are much more rare. For review, Settergren (2003) addresses the problem of financial and intergenerational balance in the Swedish pension system in the face of intergenerational conflict. Osberg (1998) studies intergenerational fairness on the example of Canada. Mazzaferro and Morciano (2011) explore a similar issue on the basis of the Italian pension system, including not only intragenerational, but also intergenerational redistribution. Auerbach, Gokhale and Kotlikoff (1994) develop the concept and methodology of generational accounting to study intergenerational fairness. Their approach is widely applied by other authors, but has also some limitations (see e.g. Ruffing et al. 2014; Williamson and Rhodes 2011). Today, generational accounting is one of the main methodologies, along with overlapping generations models, serving for modelling intergenerational relations in economic terms. However, these methods, due to the fact that they require much detailed information and many assumptions concerning the future, such as e.g. demographics, the labour market, household behaviour, firm behaviour, governmental policy, or wages (see e.g. de la Croix et al. 2013) have the nature of simulations and are applied in studies usually concerning one country (Balestra and Dottori 2012; Boldrin and Montes
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2009; Hagemeyer et al. 2015; Kotlikoff 2004; Makarski et al. 2016; McCarthy et al. 2011; Sánchez-Romero 2013; Wrede 1999). The study by Libera (2006) is an example of a multidimensional approach to intergenerational fairness. She analyses the intergenerational equilibrium in terms of a pension system and other social transfers using generational accounting for Poland. The study also takes into account household savings and investments in education and health.

As we can see, the methodology of studies on intergenerational fairness prefers a one-dimensional or a one-country approach. In consequence, an important empirical gap in this field exists since there is a significant lack of cross-country comparative analyses of intergenerational fairness, especially in which not only the qualitative, but also a developed quantitative approach is applied. Apart from the studies on the generosity of European welfare states towards the elderly (Boersch-Supan and Nistico 2007) and IF European Intergenerational Fairness Index (Leach et al. 2016), which is a generalization (for European countries) of such an index calculated for United Kingdom (Leach and Hanton 2012, 2015), it is difficult to find any other studies evaluating intergenerational fairness in a broader international comparative context.

The literature review provokes a crucial question for the prospect of the development of investigations in the field of intergenerational fairness. Namely, is it possible to study this fairness on the basis of a set including many objects (countries) characterized by more than one aspect of intergenerational fairness? Such an approach would make it possible to achieve a more objective and robust evaluation of intergenerational fairness than those based only on one-country studies. Such an approach requires two assumptions. The first is that all the defined dimensions of intergenerational fairness under investigation are comparable across the countries discussed. The second is that statistical data describing each dimension are comparable across these countries. Such a multidimensional approach applied to many countries would have a very important application value since it would allow one to compare different models of welfare policy towards more effective intergenerational relations and more just division of wealth between generations, not only today but also in the future. Obviously, such a comparative approach has a relative nature since a given country, assessed as the best in terms of multidimensional intergenerational fairness, is actually the best one only in the set studied. This means that if the set of countries were completed with other countries, the country assessed as the best one could appear to be e.g. an average one in the extended set of objects. However, the intergenerational fairness is difficult to evaluate in absolute terms. To distinguish precisely between fair and unfair policies or between acceptable and unacceptable values of given indicators characterizing intergenerational fairness, is very difficult. That is why studies based on many countries can give more objective and robust results.

In cross-country studies, all the objects are compared to each other which, in fact, means being compared to an internal benchmark (the best object in terms of intergenerational fairness), to anti-benchmark (the worst object), or to a hypothetical benchmark (e.g. having average values of all the indicators of
intergenerational fairness). To reduce the negative aspects of such relativity and minimize the risk of bias of the set (sample), the countries selected should be diversified in terms of the intergenerational fairness and their number has to be sufficient. Since in terms of international comparisons data availability limits the number of countries that can be investigated, a number exceeding ten is very often satisfactory. Comparisons based on such sets of objects can give highly objective and universal results and conclusions, especially as compared to one- or two-, or even several-country studies. The next section of this paper aims at identifying the dimensions of intergenerational fairness that could be mentioned in cross-country comparisons.

3. Dimensions of intergenerational fairness

Before we discuss the dimensions of intergenerational fairness, it is necessary to present briefly an important assumption concerning our view on this fairness. Since this paper constitutes the continuation of considerations presented by (Chybalski et al. 2018), we perceive intergenerational fairness as “such relations between different age (or social) groups which do not discriminate against any age group in terms of its present and future living situation”. This definition has the following consequences. Intergenerational relations refer not only to present transfers (today) between different age groups (a chronological-temporal approach to generations) but also to their impact on prospects (future). Thus, intergenerational fairness should not be evaluated only through the prism of the contemporary situation but with reference to the foreseeable future as well. This is quite consistent with Tremmel's (2014) view on intergenerational justice: “Is it unjust that the old generation is normally wealthier than the other two generations? Not necessarily, unless young people have no chance to be in the same situation when they grow older. The crucial question is whether young people will attain the same wealth as senior citizens, once they have reached their age.” Obviously, the direct comparisons of different generations (perceived as different age groups) are unjustified in terms of wealth which is a simple consequence of the differences in the period of wealth accumulation. This results e.g. from life cycle hypothesis, according to which people smooth consumption through saving. They accumulate wealth to consume after they will stop working and retire (Ando and Modigliani 1963; Modigliani and Brumberg 1954). Nevertheless, as emphasized by Barr and Diamond (2006), future GDP is crucial for pensions since future pension benefits will be paid from the future GDP. Thus, current GDP division between generations is crucial for future GDP. Therefore, it is unjustified to compare the wealth of the old and young, nevertheless the current division of incomes between these age groups determines the prospects the young generation have for the future and, as a consequence, their chance to accumulate wealth comparable to that accumulated by their parents. This perspective allows us to identify the most important dimensions of intergenerational fairness.

The results of the initial literature review suggest that the following dimensions of intergenerational fairness seem to be the most important (Aydede 2010; Balestra and Dottori 2012; Beetsma and Oksanen 2007; Boldrin and Montes 2009;
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Leach and Hanton 2012, 2015; Tremmel 2014; von Weizsäcker 1995; Wrede 1999): pensions, incomes, taxation, the labour market, education, and healthcare. Climate change is also an important aspect of intergenerational fairness, especially from the youth point of view, since this change is slow but steady and may deteriorate their quality of life over their life cycle. However, we do not address this issue in our paper since climate change is very often discussed in the literature and is more ecology than an economic aspect of intergenerational fairness; however, it constitutes an important dimension of sustainable development. We also find migration to be a very important element of the analysis of intergenerational fairness. However, migration is rather not a (direct) dimension, but a side effect of intergenerational fairness (or unfairness). People, especially the young, who are more mobile, can seek for a better paid job in other countries if wages in their country are not satisfactory, e.g. due to a high tax wedge, resulting from a significant spending on pensions. The openness of labour markets in Europe stimulates this labour force migration.

3.1. Pensions

Pensions are an obvious dimension of intergenerational fairness which results from a macroeconomic definition of a pension system, perceived as a tool for dividing current GDP between generations, but also determine the prospects for young people for the future, since division of current income determines its magnitude and division in the future (see Barr and Diamond 2006; Góra 2008). As a result, pensions are probably the most frequently addressed issue related to intergenerational relations in many aspects. The first aspect refers to retirement age and early retirement as a tool of full employment policy. This policy was initiated in the period of stagnation and long-term unemployment in the 1970s and 1980s, especially in Continental Europe. However, this policy turned out to be ineffective since it did not reduce unemployment among the young through decreasing the effective retirement age (Chybalski and Marcinkiewicz 2014; Gruber et al. 2009; Jousten et al. 2010; Kalwij et al. 2010). The consequences of this policy are very long-term, since twenty years later, many countries have problems with increasing the statutory retirement age as a simple effect of the extension of life expectancy. Although economic and demographic premises undoubtedly indicate that the effective retirement age should be increased, also through a higher statutory age, political willingness to do this is very weak, which results from the growing power of the elderly electorate and the shrinking youth electorate. The intergenerational dimension of a pension system refers not only to the present time (GDP division and transfers from the middle-aged to the old) but also to the future, as present GDP division affects savings and investments and, as a result, future GDP. Many forecasts suggest unambiguously that today’s young workers will have incomparably lower pension benefits than today’s pensioners. Another issue concerning the pension dimension of intergenerational fairness is implicit debt, which arises especially during pension reforms involving the replacement of a PAYG scheme with a funded one. If a given part of pension contribution is directed from PAYG to a funded part, a financial imbalance may
be generated in the PAYG scheme, since present contributions do not balance present benefits (pensions in payment). In such a case, three main policies may be implemented: increasing taxes, reducing other public spending or borrowing from the future (through issuing public bonds). The last option means actually charging the young generation with the cost of reforms. The transformation cost, if financed through explicit debt (public bonds), increases the risk of not paying off an implicit debt in PAYG scheme, since these liabilities are not due and payable until young generation will retire. Unbalanced public budget policy increases the risk in a public PAYG pension system, which actually is based on the political promise to pay benefits in the future. As a result, policymakers may consider replacing earnings-related pension schemes or defined contribution schemes with flat-rate pension benefits, which would in fact mean a part cancellation of an implicit debt to the young (or people working today).

3.2. Incomes

Incomes, as opposed to wealth, can be used to compare the living standard of different age groups, which means intergenerational comparisons in chronological-temporal terms. Wealth can be used only when generations perceived as similar age groups living in different periods of time are compared (a chronological-intertemporal approach). This results from the fact that income is a stream, whereas wealth is a resource (accumulated over the life cycle). We mainly focus on a chronological-temporal approach, since it is more feasible to compare different age groups living today than the same age groups living in different periods of time. What matters in this case is comparative cross-country data availability. Income, as one of the dimensions of intergenerational fairness, has to be treated in a wide sense and include different measures like those referring to poverty, income inequalities, average or medium incomes etc. Focusing only on e.g. median income as Leach and Hanton (2012, 2015) do, is a far-reaching simplification, since median or average income measures do not account for income inequalities. As a result, it does not give any picture of poverty or income distribution among different age groups. The comparison of incomes across different age groups should be conducted with reference to the present and future (expected) situation. Today’s incomes can be treated not only as a measure of current living standards but also as a predictor of the future living standards of people at working age or youth. Current incomes determine the ability of the working generation to save and to invest in their children, especially when government spending on education is low and does not allow young people to achieve a competitive level of knowledge and skills. In such cases, intra-family transfers are used to mitigate ineffective state education policy. Moreover, government policy in the field of income redistribution also matters. Transfers directed to poor families with children reduce the inheritance of economic status through increasing the investment in human capital across poor households (Cooper 1998; Li et al. 2014). This fact supports the thesis that income as a dimension of intergenerational fairness should be perceived as a complex
measure instead of as a simple one (e.g. median income). Income inequalities and poverty matter as well.

3.3. Taxation and public debt

Public debt represents a commitment by taxpayers in the future to make payments for goods and services that have been supplied in the present (EEAG Report 2016). Consequently, debt should be used for investments (e.g. in infrastructure) that will benefit future citizens, although this means greater future burdens (debt repayment). So, the intergenerational effects would be strongly negative due to the long-term growth of taxation that are to be paid by non-borrowers of financial resources (Lucian 2013). In addition, the effect that taxation probably causes on future generations is the reduction of private consumption, so then two types of debt must be distinguished: i) the costs of current needs that must be covered by the current generation; and ii) the accumulated capital expenditure that must be covered at the time the benefits are produced, which is the one that will be inherited through high taxation by future generations. Krugman (1988) calls this “debt overhang”.

Following Bangham, Finch and Phillips (2018), the future average expenditure on welfare state services – health, education and social security – depends on the age of the individuals. It will be the working-age population who will pay for these services. The maximum financial burden is incurred on the age group 40-50. After that age, the burden will decrease until it reaches a low level during the retirement period. However, there is an increase in the expenses in healthcare provision for the latest years of life. This distribution of expenses and taxation is based on the life-cycle perspective that makes the generosity of the welfare state among the different generations more understandable.

Regarding the evolution of public debt as the ratio of GDP, since the recession of 2008 it has increased in recent years in the European countries. In 2016, the average public debt for EU-28 was 85% of GDP, 27 percentage points higher than in 2007. Likewise, the public debt per worker has increased since 2008, reaching its maximum in 2014 (Hanton 2016). In this sense, the high level of public debt is important regarding intergenerational terms because it represents the economic cost that future generations will have to face. Therefore, those cases in which the public debt is excessively high will damage the living standards of the youngest cohorts. According to Lucian (2013), the impact of taxation and public debt should be distributed fairly between generations, including the PAYG public pension system. On the other hand, the level of public debt is closely related to fairness and improvements in the labour market due to the fact that: i) an increase in productivity would decrease the ratio between public debt and GDP, and ii) because an increase in the number of workers in the economy would cause a fall in public debt per capita.
3.4. Education

The intergenerational equity of education seems to be an obvious postulate whose realization determines whether young people get access to better education through investments made by the working-age population in human capital development. Possible burdens on education spending charge middle-aged cohorts which are under-educated and have fewer competitive skills when entering the labour market. The financing of education is based on what is known as the implicit commitment (social contract) that the younger generations, once they complete their training, contribute to the system through their participation in the labour force and in production. Improvements in education financed by the government through taxation of the working-age population but also pensioners impacts the young workforce productivity which stimulates GDP growth and the future product. Therefore, investment in education and economic growth are correlated (Bajo 2005).

Investment in education depends on the policies implemented by the government. Such policy can change over time as politicians in power change and political goals evolve. Moreover, the political time-perspective is usually shorter than the economic one. As a result, cyclical decreases (underfunding) in investment in education are possible and may cause worse future job prospects for younger people relative to older workers who will obtain better wages and, as a result, will be paid higher pension benefits as compared to the younger generation. The relation between intergenerational fairness in education and the labour market is evident and affects even a pension system. In a three-period overlapping generation (OLG) model with a PAYG pension system, the working-age generation is willing to invest in education of the young generation and expects to be paid pension benefits in the future (after retirement) when the young generation will become the working-age generation (and will finance the pension benefits of their parents). Thus, in such a model pensions can be perceived as a form of return on the investment in education. These relations result from an implicit intergenerational contract which is actually based on reciprocity or even a promise (Richman and Stagner 1986; Boldrin and Rustichini 2000; Boldrin and Montes 2005, 2009).

3.5. Labour market

Intergenerational fairness also means that the different generations of workers receive a fair proportion of the total remuneration of the work as one of the production factors (European Commission 2017a). Therefore, economic growth is transferred to improvements and more competitive labour markets, from which society has the capacity to create new opportunities for future generations. According to the characteristics of the current and future labour market, the average activity rate (73% in 2016) in the European Union shows an upward trend, with an employment rate representing 71.1% of the European population (European Commission 2017a). However, there are important differences across countries in terms of the age- and gender structure of participation in the labour
force. Despite the fact that the employment rate for females has increased significantly in recent years, the wage gap still persists – males’ wages are 16% higher in average terms. Regarding the age groups, the employment rates of older men and women have been increasing. For older workers (55-64 years old), the employment rate in the EU equalled 55.3% in 2016. This represents an increase of two percentage points as compared to 2015. Nevertheless, the employment rate of older workers is still 23.5 percentage points lower than in the case of people aged 25-54. Older workers (aged 55-64) accounted for 16.9% of total employment in the 20-64 age group in 2016. According to projections, this proportion will rise to 19.5% in 2060, which will be the result of an ageing population, including the workforce (European Commission 2017a). Although in the last three years there have been significant improvements in the employability of the youngest (15-24 years old) and least qualified, this age group has been the most affected by the economic crisis, which is reflected in very high unemployment rates, especially in countries like Greece and Spain. In 2016, the youth unemployment rate in EU fell to 18.7% in average terms.

Although the trends are optimistic, the impact of the crisis is likely to have reinforced generational inequalities implied by long-term structural changes in European economies. The high youth unemployment has severe implications for the future situation of young people and their households, concerning e.g. lower salaries and lower financial stability. They are also more likely to accumulate less pension wealth and other savings. Moreover, the inferior economic situation can affect also their housing condition (lower home ownership rates).

The labour market flexibility can yield greater benefits and be more effective in terms of reducing the exclusion of young people from the social contract through a more effective and better financed education system, which is crucial for workforce competitiveness and productivity. However, on the one hand, low qualifications can cause high youth unemployment. Unemployment causes a decline in economic growth and, therefore, also in investment in education. On the other hand, there are agents who present "over-qualification" in relation to the demands of the labour market, which implies the inefficient use of qualifications, skills and knowledge. Consequently, it can be affirmed that the labour market inevitably becomes an element of pressure on the educational system and educational policies. The efficiency of this policy affects intergenerational relations. Regarding the relationship between the labour market and pension system, pension system and labour market reforms undertaken in recent years in many countries, as well as recommendations made by institutions such as the OECD or the European Commission, highlight the need to encourage "active aging". The main goal is to postpone retirement and extend the duration of working life. This is consistent with the idea of fair responsibility of different generations for the process of ageing population and, as a result, affects intergenerational fairness.

### 3.6. Healthcare

Healthcare presents two peculiarities to question the intergenerational fairness; on the one hand, the increase in health spending varies by age, and, on the other hand,
healthcare is heavily subsidized by government, contributions or taxes. People would either consume less when they are young in order to finance healthcare when they are older, or they would spend more on healthcare and less on other goods when they are older (Sheiner 2009). As some researchers claim (Sheiner 2009, Corak et al. 2005), the working-age population is the one that finances health expenditures while the greater benefits occur during old age. However, the difference between spending on pensions and healthcare is obvious. The former is devoted only to the generation of pensioners, whereas the latter is for all generations (from the youngest to the oldest).

Due to the aging population, an increase in life expectancy and technological development, most medical expenses occur in the last years of life (EEAG 2016), so similarly to old-age pensions, the public healthcare system allows old age agents to be independent (or at least independent to a significant degree) of their families. The combination of pension and medical benefits, which are ensured for the whole old-age period (like life annuities), allowed people to preserve larger shares of their accumulated assets (including e.g. home ownership, other durable goods). According to Bangham, Finch and Phillips (2018), a continuous increase in the cost of healthcare for each generation is noteworthy. Health spending was 9% of GDP on average in the OECD countries in 2016, ranging from 4.3% in Turkey to 17.2 in the United States (OECD 2017). According to the forecasts of the European Commission (2017b), healthcare costs will continue to grow, faster than revenues to the healthcare systems and GDP (providing a stable level of the system’s generosity). This means that the young cohorts will have to pay for the future increase in spending on healthcare. These are the same cohorts which have experienced very high unemployment rates.

4. Summary

Intergenerational fairness expresses the degree to which a society is capable of generating and distributing well-being among all its members (Sánchez-Santamaria and Manzanares 2012). Ensuring intergenerational fairness is one of the greatest challenges the European countries have to face today. The ageing population has important implications for economic growth and the fair distribution of resources between generations. The long-term socio-economic policy developed and implemented by governments has to account for a possible intergenerational conflict. Its goal should be to minimize the likelihood of this conflict and the tool to achieve this is to build a long-term and fair intergenerational contract. This means not to discriminate against any generation in favour of another. A fair intergenerational policy needs references to many dimensions, from which the most obvious in economic terms seem to be: pensions, incomes, taxation and public debt, education, labour market and healthcare. In this paper, we focused on these dimensions of intergenerational fairness and tried to justify them as well as to indicate their meaning in creating a fair intergenerational policy. We can conclude that all these dimensions are closely related one to each other. Moreover, all of them are closely linked to the life cycle theory. Intergenerational relations in the future are to a large extent determined by
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The distribution of resources between generations today affects what will be distributed tomorrow. Unfair distribution of current GDP will have its consequences in the future and any mitigation of these negative consequences will be very difficult in the short period since the economic situation of a given generation is the result of the intergenerational game, which has a zero-sum result in the short-term perspective. Thus, the inertia of intergenerational relations is very strong which means present relations determine future relations. This means that the future situation of young generation is shaped today.

We also see some other important aspects of intergenerational fairness that were not discussed in our paper, which however can constitute the subject of further conceptual developments. The first one is natural environment, which is more an ecological than an economic notion, but is nevertheless strongly embedded in sustainable development theory. The second one is housing, reflected e.g. by home ownership rates across different generations. As we mentioned before, migration is also an important aspect of intergenerational fairness; however, we perceive it more as a side-effect of intergenerational relations than a dimension of them. People emigrate to seek better jobs and higher incomes.

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PUBLIC PENSION SYSTEM SUSTAINABILITY

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**Abstract**  
Since many years the pensions debate has played a fundamental role in the political program of many countries of the world. The public PAYG pension schemes have faced a crisis due from one hand to the aging population for which the pension must be paid for a long time, and from the other hand the stoppage in economic growth has slowed down the flow of contribution revenue.  
In this work it is analyzed the sustainability of a PAYG pension scheme, after the introduction of a funded component to balance the PAYG part when the ratio between contributors and pensioners is decreasing. Risk indicators are presented to assess the sustainability of the scheme. The aim is to find the optimal share of the funding component, in order to maximize the sustainability indicators.  
**Keywords:** demographic risk, public pension system, sustainability.  
**JEL codes:** H55, J11, J26.

1. Introduction

Pension schemes can be classified, according to the financing method, into pay-as-you-go (PAYG) and funded. In a PAYG scheme retired generation's pensions is financed by contributions paid by current working-age generation. By contrast, in a funded scheme, the contributions of each generation are invested into a fund and the accrued amount is used towards meeting the benefits upon retirement. In Europe, public pension schemes are generally managed as PAYG while private are funded.

To be in balance, a PAYG pension scheme needs equilibrium between the contribution income and the pension expenditure. In many developed countries this balance has begun to fail due to the decrease in fertility rates and the increase in life expectancy that have reduced the share of active populations. The situation will be worse when the generation of the baby boomers will be retired in the next years.

In the last decades many governments, in particular in Europe, have implemented reforms in the public pension system. Some countries adopted some reforms like increasing the pensionable age, raising the contribution rates and limiting the generosity of retirement benefits; these reforms are usually called in the literature “parametric” (see also Disney 2000; Haberman and Zimbidis 2002).
Others countries, like Sweden, Italy, Latvia and Poland introduced *Notional Defined Contribution* NDC systems, which are financed on a PAYG basis, but where the pension is linked to the contributions paid during the working life, with a notional account for each participant (see Auerbach and Lee 2009; Settergren 2001; Settergren and Mikula 2005; Holzman et al. 2012). These schemes are “actuarially fair” because there is a direct link between the paid contributions and received benefits.

Another possibility to reform public pension system is the privatization. But, as pointed out in Fajnzylber and Robalino (2012), a transition process from PAYG to funding has high transition costs because a generation pays twice the pension. Diamond (2002) and Diamond and Orszag (2005), investigate the social security reforms and the social security policies in order to restore the long-term sustainability. Andersen (2012) addresses the fiscal sustainability of public policies when the demography is changing. Grech (2013) analyses the sustainability of pension reforms in Europe. Holzmann (2013) provide an exhaustive review of different pension reforms worldwide. Melis and Trudda (2012a, 2012b) study the sustainability of a PAYG pension fund also with the introduction of a funded component. The model is applied to the pension fund of Italian Professional Orders. Devolder and Melis (2015) study the financing of a public pension scheme in a stochastic framework. They introduce a funded component and develop a model to find the optimal share to invest in both systems. Godínez-Olivares et al. (2016) propose an automatic balancing mechanism to restore the sustainability of a PAYG pension system in order to calculate the optimal path of the contribution rate, age of retirement and indexation of pensions. Attias et al. (2016) analyze the Italian pension system in terms of adequacy, by proposing a reform based on the introduction of a fully funded component, when the population is stable.

In this paper we present a mixed model for a public pension scheme with the introduction of a funded component in order to analyze the future sustainability. For the PAYG part we adopt an NDC scheme, i.e. without the accumulation of resources, but with defined contribution. A funded component is introduced and it is analyzed how the financial sustainability varies with the partial accumulation of amount into a fund invested on capital markets.

### 2. The model

The model describes a pension scheme for a social security system in a discrete time with an age structured population. The population is closed to migration.

#### 2.1. Population

Let $N(x,t)$ be the population aged $x$ at time $t$, $\alpha$ is the entry age into the scheme, $\pi$ is the age of retirement and $\omega$ is the extreme age (See Fig. 1).
The population evolves as follows for each age:

\[ N(x,t) = N(x-1,t-1) \cdot p_{x-1,1} = N(x-t,0) \cdot p_{x-t,t} \]  

(1)

where \( p_{x-1,1} \) is the probability that a member aged \( x-1 \) is alive after one year. If \( N_{\alpha,t} \) the number of people aged \( \alpha \) at time \( t \), the cohort of the new entrants evolves as follows:

\[ N_{\alpha,t} = N_{\alpha,t-1} \cdot (1+d) = N_{\alpha,0} \cdot (1+d)^t \]  

(2)

where \( d \) is the rate of increasing of the new entrants.

2.2. Contributions

The total contribution \( C(t) \) is calculated as follows:

\[ C(t) = \gamma \sum_{x=\alpha}^{\pi} N(x,t) \cdot w(x,t) \]  

(3)

where \( \gamma \) is the contribution rate, \( w(x,t) \) indicates the average wage for a person aged \( x \) at time \( t \).

2.3. Wages

The wage function \( w(x,t) \) evolves as follows:

\[ w(x,t) = w(x,t-1) \cdot (1+g) = w(x,0) \cdot (1+g)^t \]  

(4)

where \( g \) is the annual growth of income.

2.4. Pensions

The total pensions are calculated by the following equation:

\[ P(t) = \sum_{x=\pi}^{\omega-1} N(x,t) \cdot b(x,t) \]  

(5)

where \( b(x,t) \) is the average pension for people aged \( x \) at time \( t \). The pension is the sum of two components, the former calculated with the PAYG system and the latter calculated with the funding system:

\[ b(x,t) = b_k(x,t) + b_p(x,t) \]  

(6)

After the retirement we assume that pensions are indexed at the rate \( g \):

\[ b(\pi+1,t+1) = b(\pi,t) \cdot (1+g). \]  

(7)
Let us consider the generation retiring at time $t$.

The funded component $b_f(x,t)$ is calculated by capitalizing on the contributions paid during the working life at the rate of return of the fund.

Indicating with $A_f(\pi,t)$ the amount accumulated in the funded scheme by a member of age $\pi$ at time $t$ we have:

$$A_f(\pi,t) = \gamma \cdot \sum_{x=\pi}^{\pi-1} w(x, t - \pi + x)(1 + i)^{(\pi-x)} \quad (8)$$

Indicating with $A_p(\pi,t)$ the notional amount accumulated in the NDC system by a member of age $\pi$ at time $t$ at the rate $j$ we have:

$$A_p(\pi,t) = \gamma \cdot \sum_{x=\pi}^{\pi-1} w(x, t - \pi + x)(1 + j)^{(\pi-x)} \quad (9)$$

Let us consider that a share of the contributions $a$ (with $0 \leq a \leq 1$) is invested in funding and the fraction $1-a$ is invested in PAYG.

For the PAYG component we calculate the value of the pension at time of retirement by multiplying the total contributory accrued amount by the annuity factor $TC(x,t)$, the transformation coefficient (see Janssen and Manca 2006) for a member aged $x$ at time $t$:

$$b_p(\pi,t) = (1-a)A_p(\pi,t) \cdot TC(\pi,t) \quad (10)$$

For the sake of simplicity we consider that all people retire at the same age $\pi$.

For the funded component we have:

$$b_f(\pi,t) = aA_f(\pi,t) \cdot TC(\pi,t) \quad (11)$$

The average pension is:

$$b(\pi,t) = TC(\pi,t)[aA_f(\pi,t) + (1-a)A_p(\pi,t)] \quad (12)$$

The pension balance is:

$$C(t) - P(t). \quad (13)$$

If a component is capitalized every year then $aC(t)$ is invested into the fund, while $(1-a)$ is used to pay PAYG pensions.

Then we will have the recursive formula of the fund:

$$F(t) = F(t-1)(1+r(t)) + aC(t) - P_f(t) \quad (14)$$

where $r(t)$ is the return rate of the amount invested in the fund and $P_f(t)$ indicates the total funded pensions paid at time $t$.

Without the accumulation into the fund, the general formula for the evolution of the system will be:

$$Y(t) = Y(t-1)(1+\theta(t)) + C(t) - P(t) \quad (15)$$

---

1 The notional rate $j$ is usually set by law.

2 The total pensions paid at time $t$ is the sum of the total PAYG and funded pensions at time $t$: $P(t) = P_{PAYG}(t) + P_f(t)$. 

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where \( Y(t) \) is the overall balance and \( \theta(t) \) is the rate of the cost of public debt (positive or negative).

If we accumulate the amount \( aC(t) \) into a fund, then the total balance will be:

\[
Y(t) = Y(t-1)(1 + \theta(t)) + F(t) + (1 - a)C(t) - P_{PAYG}(t)
\]

(16)

3. Numerical applications

This section presents a numerical example of the model above applied to a pension system. Italian data from ISTAT (Italian National Institute of Statistics) are used. We take into account only the data from dependent workers.

The following assumptions are adopted:

- the pension is calculated with the NDC pension system for people starting to work after 1996, while for people starting before 1996 pension is calculated using the mixed method, the so called pro rata. Until 1996, the defined benefit DB formula is used and the pension is calculated by multiplying the pensionable earnings, i.e. the mean of the earnings obtained over the final years of work, revalued at a given rate, by the number of years of contributions accrued in the DB system;
- italian mortality tables 2015 (source ISTAT);
- for new entrants fixed entry age \( \alpha = 25 \), retirement age \( \pi = 66 \);
- the inflation rate is fixed at 1.5\%;
- the contribution rate is fixed at 25\%;
- the last transformation coefficients (2016) have been employed;
- salaries are appreciated at rate of inflation;
- benefits are calculated with the mixed method;
- the return on assets is fixed at 2\%;
- the rate of cost of public debt is fixed at 1\%;
- the notional rate is fixed at 1.5\%.

The pension scheme balance is projected for 50 years. We first consider the case of \( a = 0 \), without the accumulation into the fund. The obtained results are summarized in Figures 2-6.
Figure 2 shows the projection of the total contributions received by the pension system. As it is possible to observe, there is an initial increase, but after 16 years there is a decrease in the total inputs. At the same time, by looking at Figure 3, we can see that in the same period of time there is an increase in the total pensions paid by the system. This situation causes a financial instability to the scheme because the system in the long run is not able to pay pensions without the public intervention to cover the pension liabilities.

Figure 4 shows the projection of the liquidity ratio, the ratio of the total contributions to the total pension. This relation is considered as an indicator of the liquidity of the system. For a system in equilibrium this value must be over 1. As we can see also this indicator is going to decrease after 16 years. Figure 5 shows the pension balance, i.e. the difference between the total contributions received and the total pensions paid, which reflects the same problem for the system.
In order to measure the level of individual performance, we calculate the replacement rate, the ratio of the first pension received to the last wage earned before the retirement. Figure 6 shows the projection of this indicator. As we can see, replacement rate is going to decrease, stabilizing slightly above 50%.

We must stress that we consider only full careers, i.e. 40 years of contribution. If, instead, you do consider the unemployment and delayed entry into the working world, the replacement rate will be even lower, about 40%.

Then we consider the case in which a fraction $a$ of the contributions is invested into a fund. We calculated the overall balance for different values of $a$ in order to
find the number of years it will get the balance of the system and a state of autonomy, without the intervention of the state to cover the negative balance. Our findings is that the minimum $\alpha$ that makes the system sustainable is $\alpha = 0.04$, for which the balance is positive after 27 years. The results are shown in Fig. 7.

![Overall balance for $a = 0.04$ – years 2013-2062](image)

Source: own elaborations.

4. Results and conclusion

In this paper we introduced a funded component in order to improve the sustainability of a public pension system, i.e. the capability of the scheme to cover the pension liabilities in the long run, given the actual and future demographic scenario.

The model has been applied to a fund with the features of the Italian public pension system.

For the public budget, if there is set aside a part of the contributions, after a number of years it will get the balance of the system and a state of autonomy, without the intervention of the state to cover the negative balance of social security.

The minimum component to be allocated according to the assumptions used in the simulations of new contributors, interest rate and cost of debt is 4% of the contributions, which ensures an overall positive balance after about 27 years.

On the other hand, at the level of individual performance, the replacement rate increases with the introduction of a capitalization component, but not significantly.

We must emphasize that in the paper hypothesis we consider only full careers, i.e. 40 years of contribution, as the purpose of the study is to assess the impact of the introduction to the public system of a capitalization component. If, instead, you do consider this, given the unemployment and delayed entry into the working world, the replacement rate will be even lower, about 40%.
References


TWO-STEPS MIXED PENSION SYSTEM: THE CASE OF THE REPRESENTATIVE INDIVIDUAL WITHIN A SOCIAL SECURITY NOTIONAL DEFINED CONTRIBUTION FRAMEWORK

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Abstract
The change in economic and sociodemographic reality, characterized by a continuous increase in longevity, the consequences of the economic crisis as well as the lack of adequate adjustments of the Social Security retirement pension systems everywhere, entail risks for workers and the Social Security itself. Many reforms of public pension systems have been carried out in recent years, based on modifying system parameters and structural changes. Some reforms aim at increase capitalization in the determination of the final pension through a life annuity to complement the public retirement pension as a second retirement income. Against the background of the change of agents’ behaviors throughout the life cycle and the presence of an adverse selection problem in the annuities market, we describe in this paper a ‘two-steps mixed pension system’ that tries to solve the pressure that increasing longevity is putting on pension schemes to provide adequate and sustainable pensions for all. In our two-steps mixed system, when workers reach their ordinary retirement age they receive a ‘term annuity’ generated by their previous capitalized savings to be replaced by a Social Security defined contribution ‘pure life annuity’ when the so-called ‘grand age’ is reached. The analysis is carried out from an individual perspective, through the Internal Rate of Return that workers will receive since ordinary retirement in both schemes compared with the one they would get with the same contributions in the current situation. We also analyze some possible transition strategies to the new system.

Keywords: grand age, individual analysis, term annuity, two-steps mixed system.

JEL codes: G00, G22, G29.
1. Introduction

The objective of Social Security can be defined as protecting workers against old age and related risks, which they cannot cope with individually. The conventional mixed pension systems are based on a two-pillar structure with a first pillar being the conventional SS, pay-as-you-go scheme that provides a public retirement pension which is complemented with a life annuity, generated by a fully funded, employers’ sponsored scheme. Both benefits are received during the entire retirement period in a simultaneous and complementary way. We will name this type of conventional complementary system “standard system” in our analysis. Thus, many countries have included the complementarity of public and private pensions in their pension system, seeking that the income Social Security grants to pensioners, coming from the pay-as-you-go system, be supplemented with income generated by a private defined contribution funded system (Herce et al. 2017).

For income security reasons, the income which contemporarily complements the public system should be a life annuity similar in amount to Social Security benefits (Galdeano et al. 2018). This obliges the providers of the product and/or the benefit holders to be strongly exposed to the longevity risk, since as life expectancy increases regularly, the value of the periodic income will be reduced, given the premium paid ex ante by the beneficiary. It is therefore necessary to make a relevant saving effort, a careful planning of such effort and a sound risk assessment to adequately complement for life, the equally life-long provision of the Social Security, from retirement age to death.

Mitchell et al. (1999) show that life annuities in the United States are between 15% and 25% lower than those obtained when using overall population mortality tables. Finkelstein and Poterba (2000) also show that life annuities in the UK, which are taken out by 65-year-old men, are between 10% and 15% lower than those that would be obtained using ordinary overall population mortality tables. Note that the problem that occurs when adverse selection and over-weighted mortality combine in the case of life annuities is significantly reduced in the case of term annuities.

We can say that this “standard system” suffers several problems. Firstly, annuities entail a severe problem of adverse selection (see Blake et al. 2008; Domínguez et al. 2018; Herce and del Olmo 2013; Whitehouse and Zaidi 2008; Morales and Larraín 2017) and thus they become unduly expensive. On the other hand, the kind of longevity insurance, offered by the Social Security, is unsustainable as the system has barely changed the retirement age since it was created, when life expectancy at birth was around 40 years, and around 10 years at age 65.

In this paper we present what we call a “two-step” mixed pension system in which contributions are paid as in the standard system but benefits are received by steps: a DC term annuity from retirement until grand age and a Social Security NDC life annuity afterwards.

This two-steps pension system solves two major problems: the adverse selection problem in private pensions and the pension adequacy problem in public pensions. Social Security, in particular, will continue to be PAYG but
will have to pay better adjusted benefits for a shorter period thus managing more efficiently longevity risk.

As said, workers’ and employers’ contributions are assumed to be the same as in the standard model, while benefits since retirement are restricted to be at least as good as in the standard model. Our quest is thus for those conditions under which retirees improve under the two-steps system with respect to the standard system.

The pension model we have baptized as a ‘two-steps’ mixed pension system is based on the need to adapt pension schemes (public and private) to the longevity-induced behaviors of individuals, and responds to those financial needs that workers cannot cope with individually faced with ever increasing longevity.

In this paper, firstly, we define the two-steps model, in order to make a comparison in mathematical terms in the second section, from the individual point of view, of the standard system and the two-steps one. In the third section we perform a graphical comparison to illustrate the case and in the fourth section we analyze this empirical relationship concluding the paper with a summary discussion of the main results and some ideas about the transition from the standard mixed system to the two-steps mixed pension system.

2. Description of the ‘two steps mixed pension system’

Pension systems are structured in two main flows: during the contribution phase individuals contribute a part of their salary until the retirement age \( x_j \). After which, during the retirement stage, they perceive a total lifetime pension from the system, generated since the retirement moment until the death event. This general scheme runs everywhere, regardless of the system, either a pure public pay-as-you-go (PAYG) system, a funded system or a mixed system.

Taking into account the demographic risks and the fact that most of the reforms implemented seek to make the system sustainable, mainly through reduction in the amount of pensions, this implies a problem of adequacy of benefits and, therefore, a strong risk of impoverishment for retired people.

The two-steps system that we propose, considers a period of active life, from the beginning of the working life to the moment of retirement (chosen with sufficient flexibility); and a retirement period that is divided into two steps: one from ordinary retirement age to the so-called ‘grand age’ (the ‘old age’, that historical Social Security systems fixed at inception) and another one from that ‘grand age’ until the individual’s death.

During the active stage, contributions will be made both to a DC funded scheme and to a reinvented NDC Social Security scheme. It is very important to indicate that, in our analysis, these levels of contributions will be the same in the two-steps system than in the standard system. Thus, annual contribution made by individuals is divided into two parts:

- A part of the contribution generates a term actuarial income that the worker will receive from the moment he or she retires to the so-called grand age.
- The other part of the contribution allows to finance pensions generated by a Social Security scheme based on NDC accounts, which consists of a life annuity which pays a monthly income from the mentioned grand age until the individual's death event.

Therefore, when an individual retires, in the two-step mixed system he or she will receive a term income, based on capitalization rules, from the retirement age he/she has freely chosen until the grand age, after which he or she will receive a retirement pension financed through a NDC account PAYG method, until the moment of death.

This ordering of contribution and benefit flows solves several crucial aspects of the pension arithmetics and workers’ behavior, namely:

- Firstly, during the first retirement step, between the ordinary retirement age and the grand age, a term annuity or retirement income based on private capitalization is paid. Due to this reason, each worker, duly informed and according to his or her long-term savings achieved, will be in the best conditions, to choose the ordinary age in which he or she want to retire, or even making both statuses compatible as Social Security permits this often. Temporary incomes will ideally be insured through actuarial products and, due to the fact that they do not cover a lifetime period (but limited up to the grand age), longevity risk gets effectively capped and efficiently covered until grand age. The highest efficiency derives by the fact that term annuities are not designed with the aim of covering ordinary longevity risk, which increases enormously after grand age and which is, clearly, more expensive to hedge.

- Secondly, during the second step, which occurs between the grand age and the death event, retired people perceive a retirement pension from Social Security, which, by definition, is structured by an annuity calculated with strict actuarial criteria. As it is said above, this pension is financed through the pay-as-you-go method, so formally the system of this second step is equivalent to a public system with notional defined contribution individual accounts (an NDC scheme).

This way of presenting the sequence of contributions and benefits combined in time, is what allows us to talk about the ‘reinvention’ of Social Security (Herce and del Olmo 2013).

The following diagram compares the standard model with the two-steps mixed system that we propose. Diagram 1 shows the contributions and benefits blocks for each scheme in a crude illustration of the actual numbers we have assumed for the standard system. It also shows the rearrangements that contributions and benefits must undergo in order to implement the two-steps idea without net losses for individuals.
3. Comparative analysis of the standard system and the two-steps system in terms of individual financial solvency

This section shows a comparative analysis, in terms of financial-actuarial solvency, between the standard system and the two-steps one. There are two basic periods: capital accumulation, which goes from $X_0$ (age of access to a first job) to $X_r$ (retirement age) and the period of decumulation, which takes place from $X_r$ to $\omega$.

Some remarks are in order:
1) Funded capital $C_F^{X_r}$ can be supplemented with other wealth sources, a house, for instance. The financial strategy is decided by individuals depending on their previous saving decisions.
2) In the two capital computations, life tables haven’t been used, these will be used for computing benefits after retirement age $X_r$.
3) An overlapping generations model with four periods, where steady state is defined as: $X_0 = X_{r-1}$, $X_g = X_{r+1}$ and $w = X_{g+1}$.

3.1. Accumulation period

Through a mixed system structured by a notional accounts pillar (NDC) and by a funded pillar (FDC), being the accumulation period the same both in the standard system and in the two-steps system. Both systems share the following information:

- $\pi_N$ = Contribution rate in NDC pillar.
- $\pi_F$ = Contribution rate in Funding pillar.
- $C_F^{X_r}$ = Funded capital obtained through the NDC pillar at retirement age $X_r$.
- $C_N^{X_r}$ = Notional capital obtained through the FDC at retirement age $X_r$.
These capitals are given by:

a.- Notional Part (NDC):

\[ C_N^{X_r} = \sum_{X=X_0}^{X_{r-1}} \pi_N \cdot W(X) \cdot (\Pi_{y=x}^{X_r}(1 + r_y)) \]  

where:

\[ W(X) = \text{Salary at age } X \]
\[ r_y = \text{Notional rate applied at age } y \text{ (between } y \text{ and } y+1) \]

For initial wage \( W(X_0) = 1 \) and being \( r \) the notional rate of the NDC we have:

\[ C_N^{X_r} = \pi_N [(1 + r)^2 + (1 + \beta) \cdot (1 + k) \cdot (1 + r)] \]  

where:

\[ \beta = \text{constant inflation rate}; \]
\[ k = \text{baremic increase of salary} \]

b.- Funded part (FDC):

\[ C_F^{X_r} = \sum_{X=X_0}^{X_{r-1}} \pi_F \cdot W(X) \cdot (\Pi_{y=x}^{X_r}(1 + f_y)) \]  

where:

\[ W(X) = \text{Salary at age } X \]
\[ f_y = \text{Financial return at age } y \text{ (between } y \text{ and } y+1) \]

For the canonical choice (steady state) \( (1 + r) = (1 + d) \cdot (1 + \beta) \), being \( i \) the technical interest rate of the insurer

\[ C_F^{X_r} = \pi_F [(1 + i)^2 + (1 + \beta) \cdot (1 + k) \cdot (1 + i)] \]  

3.2. Decumulation period

In the standard system, each of the two capital amounts is converted into a pure life annuity, following the NDC technique or the funding “insurance” technique. In the two-steps system, the funded capital is converted into a term annuity, which will provide retirement income between the retirement age \( X_r \) and the grand age \( X_g \), being the notional capital deferred until age \( X_g \) and then converted into a life annuity, and a proper Social Security pension, however, between grand age \( X_g \) and death.

Several parameters have to be taken into account:

\[ d = \text{rate of demographic increase}; \]
\[ \beta = \text{constant inflation rate}; \]
\[ k = \text{baremic increase of salary}; \]
\[ i = \text{technical interest rate of the insurer}. \]

In relation with mortality, few other hypothesis are needed:

1) We have not assumed mortality before retirement age.
2) We have assumed that, after retirement, \( p_{X_r} \) is the probability to survive until grand age being alive at retirement age.
3) We have assumed that the mortality rate used by the insurer is given by

\[ p_{X_r}^* = p_{X_r} \cdot (1 + \alpha) \]  

with \( \alpha > 0 \) and \( \alpha \) being the safety coefficient.

Loading applied by the insurer (commission) on life annuity is \( g \).

The price of the life annuity (indexed) is given by:
Two-steps mixed pension system: the case of the representative individual...

\[ a_{x_r}^F = \frac{1}{1 - g} \cdot \left[ 1 + \frac{p(1 + \alpha)(1 + \beta)}{(1 + i)} \right] \]

3.2.1. In the standard system, total retirement income is composed by two different life pensions, one coming from funded scheme and the other coming from the NDC Social Security scheme.

1) Funded part in the standard system

First pension benefit at retirement age is:

\[ R_{F_r}^{X_r} = \frac{C_{F_r}^{X_r}}{a_{x_r}^F}; \quad R_{F_r}^{X_r} = \pi_F \cdot \frac{[(1+i)^2 + (1+\beta) \cdot (1+k) \cdot (1+i)]}{\frac{1}{1-g} \cdot \left[ 1 + \frac{p(1+\alpha)(1+\beta)}{(1+i)} \right]} \]  

(5)

The unfunded pension is computed with the following expression:

\[ R_{F_r}^{X_{r+1}} = R_{F_r}^{X_r} \cdot (1 + \beta) \]  

(6)

2) The notional part in the standard system

\[ R_{N_r}^{X_r} = \pi_N \cdot \frac{[(1+r)^2 + (1+\beta) \cdot (1+k) \cdot (1+r)]}{1+p \cdot \frac{1+\beta}{1+r}} \]  

(7)

The unfunded pension is now computed with the following expression:

\[ R_{N_r}^{X_{r+1}} = R_{N_r}^{X_r} \cdot (1 + \beta) \]  

(8)

3.2.2. In the two-steps system there are two also pension flows, one coming from the funded pillar and received from \( X_r \) to \( X_g \) and another one coming from the NDC pillar that is received from \( X_g \) to death.

1) Funded part (at retirement age) in the two-step system

\[ R_{F_r}^{X_{r}} = \pi_F \cdot \frac{[(1+i)^2 + (1+\beta) \cdot (1+k) \cdot (1+i)]}{\frac{1}{1-g}} \]  

(9)

2) Notional part (at grand age) in the two-steps system where the notional capital at grand age becomes

\[ C_{N_{r+1}}^{X_{r}} = C_{N_r}^{X_r} \cdot \frac{1+r}{p} = \pi_N \cdot \frac{1+r}{p} \cdot [(1 + r)^2 + (1 + \beta) \cdot (1 + k) \cdot (1 + r)] \]

\[ R_{N_r}^{X_{r+1}} = \pi_N \cdot \frac{1+r}{p} \cdot [(1 + r)^2 + (1 + \beta) \cdot (1 + k) \cdot (1 + r)] \]  

\[ R_{F_r}^{X_{r+1}} = 0 \]  

(10)

Table 1 shows the pension computations in each system.
Table 1. Pensions in each system in one overlapping generation model with four periods, and with steady state

<table>
<thead>
<tr>
<th>Age</th>
<th>Pensions in the classical complementary system</th>
<th>Pensions in the two steps system</th>
</tr>
</thead>
<tbody>
<tr>
<td>(X_r)</td>
<td>(R^X_{F} + R^X_{N} = R^X_{r})</td>
<td>(R^*X_{r})</td>
</tr>
<tr>
<td>(X_G = X_{r+1})</td>
<td>((R^X_{F} + R^X_{N})(1+\beta) = R^X_{r+1})</td>
<td>(R^*X_{G})</td>
</tr>
</tbody>
</table>

Source: own calculations.

We now compare both systems, from an individual point of view, though the Internal Rate Return (IRR).

In the standard system, we have:

\[
C_N + C_F = R^{X_r} + \frac{p}{1+IRR} \cdot R^{X_{r+1}}
\]  

And in the two-step system we have:

\[
C_N + C_F = R^{X_r} + \frac{p}{1+IRR^*} \cdot R^{X_{r+1}}
\]

And the main question is how IRR compare in both systems. So we will try to find conditions such that it could be proved that two-steps system IRR* is higher than standard IRR.

Assuming capital amounts at retirement to be known, it implies that it is not necessary to work with the contribution rate and we can concentrate in what happens only after retirement provided capitals in both situations are the same.

Firstly, sensibility analysis is the best way to compare the interest rate \(i\) and the notional rate \(r\). So we consider the following cases.

Case 1. Without management fees to be paid during funding and using the same as table to notional and the funding and with the interest rate \(i\) different to notional rate \(r\).

\[
IRR^* > IRR \quad \text{if and only if:} \quad \frac{p \cdot R^{X_{r+1}}}{C - C_F} > \frac{p \cdot R^{X_r}(1+\beta)}{C - R^{X_r}}
\]

with \(C = C_N + C_F; \ R^*_{N} r^{X_{r+1}} (C - R^{X_r}) > R^{X_r} (1 + \beta) (C - C_F)\)

with \((C - C_F) = C_N\)

\[
R^*_{N} r^{X_{r+1}} = C_N \cdot \frac{1 + r}{p}
\]

\[
R^{X_r} = R^X_{F} + R^X_{N} = \frac{C_F}{1 + p \cdot \frac{1 + \beta}{1 + i}} + \frac{C_N}{1 + p \cdot \frac{1 + \beta}{1 + r}}
\]

It is obtained:

\[
C_N \frac{1 + r}{p} \left[ C_F + C_N - \frac{C_F}{1 + p \cdot \frac{1 + \beta}{1 + i}} - \frac{C_N}{1 + p \cdot \frac{1 + \beta}{1 + r}} \right] = \left( \frac{C_F}{1 + p \cdot \frac{1 + \beta}{1 + i}} + \frac{C_N}{1 + p \cdot \frac{1 + \beta}{1 + r}} \right) (1 + p) C_N
\]
Or
\[
\frac{1+r}{p} \left[ C_F \cdot p \frac{1+\beta}{1+i} + C_N \frac{1+\beta}{1+r} \right] = \left( \frac{C_F}{1+p} \frac{1+\beta}{1+i} + \frac{C_N}{1+p} \frac{1+\beta}{1+r} \right) (1 + \beta) \] (13)

Finally
\[
\frac{C_F}{1+p} \frac{1+\beta}{1+i} + \frac{C_N}{1+p} \frac{1+\beta}{1+i} = \frac{C_F}{1+p} \frac{1+\beta}{1+i} + \frac{C_N}{1+p} \frac{1+\beta}{1+r} \] (14)

Getting the final conventional condition that
\[
\frac{1+r}{1+i} > 1
\] (15)

for the NDC pension to be larger than the DC one.

Result 1. It can be appreciated that the relation between the IRR will be independent of the proportion \( C_F/C_N \) and then, without fees paid and using the same life table for notional and funding computations, in terms of IRR for both systems:

1) If \( r > i \) then two-steps system is better in term of individual IRR
2) If \( i > r \) then standard system is better in term of individual IRR

Case 2. Working with the general case with fees paid in the funding scheme and using the different like life table to notional and the funding and with the interest rate \( i \) different to notional rate \( r \).

\( i \neq r \); \( p^* \neq p \); \( g \neq 0 \)

It will be used the same relation that in Case 1 above \( R_{Nr}^{Xr+1} (C - R_{Nr}^{Xr}) > R_{Xr}^{Xr} \) \((1 + \beta) (C - C_F)\) and the only difference now is the way to compute \( R_{Xr}^{Xr} \):
\[
R_{Xr}^{Xr} = R_{F}^{Xr} + R_{N}^{Xr} = \frac{C_F(1-g)}{1+p^* \frac{1+\beta}{1+i}} + \frac{C_N}{1+p^* \frac{1+\beta}{1+r}} \] (16)

Getting now
\[
C_N \frac{1+r}{p} \left[ C_F + C_N \frac{1+\beta}{1+i} + g \right] = \left( \frac{C_F}{1+p} \frac{1+\beta}{1+i} + \frac{C_N}{1+p} \frac{1+\beta}{1+r} \right) (1 + p) C_N
\]

\[
\frac{1+r}{p} \\left[ C_F \cdot p^* \frac{1+\beta}{1+i} + g \right] = \left( \frac{C_F(1+g)}{1+p^* \frac{1+\beta}{1+i}} + \frac{C_N}{1+p} \frac{1+\beta}{1+r} \right) (1 + \beta)
\]

or
\[
\left( \frac{C_F}{p} \frac{1+r}{1+i} (1 + \beta) + g \cdot \frac{1+r}{p} \right) = \frac{C_F(1+g)(1+\beta)}{1+p^* \frac{1+\beta}{1+i}}
\]
Finally
\[ \frac{p^*}{p} \cdot \frac{1+r}{1+i} (1 + \beta) + g \cdot \frac{1+r}{p} > (1 + g)(1 + \beta) \]  \hspace{1cm} (17)

or
\[ \frac{p^*}{p} \cdot \frac{1+r}{1+i} > 1 - g - \frac{g}{p} \cdot \frac{1+r}{1+\beta} \]  \hspace{1cm} (18)

If \[ \frac{1+r}{1+i} > \frac{p^*}{p} \left( 1 - g - \frac{g}{p} \cdot \frac{1+r}{1+\beta} \right) \] then, the two-steps system is better.

But if \[ \frac{1+r}{1+i} < \frac{p^*}{p} \left( 1 - g - \frac{g}{p} \cdot \frac{1+r}{1+\beta} \right) \] then, the standard system is better.

This can be written as a condition on the Rate of Return as follows:

If \[ 1 + i > \frac{(1+r) \frac{p^*}{p} (1+\beta)}{1-g-\frac{g}{p} \cdot \frac{1+r}{1+\beta}} \]

Then, IRR in the standard system \( > \) IRR in the two-steps one.

In particular, if \( p^* > p \) and \( g > 0 \) then \( \partial_1 = \frac{p^*}{p} > 1 \) and \( \partial_2 = \frac{1}{1-g-\frac{g}{p} \cdot \frac{1+r}{1+\beta}} > 1 \)

So if \[ 1 + i > (1 + r) \cdot \partial_1 \cdot \partial_2 \], then, IRR of the standard system \( > \) IRR of the two-steps one.

Result 2. The “i” must be very large to compensate for extra longevity in the life table (to cope with adverse selecion) and for the fees paid and an important conclusion is that the condition is independent of the relative level of the two capitals under both systems, \( C_N \) and \( C_F \).

On the other hand, and although the results on IRRs are independent of the relative level of the capitals, it is considered that it will be desirable that the two capitals at retirement (notional capital, \( C_N \) and funding capital \( C_F \)) are roughly equivalent in order to assure some continuity in the levels of retirement income in the transition from the funded income to the NDC income under the two-steps system.

The condition is that:

\[ R^{*Xg} = R^{*Xg-1}(1 + \beta) \]  \hspace{1cm} (19)

And in our 4 period model, \( X_g = X_r + 1 \).

And \( R^{*Xr} = C_F \); \( R^{*Xr+1} = C_N \frac{1+r}{p} \); the condition \( R^{*Xr+1} = R^{*Xr}(1 + \beta) \);

becomes
\[ C_N \frac{1+r}{p} = C_F (1 + \beta) \] or \[ \frac{C_F}{C_N} = \left( \frac{1+r}{1+\beta} \right) \frac{1}{p} \]  \hspace{1cm} (20)

Result 3. In the two-steps system, if it is desirable to maintain continuity in pensions, it is necessary for the ratio set between the capital amount obtained by the funded pillar and the notional accounts pillar to be a function of the notional rate, the growth of wages and the probability of survival.

In the following section, through an empirical analysis, the results obtained in this section, from a theoretical perspective, are illustrated.
4. Empirical analysis

In this section, the conclusions obtained above will be matched with two examples and the follows graphics show like IRR change in relation with the changes in another parameters. The basic parameters are shown in Table 2.

Table 2. Basic parameters considered

<table>
<thead>
<tr>
<th>Initial salary</th>
<th>W(X0)</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant inflation rate</td>
<td>B 0.02</td>
<td></td>
</tr>
<tr>
<td>Increase of salary</td>
<td>R 0.01</td>
<td></td>
</tr>
<tr>
<td>Total Capital</td>
<td>C 1000</td>
<td></td>
</tr>
</tbody>
</table>

**Case 1**  
Increase of probability Alfa 0 0.021  
Probability company p* 0.95 0.97  
Demographic increase d 0.08  
Probability real p 0.95  

**Case 2**  
Increase of probability Alfa 0 0.021  
Probability company p* 0.95 0.97  
Demographic increase d 0.08  
Probability real p 0.95  

<table>
<thead>
<tr>
<th>NDC parameters</th>
<th>Contribution rate of NDC</th>
<th>0.8</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Notional rate</td>
<td>r 0.04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DC parameters</th>
<th>Contribution rate of Funding Pillar</th>
<th>0.2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fees for the life annuity</td>
<td>g 0 0.0125</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: own calculations.

Case 1. Without commission in the funding and using the same like table to notional and the funding and with the interest rate i different to notional rate r.

Case 2. It is interesting to work with the general case with commission in the funding and using the different like table to notional and the funding and with the interest rate i different to notional rate r.

Case 1 is shown in left panel of Graph 1 below. We use different values of i to show the effect on IRR in the standard system and in the two-step system. The IRR of the standard system is higher than the IRR in the two-steps system only when the interest rate exceeds the value of the notional rate. This extreme case however is no realistic.

Fig. 2. IRR with r = 0.04 and with different values of i
Source: authors’ elaboration.

Case 2 is shown in right panel of Graph 1 above. Using different interest rate values, and then verifying that even in cases where the interest rate is higher than
the notional rate, the IRR of the two-steps system can be higher than the IRR of the standard system, and only in cases in which the interest rate is more than twice the notional rate, the IRR of the standard system is higher.

From an individual perspective, thus, the IRR is better, under the assumptions adopted, for the two-steps system than for the standard system. This improvement is due to the superior profitability of a term annuity over that of the pure life annuity.

Now some other numerical examples will be presented, based on the parameters assumed in Table 2 above, where capital amounts are such as to ensure continuity of benefits in the two-step system.

It is shown in left panel of Graph 2 below how the amounts of pensions are reduced as survival probability increases.

Central panel of Graph 3 above shows how the amounts of pensions increase as the notional rate increases, for given values of survival probability and inflation rate.

Finally, right panel of Graph 3 above shows how pensions are reduced in value as the inflation rate increases, with given survival probability and notional rate. To be noted in this graph how the amount of pension at $x_g$ is constant.

5. Conclusion

What we have termed the ‘standard mixed system’ or, in short, the ‘standard system, has two pension schemes. A Social Security, PAYG albeit NDC, scheme and a fully funded (compulsory) DC scheme. In a way, this set up represents well many of advanced countries’ pension arrangements. Many other countries, where Social Security DB schemes are prevalent and DC pension arrangements are complementary and voluntary, are however marching towards that kind or total pension set ups through continuous reforms.

All these pension systems, however, are far away from having fully adapted to the increase of life expectancy that all nations have witnessed in last hundred years, just after Social Security was invented in continental Europe.

Our ‘two-steps mixed pension system’, or ‘two-steps system’, proposal tries to put pensions in line with the social, demographic and economic reality of the 21st Century. Its concept is simple, and amounts to a kind of reinvention of Social
Security. We still consider ‘ordinary retirement’ around age 65, say, although workers should have large capacity to decide when to retire or whether to retire at all, as long as they are aware of the numbers concerning their savings till that age and how to handle them via term annuities until what we call their ‘grand age’ as we are not contemplating Social Security pensions until precisely that grand age. This is why we call this total pension scenario the ‘two-steps system’.

That is, workers, once retired at ordinary retirement age, count on a term annuity obtained out of their previous savings, real assets or contributions to a funded scheme, for their living, but cannot count on public pensions until they reach their grand age. When a renewed NDC Social Security, will grant them, against their previous social contributions, a life public pension till death.

Grand age, by the way, when defined, for instance (there are several metrics that are relevant here), as that age today at which life expectancy coincides with life expectancy at 65 in 1900, will easily lie, for many advanced countries, around 80! We are not that extreme in this paper, but what historical European Social Security systems did around 1900 was, exactly, this: to protect workers from their grand age until death.

In our view, this arrangement is more effective and more efficient than standard pension practice everywhere. As term annuities are cheaper than life annuities, they suffer from far less adverse selection, they don't need longevity adjustments that are expensive, and, together with Social Security pensions, induce more productive behavior on workers.

Our numeric results show indeed that the two-steps system has a higher IRR than the standard system for workers and that only under rather exceptional conditions things would be the other way round. The economy would also profit from that because of the larger availability of long term saving and more active mature workers. This, of course, for identical saving efforts during labor life to both systems.

When considering transitions aspects, were we to depart from the standard system towards the two-steps system, it is important to consider that our simulations have been done for identical saving + contribution efforts, equivalent to current ones in advanced societies. So that transitional costs could be relatively small and easy to compensate with transitional benefits.

Other relevant transitional issue concerns who to let move from the standard system to the two-steps system. Many alternatives exist, but they share a dividing age line among current workers. However, a crucial element appears in this scenario. That is the fact that the NDC Social Security life annuity could well be higher than the DB Social Security it would replace.

Lastly, but not precisely least important, it is the issue of where to place the grand age in the time arrow. The grand age is the cornerstone of the two-steps system design and almost everything depends on its choice. To reassure the reader, we aren’t saying that the grand age should be set at 80, or latter. In fact, in our computations, this age has been set at 75. Two other things are important about this variable. First, it should be set so that the aggregate balance of the NDC Social Security scheme, that continues to be of a PAYG nature, reaches and keeps
a proper balance between its income and expenditure flows over time. Second, and closely related to the previous one, this age should be regularly reassessed to keep proper distance with life expectancy.

On the other hand, the first step DC scheme is sustainable by definition, even if it also should be rearranging some of its parameters with time if term annuities have to be kept adequate.

For the sake of easing transitional issues related to fairness, income adequacy and sustainability of the whole two-steps system, many things could be done at relatively low cost, given the superior efficiency and shorter term effectiveness of this system as compared, for instance, with a deep replacement of sole Social Security systems today with fully funded mixed systems tomorrow. The details concerning these crucial transitional issues are left for further research by the authors.

References


Downloadable at //blog.institutoaviva.es/pensiones-en-transicion-sistemas-de-pensiones/


Abstract
The initiation of benefits versus postponement of benefits decision and the optimal age for starting Social Security benefits are subjects of many recent papers. By law, benefits are paid only to live beneficiaries. Thus, the anticipated future benefits should be weighted by the recipient’s survival probabilities – the probabilities that the recipient is alive when the benefits will be received. Many published papers, mainly by business school’s professors, assume that benefits will be received “on average” throughout the recipient’s expected remaining lifetime and estimate the present value of Social Security benefits by discounting the cash flow through life expectancy. This paper shows that the preferred approach is to estimate the Actuarial Present Value (APV) which weighs each future payment by the probability that it will be received. Based on survival probabilities and life expectancy tables that are compiled by the CDC the paper demonstrates that the present value through life expectancy approach overstates the APV by approximately 5-8 percent. Therefore, timing decisions that are not based on the APV are incorrect.

Keywords: retirement annuities, social security.

JEL codes: D81, J26, H55.

1. Introduction
Almost all American workers are entitled to receive Social Security benefits when they retire, and this entitlement represents an important source of retirement income for most retirees. The Social Security entitlement is often called Social Security Wealth by economists, see for example Martin Feldstein (1976) who argued Social Security wealth must be added to fungible wealth when figuring out people’s Total Wealth. Social Security Benefits (SSB) may be initiated at any age between 62 and 70. Retirees who choose to initiate SSB at a younger age, all other things equal, will receive smaller benefits than those who postpone initiation of SSB to a later age. On the other hand, early initiators receive their reduced SSB for a longer period. The optimal timing for initiating SSB has been the subject of many recent papers. It is generally agreed that the timing of initiation versus postponement of benefits decision may have significant consequences, but there is less agreement on how to model the problem or measure its financial implications. All recent papers use present value (PV) calculation to compare alternative future cash flows but they differ in the way they account for the fact
that SSB are paid only to live recipients who have uncertain lifetime (see Docking et al. 2013 for a recent literature review).

SSB are Whole-Life-Annuities – the benefits are paid monthly for as long as the beneficiary survives\(^1\). Since SSB are paid only to live recipients, each anticipated future payment should be weighted by the probability that the payment will be received. That is, future payments should be weighed the probability that the recipient or his/her spouse will still be alive at the beginning of the period in which a payment is due. Thus, the expected present value of any future payment is determined not only by its discount rate assumption and cash flow definitions but also by the time horizon over which payments are assumed to be received.

The correct method to calculate the present value of SSB is the Actuarial Present Value (APV), also known as the Expected Present Value. The seminal paper that uses APV in economics (for the general case of demand for annuities) is Yaari (1965), but the actuarial literature is much older (see e.g. de Witt 1670-1672 and Allen 1907). The APV is computed by multiplying each present value of a future payment by the probability that it will be received and all the products are then added up. Examples of papers using the APV are Munnell and Soto (2007), Coile et al. (2002), Friedman and Phillips (2008, 2010) and Friedman (2018).

When they calculate the SSW many professionals, financial advisers and business school professors assume that annuity payments will be received “on average” throughout a beneficiary’s Expected Remaining Lifetime (ERL) and estimated the present value of an Annuity Certain with a time horizon that equals the ERL. However, as Jordan (1967) stated, this is a “persistent misconception.” Jordan proved mathematically that the APV of a life-annuity at age \(x\) is, in fact, smaller than “the present value of a life annuity certain for a term equals to the life expectancy at age \(x\)” (see Jordan 1967, p. 174). Examples of papers using this approximation are Fraser et al. (2000), McCormack and Perdue (2006), Spitzer (2006), Docking et al. (2013) and many others.

This paper explains why the APV method is the preferred method when compared to Annuity Certain with ERL as the time horizon (ACLE). Using survival probabilities and life expectancy tables that are compiled by the Center for Diseases Control (CDC) this paper demonstrates that the ACLE approach overstates the APV by approximately 5-8 percent.

The ACLE approach is even more problematic when the present value of a joint annuity evaluated. In the USA married couples can choose to receive Social Security benefits as two single individuals, as an individual and his/her spouse, or as a surviving spouse (if the other spouse is deceased). For the case of married couples, the value of each period’s benefits depends on the probability that the spouse A and spouse B are jointly alive, the probability that spouse A is alive and the spouse B is dead and the probability that spouse B is alive and spouse A is dead. Thus, the APV cannot simply be approximated by the sum of spouse A and

\(^1\) Actuaries call an annuity “whole-life” when payments are made for as long as the beneficiary survives. That is, survival is a condition for receiving payment. Most readers of this Review are familiar with “annuity-certain” which has a fixed (certain) time horizon.
A prevalent bias in evaluating life annuities

spouse B’s ACLE as was done, for example, by McCormack and Perdue op. cit. and Docking et al. op. cit.

It should be noted that the SSB of married couples is a joint-life annuity, with benefits received until the second spouse dies. Thus, the life expectancy that matters is the couple’s joint life expectancy, not the spouses’ life expectancies as individuals: For example, the ERL of a 66 years old male is 16.9 and the ERL of a 66 years old female is 19.5, but the joint life expectancy of a married couple (where both husband and wife are 66) is 25.3 years -- one of them is likely to survive that long\(^2\). Moreover, consistent with the formal definition of ERL, the probability that a person will outlive its life expectancy is 50\% (that is, 50\% of people die before their ERL and 50\% die after their ERL). For a married couple, the probability that at least one member of a couple will outlive his/her life expectancy 75\%.

This paper proceeds as follows: section 2 discusses the difference between the APV and ACLE methods for a single retiree and for married couples. Section 3 presents numerical examples. Summary and conclusions are presented in Section 4.

2. Estimating Expected Present Value

Our goal is to calculate the value of an income stream that is contingent on the recipient being alive. Consider the following example. Sally is trying to determine when she should start collecting Social Security. Her latest Social Security statement shows that if she initiates SSB at her Normal Retirement age, 66, her monthly benefit will be $1,000. If she initiates at age 62, her monthly benefit will be $750, and if she postpones initiation to age 70 her monthly benefit will be $1,320. She has enough income from other sources that she can wait the extra eight years if it would be more beneficial to her. What should Sally do? On the one hand, she receives a much higher benefit if she waits. On the other hand, she might die before or soon after she reaches age 70. She can use a financial calculator or an Excel spreadsheet and compute the present value of the three alternative streams of payments, but how should she take her mortality into account? This is explained below.

Because the available Life Tables provide survival probabilities only for integer ages, the author will assume that the benefits are paid once a year at the beginning of each year\(^3\). Let \(a(x, r)\) denote the actuarial present value of $1 to be received each year for as long as the recipient is alive, where \(x\) = the recipient’s current age and \(r\) = real interest rate. Then \(a(x, r)\) is calculated as

\[
APV = a(x, r) = \$1 \cdot \sum_{t=x}^{\Omega} \cdot p(x, t) \cdot v^t
\]

\(^2\) Data for joint life expectancy is from IRS publication 590, Appendix C, Table II.

\(^3\) The annual \(p(x,t)\), can be converted to monthly probabilities by assuming that people are dying at a constant monthly rate between year \(t\) and year \(t+1\). Increasing the granularity of the life table will make the calculations more cumbersome but will not affect the main results.
Where \( p(x,t) \) is the probability that an individual aged \( x \) will be alive at age \( t \), \( v^t = \frac{1}{(1+r)^t} \) is the discount factor and \( \Omega = \) the upper limit of the life table (100), \( p(x,t) \) is defined by:

\[
\prod_{t=0}^{T-1} (1 - q_{x+i})
\]

Equation (1) is often approximated by Equation (3), the ACLE, by arguing that income will be received on average through the ERL.

\[
ACLE = v(x,r) = \sum_{t=x}^{E(T_x)} v^t
\]

In Equation (3) \( E(T_x) \) is the ERL and \( T_x \) is the remaining lifetime of an individual aged \( x \) and \( v^t = \frac{1}{(1+r)^t} \).

According to Bowers et al. (1986, pp. 149-150), Jordan (1967, p. 174) and Milevsky (2006, p. 116), the approximation of the APV by using Equation (3) will overstate the APV, that is, \( v((x,r)) > (a(x,r)) \). This fact is a corollary of Jensen’s Inequality, a well-known mathematical theorem.

The relationship between Equation (1) and Equation (3) can be seen if a second term (whose value is zero) is added to the right-hand side of Equation (3). The second sum in Equation (4) is redundant but is included for ease of exposition:

\[
v(x,r) = \sum_{t=x}^{E(T_x)} 1 * v^t + \sum_{t=E(T_x)}^{\Omega} 0 * v^t
\]

Comparing Equation (1) with Equation (4) one can see that the ACLE approximation requires two assumptions that are rarely stated:
- All the payments until age \( E(T_x) \) will be received with certainty, that is \( p(x,t) = 1 \) for \( t \) smaller or equal to \( E(T_x) \).
- No payments will be received past \( E(T_x) \); that is \( p(x,t) = 0 \) for \( t \) greater than \( E(T_x) \).

The magnitude of the overstatement (bias) is shown in Table 1, below.

### 3. Numerical Example

Table 1 contrasts the results of APV and the ACLE calculations for a 66 years old retiree whose Social Security benefits are $1,000 per month. Since the US Life Tables are tabulated only for integer years it is assumed in the calculations that benefits are received as a single payment of $12,000 per year. The APV and ACLE values shown in the table were computed for three assumed real interest rate, 1, 2 and 3 percent and life expectancy (ERL) of 66 years old males = 16.9, and ERL of 66 years old females = 19.5.
Table 1. Present Value of Social Security Benefits evaluated at Age 66

| Real Interest Rate | ERL* | APV \(a(x,r)\) | ACLE \(v(x,r)\) | Difference | \(\%
\)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MALE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(r=1%)</td>
<td>16.9</td>
<td>$198,747</td>
<td>$188,878</td>
<td>$9,869</td>
<td>5.2%</td>
</tr>
<tr>
<td>(r=2%)</td>
<td></td>
<td>$183,502</td>
<td>$172,155</td>
<td>$11,347</td>
<td>6.6%</td>
</tr>
<tr>
<td>(r=3%)</td>
<td></td>
<td>$169,993</td>
<td>$157,810</td>
<td>$12,183</td>
<td>7.7%</td>
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<tr>
<td><strong>FEMALE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(r=1%)</td>
<td>19.5</td>
<td>$228,547</td>
<td>$214,795</td>
<td>$13,752</td>
<td>6.4%</td>
</tr>
<tr>
<td>(r=2%)</td>
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<td>$208,193</td>
<td>$193,882</td>
<td>$14,311</td>
<td>7.4%</td>
</tr>
<tr>
<td>(r=3%)</td>
<td></td>
<td>$190,530</td>
<td>$176,152</td>
<td>$14,378</td>
<td>8.2%</td>
</tr>
</tbody>
</table>

Source: authors Calculations.

* Expected Remaining Life, data are from Arias 2014.

Key:

- APV = Present Value of Life-Annuity, see Equation (1)
- ACLE = Annuity Certain with ERL as the time horizon, see Equation (3)

These results are consistent with the Jensen Inequality theorem which predicts that ACLE overstates APV. Therefore, consistent with economic theory, if one accepts that APV is the correct way to evaluate life-annuities then one must conclude that models based on ACLE incorrect.

4. Conclusion

This paper shows that the two methods of evaluating Social Security Wealth (SSW), the present value of Social Security retirement benefits, lead to different results. When compared to the theoretically correct method of calculating annuity value as the expected present value, calculations using the discounting the cash flow through life expectancy method overstate value of SSW.

References


POSTGRADUATE PENSION SYSTEM'S EXTENSION: SUPPORT TOOL FOR ACTIVE AGEING

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Abstract
This paper is focused on construction and significance of voluntary fully merit-based and fully closed postgraduate extension of current pay-as-you-go pension insurance. The created model shows that the resources that a man gets when extending his productive employment enable him to gradually decrease his economic activity (when combining partial pension benefit payment and income from economic activity) and at the same time utilize the resources for individual health care and other well-being services prolonging his active life. This way, economic base is created for starting the rise of market based productive services’ branches that contribute to acquisition, preservation and utilization of human abilities. Prolonging the zenith and horizon of productive employment of those people that help to increase the innovation potential of society does not limit the employment of younger generations but does the opposite – it significantly contributes to the creation of qualified jobs and teams. Socioeconomic schemes that are included in this paper support the effective use of available human resources.

Keywords: health systems, human capital, pension insurance, postgraduate extension of pension insurance.

JEL codes: H55, H75, J24.

1. Introduction
The sustainability of pension systems has been discussed frequently since the populations in developed countries started to age (OECD 2017a). Additionally,
overall demographic behaviour and job market situation has been changing rapidly. In this paper, we aim to show the postgraduate extension of pay-as-you-go pension system and its supportive role for active ageing (WHO 2002).

2. Theoretical and methodological background

The first methodological basis to our approach comprises the model of postgraduate extension of the current social pension insurance system. The term “pension insurance” is commonly used without thinking about the risk that this system insures. The fact that sometimes we cannot give a satisfactory answer to this question leads us in some cases to leave the term “insurance” and replace it with the term “security”. We shall now explain deeper how we see the problem in context of used terminology.

Let us first look at how the term “pension insurance” is defined in Czech law (Czechia 1995). Section 1 (1) states: “This Act regulates pension insurance (hereinafter referred to as “insurance”) with respect to old age, invalidity and death of a breadwinner.” When an insured event occurs (in the sense of old-age pension insurance) is regulated by Section 28: “An insured person is entitled to a retirement pension if he has acquired the necessary period of insurance and has reached the stipulated age, or possibly if he fulfils other conditions set forth in this Act.” This definition is also taken over by the 2011 “small pension reform” regulation (Czechia 2011).

Let us think about what these definitions say. According to them, the insured event is supposed to occur at a certain age. It is very similar as if the law on compulsory accident insurance stated that the insured event would occur not in the event of a crash, but after going (let’s say) 150,000 kilometers. As Goethe said, “whoever does not button up well, will not get dressed well”. This definition of an insured event in the law leads to fundamental conceptual shortcomings both in the construction of the current pension system and in discussions about its reform.

In our approach, we assume that the insured event comprises loss of ability to provide sufficient means to live in dignity through productive (gainful) activity as a result of aging. This is an equivalent of invalidity insurance, where the cause of invalidity, however, does not comprise accident or illness, but the aging process that affects an individual in a differentiated way (like injury or illness mentioned above). This means, among others, that the basic type of solidarity is the one between those, with respect to whom the insured event occurs (i.e., those who lose their full or partial ability to earn a living in job markets) and those who are also able to participate in job markets at a higher age.

In recent theoretical literature, Vostatek (2016) gives a clear overview of all approaches to pension insurance, or more precisely social security and based on their comparison presents the NDC system (gradual, the so-called contributory-defined, i.e., highly merit based) as the most suitable. In defining the concept of postgraduate extension of pension system and the creation of its model, which demonstrates the real nature of complex reforms of the social investment and social insurance system, we follow up on his work on pension systems’ typology.
We also consider those works that in various aspects emphasize the importance and the possibility of selectively extending the horizons of the productive employment of human being beneficial. Vavrejnová et al. (2004) state that the issue of pension reform is not limited only to aging and financial issues. According to them, it is a combination of different types of pension benefits and other types of savings together, which is particularly important, with an extended economic activity. In this respect, Fiala and Langhamrová (2014) perform model calculations of income and expenditure developments of the pension system in Czechia based on the latest demographic projection and taking into account the projected sustained increase of the retirement age, i.e., the period of productive employment of a person, and they logically conclude that the growth in share of persons with higher age will not result in such a large increase in the share of pensioners, i.e., increase in life expectancy will not automatically mean an increase in time of taking pension (Fiala and Langhamrová 2014, p. 233). Janičko and Tsharakyan (2013) through a model show a key importance of prolonging the period of productive employment and, on the basis of this, formulate economic and political recommendations directed at different groups of people - especially women, people in higher productive age (55-64 years). According to them, the suitable measures should comprise retraining programmes, training programmes, active job search support, or efforts to reconcile family and work life, suitable incentive structure to extend periods of productive employment (Janičko and Tsharakyan 2013, pp. 335-336). They conclude that using these options we can maintain stability of the on-going pension system. Loužek (2014) views the problem as "security for retirement" where it considers three ways: savings, children, participation in the social pension insurance scheme (Loužek 2014, p. 26). He concludes that older people need to be persuaded to continue in economic activity at a later age because they are worth it. His list of professions that are performed at an older age or possibly forever is interesting (Loužek 2014, pp. 94-95). It is worth mentioning one of the few works that deal with internal motivations to prolong the productive employment period and their effect from the point of view of lifelong costs of “impatience”, giving preference to current consumption before investing in human capital (Cadena and Kays 2015).

Based on the discussions concerning the reform of the pension insurance system, that we have participated in, we have come up with the idea of full-closed and fully merit based postgraduate extension of the current ongoing pension insurance system that can be easily and gradually implemented without significant problems and side effects and is based on voluntary participation. This can result in a gradual and smooth transformation of the entire pension insurance system. From a practical point of view (which is important when considering the applicability of research results and public choice behaviour), this path is more suitable than achieving a social consensus and ensuring sufficient political will to fundamentally reform the entire pay-as-you-go pension insurance system into the fully merit-based system of NDC type with a single basic pension benefit. In addition, our approach is compatible with NDC system in compulsory pension pillar if it is introduced in the future.
The second methodological approach is to demonstrate conditionality of the so-called Industry 4.0 by a transition to an economy based on productive services, i.e., services that enable the acquisition, preservation, and employment of human capital. One of the main theorists of Industry 4.0, or more precisely the 4th industrial revolution is Mason (2015). He devotes extensive attention to Marx’s “Grundrisse” manuscripts, noticing how Marx predicted the process of automation and computerization of the economy, but misses, like other contemporary theorists, what Marx considered to be the most important and what was understood and interpreted by Richta (1966) more than fifty years ago in a work titled “Civilization at the Crossroads”. Marx puts emphasis on expressing the form of real human abilities and what the development of human abilities means; person’s ability to perform “general work”, i.e. to mutually intermediate and to bring to one another the processes in the field of his or her activity. This specific human ability can develop in an unlimited way because it is directly linked to the development of scientific knowledge. That is why Marx emphasizes that saving of working time means increasing the “time for the full development of an individual, which in turn reverses the productive power of labour as the greatest productive force (Marx 1974, p. 343). It is about how to imagine this transformation of free time to the full development of an individual who is retrospectively the most important economic source. Absence of this idea then often leads to catastrophic reflections on the “uselessness” of the majority of population. In fact, it can be the complete opposite. The so-called Industry 4.0 (as a major technological change) will release a large number of people from the industrial production process, but the demand will grow for people in the field of productive services for the acquisition, preservation and employment of human capital, and so will in the field of personal care services to save time in personal life (in order to meet every day needs and in the area of care-taking in order to prolong the time for creative professional activity). This absence is also reflected in the fact that those who speak about the problem of employing people released by so-called Industry 4.0 also point out that there are few people who would be able to perform the professional tasks required by Industry 4.0. This schism is clearly reflected in documents, in which the state authorities devote attention to the so-called Industry 4.0 issue (MPO 2015; OECD 2017a).

The fact is that the process of transforming the development of human capacities into a factor of economic growth and a change in the nature of economic growth implies expansion of the productive services sector (education, health care, wellness etc.) and the transformation of this sector into the most important sector in the economy. We will try to show that it implies significant increase in the importance of teamwork and the formation of intergenerational and cross-generational teams aimed, among others, at mastering projects in the so-called Industry 4.0 field.

Firstly, we are going to define the basic concept of the fully-closed and fully merit based postgraduate extension of the current ongoing pension insurance system.

- The fully-closed nature of the system means that all the resources that will come to this system will be distributed by this system (there needn’t be any money revenues or subsidies from outside investments, and no money will leave the system).
- The fully merit-based nature of the system means that pension benefits are based equivalently on what a person has paid into the system according to the rules we specify.
- We call the system a postgraduate extension because it is only for those who have reached the statutory retirement age.
- This is a voluntary extension of the primary pay-as-you-go pension insurance system. As such, this extension does not utilize capital or fully-funded approach.
- A certain taxation of pension benefits is expected, from which a single basic benefit can be paid to all participants in the whole pension insurance system.
- It is also assumed that the system will be voluntary (everyone can decide whether he will participate or not) and that the system is individually adjustable in the sense that it can be used by a participant of the system at any given time and by any percentage he may draw the relevant pension benefit, whereas the undrawn amount enters back into system as its deposit.

Based on this notion, a mathematical model has been created (Mertl et al. 2016; Mertl and Valenčík 2017). Because of limited space in paper, we can briefly describe the results of maximum model calculation as follows.

- We assume a person with constant gross wage (e.g. 40 000 CZK – approximately 1.3 times the average wage in Czechia).
- We assume a social insurance contribution rate at 20% of the gross wage (e.g. \( p_m = 8 000 \text{ CZK} \) for wage 40 000 CZK).
- We assume expected length of life as an average of men and women (unisex approach) and the mortality tables as published by Czech Statistical Office in 2016 (CZSO, 2016).
- We assume that a person is entitled to a pension 15 000 CZK from the pay-as-you-go social insurance since the social insurance statutory retirement age (65 years now, can be gradually decreased to e.g. 60). He pays both this whole amount and his social insurance contribution to the postgraduate extension and he does not receive any benefit during this payment phase.
- We assume the possibility of extension benefits’ taxation (e.g. 15%).
- When retiring at the statutory retirement age (65 years) a person gets just old-age pension benefit from pay-as-you go system \( d_s = 15 000 \text{ CZK} \).
- Stimulating increase with retiring at age 65 and 1 month \((T = 65 + 1m, n + 1m)\) we can compute as the sum of those values divided by life expectancy \((n)\), e.g. \( d_k(65 + 1m) = d_s + p_m, \)
\[d_m(65 + 1m) = d_k(65 + 1m) / (12 \times t(n)),\]
\[d_n(65 + 1m) = d_k + d_m(65 + 1m).\]
- Taxed pension is \(dd(n) = 0.15 \times d(n)\).
- If he retires at age 65 and 2 months his increase will be computed similarly but higher by the increase from previous period, e.g.
\[d_k(65 + 2m) = d_k + p_m + d_k(65 + 1m) + d_m(65 + 1m),\]
\[d_n(65 + 2m) = d_k(65 + 2m) / (12 \times t(n)),\]
\[d_n(65 + 2m) = d_k + d_m(65 + 2m).\]
where \(n = 65, 66 \ldots \) years and \(T = n+1m, n+2m, \ldots \) months.

**Table 1.** Resources’ accumulation, 65-80 years, full participation, thou. CZK

<table>
<thead>
<tr>
<th>Age</th>
<th>life exp.</th>
<th>Amount paid (d_s(n))</th>
<th>Supp. pension (d_m(n))</th>
<th>Paygo Pension (d_l)</th>
<th>Total pension (d(n))</th>
<th>Taxed pension (dd(n))</th>
</tr>
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<tbody>
<tr>
<td>65</td>
<td>18,12</td>
<td>23</td>
<td>0,11</td>
<td>15</td>
<td>15,11</td>
<td>12,84</td>
</tr>
<tr>
<td>66</td>
<td>17,40</td>
<td>307,39</td>
<td>1,47</td>
<td>15</td>
<td>16,47</td>
<td>14,00</td>
</tr>
<tr>
<td>67</td>
<td>16,67</td>
<td>608,92</td>
<td>3,04</td>
<td>15</td>
<td>18,04</td>
<td>15,34</td>
</tr>
<tr>
<td>68</td>
<td>15,95</td>
<td>930,19</td>
<td>4,86</td>
<td>15</td>
<td>19,86</td>
<td>16,88</td>
</tr>
<tr>
<td>69</td>
<td>15,22</td>
<td>1274,30</td>
<td>6,98</td>
<td>15</td>
<td>21,98</td>
<td>18,68</td>
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<tr>
<td>70</td>
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<td>1645,04</td>
<td>9,46</td>
<td>15</td>
<td>24,46</td>
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</tr>
<tr>
<td>71</td>
<td>13,84</td>
<td>2047,07</td>
<td>12,32</td>
<td>15</td>
<td>27,32</td>
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<tr>
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<td>30,71</td>
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<tr>
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<td>2966,26</td>
<td>19,73</td>
<td>15</td>
<td>34,73</td>
<td>29,52</td>
</tr>
<tr>
<td>74</td>
<td>11,87</td>
<td>3498,17</td>
<td>24,55</td>
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<td>39,55</td>
<td>33,62</td>
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<tr>
<td>75</td>
<td>11,22</td>
<td>4091,34</td>
<td>30,39</td>
<td>15</td>
<td>45,39</td>
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<tr>
<td>76</td>
<td>10,64</td>
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<tr>
<td>77</td>
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<td>15</td>
<td>60,66</td>
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<tr>
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<td>56,02</td>
<td>15</td>
<td>71,02</td>
<td>60,36</td>
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<tr>
<td>79</td>
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<td>7371,96</td>
<td>68,95</td>
<td>15</td>
<td>83,95</td>
<td>71,36</td>
</tr>
<tr>
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<td>85,35</td>
<td>15</td>
<td>100,35</td>
<td>85,30</td>
</tr>
</tbody>
</table>

Source: own calculations.
The primary objective of model testing has not been to show that if a person works as long as possible on the job market, his pension could reach very high amounts – that was just a demonstration of what the model is capable of. The aim was to show that with a suitably chosen lifelong career strategy one can gradually (e.g. after five years of full engagement in a postgraduate extension) loosen his workload, i.e., reduce his workload without lowering his income and reducing the entitlement to payments from postgraduate system after completing full employment. It is even possible to achieve a concurrent loosening of workload and income increases in the form of post-graduate extension payments from the pension system, which can be used by persons of higher and senior age for both above-standard productive services, which allow the consumption of required services, which will allow substantial time savings for creative activity.

The model and its testing show that the introduction of the postgraduate extension of the current pension insurance system is, among others, capable of:

- Ensuring uninterrupted sustainability of the on-going pension insurance system with sufficiently high retirement benefits.

- Creating conditions for active aging and quality fulfilment of life even in higher and senior age, both by source and by creating suitable motivations.

- Enabling gradual painless, risk-averse, and smooth reform of the entire current pension insurance system by shifting the threshold of 65 gradually lower according to current (or appropriately modified) early retirement rules. How the calculations change in this case is shown on the figure lower.
However, the main purpose of the model is that it shows the real possibility of creating an economic base for the expansion of productive services enabling the acquisition, preservation, and employment of human capital. Therefore, it is not only about how to ensure a decent standard of living and quality realization for people in older age, but primarily that a very strong and big demand for productive services and, at the same time, sources for their financing, which are created on a purely economic basis, is created by employing these people (to which the postgraduate extension motivates). This is not the only one, but significant and easily achievable, and concrete form of transforming the development of human abilities into the most dynamic factor of economic growth and the change in the character of this growth.

At this point, it is important to indicate for what the benefits from the postgraduate extension can serve. In various life situations, the following usage may become essential:

1) Above-standard forms of health insurance and schemes of their financing, which will be oriented to prolonging the productive time and quality of life. From the pure point of view of financial flows, we consider this area to be the most important. As a possible alternative to private health insurance, which has strong limitations caused especially by the necessity of individual health risk evaluation (medical underwriting) and related information asymmetry, prepaid schemes for individually adjusted health packages can be considered. Systemically in the form of health savings accounts, they also have disadvantages that become highly prominent if they are not supported by good universal health system (they quickly fail in poorer, older or sicker population with no or weak universal coverage). Therefore, we designed the prepaid schemes as an extension of well-covering universal health care system and
without special incentives to save money there, overcoming those disadvantages largely (Mertl 2017).

2) Providing at older age social and support services that can enable the relevant productive person to spare time and energy in order to perform the relevant work activities. Nowadays, this is underdeveloped sector of economy, which, of course, for many older experts’ case, means a waste of resources.

3) Educational activities in the context of lifelong learning. There is currently not a sufficiently sophisticated "upgrade" system that would be functional. It is an opportunity for universities to expand their sphere of activity at a time when income-raising opportunities in the form of student outreach are in fact already exhausted, and when due to a one-sided focus on mass tourism, some hidden demand was created for the further education of university graduates. the future can manifest in different forms.

4) Opening professional activities to extend the (limited) productive time. In several concrete scenarios, this can be a very important area of funds drawn from the postgraduate pension system. It is a means of compensating income reductions due to the restriction of earning activities while maintaining the ability to pay for the services mentioned in the preceding points. In other words, from a certain age (which may vary in different cases, but a period between 70 and 75 years can be considered), it is appropriate to gradually reduce productive and gainful activities in such a way as to create conditions for preserving the ability of teamwork associated with the application of that knowledge and the experience he has gained during his life.

From the point of view of preliminary considerations based on the testing of different accumulation strategies within the postgraduate system and their utilization, it appears that significant share of the funds can be used for prepaid health care and related services, aiming at preserving the physical and mental well-being of a person who, as much as possible, he is interested in long-term employment, which subordinates to his life and career strategy.

4. Intergenerational Complementarity, Teamwork, and the Innovation Potential of Society

One of the main objections to the proposed approach to pension reform in a direction that would motivate a person to prolong a period of voluntary productive employment comprises the fact that extending the time of a person’s productive application reduces opportunities for employing young people. If we rephrase this question into economic terminology, we can ask: Is there a substitutive or complementary relationship between the employment of people of different generations (i.e. older and younger)?

This question needn’t have a single answer. The relationship between the employment of older and younger persons, between the employment of members of different generations may be both substitutive (and then a displacement effect will apply) and complementary (and then an induction effect may apply in the sense that the more and the longer it is possible to preserve the employability of
older people, the greater the opportunities to hire younger people). It depends on the type of productive, or more precisely gainful activities.

In general, it applies that in inertial development there is a substitution relationship between the employment of older and younger people. This is mainly because job performance is more or less routine and individual. Young people are better suited to perform in it.

In case of development that is characterized by a high innovation intensity that is associated with the spread of innovation waves of higher intensity and higher density, i.e., in case of development that is based on human capital there is a complementary relationship prevailing between the employment of older and younger persons and induction effect is occurring here. This is mainly due to the fact that the necessary prerequisite of the preparation, suitable targeting and realization of the innovations comprises, by nature, performances not of a routine (i.e. creative) character; especially teamwork becomes absolutely necessary, namely, such teamwork that fully reflects the complementarity of performances not only of different skills but also of different generations. The importance of intergenerational transfer of professional experience grows and so does the importance of the innovative skills that one acquires gradually in the course of his professional career, which is based on long-time systematized and in practice verified knowledge.

In terms of requirements posed by the so-called Industry 4.0 (OECD 2017b) we can say that the near future in performing economies will belong not only to teams, but teams of three to four generations, i.e., intergenerational or rather cross-generational teams; teams that will be based on effective collaboration for up to four generations. Everyone who has been involved in realizing some truly significant innovation is aware of this.

Therefore, a comprehensive solution to the question related to the prolongation of term of productive professional employability of those persons who are capable of lifelong acquisition of knowledge in relation to gradually gained experience and who behave responsibly even in terms of preservation of their human capital, is of paramount importance for the economy, which is born from the current conditions.

The reader of this paper can develop the clearest idea of what complementarity is in cross-generational teams focused on implementation of innovations of higher order, among others, in connection with the question of what a precondition for social use is, i.e., the application of findings in practice, which are published in professional periodicals registered in recognized databases. Finally, the final effect of published ideas is relatively rare, despite several intermediations, indirectly, based on circumstances. With the current way of functioning of the relationship between theory and practice, the theory presented in expert press and social practice, there is often even a substitute relationship between innovation and the applicability of knowledge. The higher the innovativeness, the more difficult is the immediate applicability. This is naturally due to the functioning of science in conditions of very little developed team spirit, or more precisely the
absence of innovation-based teams, both in the field of manufacturing and industry, as well as in services, including services provided by public institutions. In an economy that is based on the application of significant innovation in the industry related to the use of options offered by Industry 4.0, as well as innovations in the sphere of institutional support for economy, the teamwork, ensuing from the generation of innovations, will form the basis of its performance. And under such conditions of non-inertial development, the demand for trans-generational complementary teams will grow significantly.

With a little exaggeration, it can be said that the teamwork education in our education system ends at the kindergarten level and is very much disappearing from the university environment. Forms of interdisciplinary collaboration between students, also from different study years and branches, at universities are developed minimally. Especially the universities must adapt to the new approach. The transition from low-innovation economy of particular individual performances to an economy based on the systematic creation and dissemination of relevant innovation through interdisciplinary and trans-generational teams will occur while saving work (as indeed all sources), but the demand for productive activities of two kinds will also significantly increase:

- Productive services activities aimed at acquiring, preserving and employing human capital (which will become the base of the economy in a similar way as industry at the time of the industrial revolution became a dominant sector as opposed to agriculture).
- Personnel service activities (social care and assistance) that will save time in the out-of-work hours of those to whom these services will be provided, and more effective spending of leisure time (both in terms of relaxation or acquiring social contacts, etc.).

It concerns a complex transformation not only in the economic but also in the social system. Their common denominator comprises an emphasis that the fulfilment of the real wealth of human life in full use of the possibilities of development and the application of its abilities is simultaneously the most important factor determining the dynamics and quality of economic growth. Economy based on these foundations will be characterized by a high intensity and innovation breakthrough, leading to significant savings of all kinds of resources (raw materials, energy, time, labour), but will also generate demand for human abilities and their diversity, so that no one wanting to engage in economy of this type, will be unnecessary, will not be forced to live in a suffused enclave saturated from public sources. The changes in the pension system we are proposing can be one of the important stimuli that will lead to fundamental changes in the economy. This is precisely because they contribute to the creation of a real economic base, which will show the economic effect of services connected with the acquisition, preservation and utilization of human capital (Valenčík 2014).

5. Conclusion

Current Czech pay-as-you-go pension system is not prepared well for the changes that are required by the transition to economy of productive services and
prolonging active participation of citizens on labour market. The full reform into NDC system with basic pension benefit has currently not been feasible within public choice framework, and fully-funded extensions have their limitations, too. Therefore, we introduced postgraduate pension system’s extension, that can relatively quickly increase the additional resources that a person can utilize at higher age to prolong his working career as well as reduce the workload and utilize services that improve his living standard and quality of life. This extension is targeted on later period of life where it is most important, especially for some professions, to maintain productive capacity and utilize the lifelong experience.

The payments to this extension are made from pay-as-you-go pension benefits and social insurance contributions that he is obliged to pay. He can either have full engagement for which we presented model calculations, or since some point he can gradually decrease the engagement and start to receive the benefits. The benefits from postgraduate extensions can be used for financing above-standard prepaid health packages, that shall help to maintain the participants’ health at adequate level, including his well-being and management of health services that he consumes. Also, lifelong education, social care and other productive services can be financed from those benefits. It is worth noting that primary purpose of this extension is not to save money there, but rather smoothen the financial flows that help participants to maintain good life standards and empower them with buying power for productive services they need. Also, having the possibility of gradual decrease of workload and working hours, together with partial replacement of the work income from the postgraduate extension benefit, is very important for older workers.

The participation in postgraduate extension influences the job market and employment. Traditional inertia vision that older workers can occupy jobs than could be overtaken by younger ones, and on the other hand that there are many jobs that cannot be done well by older workers has some merit. But it could be resolved (at least to some extent) by creation of cross-generational teams, specific jobs that will utilize mainly the experience of older workers, and also transition to economy of productive services, which can create new working places based on demand for specific abilities and innovative concepts that require cooperation between generations rather than competition. This can help to overcome one of the issues of Industry 4.0 concept, where on one hand jobs could disappear and on the other hand new qualifications and abilities are required.

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References


Abstract
The paper develops a hypothesis that some risk elements and gaps of national and public pension system come from typical mental models, system’s archetypes and patterns of behaviours, as a result of many demographic, macroeconomic, financial, political and global factors, particularly closed loop feedback relations with delays and amplifications. There are important messages in the paper for social insurance policies design, structures and management, the meaning of data mining and collection, and for model refinement with modelling approaches in a systems’ thinking way. The shortcomings of national social insurance systems in dealing more effectively with upstream social insurance risk prevention in population are systemic, and include also a failure to empower members of population and involve them in their own, entrepreneurial downstream care. The paper contains a system dynamics point of view, as a method of macroscopic, continuous simulation modelling, to surface and explain some cycles and discrepancies between demography, management policies, system’s aspects of national social insurance, particularly pension system. The conceptual and simulation model presented in the paper, followed by experiments’ results, uses SD method approach with causal loop diagrams (CLD) and stock-and-flow diagrams (SFD), displaying delays, amplifications and structure cycle dynamics in national pension system. Further research should concentrate on the detailed analysis of additional modelling requirements in order to conduct more profound multi-factor experiments to forecast and evaluate contemporary national politics, and to test some new assumptions in social insurance.

Keywords: pension system, simulation, social insurance, system dynamics.

JEL codes: H55, J32, G20.

1. Introduction
The basic factors influencing the ageing population are fertility and birth rate decline and increasing life expectancies. Generally, people are expected to live up until 74 years in 2045-2050 while in developed countries, life expectancy will rise to 82 years (according to the data from “The Population Division of the United Nation Secretariat” 2003). In a country like Poland, being classified between developing and developed countries, population of people aged 60 years and above in total population was 15.7% in 1995, and is expected to increase to 23.6% by the year 2020 and is estimated to increase to 24.7% by the year 2025, while life expectancy for ageing population increased to 73.6 years for males and 81.6
years for females in the year 2015 (GUS 2016). In terms of coefficients of: demographic age, work activity, work resource ageing, work resource load, “early pensioners” and generations replacement, even some forecasts for Poland seem to be more optimistic, than for all EU countries (as averages), generally the process of ageing population is a progressive process. These demographic trends are believed to exert pressure on the public pension system as well as have a major impact on governmental social and economic policies. For these reasons, pension has become one of the most important issues for the policy makers where in most countries pension spending is projected to grow substantially subject to the increased number of retirees. The ageing population also creates concern on the dynamic, and particularly sustainability of the public pension systems. Most countries are reforming their pension systems with the intention that the pension system will continuously and in a sustainable way function to provide the pensions to the retired people (Balcerowicz-Szkutnik et al. 2010). Poland is also confronting the same phenomena when the public pension system reform was developed in 1998 and implemented in 1999 (Iglicka 2017, pp. 1-4). Now some pension system modifications are still being implemented (Matyjaszczyk 2016, pp. 61-76), as contemporary changes in the second (OFE) pillar (e.g. premium decrease, new rules of investments, new accounting procedures, voluntary access), consolidation of the first (ZUS) and second (OFE) pillar, decreasing and unifying retirement age for males and females, development new offers for third pillar (e.g. IKZE investment), and development of supplementary pension scheme (Jedynak 2016, pp. 34-48). Also some new political ideas and concepts are being discussed and suggested, as “citizen retirement” pension system proposal (no premium and pensions financed by central budget), “repartition-alimentary” pension system proposal by KoLiber organisation (pensions financed by central budget and 3-pillar system based on social “citizen retirement”, pro-demographic bonus motivation benefits caused by children alimentation, and capital investments), and “pension savings account” (EKO) proposal by Polish Financial Supervisory Commission (KNF) – as governmental institution (new third pillar based on individual and employer 3-partition premium payment with some tax benefits), some professions’ retirement privileges elimination (e.g. retirement in mining, agriculture, military-police-custom services, judicature), and differentiation of pension system for males and females proposal by a popular party (PSL) - an agriculture political party (family status influence with increase of premium-payment periods by non-premium-payment periods for females having children).

Due to demographic and economic changes and increasing pension expenditures, pension systems around the world (not only in Poland) are in volatile condition. This condition is caused not only by many uncertainties or inherent risk that affects the pension systems, but also by the specific dynamic pension system features, mainly determined by system’s structure (“structure drives behaviour” paradigm). The existence of risks and structure specific features will also affect the national pension system expenditure. Among the risks that the national policy (politics) makers in public social insurance are exposed to, are demographic risk,
economic growth risk, financial market risk, national budget as subsidy source risk (Bednarczyk and Raszewski 2017, pp. 13-19), salary risk, and ironically saying even a “political risk” (in a context of next elections to parliament). This research focuses on only demographic and some selected economic risks (particularly GNP growth and average salary level). Demographic risk is always defined as the increasing risk due to population ageing while salary risk refers to the salary growth affecting the premium payments and cost of providing pension benefits, as social indemnity payment. And still there is an issue, how will the risk and pension system structure influence the pension system functioning? The complex phenomenon of demographic (particularly ageing structure and dynamics) and economic (particularly gross national product GNP and average individual salary) changes in a public (national) pension system performance involve numerous factors which are inter-connected in different directions. Therefore, this study attempts to develop a dynamic generic and archetype (rather a synthetic one) pension system model with social policy design factors, which analyses pension expenditure as a result of some demographic and economic risk. Finally, after next-step calibrations of the model (with the up-to-date precise statistics of Polish pension system indicators) some short, and long-range forecasts and rough verifications of “worst-case” scenario will be possible.

2. Research method

For the research purpose, a dynamic, continuous simulation policy design model of Polish public pension system is developed with an application of System Dynamics (SD) method. This method, originated by J.W. Forrester (Forrester 1961), is belonging to systems thinking and macroscopic continuous simulation modelling methodologies, and also risk analysis and management approach by scenario testing is to be applied. The main focus of this modelling research is to analyse pension system dynamic features, particularly in terms of costs and expenditures as a result of demographic and economic factors. It also includes a proposal of pension system archetype (or generic) structure and assumptions used for the pension system expenditures’ forecasts. Cause-effect and causal-loop relations (as influence and structure diagrams), quantitative SD models of these (as a set of mathematical differential equations translated into Vensim PLE simulation modelling package notation and as a simulator interface), and some selected results of simulation one-, and multi-factor experiments are presented.

2.1. System Dynamics simulation of pension system

The System Dynamics method relies extensively on system’s structure (particularly feedback loops and delays) in order to analyse and explain how system structure drives behaviour and leads to particular patterns of behaviour. Even some formal methods are being developed for an analysis of “structure-behaviour” relation (e.g. loop polarity dominance, behavioural analysis for loop dominance, pathway participation metrics, graph theory measurements), still practical analysis by simulation modelling and one- and
Pension system dynamics modelling, policy design and risk analysis

multi-factor experimenting have largely been restricted to laboratory simple examples as guides to intuition. In social pension systems’ SD modelling and analysis practice, large-scale models with many loops are still analysed in a largely informal way, using trial-and-error simulation (Sapiri at al 2014, pp. 1450046-1:24). Although this is not a weakness, any formal tool that might help identify important structures in the model as they affect a particular mode of behaviour could be of enormous utility, particularly in large models trying to map complexity relations in social systems (Pietroń 2014, pp. 301-320). System dynamics applied to pension system research can be interpreted as a systems thinking approach and a branch of management science, which deals with the dynamics, and controllability of managed pension systems. SD method implementation in business and organisation systems’ modelling and analysis usually focuses and addresses on the following basic research issues:

- circumstances in a system to use different policies in order to control its behaviour as time passes and circumstances change;
- system’s policies design to become robust against change and ability to create and exploit opportunities and avoid, or defend itself against, setbacks;
- information feedback structure design to ensure that effective policies become possible.

The basic viewpoint and associated methodologies of SD approach require a definition of a 'system'. Pension system is a collection of parts organised for a purpose, and this system may also fail to achieve its purpose. Knowledge acquisition, system activities, decision making choices and learning consequences of choices need time – there are 3 delays (Fig. 1) in: data and information mining and acquisition to develop knowledge (basically national demographic and economic statistics), governmental and individual activities in making decisions (social insurance, economic acts and regulations made by parliament and government, individual personal life decisions made by individuals and employers), and experiencing consequences of decisions in a pension system state.

**Fig. 1.** The information/action/consequences paradigm of System Dynamics
Source: author's own elaboration.

SD method of system modelling allows to analyse a managed pension system so as to:

- model the ways in which its information, action and consequences components interact to generate dynamic behaviour;
- diagnose the causes of faulty behaviour;
- tune its feedback loops to get better behaviour.
The first stage (Fig. 2) in SD application to pension system modelling is to recognize the problem and to find out which people care about it, and why. It is rare for the right answers to be found at this stage, and one of the attractive features of SD as a management science methodology is that one is often led to re-examine the problem that one is attempting to solve. Secondly, and the first stage in SD as such, comes the description of the pension system by means of an influence diagram, sometimes referred to as a “causal loop diagram” (CLD) or “cause-effect diagram”. This is a diagram of the forces at work in the system, which appear to be connected to the phenomena underlying people's concerns about it. Influence diagrams are constructed following well-established techniques – basically “least-extension” technique. Having developed an initial diagram, attention moves to Stage 3, 'qualitative analysis'. The term simply means looking closely at the influence diagram in the hope of understanding the problem better. This is, in practical SD, a most important stage, which often leads to significant results (sometimes it is the end of modelling project). If qualitative analysis does not produce enough insight to solve the problem, work proceeds to Stage 4, the construction of a simulation model. At this stage, we exploit the important property that the influence diagram can be drawn at different levels of aggregation. It is usually not even necessary to show every single detail, because, if the influence diagram has been properly drawn, the simulation model can be written from it without a separate stage of flow-charting. Stage 5 is where results based on quantitative analysis start to emerge. Initially, use is made of the insights from the bright ideas and pet theories from qualitative analysis. This stage represents exploratory modelling of the system's characteristic patterns of behaviour by laboratory experimenting with the aim of enhancing understanding and designing new decision rules for pension system stakeholders.

![Fig. 2. The structure of SD approach to pension system modelling](source)

Basically, SD simulation modelling method is an approach used to study a nonlinear system and feedback control in engineering, economic, social and human sciences. With the aid of computer continuous simulation, supported by Iceberg Model of systems thinking approach in collecting knowledge through the simulation runs, it is a powerful tool in understanding complex systems. SD is originally based on feedback control theory which includes both hard (quantitative) and soft (qualitative) approaches in analysing dynamic behaviours of the development and changes of a system. SD assists to improve decision making process and policy formation through its characteristics of incorporating all relevant cause-effect relationships as well as feedback loops in dynamic behaviour modes of systems. By developing a mathematical model as a set of differential equations solved by numerical integration (using basically Euler integration method) and in an environment of computer simulation technologies, SD is capable to resolve a dynamic, inter-dependent, counter-intuitive and complex system such as problem of investigating the impact of demographic and economic risk on public pension system expenditure.

Public pension system involves a long-range forecasts horizon and political (mainly economic) consensus in social insurance policy design, therefore, risk management approach plays an important role in facing this problem – by absolving, resolving, solving and maybe finally dissolving it. Also, the complex phenomenon of demographic and economic volatility in a public pension systems involve numerous factors which are inter-related. Due to these reasons, a problem such as analysing risks in a public pension system requires a technique that would deal with complexity and allow the problem to be holistically viewed. As a consequence, an integration of risk management and a simulation modelling end experimenting methods in developing a public pension system expenditure model are needed, and to discover dynamic and macroscopic properties of such a system, SD method is the most appropriate method in modelling and analysing social insurance risk management problem in Polish public pension system. Risk management is a process consisting of the following activities (steps): risks identification to examine all the important risks involved in the system, risk analysis of the expected consequences of risk factors on specific other factors (variables), and monitoring of risk exposure to evaluate the exposure of risk based on decision making information.

2.2. Risk identification in social insurance

In this research, Polish public pension system is studied and modelled to analyse system expenditure due to basic demographic and ageing risks, economic GNP growth risk, average gross salary in economy risk. In Poland, public pension system is also exposed to the other risks, e.g. financial and investment risks, political risks in reaching consensus of public pension system transformation and reform, and some risks concerning overdue liabilities from the past (old system liabilities in a new system). These risk factors are identified to be basically as time dependent relations, estimated on the base of time-series statistical data.
3. Pension system SD model development

SD method basic paradigm is that a system’s behaviour depends on underlying causal feedback structure, decision rules, amplifications and delays. Causal loop diagrams (CLD) and stock-and-flow diagrams (SFD) are used to represent cause-effect structure (open and closed relations as feedback loops) with delays in information and physical flows. The CLD and SFD diagrams of pension system generic and archetype model are presented in Figure 3 and Figure 4. The dynamic equations of the model refer to nonlinear relations between identified basic variables and data estimated with an application of some empirical official statistics regarding public pension system indicators.

3.1. Pension system mental model and dynamic hypothesis

Causal loop diagramming is a recommended part of SD modelling stages in order to analyse complex relationship that exists in a dynamic system. A causal loop is referred to as closed influence diagram (or mathematically known as directed graphs) with polarity signs. A causal loop enlightens a dynamic process of a system in which the chain effects of a cause are traced, through a set of related variables, back to the initial cause. A causal loop is formed when a set of variables has been linked together in a connected path. There are two types of causal loop namely “reinforcing loop” (indicated by symbol R or plus sign) and “balancing loop” (indicated by symbol B or minus sign). Balancing loops generally (and always for 1st and 2nd order feedback loop) tend to stabilise the system while reinforcing loops always tend to destabilise the system. The loop is defined as positive (known as reinforcing loop) when the number of negative relationships is even (or multiplication of polarity signs within loop gives plus sign), otherwise the loop is negative one (known as balancing loop). Causal loop is also represented by an arrow headed line with sign “+” which means that a change in the influencing variable produces a change of the target variable in the same direction, while sign “-” means that a change in the influencing variable produces a change of the target variable in the opposite direction. The holistic summary analysis of causal loops relations is a helpful tool to predict the impact of desired factors in the system (even sometimes this is quite difficult activity in complex and many different in polarities feedback loop structures – which feedback loop is a dominant structure?).

Causal loop diagram of simple generic public pension system model in this research consists of four parts (Fig. 3): causal loop diagram of population ageing sub-model, causal loop diagram of public pension system central fund sub-model with basic incomes and expenditures, causal loop diagram of economic growth sub-model with influence of economic investments, and causal loop diagram of average salary estimation sub-model, as a base to calculate social insurance premium annuity and finally the pension system liabilities. The first part diagram is mapping general population with ageing stages – population in the age between 0-18 years, economically active population in the age between 18-65 years, and retired old population in the age above 65 (65+). This sub-model is a rather
sensitive structure for births and deaths rates, and in the model some statistics from the past are taken as multiplier time functions. To simplify analysis, the assumption that unemployed population always (after a delay) can find a job is taken into account. The second part diagram is modelling the essential part of any public pension system – central fund which finances social insurance indemnity payment (basic expenditure), sourced by regular premium payment by insured population, and some incomes from financial investments based on interest rates. Also this sub-model is rather a synthetic representation, without detailed structuring of types of financial sources, national budget donations, legal constrains, etc. The third part diagram is mapping an economic growth sub-model by gross national product (GNP) level as a result of two feedback loops (reinforcing and balancing loops) influenced by investment ratio in national economy. And also for this sub-model official GNP and investments rate official statistics from the past are taken as multiplier time functions. The fourth part diagram is describing roughly the estimation of average salary level as a result of economic growth (measured by GNP) influence to salary payment by employers to employees. And this relation is also calibrated using official statistics from the past to set multiplier GNP related functions. As we can notice, the SD generic and synthetic model of public pension system, which is a result of risk factors’ identification in this research, has five balancing (B) feedback loops and five reinforcing R feedback loops.

**Fig. 3.** Causal-loop diagram (CLD) of generic public pension system model
Source: author's own elaboration.
3.2. Pension system SD model concept and simulator

In this research, all factors presented in Fig. 3 were translated into stock and flow diagrams (Fig. 4) with an application of Vensim PLE software package to build the SD model of public pension system expenditure. The development of SD model includes several types of variables such as stocks, flows, auxiliary variables, lookup functions, constants and connectors. Stock, which is also known as level, acts as an accumulate (integration) reservoir of quantities (represented by rectangle) and describe the state variable of the system. The increasing flow (inflow) and decreasing flow (outflow) of a stock are also known as rates (represented by valve). The condition of the stock depends on the rates while the rates can be influenced by the other factors affecting inflow or outflow which are known as converters or auxiliaries (sometimes represented by circle). Finally, the connector that represents cause and effect links within the model structure is represented by the single-line arrow with polarity sign.

![Stock-and-flow diagram (SFD) of generic public pension system model](source: author's own elaboration.)
4. Simulation results

The simulation experiments on the research model which was developed for the purpose to verify some common sense opinions have proved, that the financial crisis in social insurance, particularly public pension system in current system’s structure and under current constrains, is nearly certain. For the laboratory experimenting, some rather unrealistic assumptions ware made. As an example, initial level of FUS was set as equal to 100,000 mln zł, which imply in reality a budget subsidy at this level. Indeed, currently running demographic processes for presumed birth, death, and unemployment rates, as time dependent multiplier functions, allow to forecast rather negative demographic and employment tendencies in Poland in long-range time horizon (Fig. 5, Fig. 6).

![Selected Variables](image)

*Fig. 5. Population levels in basic (Exp 0) experiment*
Source: author's own elaboration.

![Selected Variables](image)

*Fig. 6. Population flows in basic (Exp 0) experiment*
Source: author's own elaboration.
In the financial system aspects (public social insurance) an increase of social premium annuity payment to FUS fund (as a result of average salary increase in economy) is not compensating FUS basic expenditure – payments of social indemnity for social insurance liabilities (Fig. 7). But it can be reasonable to search for some possible remedies in system structuring and tuning to avoid rapid financial crisis. Some solutions can be found by an attempt to calibrate system parameters, for example a change of replacement coefficient from 1 (pension amount is equal to 100% of the last salary) to 0.5 (pension amount is equal to 50% of the last salary). It is even possible in the model to find a break-even point for this parameter to allow sustainable growth of FUS fund (Fig. 8).

**Fig. 7.** Financial levels and flows in basic (Exp 0) experiment
Source: author's own elaboration.

**Fig. 8.** National FUS pension fund with a change of replacement coefficient from 1 (Exp 0 experiment) to 0.5 (Exp 1 experiment)
Source: author's own elaboration.
5. Conclusion

This research paper discusses the SD methodology and a generic, public pension system model, which can be used in discussing and tuning the structure and dynamic properties of pension systems, and in the first steps to analyse, test and design some proposals (as recommendations) for decision makers.

The SD generic model of public pension system, presented in this research consists of four sub-models: ageing population, central pension fund with basic incomes and expenditures, economic growth with influence of economic investments, and average salary estimation as a base to calculate social insurance premium annuity and finally the pension system liabilities. The first simulation experiments results have proved that for the relevance of representation and next practical application of this model, some multiplier and lookup functions must be recognised as very sensitive input data parameters – thus they must be calibrated on real data bases. Basic dynamic behaviour of the system under consideration (as a complex of 5 positive and 5 negative feedback loops) is that the system tends continuously in long-range horizon to financial deficit and must be subsided by external financial source. Or the dynamic system structure is to be transformed into more sustainable behaviour. Therefore, in the next and more profound research simulation testing and results analysis, some other effects of demographic and economic risks on public pension system expenditure will be possible to identify, and to formulate rough forecasts with scenario for recommended structure changes.

References


THE PROCESS OF MAKING PENSION DECISIONS – THE NEOCLASSICAL CONCEPT VERSUS BEHAVIORAL ECONOMICS

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Abstract
The explanation of retirement decisions making is based – implicite or explicite – on neoclassical basis, such as expected utility theory or efficient market theory. Decisions of participants of pension systems are explained in the sense of an optimal choice, according to the criteria of neo-classical economics. Behavioral economics – such as prospect theory of Kanheman and Twersky, the theory of bunded rationality of Simon or the concepts of “mental framing” and ”mental accounting” of Thaler – represent a different point of view, based on more realistic assumptions and evidence of psychological experiments and observations. The aim of this paper is a comparison between these two basic economic theories that are applied in pension economics. This publication is of a conceptual nature. The goal is not a detailed presentation of research results on the practical applications of behavioral decision-making theory in reforming pension systems. The literature analysis method and a comparison method have been used in presented paper. The comparative analysis of the neoclassical and behavioral theory of decision-making shows that the traditional neoclassical way of explaining pension decisions based on the theory of expected utility and the concept of homo economicus turns out to be too simplistic and inadequate. Research conducted within the framework of behavioral economics is not yet a new paradigm in economic sciences, but should be included in pension economics.

Keywords: behavioral economics, bounded rationality, expected utility theory, mental framing, prospect theory.

JEL codes: J32, J38, H55.

1. Introduction
The neoclassical economic theory developed its concept of a rationally acting subject (or entity) – so called homo economicus – as early as the 19th century. It was further developed, within the concept of expected utility. Expected-utility theory was axiomatically derived by von Neumann and Morgenstern (1944) as a criterion for rational decision-making. This work was highly influential and still serves as the benchmark theory of individual decision-making. The expected utility theory deals with the analysis of situations where individuals must make a decision under uncertainty (that means: decision making without knowing which outcomes may result from that decision). These individuals will choose the act
that will result in the highest expected utility, determined by utility over all possible outcomes and their probability. The decision made will also depend on the agent’s risk aversion and the utility of other agents.

The concept of the decision-making process adopted on the basis of neoclassical economic theory was normative, not descriptive, but it also found the application in explanations of the real-life economic phenomena. The big advantage of this approach was the possibility of creating advanced statistical models allowing for the optimization of decision-making processes and forecasting. At the same time, the psychological and sociological aspects of decision-making processes were omitted. For a long time there was a kind of anti-psychology in the approach to explaining the decision-making processes in “main-stream” economic theory. Neoclassical economics, for many decades, has revolved around the choices that human beings make in a perfect world.

Studies of behaviors and decisions of real people making economic decisions have shown that they have limited knowledge, do not always act in a consistent manner, and in their behavior there are a number of deviations and anomalies in relation to the concept of homo economicus (Thaler and Sunstein 2009, p. 7). Too many deviations from the neo-classical economic theory paradigm, revealed in the analysis of real decision-making processes, led from the mid-20th century to the emergence and development of a new alternative trend: penetration of psychology into economics and development of behavioural economics.

One of the precursors of behavioral economics was Simon, the creator of the concept of bounded rationality. His theory was developed by the creators of the prospect theory – Kahneman and Twersky and by Thaler. Behavioral economics theory – contrary to the neoclassical decision-making theory and the concept of purely rational homo economicus – is descriptive, not normative. It is based on linking economic research with psychological experiments, referring to choices made in risk conditions and with limited access to knowledge, decisions made by economic subject with bounded rationality. Its results have undermined not only the neoclassical model of making economic decisions based on maximizing the expected utility, but also the standard theories explaining decisions on the distribution of income between consumption and savings, such as the lifecycle saving theory of Ando, Brumberg and Modigliani (Modigliani and Brumberg, 1954; Ando and Modigliani, 1957), and Friedman’s permanent income hypothesis (1957).

2. Aim and Methodology

The aim of this paper is an attempt of comparison of two approaches of contemporary economics. First of them – stamming from neoclassic approach – can be situated in so called main stream economics and still dominates in economics textbooks and also pension economics (Blake 2006; Byrne et al. 2009). The second one, funded on behavioural economics, become more visiable since last two decades of the XX-th century and especially in first two decades on XXI-st century. Both approaches differ mainly in the general concept of rationality.
In the studies, which results are presented in the article, the methods of the literature, description, explanation and comparative method have been used.

3. Neoclassical, rationalistic approach to the decision-making process

The basic model of conventional (classical and neo-classical) economics actor (economic subject, economic entity) – commonly referred as homo economicus – is characterised by a number of very strong behavioral assumptions, which form the basis for key economic predictions. They are especially useful to build economic models and serve as tool to statistical analysis (for example – to distinguish between correlation and causation).

The most important conventional assumptions of the neoclassical theory of economics, which have found application in explaining economic decisions (also – pension decisions) include (Soukup et al. 2015, p. 2):

1) The entity (economic subject) makes a choice from a closed set of given and known alternatives.
2) The entity knows all relevant information for each alternative.
3) The entity’s preferences are stable and consistent.
4) The preferences are given exogenously, they are complete and transitive.
5) The entity’s utility function is clearly given mainly by its preferences.
6) Choices (decisions) of an entity are not dependent on framing of the problem (including prejudices, superstitions etc.).
7) The individual is the sole entity of decision making (the principle of methodological individualism).

These simplifying assumptions haven been critiqued as not realistic (not only by representatives of behavioural economics) but still belong to the main stream of economic theory – also the theory of pension economics. A model of a perfectly calculating and selfish entity is suitable for mathematical modelling. Theoreticians of this stream (e.g. Friedman) understand how unrealistic these assumptions are. However, they use them not for the description but for predictions. This is a well-known theory of “as if”. In his famous essay “The Methodology of Positive Economics” (1953) Friedman claimed the unrealism of a theory’s assumptions should not matter; what matters are the predictions made by the theory. A truly realistic economic theory would have to incorporate so many aspects of humanity that it would be impractical or computationally impossible to do so. Hence, it is necessary to make simplifications, and cross check the models against the evidence to see if we are close enough to the truth. The internal details of the models, as long as they are consistent, are of little importance. Friedman’s famous exposition of the “as if” argument has been also presented in his example of decisions of a snooker player. He used the analogy of a snooker player who does not know the geometry of the shots they make, but behaves in close approximation to how they would if they did make the appropriate calculations. We could therefore model the snooker player’s game by using such equations, even though this wouldn’t strictly describe the mechanics of the game.
4. Criticism of the neoclassic theory of making economic decisions carried out in the field of behavioral economics

Observations of humans making economic decisions led the representatives of behavioral economics to the conclusion that in real situations of choice, people do not behave according to the homo economicus model. Accepting unrealistic assumptions leads to erroneous and can have serious consequences for both individuals and the entire economy.

Empirical findings in the areas of judgment and decision making (JDM) and behavioral economics depart from the notion of man as economically rational, explain instead that people often act in ways that are economically suboptimal (Knoll 2010, p. 1).

One of the basic and most influential thesis of behavioral economics is Thaler’s concept on bundededly rational decision making.

It is worth to mention at least some of his predecessors, such as Simon, Kahneman and Tversky.

Already in 1950’s Simon (1978 Nobel Prize winner in Economic Sciences) explored the effects of limited cognition. He used the term “bounded rationality” to explain the dependence of human decisions from the design and performance of organizations (Simon 1955). His thesis, based on the results of theoretical analyses and empirical studies in American corporations, opposed the neoclassical homo economicus model. Simon argued that, rather than finding optimal solutions that maximize lifetime expected utility, decision-makers typically try to find acceptable solutions to acute problems. According to Simon, bounded rationality is a result of the existence of two types of reasoning: the first – intuitive, unconscious, making conclusions more quickly; and the second one – rational, functioning according to the principles of logical thinking, working more slowly.

The thinking process, as a whole, integrates both types. These two types of thinking can sometimes complement each other. But in many situations the intuitive type modifies the results of the second and has impact on important decisions, which should be made very carefully with the use of logical thinking and calculations. The is why errors in reasoning or mental shortcuts do not show in every situation, but only in some.

In 2002, psychologist Kahneman received the Nobel prize in economics for his research on human judgement and decision-making under uncertainty. Together with fellow psychologist Tversky (Kahneman and Tversky, 1979) he developed the prospect theory which aims to describe the actual behavior of individuals when making decisions under risk. They proved that many of such decisions may not necessarily be rational or optimal. Their theory was motivated by a number of findings on how people systematically violate the predictions of expected-utility theory.
Prospect theory contains four main elements:
1) Individuals derive utility not from wealth (or consumption) levels, but rather from gains and losses relative to some reference point;
2) Individuals are more sensitive to losses than to gains, i.e., they exhibit loss aversion (see Fig. 1);
3) Individuals exhibit diminishing sensitivity to gains and losses;
4) The Prospect theory incorporates probability weighting: individuals weigh outcomes by subjective, transformed probabilities or decision weights, overweighting low probabilities and underweighting high probabilities.

Fig. 1. Kahneman’s value function
Source: Kahneman and Tversky 1979.

Thaler (1980) was the one of the first economist to apply prospect theory to economic issues and problems. For example, he analysed so called endowment effect, connected with risk aversion: he proved in psychological experiments that if giving up an object is perceived as a loss, then loss-averse individuals will behave as if the objects they own are more highly valued than similar objects they do not own.

Very important from the view of pension economics was the next Thaler’s concept of mental accounting (Thaler 1985, 1999) – a psychological theory of how limited cognition affects spending, saving, and other household behaviour. It was a radical break with the standard neo-classical of utility maximizing consumers. The theory of mental accounting is the empirical observation that people group their expenditures into different categories (housing, food, clothes, etc.), with each category corresponding to a separate mental account.

Mental accounts are used more generally as a way for boundedly rational individuals to simplify their financial decision-making. Each account has its own budget and its own separate reference point, which results in limited fungibility between the accounts. Thaler and other authors (Hastings and Shapiro, 2013) provide evidence for a key aspect of mental accounting: the lack of fungibility of money. For example, many people have large surplus on their current bank
account and at the time huge debt on credit card account. It is also hard to move money from one mental account (consumption, short term savings etc.) to another mental account (for example long-term savings for retirement). But different presentation of possible options (so called choice architecture) can change the structure and reference points used in mental accounts. In mental-accounting theory, consequences are perceived and evaluated depending on context, as well as on how the decision-problem is presented (“edited”): the pain of a loss can be mitigated by grouping it together with a larger gain.

The next stage in the development of behavioral economics were works on the influence of weaknesses of will and limits of self-control on decisions regarding the distribution of income between current consumption and savings.

Consuming more today usually means consuming less tomorrow. The standard neoclassical model of rational intertemporal choice is the exponential discounting model of Fisher (1930) and Samuelson (1937). Fisher's model showed how rational forward looking consumers choose consumption for the present and future to maximize their lifetime satisfaction. The standard exponential discounting model implies time-consistent preferences. In reality, many preference reversals and problems with self-control have been observed and verified in psychological experiments and observations of decision making (also decisions about savings for retirement).

Also the Life Cycle Hypothesis (LCH) model of Modigliani defines individual behavior as an attempt to smooth out consumption patterns over one's lifetime (see Fig. 2).

![Fig. 2. Consumption, Savings and Wealth in Life-Cycle Model of Modigliani](source: Modigliani 1986)

The theory of the Life Cycle Hypothesis states that individuals seek to smooth consumption over the course of a lifetime – borrowing in times of low-income and saving during periods of high income. In his lecture on the occasion of receiving the Nobel Prize, Thaler directly referred to the theory of Modigliani and showed that it cannot be used as a universal model of building and consuming savings in the life cycle, because it does not include such important external and internal factors in relation to the entity making pension decisions, such as unexpected income disruptions or problems concerning self-control (Thaler 2017).
Thaler has also identified another psychological mechanism that can influence retirement decisions, called *endowment effect*. Referring to the prospect theory of Kahneman and Tversky, he pointed out an interesting phenomenon, consisting in that giving up an object is perceived as a loss, then loss-averse individuals will behave as if the objects they own are more highly valued than similar objects they do not own. Loss-averse individuals have a strong tendency to remain at the status quo, because the losses from a change are weighted more heavily than the gains. This so-called status-quo bias (Kahneman et al. 1991) can be a barrier when joining voluntary, employer pension programs. But changing the design of the program, using the heritage of behavioral economics, can help make better retirement decisions.

5. Verification of neoclassical and behavioral theory of decision making

It is a truism to say that the final criterion for assessing the validity of theories and scientific hypotheses is their empirical verification. The commonly occurring offenses from the homo economicus model in the sphere of pension decisions – such as procrastination, wrong choice of strategies and instruments in additional pension systems, lack of consistency and consistency of preferences – undermine and make inadequate neoclassical decision-making theory. What's more, the positive effects of using behavioral strategies in reforming pension systems make it possible to say that at least some of its assumptions have been positively verified empirically. In particular, it is about assuming the important role of default options and architecture of choice, emotions and emotional factors in making pension decisions and the possibility of controlling pension decisions in the desired direction, with the free will and freedom of choice for pension system participants. The innovations in occupational pension systems introduced in the US, and then in New Zealand and Great Britain can be considered as positive verification of the theory of decision-making. For example, Thaler and Benartzi (2013) designed and implemented a mechanism that increases pension savings by overcoming self-control problems and other behavioral biases. Their “Save More Tomorrow” (SMarT) program helped to increase savings (contributions) paid by employees to occupational pension plans such as 401(k). Employees decided to increase their savings a considerable time before a pay increase, so the decision does not involve a trade-off between current consumption and future consumption, but rather a trade-off between consumption at different times in the future. This solution introduced in 2004 in employee pension programs of selected American companies has proven itself in practice. Just like changing the default option when joining the company's pension systems. Already in 1994 Thaler proposed changing the default in defined contribution plans for pension savings offered by US employers, such as 401(k) plans. The prevailing default was that employees needed to actively sign up for the plan by filling in several forms, choosing a savings rate and deciding how to invest the money. Thaler (1994) suggested that the new default option should be joining the plan (so called automatic enrolment).
Subsequently, auto-enrollement was successfully applied to increase the level of participation in occupational pension systems in New Zealand (KiwiSaver) and in Great Britain (Szczepański 2017).

6. Conclusion

Behavioral economic has given economists new insights into human psychology and new frameworks for understanding and predicting economic outcomes. There is no doubt that behavioral economics opens new perspectives also for pension economics. It does not replace of the paradigm of classical and neoclassical economics with a new pradigm in economic sciences, but helps to create a new synthesis – more realistic, based on the synthesis of economic and psychological research, description and explanation of pension decisions.

But it is also worth to mention a number of questions and doubts that arise in connection with behavioral economics and its possible applications in the pension economy. Are the mental barriers and decision-making mechanisms – identified in the behavioral decision-making theory – universal, or are they culturally determined and depend on the state of pension awareness and the institutional tradition in a given country? Is the stimulation of pension decisions in the desired direction through the creation of an appropriate choice architecture (the “nudges” – in terminology of Thaler) not a form of more sophisticated manipulation? These are just some of the questions and doubts that can be an inspiration for further conceptual work and empirical research.

References


ADEQUATE RETIREMENT PATHS IN DEFINED CONTRIBUTION AND DEFINED BENEFITS PENSION SCHEMES

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Abstract
An adequate pension benefit is one of the most important values for future pensioners. They want to know how they should live, and what kind of decisions they should make in their family and work life in order to achieve an adequate pension. This article aims to identify a life trajectory which leads to an adequate pension in different pension schemes. The defined contribution and defined benefit pension scheme is considered. This research has been done by using sequence analysis and cluster analysis. The data used in the study come from the third round of SHARE 50+ in Europe (SHARELIFE). The results show differences in people’s life trajectories depending on the type of pension system to which the future pensioners belong. An adequate pension in DC system is connected with longer time of education and longer seniority. People in that kind of pension system retire later and they have less children.

Keywords: adequacy, pension benefit, sequence analysis.
JEL codes: C18, H55, J32.

1. Introduction
Recently, with the implementation of reforms of pension systems, both on theoretical grounds and in daily practice, there have been more and more questions and doubts about the advantages and disadvantages of different kinds of systems. This article contributes to the debate by studying life trajectories of people who belong to the defined benefit scheme (DB) and to the defined contribution scheme (DC). More specifically, we have studied adequacy of pension benefit in the DB system and the DC system. Since life trajectories are substantially different for men and women, gender differences have also been taken into consideration.
This paper aims to show the difference between individual career paths to adequate pension benefit, both men and women, in the DB and DC pension system.
We examine by using sequence analysis the impact on the level of pension following variables: time spend of education, seniority and retirement age, and the number of children. First are explored the adequate trajectories for the whole population, then the trajectories in clusters which has been achieved by cluster analysis.
The first pension scheme we consider is the DB system. As an example of the DB system, we have applied the old pension system in Poland. We have chosen the pension scheme in Denmark as an example of the partial DC system (Szumlicz and Żukowski 2004; Mercer 2017).

Literature on pension system describes a vast range of factors potentially affecting the adequacy of pension benefit. Among them are factors directly affecting the level of pension benefits such as expected earnings’ growth (Cocco and Lopes 2011), retirement age, and seniority (Ponomarenko 2016). Other factors may affect the individual level pension benefit indirectly. These include various socio-economic factors, such as gender, education period, or the number of children (Aisenbrey and Fasang 2010; Madero-Cabib and Fasang 2015). We include the following variables in the empirical analysis: the education period, the working status and the number of children. The adequacy of pension benefit has been measured by the individual replacement rate (Borella and Fornero 2009; EU 2015; Chybalski 2016a). Using data from the SHARELIFE survey, we have conducted sequence analysis and cluster analysis to identify groups of typical work-family life trajectories between the age of 20 to 65 for individuals who achieved an adequate pension benefit. Sequence analysis is widely used in social research such as motherhood (Rybińska 2014), family life course (Struffolino et al. 2015), determinants of vulnerability in late careers (Madero-Cabib and Kaeser 2016), or life course regimes (Möhring 2016).

2. Data, Variables and Method

In the paper, data was used from the Survey of Health, Ageing and Retirement in Europe (SHARE) (Börsch-Supan 2017; Schröder 2011), especially the data from the third wave, SHARELIFE. This data was collected in 2008-2009 and provides detailed information about pension income, household income as well as retrospective information about individual work-family trajectories starting from early adulthood until retirement. Data collection of SHARE was based on a probability sample and face-to-face interviews.

We extracted two groups of pensioners from SHARELIFE. The first one represents people who live in the DB pension system, whereas the second one includes people from the DC system. Next, in both groups we selected people who had given information about their first pension benefit and about the last income/last wage. For those pensioners, the replacement rate (RR) was calculated (OECD 2018). We chose this measure as the most popular to assess the level of pension benefits, aware of the shortcomings that are associated with this measure (Chybalski and Marcinikiewicz 2016). Nevertheless, Chybalski claims that “the replacement rate is a complete measure, good enough to use it to make a synthetic assessment of the adequacy of pension systems” (Chybalski 2016b, p. 27).

Then, the population was divided in two groups according to the level of the replacement rate. One group is related to an adequate pension, which means the replacement rate over 70% (Czepulis-Rutkowska 2000). We assume this level of RR because the pension benefit received from the ZUS in Poland was about 60-70% of the RR (ZUS 2011). This level of the benefit was considered sufficient
to maintain the previous standard of living. This aspect of adequacy is examined in the paper. Another group contains pensioners with no adequate pension. The groups of pensioners from the DB and DC pension systems and pensioners with adequate and inadequate pension benefits were divided by gender as well. Table 1 provides an overview of case numbers.

**Table 1. Sample size by gender and the level of pension benefit**

<table>
<thead>
<tr>
<th>Pension Benefit</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DB</td>
<td>DC</td>
<td>DB</td>
</tr>
<tr>
<td>Adequate</td>
<td>137</td>
<td>121</td>
<td>143</td>
</tr>
<tr>
<td>No Adequate</td>
<td>121</td>
<td>149</td>
<td>122</td>
</tr>
<tr>
<td>Total</td>
<td>258</td>
<td>270</td>
<td>265</td>
</tr>
</tbody>
</table>

Source: own calculation SHARELIFE data.

Among 523 pensioners in the DB system, there were 280 (54%) people who had achieved an adequate pension benefit. In the DC system there were 259 (45%) people with an adequate pension among 570 interviewed. Adequacy varied by gender as well. In the DB pension system there were 49% of men with an adequate pension benefit; in the DC system, there were 47% of men.

In our research we consider three variables connected with work-family life:

1) Education – in education (iE) or no education (nE);
2) Work – in Work (iW) or no Work (nW);
3) Children – no Children (nC), few Children (fC) (mean 1 or 2 children), many Children (mC) (mean 3 and more children).

A combination of these variables gives us a dimension of states presented in Table 2. Work-family trajectories from age 20 to 65 were operationalized as sequences of yearly states combining education, work and the number of children.

**Table 2. Dimension of states in pensioner trajectories**

<table>
<thead>
<tr>
<th>L.P.</th>
<th>Symbol</th>
<th>L.P.</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>iEnWnC</td>
<td>4</td>
<td>iEiWnC</td>
</tr>
<tr>
<td>2</td>
<td>iEnWfC</td>
<td>5</td>
<td>iEiWfC</td>
</tr>
<tr>
<td>3</td>
<td>iEnWmC</td>
<td>6</td>
<td>iEiWmC</td>
</tr>
<tr>
<td>7</td>
<td>nEnWnC</td>
<td>10</td>
<td>nEiWnC</td>
</tr>
<tr>
<td>8</td>
<td>nEnWfC</td>
<td>11</td>
<td>nEiWfC</td>
</tr>
<tr>
<td>9</td>
<td>nEnWmC</td>
<td>12</td>
<td>nEiWmC</td>
</tr>
</tbody>
</table>

Source: own calculation on SHARELIFE data.

As the method of study we have used sequence analysis. Sequence analysis is a method that provides a comprehensive look at the whole course of one’s life. In addition, it allows for the identification of typical trajectories of the life course (Abbott and Forrest 1986; Sackmann and Wingens 2003; Brzinsky-Fay et al. 2006). In sequence analysis, the algorithm comparing sequences has been used; it was proposed by Needleman and Wunsch (1970). It leads to the creation of a matrix of unlikeness between sequences. In the next step the distance measure between
sequences has been checked; it allows to build a typology of the sequences using cluster analysis. We have used the Ward method, which allows to achieve stable sequences and to minimize the variance between clusters.

3. Results

The results of the sequence analysis are presented in Figs. 1, 2 (men) and 3, 4 (women). The results of clustering are provided in Figs. 5, 6 (men) and 7, 8 (women). Additionally, Table 3 shows distribution of states among pensioners. Table 4 summarizes the descriptive statistics of the variables that are used in building of sequences: education time, work time and number of children. Work time is represented by retirement age and seniority.

Fig. 1 and 2 shows state distribution plots for men in the DB and DC system. Fig. 3 and 4 concerns women. State distribution plots show, at each age, the distribution of the statuses for combinations of education, work and number of children.

---

**Fig. 1.** Distribution of states across the life course in the DB pension scheme for men

Source: SHARELIFE data and own calculation in STATA.
The first significant difference between the two groups of pensioners, from the DB and DC system, both men and women, is the difference in the time spent in education. We can reveal that by the age of 20, 89.8% of men in the DB system have already finished education compared to 59.5% of men in the DC system. Almost every man in the DB system left school before the age of 25, while in the case of the DC system at that age 10.7% of people were still at school. In the case of women the difference is similar. Women from the DB system left school at the age of 20.2, while women in the DC system stayed in education longer, up to the age of 21.3 years.

What is more, pensioners in the DB system have worked on average 48.2 (SD 7.8) years before the retirement at the age 57.2 (SD 7.2), while in the DC system people have worked longer, 49.8 (SD 8.0) years on average, till the retirement age around 61.2 (SD 8.1) years. The difference for women is even greater. In the DB system, women have worked on average 43.0 (SD 8.5) years before the retirement at the age of 55.0 (SD 4.5). This can be compared to 48.7 (SD 8.0) and 61.2 (SD 8.1) years on average in the case of women in the DC system.

The next difference among pensioners in the DB and DC system can be observed in the number of children. Both women and men in the DB system have more children. On average, men have 2.5 (SD 1.5) children and women have 2.6 (SD 1.5) children.
Women who have lived in the DB pension system remained in education system the shortest period of time. At the same time, the lowest percentage of women from this group was still working after the age of 55. However, the largest part of this group (around 75%) had children before the age of 25, and their average number of children is the highest in the examined populations.
Men from the DC system can be located at the other end of the spectrum. They stayed in education very long, and they worked as long as it was possible (over 76% of them is still working at the age of 60), and many of them (more than 13%) decided not to have any children.

**Table 3.** Distribution of states in the DB and DC system among pensioners who achieved an adequate pension benefit at the age provided

<table>
<thead>
<tr>
<th>at the age of</th>
<th>Percentage of pensioners who finished education</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DB</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>20</td>
<td>89.8%</td>
<td>88.8%</td>
<td>59.5%</td>
</tr>
<tr>
<td>21</td>
<td>92.7%</td>
<td>95.8%</td>
<td>70.2%</td>
</tr>
<tr>
<td>22</td>
<td>95.6%</td>
<td>99.3%</td>
<td>75.2%</td>
</tr>
<tr>
<td>23</td>
<td>97.1%</td>
<td>99.3%</td>
<td>84.3%</td>
</tr>
<tr>
<td>24</td>
<td>97.8%</td>
<td>100.0%</td>
<td>87.6%</td>
</tr>
<tr>
<td>25</td>
<td>99.3%</td>
<td>100.0%</td>
<td>89.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>at the age of</th>
<th>Percentage of pensioners working</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DB</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>20</td>
<td>71.5%</td>
<td>78.3%</td>
<td>57.0%</td>
</tr>
<tr>
<td>30</td>
<td>98.5%</td>
<td>85.3%</td>
<td>95.9%</td>
</tr>
<tr>
<td>40</td>
<td>98.5%</td>
<td>91.6%</td>
<td>96.7%</td>
</tr>
<tr>
<td>50</td>
<td>81.8%</td>
<td>86.0%</td>
<td>90.1%</td>
</tr>
<tr>
<td>55</td>
<td>62.8%</td>
<td>51.7%</td>
<td>84.3%</td>
</tr>
<tr>
<td>60</td>
<td>34.3%</td>
<td>11.2%</td>
<td>76.0%</td>
</tr>
<tr>
<td>65</td>
<td>8.0%</td>
<td>2.8%</td>
<td>14.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>at the age of</th>
<th>Percentage of pensioners who have no children</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DB</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>20</td>
<td>95.6%</td>
<td>79.7%</td>
<td>94.2%</td>
</tr>
<tr>
<td>25</td>
<td>54.7%</td>
<td>25.9%</td>
<td>61.2%</td>
</tr>
<tr>
<td>30</td>
<td>19.0%</td>
<td>9.8%</td>
<td>27.3%</td>
</tr>
<tr>
<td>35</td>
<td>8.8%</td>
<td>5.6%</td>
<td>16.5%</td>
</tr>
<tr>
<td>40</td>
<td>5.8%</td>
<td>4.2%</td>
<td>13.2%</td>
</tr>
</tbody>
</table>

Source: own calculation on SHARELIFE in STATA.
The empirical analysis was conducted in two steps: the first one aimed to make a calculation the matrix of the distance between the sequences describing the work-family trajectories. The second step relied on making the sequence classification using cluster analysis.

The cluster solution for men resulted in 3 clusters in the DB system and 3 clusters in the DC system, as shown in Fig. 5 and 6. Cluster 1 (“Few Children”) is the largest cluster and contains 50.0% of men in the DB system and 55.5% in the DC system. This cluster includes men who have few children: one or two. This is the most typical trajectory leading to an adequate pension benefit. The second cluster (“No Children”) comprises men who had no children. This cluster is the smallest one in both pension systems and counts 6.4% (DB) and 12.1% (DC) of men. Cluster 3 (“Many Children”) summarizes trajectories for men with many (3 and more) children. This way to an adequate pension benefit was chosen by 43.6% of population in the DB system and 32.3% in the DC system.

### Table 4. Descriptive analysis for variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>DB</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean time spent in education after age of 20 in years</td>
<td>0.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Mean seniority</td>
<td>48.2</td>
<td>49.8</td>
</tr>
<tr>
<td>SD</td>
<td>7.8</td>
<td>8.4</td>
</tr>
<tr>
<td>Min</td>
<td>33.0</td>
<td>28.0</td>
</tr>
<tr>
<td>Max</td>
<td>70.0</td>
<td>70.0</td>
</tr>
<tr>
<td>Retirement age</td>
<td>60.0</td>
<td>67.0</td>
</tr>
<tr>
<td>Modal</td>
<td>57.2</td>
<td>61.9</td>
</tr>
<tr>
<td>SD</td>
<td>7.2</td>
<td>7.2</td>
</tr>
<tr>
<td>Min</td>
<td>28.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Max</td>
<td>82.0</td>
<td>70.0</td>
</tr>
<tr>
<td>Number of children</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Modal</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>SD</td>
<td>1.5</td>
<td>1.2</td>
</tr>
<tr>
<td>Min</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Max</td>
<td>14.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Source: SHARELIFE data and own calculation in STATA.

The empirical analysis was conducted in two steps: the first one aimed to make a calculation the matrix of the distance between the sequences describing the work-family trajectories. The second step relied on making the sequence classification using cluster analysis. The cluster solution for men resulted in 3 clusters in the DB system and 3 clusters in the DC system, as shown in Fig. 5 and 6. Cluster 1 (“Few Children”) is the largest cluster and contains 50.0% of men in the DB system and 55.5% in the DC system. This cluster includes men who have few children: one or two. This is the most typical trajectory leading to an adequate pension benefit. The second cluster (“No Children”) comprises men who had no children. This cluster is the smallest one in both pension systems and counts 6.4% (DB) and 12.1% (DC) of men. Cluster 3 (“Many Children”) summarizes trajectories for men with many (3 and more) children. This way to an adequate pension benefit was chosen by 43.6% of population in the DB system and 32.3% in the DC system.
Fig. 5. Index plot of states across the life course in the DB pension scheme for men in clusters
Source: SHARELIFE data and own calculation in STATA.

Fig. 6. Index plot of states across the life course in the DC pension scheme for men in clusters
Source: SHARELIFE data and own calculation in STATA.

In the case of women tree clusters of pension careers have been revealed as well, as one can see in Fig. 7 and 8.
The first cluster is the biggest and includes women who have one or two children (“Few Children” Cluster 1 in DB and 3 in DC). Just as in men’s case, it is the most popular trajectory to an adequate pension. In the DB system, 53.1% of women walk this way. In the DC system, the number of women (53.2%) is exactly the same.
The second popular way leading to an adequate pension is life with many children (Cluster 2 “Many Children”). This cluster combines 42.7% (DB) and 38.3% (DC) of women. The third cluster (3 in DB and 1 in DC) (“No Children”) includes 4.2% women in DB and 8.5% in the DC system. This cluster is composed of women that have no children. It is the smallest cluster.

4. Conclusion

The main aim of this study has been to compare life trajectories of pensioners who have achieved adequate pension benefits in the defined benefit pension scheme with lives of pensioners in the defined contribution pension scheme. The results indicate significant differences between pensioners in both pension schemes. First of all, people in the DC pension system have spent more time in education. The second conclusion is that people in the DC system have worked longer and entered retirement later than in the DB system. A high percentage of them is still working, without long breaks in their whole life as well. Another important factor which strongly differentiates population of pensioners for the adequacy of pension benefit is the number of children. Attention should be paid to the diversity of trajectories for women and men. Every difference that concerns men is even stronger for women. People in the DC pension system are probably more aware of the relationship between their contributions and the level of pensions; therefore, they are more focused on work. Longer education, and probably its higher level, also promotes better paid work. However, paradoxically, pensioners in DC system do not appreciate the relationship between pension benefit and children. On the other hand, the people in the DB system who do not see great correlation between the contributions paid into the system and the amount of future pension benefit are less concerned with their work period. What is more, the prospect of a certain, high pension benefit is conducive to greater fertility among these people.

The research has shown that the type of system in which an individual person is involved plays a very important role in the level of pension benefit. Therefore, an analysis of various types or pension regimes will constitute the subject of further research. In addition, the dependencies obtained will be modeled using logistic regression analysis. To summarize, in the study it was possible to discover the differences in the trajectories of lives of adequate pensioners in the DB and DC pension system. The use of sequence analysis has given us an opportunity to see correlation between the level of pension and the time of education, work time, and the number of children.

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Adequate retirement paths in defined contribution and defined benefits pension schemes


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SUB-ACCOUNT OF THE INSURED PERSON AS AN INSTRUMENT OF INCOME ALLOCATION OVER THE LIFE COURSE. LEGAL ASPECTS

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Abstract
The sub-account held in the Social Insurance Institution is a mechanism for income allocation over the life-cycle, which is supposed to have a less distortive effect on the fiscal situation of the pension system than member’s account held in the Open-end Pension Fund. However, due to frequent legal changes in the Polish pension system, motivated by the temporary politics, it is not so. Contributions registered on the sub-accounts are the growing financial liability to the pension system in Poland. This indicates that the pension rights acquired and registered at the sub-account are not as firm as insured individuals might expect. The purpose of this research is to: 1) describe the construction of the legal institution of the sub-account held in the Social Insurance Institution; 2) determine if the legal institution of the sub-account is coherent with general principles of social insurance; 3) to evaluate if sub-account is a reliable instrument of income allocation over the life course. To achieve the research objectives the logical and historical legal methods were applied and scientific literature and normative documents were critically reviewed.

Keywords: pension systems, pension wealth, Social Insurance System, sub-account.

JEL codes: H53, I38, J11.

1. Introduction
The reform of the Polish pension system in 2011 introduced new legal institution of sub-account of the insured person. Since that moment the Social Insurance Institution (ZUS) is obliged to register information on the number and the value of the retirement pension insurance contributions paid to the sub-account. This new legal institution is regulated by art. 40a of the Act of 13th October 1998 on the Social Insurances System (Journal of Laws 2017, item 1778, with further amendments, from now on: the Social Insurance System Act). The sub-account has an individual character, and for each insured person only one sub-account is kept, which is marked with the PESEL identification number (Polish equivalent of Social Security Number).

The primary function of the sub-account is accounting and controlling. The information on registered retirement pension insurance contributions of the
insured person is used to calculate a temporary retirement pension as well as a final pension from the Social Insurance Fund. Moreover, the information registered on the sub-account is also used to calculate payments in cash from the Social Insurance Fund. If the insured person dies before the retirement age or within the first three years from the day of claiming the first retirement benefit his family or other inheritors receive lump-sum payments.

The introduction of the sub-account fuelled the dispute among the representatives of social insurance law doctrine. The first controversy is over the coherency of this legal institution with the Polish Social Insurance System and general principles of social insurance. The second controversy is over the inalterability of acquired pension rights registered on the sub-account (Pacud 2015; Ślebzak 2009).

Therefore, the purpose of this research is to:
1) describe the construction of the legal institution of the sub-account held in the Social Insurance Institution,
2) determine if the legal institution of the sub-account is coherent with general principles of social insurance,
3) to evaluate if sub-account is a reliable instrument of income allocation over the life course.

To achieve the research objectives the logical and historical legal methods were applied and scientific literature and normative documents were critically reviewed.

Legal status as of March 1st 2018.

2. Introduction of the sub-account held in the social insurance institution

The reform of the pension system in Poland, introduced in 1999, ultimately changed the rules of financing and functioning of the mandatory pension system for people born after 1968 (Dybał 2017). The old system was a traditional, pay-as-you-go defined benefit scheme (DB scheme). The new system is a defined contribution scheme (DC scheme) (Chłoń-Domińczak and Strzelecki 2013). The financing of the reformed pension system has been changed (Stevens 2017). At first, the pension insurance contribution (19.52% of the basis of contribution rate1 was split into two accounts: first public and based on pay-as-you-go method is held in the Social Insurance Institution. Second private and based on capitalisation method is held in an Open-end Pension Fund.

The account held in the Social Insurance Institution is non-financial defined contribution scheme (NDC). Till today 12.22% of the basis of contribution rate is recorded on this account and is indexed to the price index of consumer goods and services magnified by the change in the overall contribution revenue (to covered wage bill growth). Therefore the final indexation is a mixture of price and wage

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1 Basis of retirement and disability pension insurance contribution rate is regulated by art. 18 of Social Insurance System Act. In case of majority insured persons it’s equal to remuneration for work.
indexation (Nerka 2015, pp. 63-74). The second account held in an Open-end Pension Fund is financial defined contribution scheme (FDC). Until 2011 a contribution of 7.3% of the basis of contribution rate was transferred to the chosen Open-end Pension Fund and invested in assets on the financial markets. Therefore a rate of return that account in a private pension fund earns is linked to the financial market performance.

From 2008 to 2014, facing worsening public finance situation resulting from the global financial crisis Poland decided to introduce changes to her pension system (Dybał 2014), which strengthened the role of pay-as-you-go (PAYG) components in her scheme. First significant change of the design and financing of the pension system was introduced in 2011. The private pillar based on capitalisation method was downsized to 2.3% of the basis of contribution rate. The remaining part of the open-end pension fund contribution was directed to a newly introduced sub-account held in the Social Insurance Institution (Dybał 2014). This new sub-account is quasi non-financial defined contribution account (NDC-2) because indexation is based on five-year averaged GDP growth and contribution recorded there is inherited if an insured person dies before reaching the retirement age or dies in the first three years after claiming retirement.

Thus, those that are fully covered by the new system have currently three separate pension accounts: primary account held in the Social Insurance Institution (NDC), sub-account also held in the Social Insurance Institution (NDC-2) and member account held in Open-end Pension Fund (FDC).

Second significant change of the design and financing of the pension system was introduced in 2014 when 153 151,2 mln PLN was transferred from Open-end Pension Funds to the Social Insurance Fund and reduction of fully funded contribution was permanently set at the level of 2.92% of the basis of the contribution rate (Jedynak 2016).

3. Inflows registered on the sub-account

People born after 1948 who decided in 1999 to become a member of an Open-end Pension Fund and all the people born after 1968 that are obliged to participate in the social insurance are the holders of the sub-account. Therefore a portion of their retirement pension contribution is transferred to their sub-accounts.

The contribution rate registered on a sub-account is calculated in accordance with art. 22 par. 3 of the Social Insurance System Act. The amount registered on a sub-account depends on the decision of the insured person. Since February 2014 insured individuals are enabled to choose if they still want to pay part of their retirement pension contribution to Open-end Pension Fund. According to art. 11 of the Act of 6 December 2013 on the amendment of certain laws relating to rules of paying out retirement pensions from assets accumulated in Open-end Pension Funds (Journal of Laws of 2013, item 1717, from now on the Reforming Act of 2013) between April 1st and July 31st 2014 every member of Open Pension Fund had a chance to officially declare the will of continuation to pay pension contribution to a chosen Open-end Pension Fund. Since 2016 every four years, between April 1st and July 31st every member of OPF will have to formally
declare the will of continuation to pay part of pension contribution to Open-end Pension Fund (art. 39a par. 1 of the Social Insurance System Act).

If an insured person formally declares the will to continue to pay part of his retirement pension contribution to an Open-end Pension Fund his contribution is split between:
- a basic account held in Social Insurance Institution (12.22% of the basis of contribution),
- sub-account also held in Social Insurance Institution (4.38% of the basis of contribution),
- member account held in Open-end Pension Fund (2.92% of the basis of contribution).

If an insured person does not declare his will to continue paying part of his pension contributions to an Open-end Pension Fund the total pension contribution (19.52% of the basis of contribution) is received by the Social Insurance Fund and split between:
- a primary account held in Social Insurance Institution (12.22% of the basis of contribution),
- sub-account also held in Social Insurance Institution (7.3% of the basis of contribution) (Chybalski 2013).

The contributions shall be registered by the Social Insurance Institution on a sub-account immediately, no later than within 15 working days since the receipt of the contributions paid with the documents of payment, monthly reports and declarations.

Not only part of the pension insurance contribution is registered on the sub-account. Also, transfers of assets from the Open-end Pension Funds to the Social Insurance Fund are registered there. First and so far the most significant transfer took place on February 3rd 2014. The legal basis for this transfer was the Reforming Act of 2013. According to this statute, Open-end Pension Funds were forced to transfer 51.5% of their accounting units to Social Insurance Institution on February 3rd 2014. The total value of transferred assets was 153 151,2 mln PLN. The nominal value of transferred securities was 146 bn PLN. This included:
- bonds and bills issued by the Treasury;
- bonds issued by the Bank Gospodarstwa Krajowego (highway bonds guaranteed by the State Treasury);
- other securities guaranteed by the State Treasury;
- cash;
- bank securities;
- bonds and other debt securities issued by local government units, their unions or the city of Warsaw.

Debt securities transferred to Social Insurance Institution were redeemed by the Ministry of Finances. At the same time, the value of transferred accounting units was registered on sub-accounts of insured persons.

A similar transfer of remaining assets from Open-end Pension Funds to the Social Insurance Fund was announced in 2016 (Jakubowski 2017).
Last category of inflows registered on the sub-accounts are monthly transfers of accounting units from member’s account held in Open-end Pension Funds. Article 13 of the Reforming Act of 2013 also introduced monthly transfers of accounting units from member’s account held in the Open-end Pension Fund to the insured person’s sub-account held in the Social Insurance Fund (Bielawska 2016, pp. 3-17). This process starts ten years before a member of Open-end Pension Fund reaches retirement age (art. 24 of the Act of 17th December 1998 on Retirement and Disability Pensions Payable from the Social Security Fund, Journal of Laws 2017, item 1383, with further amendments, from now on: the Pensions Act and art. 100c of the Act of 28th August 1997 on organisation and operation of pension funds, Journal of Laws 2017, item 870, with further amendments, from now on: the Pension Funds Act). Each month 1/120 of accumulated accounting units of this member is transferred to his subaccount at Social Insurance Institution (art. 22 par. 3 of the Social Insurance System Act). This mechanism was introduced to protect insured individuals form the volatility of financial markets in the last stage of their professional career (Dzienisiuk 2016).

4. The conjugal property and succession of amounts registered on the sub-account

The primary purpose of holding a sub-account is to use the registered information to calculate the periodic capital pension (as regulated in the Act of 21st November 2008 on Capital Pensions, Journal of Laws 2014, item 1097, with further amendments) or retirement pension payable from the Social Security Fund (as regulated in the Pensions Act). However in the case of early death of the insured person, before reaching the retirement age, the information is used to calculate one-off money payment benefit from the sub-account. Also in a case of early death that takes place after retirement, within three years after claiming the first retirement pension benefit, the information is used to calculate guaranteed payment. Also, this payment has a form of lump-sum payment (in cash) to one or several persons.

The specific feature of the sub-account is the legal possibility to inherit the sub-account balance. This is unique even from the international point of view. It is difficult to find other public Social Security Systems that are based on pay-as-you-go method and allow the deceased individuals’ families to inherit registered pension insurance contributions.

The first aspect that needs to be analysed is the conjugal property of amounts registered on sub-account (art. 31 § 1 of the Act Of 25th February 1964 Family and Guardianship Code, Journal of Laws 2017, item 682, with further amendments).

The amounts registered on sub-account are divided between the spouses when:
- the marriage of an insured person is dissolved by divorce or declared void,
- the joint property of spouses is ceased during the marriage of an insured person,
- the statutory joint property of spouses between an insured person and his/her spouse is excluded or limited by an agreement,
- death of an insured person (Jędrejek 2015, p. 173).

The amounts registered on the sub-account of that insured person which are due to his/her ex-spouse are transferred to the sub-account of the ex-spouse in Social Insurance Institution (art. 40e of the Social Insurance System Act).

The joint property of spouses of amounts registered on sub-account is similar legal construction to the conjugal property of accounting units accumulated on member’s account held in an Open-end Pension Fund (art. 126-128 of the Pension Funds Act). The significant difference is that the latter account is financial defined contribution scheme (FDC) (Nadrowski 2000, p. 14) and accounting units are assets similar to financial instruments (Jakubowski 2015). In this legal construction conjugal property of accounting units is reasonable. In opposition to that, the sub-account is non-financial defined contribution scheme (NDC-2) and contains only information on registered pension insurance contributions (Jędrasik and Jankowska 2010, pp. 141-142).

The reasons why amounts registered on sub-account are subject to the conjugal property are rooted in the origins of the sub-account. It was created in 2011 by splitting and downsizing the private pillar of the pension system. The contribution to Open-end Pension Funds was lowered to 2,3% of the basis of contribution rate. The remaining part of the Open-end Pension Fund contribution rate was directed to the newly introduced sub-account. To limit the discontent of insured individuals, the sub-account has to imitate legal constructions of member’s account held in Open-end Pension Fund. Therefore the sub-account is linked with legal relations characteristic for a capital part of the Polish pension system, also from the legal point of view.

Nevertheless, application of joint conjugal property of amounts registered on sub-account is questionable and is commonly criticised in the doctrine of social insurance law (Pacud 2012, p. 21).

Another unique feature that needs to be analysed is the division of registered amounts on the sub-account, that are not subject to joint property of spouses, in case of insured person death before reaching the retirement age. The insured person has the legal right to nominate a natural person or natural persons in favour of whom the payment of registered amounts should be made after his death (art. 39 par. 1b of the Social Insurance System Act and art. 83 par. 1 of the Pension Funds Act). The Social Insurance Institution is obliged to pay amounts registered on sub-account to the persons previously nominated by the deceased insured individual in the form of lump-sum payment within three months. If no disposition is made in the case of death, the amounts registered on the sub-account become a part of the inheritance of the deceased insured person. Therefore the critical element, in case of early death of an insured person is to find out if the deceased insured person was married or not (art. 40e par. 1 of the Social Insurance System Act and art. 131 par. 1 of the Pension Funds Act). If at the time of death the insured person was married, a part of the amounts registered on sub-account is recorded on the sub-account of the spouse, to the extent that these funds were the subject
of the joint conjugal property. It should be emphasised that this part of the registered amounts on the insured deceased person sub-account is not subject to the lump-sum payment. The remaining part of the registered amounts on deceased insured person sub-account is paid out in the form of lump-sum payment to the persons previously nominated by the deceased insured individual. It should be emphasised that these lump-sum payments (in cash) do not have insurance nature and are incoherent with general principles of social insurance. The final unique feature that should be analysed is the legal institution of “guaranteed payment”. This one-time lump-sum payment in cash is paid out if the insured person dies within three years since claiming the first retirement pension benefit (art. 25b of the Pensions Act). The guaranteed payment is paid to persons previously nominated by the deceased insured individual. If nobody had been indicated, the guaranteed payment is paid to the spouse of the deceased insured person. If the deceased insured person had not been married or the spouses did not enjoy the conjugal property, the amounts registered on the sub-account become a part of the inheritance of the deceased insured person (Pacud 2015). The value of the guaranteed payment is determined by the amounts registered on the sub-account of the deceased insured person. It should be emphasised that guaranteed payment does not constitute an integrated element of the social insurance system and is not coherent with general principles of social insurance.

5. Indexation

The legal institution of the sub-account is supposed to be a substitute for member’s account held in an Open-end Pension Fund. This may create the impression that the sub-account can be alternative for pension savings. The impression is magnified by the generous indexation of the amounts registered on the sub-account. This indexation, unlike the indexation on primary account of an insured person held in the Social Insurance Institution (NDC), is related neither to the consumer price index (price indexation) nor the average wage growth index (salary indexation).

Value of contributions paid to sub-account is indexed to five-year averaged GDP growth. This indexation is difficult to match even with investments on financial markets. Moreover, from the legal point of view, the indexation cannot be negative (art. 40c of the Social Insurance System Act). Thus it is not possible to reduce the amounts registered on the sub-account, even if the economy experiences a macroeconomic shock. In this way, the legislator eliminated the possibility of suffering nominal losses on amounts registered on sub-account. This is possible from technical point of view, because the sub-account is non-financial defined contribution scheme (NDC-2). Unlike member’s account held in the Open-end Pension Fund (FDC), the sub-account contains only information on registered pension insurance contributions. The guarantee for the registered amounts on the sub-account is the Social Insurance System and the support of the state budget. According to the art. 2 par. 3 of the Social Insurance System Act payment of all social insurance benefits is guaranteed by the State. Moreover art. 62 of the Social Insurance System Act
Sub-account of the insured person as an instrument of income allocation... directly indicates that the State budget shall guarantee payment of pension benefits from the Social Insurance Fund. This means that as long as the state is solvent, retirement benefits will be paid out.

6. Conclusion

The purpose of this analysis was to describe the construction of the sub-account held in the Social Insurance Institution, to determine if this legal institution is coherent with general principles of social insurance and finally to evaluate if sub-account is a reliable instrument of income allocation over the life course.

The inheritance of the sub-account balance and payments in cash from the sub-account in case of death of insured person turn the sub-account into unique legal institution among social insurance systems. At the same time, the inheritance of the sub-account balance makes the sub-account incoherent with the general and the most basic principles of social insurance. Coherence is preferable to chaos, but it is not the most important goal of social insurance systems. More important are social security and enabling income allocation over the life course. No doubts the sub-account is an instrument that supports these goals. Nevertheless, seven years is not enough, from the pension system perspective, to evaluate if the sub-account is a reliable instrument of income allocation over the life course.

The legal institution of inheritance of the sub-account balance and the payments in cash from sub-accounts will be growing burden for the Social Insurance Fund in the future. Already today retirement pension insurance contributions are not enough to cover the payment of retirement pension benefits for today’s pensioners. Rapidly growing public debt and persistent budget deficit decrease the state guarantee potential for the System of Social Insurance in the long term. According to Social Insurance Institution’s forecasts, the budget subsidy and loans to cover the imbalance of the pension fund in the Social Insurance Fund will grow from PLN 42.5 billion in 2017 to PLN 217.8 billion in 2060. The economic and demographic situation in the future will not alleviate this problem (Marcinkiewicz 2018, pp. 207-220). This will lead to changes in the Polish pension system, again. Some modifications were already announced and are being prepared in this parliamentary term. Political uncertainty and instability of the Polish pension system are the most important factors that undermine the reliability of the sub-account as an instrument of income allocation over the life course.

References


Chłoń-Domińczak, A. & Strzelecki, P. (2013). The minimum pension as an instrument of poverty protection in the defined contribution pension system – An example


**Legal acts**


The Act of 6th December 2013 on the amendment of certain laws relating to rules of paying out retirement pensions from assets accumulated in Open-end Pension Funds, Journal of Laws 2013, item 1717.
FORECASTING THE IMPACT OF STATE PENSION REFORMS IN POST-BREXIT ENGLAND AND WALES USING MICROSIMULATION AND DEEP LEARNING

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Abstract
We employ stochastic dynamic microsimulations to analyse and forecast the pension cost dependency ratio for England and Wales from 1991 to 2061, evaluating the impact of state pension reforms initiated by the Labour and continued by the Conservative governments. To fully account for the increasing trends in life expectancies, we implemented a custom extrapolation model for mortality rates, based on deep learning techniques. Our results show that the recent reforms can effectively stave off the “pension crisis” and bring back the system on a sounder fiscal footing. At the same time, increasingly more workers can expect to spend greater share of their lifespan in retirement, despite the eligibility age rises. The population ageing due to the postponement of death until advanced old age often occurs with the compression of morbidity, and thus will not, perforce, intrinsically strain healthcare costs. To a lesser degree, the future pension cost dependency ratio will depend also on the post-Brexit relations between the UK and the EU, with “soft” alignment on the free movement lowering the relative cost of the pension system compared to the “hard” one. In the long term, however, the ratio has a rising tendency.

Keywords: Brexit, machine learning, microsimulation, state pension system.
JEL codes: H55, C53, C45.

1. Introduction
The social and economic implications of a rapidly ageing population, a consequence of low fertility rates and rising longevity, are becoming increasingly apparent in the UK and other developed countries. A shrinking share of workers has to fill the labour void left by the retiring ones and concurrently provide for their support, as reflected in the growing old-age dependency ratio (Werpachowska et al. 2017). To reduce the strain the new demographic situation places on public services, in particular the state pensions, benefits, and health care, the UK introduced a broad reform of the state pension system, raising the retirement age for all born after 1950. The former pension ages of 65 for men and 60 for women introduced in 1948 are due to be equalised by 2018, and subsequently increase for everybody to 68 by 2046. The economic and demographic effects of approaching Brexit will add to the magnitude of
population changes against which the affordability of the pension system will be tested in the following decades. This work evaluates the impact of the state pension reforms on the pension cost dependency ratio (namely, the number of people at or above the retirement age to people between ages 15 and that retirement age) under different post-Brexit scenarios. To this end, we perform stochastic dynamic microsimulations of the England and Wales (E&W) population based on available historical data, as described in Ref. (Werpachowska et al. 2017), from 1991 (and forecasting beyond 2014) to 2061. The simulated future scenarios focus on changing migration patterns between the UK and the EU after the Brexit. In each scenario, we compare the dependency ratios assuming the state pension age with and without the past reforms. To fully account for the increasing trends in life expectancies, we have implemented a custom extrapolation model for mortality rates, based on deep learning techniques. The historical overview of state pension reforms and demographic changes in the UK in Sec. 2 provides insight in the presented analysis and results. Section 3 describes the modelling framework for neural networks and the obtained mortality rate forecasts. The microsimulation results for the pension cost dependency ratio are presented in Sec. 4 followed by the summary.

2. Historical background and future scenarios

The foundations of the British social security system have been laid at the early stages of the state formation. A host of demographic, economic, political, and religious changes in the medieval England impelled the so-called Poor Law (Macnicol 1998). For several centuries, it formed the basis of the government provision of relief for the “impotent poor” while forcing able-bodied “vagrants” into the infamous workhouses. Yet the idea of retirement and state pensions dawned with the 18th century industrial revolution (Maseres 1772). At its early labour-intensive stage, millions of workers migrated to cities, to be eventually forced out from their factory jobs by rapid technological developments and the inflow of younger competition from the declining agriculture. Simultaneously, demographic trends characteristic of a maturing economy conduced to the growing share of “dependants” at the top of the population pyramid, boosting the case for the old age pension. Last but not least, industrialisation created a wealth to fund it.

The campaign for social welfare reform culminated in the Old-Age Pensions Act 1908 which established a gender-blind, non-contributory means-tested state pension for persons over the age of 70. From the start, the policy has been shaped by a multitude of conflicting agendas, from the conservative desire to limit income redistribution, through the Treasury policy of reducing government spending, to socialist demands of a tax-funded and universal subsistence scheme. Less visible (at least until the post-WW1 period) but as important as the class conflict was the gender division: although women constituted the majority of the aged poor (Caradog Jones 1934), the debate over pensions focused on the plight of
“worn-out” male worker. As a result, women’s pension rights were eroded in post-1908 reforms. 

Meeting the demands of emerging interest groups for increasing the level and scope of the pensions was considered “fiscally unsound” in the atmosphere of austerity prevalent in the 1920s (Blaikie 1990). Thus, the Conservative Party and civil service mandarins pushed for the switch to a contributory system (funded by worker’s contributions paid during lifetime and available only to those with a minimum employment record). Such a system was expected to be more resistant to demands for increasing the pension amount and to require much less redistribution of income between the wealthy and the lower classes. This reactionary policy met with weak opposition from the Labour parliamentary leadership and culminated in the Widows, Orphans and Old Age Contributory Pensions Act 1925. As well as introducing a non-means tested, contributory pension system, the policy lowered the pension age from 70 to 65 for both men and women in hope to alleviate the unemployment of younger workers. Since many women did not have paid employment, they gained the right to a full pension based on their husband’s contributions, which tied them financially to marriage and created a special group of interest (National Spinsters’ Association). In 1940, female pension age was reduced to 60 and supplementary means-tested pensions introduced to address the problem of poverty among older unmarried women (Ginn 2003).

In 1941, UK government asked Sir William Beveridge to produce a comprehensive report, proposing a new “from the cradle to the grave” social welfare system for post-war Britain. Resulting from his work, the National Insurance Act 1946 introduced a universal flat-rate contributory pension higher than the pre-war amount: £1 6s for a single person and £2 2s for a married couple, funded from workers’ National Insurance contributions and payable from the age of 65 for men and 60 for women. National Insurance contributions were mandatory for everyone except married women, and no benefits were provided for divorced women. Thus, the new system reinforced the dependency of women on their husbands’ pensions, a problem which became increasingly apparent with the post-WW2 changes in lifestyle (higher prevalence of single parenthood and divorce). Another important feature of the National Insurance was the retirement condition for the payment of pension (the aim of which was to prevent pensioners from undercutting younger workers in the labour market). However, because of post-war labour shortage, old men were encouraged to remain working past the pension eligibility age and two-thirds of them chose to do so (TNA 2008).

To satisfy the needs of higher-earning workers, the National Insurance Act 1959 (implemented in 1961) introduced an additional earnings-based top-up pension, replaced in 1978 by the State Earnings-related State Pension Scheme. Workers who decided to provision privately for an additional pension could choose to opt out of SERPS and pay lower NI contributions. SERPS was replaced in 2002 by the State Second Pension Scheme, with the aim to skew the benefits of additional pensions in favour of low and moderate earners at the expense of the wealthier workers, and improve the situation of carers and disabled persons. The optional
additional pensions have been abolished in 2016, when they have been all replaced by a single flat-rate state pension, bringing the UK pension system back to its Beveridgean roots and ending its post-war foray into the Bismarckian regime. One key element of the 1948 pension system—the different pension age for men and women—has been left unchanged until the last decade of the 20th century. Following the European Court rulings, the UK had to equalise male and female pension age, and in order to defuse the “demographic bomb”, decided to gradually increase women’s pension age to 65. Its subsequent increase to 68 for everyone in Pensions Act 2007 was motivated by rising life expectancies. The financial crisis spurred the Conservative-Liberal coalition government to accelerate this increase twice, in Pensions Acts 2011 and 2014.

As the mortality rates at all ages continue to fall thanks to improving standards of living and advances in medicine, senior citizens are the fastest growing segment of the UK population. In 1948, when the National Insurance Act was implemented, retiring men and women were expected to live additional 11.6 and 18.7 years, respectively. According to the latest Office for National Statistics projections, those numbers rose to 21.4 and 28.4 (ONS 2016). At the same time, fertility rates – after experiencing a series of demographic upheavals (collapsing during Spanish flu pandemic and World Wars, and rebounding in the 1920 birth-rate spike and during post-WW2 and the 1960s “baby booms”, the latter reaching 2.93 children per woman at its peak in 1964) – fell and stabilised around the current average of 1.81 children per woman (ONS 2017). The longevity together with high immigration (mainly from the EU after the 2004 enlargement (ONS 2017a) contribute to the growth of population size, despite the low birth rates (Werpachowska et al. 2017).

The above factors shape the population age structure, and thus are important considerations for the provision of state pensions. Additionally, economic and demographic effects of Brexit (especially the free movement arrangements) will potentially have a significant impact on the affordability of the pension system (DEEU 2017).

3. Mortality rates extrapolation using neural networks

Future mortality rates for all age and sex groups are required as inputs for our microsimulation. Rates of survival were consistently improving throughout the UK population for more than 100 years, owing to medical progress and bettering standards of living. A reasonable projection should continue this trend. How much

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1 European state pension systems range from a Bismarckian design with no redistribution and pensions that are earnings-related, to a Beveridgean one with flat pensions. The latter comprises the main part of the UK system of public support for pensioners, next to earnings-related benefits, flat-rate non-contributory benefits and means-tested benefits. It is worth noting that although its design translates into replacement rates that fall as the income increases, high earners benefit from tax allowances on private savings.

2 In July 2017, the government decided to accelerate the state pension age rise to 68 again, following the recommendations of the Cridland report. It will now be phased in between 2037 and 2039, rather than from 2044, as previously proposed (DWP 2017).
further improvement in the lifespans of future generations can be expected is, however, far from certain, with some forecasts predicting over 30% chance for a person born today of reaching the ranks of centenarians (ONS 2016a). Inevitably, the further away in the future we project mortality rates, the higher is their uncertainty. Simple analytic models (Lee and Carter 1992; Cairns et al. 2009) provide more stability, but may not be flexible enough to reflect all trends in the data.

We propose a robust model based on the deep learning approach (Goodfellow et al. 2016) to exploit the information about mortality trends available from historical data (ONS 2017b) more fully. Given last $M$ mortality rates for a fixed age group, our model uses a recurrent neural network to predict the $(M+1)$-th one and then feed it back as part of the input used to predict the $(M+2)$-th rate, etc. Differently than in (Hainaut 2018), we use a neural network to predict the mortality rates directly, without additional assumptions about the random walk model used to evolve latent parameters in time. The complete mathematical description of our model is provided in the Appendix and its numerical implementation in Python available at (Werpachowska 2018).

![Fig. 1.](image)

**Fig. 1.** Mortality rate forecasts (beyond 2014) obtained from the neural network model (solid lines) for men and women (in left and right panel, respectively) by age (indicated on the right axis) with 95% confidence intervals. The dashed lines represent the projections from the ONS model

Source: ONS (2016b) and author’s own elaborations.

The obtained forecasts, presented in Fig. 1 for selected age groups, show significant decline of mortality for men and women at all age. The men’s mortality rates fall faster than women’s. This trend is particularly strong for male teenagers, young adults, as well as ages 65-85, where it significantly diverges from the ONS results. Conversely, mortality rates for centenarians and senior women (above 85) do not fall as dramatically and remain at slightly higher levels than the ONS projections. The confidence intervals of forecast mortality rates are calculated
based on the mean $\mu$ and standard deviation $\sigma$ of calculated logarithms of mortality rates across 40 repetitions of the model training and extrapolation procedure, namely the lower and upper 95% bound equal $\exp(\mu \pm 1.96\sigma)$. (The obtained mortality rate values in Fig. 1 are calculated as the means of mortality rates from all runs, rather than exponents of means of their logarithms). The population ageing shifting the age distribution in deaths to older ages occurs with the rectangularisation of survival curves (Fig. 2).

**Fig. 2.** Survival curves for men and women (in left and right panel, respectively) by year of birth
Source: author's own elaborations.

Since fairness between generations requires that everybody spends a similar proportion of adult life contributing to and receiving a state pension, it is interesting to compare the residual lifespan for people retiring under different legislations. Table 2 displays life expectancies for cohorts who withdraw from employment in different years and at different ages: at the age of 60 for women and 65 for men, at the equal age of 65 and next 68. The life expectancies forecast by our model grow faster than the state pension age rises. In particular, women retiring in 2018 can expect to live 23 more years, which is almost 5 years longer than women retiring in 1948, despite their state pension age rising from 60 to 65. The difference is particularly striking for men (as it is not attenuated by the state pension age change), whose expected lifespan in retirement doubles. The subsequent state pension age rise to 68 does not reduce the residual lifespan of those retiring in 2048, when it comes into effect (men gain another 1.5 year of life). While under the old legislation women and men could expect to spend 22% and 16% of their lives in retirement, respectively, those periods will extend to around 23% after the reforms owing to the survival curves’ rectangularisation described in the previous paragraph. Furthermore, they can expect to enjoy more years in good health (PHE 2017), as the general health improvements that lead to increasing life expectancy can also delay the onset and progress of diseases, possibly replacing them with natural death upon reaching a biological limit of human lifespan (Fries 1980). This compression of morbidity scenario forms an optimistic projection of the impact of population ageing on healthcare costs.
Table 1. Life expectancy in retirement for cohorts of women and men retiring in different years and at ages indicated by different state pension systems reforms

<table>
<thead>
<tr>
<th>Year</th>
<th>60 women / 65 men</th>
<th>Equal age (65)</th>
<th>Current reform (68)</th>
</tr>
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<tbody>
<tr>
<td>1948</td>
<td>18.7 / 11.6</td>
<td>11.6 &amp; 12.3</td>
<td>12.3 / 9.8</td>
</tr>
<tr>
<td>2018</td>
<td>28.5 / 22.2</td>
<td>23.4 / 22.2</td>
<td>20.7 / 19.3</td>
</tr>
<tr>
<td>2048</td>
<td>31.8 / 27.9</td>
<td>26.8 / 27.9</td>
<td>23.8 / 24.8</td>
</tr>
</tbody>
</table>

Source: author's own elaborations.

In the next section we use the obtained results as an input to the microsimulation of the E&W population.

4. Pension cost dependency ratio estimation using microsimulation

Apart from the mortality rates forecasts obtained in the previous section, the microsimulation model employed in this work uses the same methods and data (updated with latest releases) as described in detail in Ref. (Werpachowska et al. 2017). It serves us to evaluate the impact of state pension reforms and Brexit by calculating the pension cost dependency ratio under two combined sets of scenarios.

The pension system scenarios assume different state pension age (SPA) with and without changes introduced by the past reforms as follows:
- **Pre-reform**: SPA equal to 65 for men and 60 for women (as introduced by the National Insurance Act in 1948 and ignoring the subsequent reforms) over the whole simulation period.
- **Equal SPA**: SPA for women starts to increase in April 2010 under the Pensions Act 1995 by one month every month (by date of birth) to reach equal SPA of 65 for man and women in March 2020. The transition is accelerated in April 2016 by the Pensions Act 2011 to complete in November 2018. SPA equals 65 for everyone over the remaining simulation time.
- **SPA 68**: SPA for men and women will equalise in 2020 following the (overridden) Pensions Act 1995 and next rise to 66 between 2024 and 2026 (one month every month), to 67 between 2034 and 2036 and to 68 between 2044 and 2046 (Pensions Act 2007).
- **Accelerated SPA 68**: (current reform) Following the current legislation, SPAs for men and women equalise faster, i.e. in November 2018. Next, they rise to 66 between March 2019 and September 2020 (three months in the first month followed by one month every one of next nine months), to 67 between 2026 and 2028 and to 68 between 2044 and 2046 (Pensions Acts 2007, 2011 and 2014).

Figure 3 displays the timeline of changes to the state pension age.

The post-Brexit scenarios focus on migration patterns between the UK and the EU after March 2019, namely:
- **Status quo** extrapolates current migration trends.
- **Soft Brexit** assumes amicable parting between the UK and the EU, causing only small changes in migration flows of the UK and EU citizens. Just 10% of the EU immigrants living in the UK will return to their country of origin (those...
who will have arrived closer to the Brexit date will leave first). This “exodus” will last 2 years and will not involve the immigrants arriving after Brexit. Simultaneously, a wave of returns of British emigrants living in other EU countries will take place. We model it by increasing their repatriation to E&W by 10%. The level of regular migration flows of EU citizens to and from the UK will fall to the average of 2000 and 2011 figures, whereas the outflow of British citizens to the EU will be reduced by 80%.

- Hard Brexit drastically limits the migration between the UK and the EU as many migrants lose the right of residence or decide to return to their country of origin. We assume the “exodus” of 70% EU immigrants currently living in the UK and the repatriation of 80% of the British living in the EU. The migration of EU citizens to the UK will return to much lower levels from before the 2004 EU enlargement, while the outflow of British citizens to the EU will decrease by 30%.

Figure 3. Timeline of changes to state pension eligibility age by man or woman’s birth date since 1921. State pension age established by consecutive reforms: National Insurance Act 1946 (implemented in 1948), European Court ruling 1995 equalising pension age to 65 and Pensions Act 2007 increasing it to 68, amended by Pensions Acts 2011 and 2014 accelerating the increase

Figure 4 shows the trends of pension cost dependency ratio under the above scenarios. The historical values of the ratio maintained a sustainable level until 2007. Beyond that period it began to rise owing to the population ageing. The unprecedented rate of this process was propelled by post-war and 1960s baby boomers entering the state pension age. In addition, their retirement considerably reduces the workforce, whose large part consists of cohorts born in the period of declining fertility rates, from the mid 1960s to 1970s. The trend is somewhat softened by the influx of EU workers, especially the post-2004 enlargement wave. The rise of state pension age for women starting in 2010 reverses the trend sharply, creating a substantial gap between the old and the new pension scheme scenarios. In particular, the reform reduces the pension cost dependency ratio to the level from 2007. Afterwards, the ratio picks up its previous upward trend fuelled by the advancing population ageing, with temporary reversions due to consecutive rises of retirement age. The rapid growth from 2027 to 2038 is caused by retiring 1960s
“baby boomers”. The growth subsides as the forecast life expectancies stop to grow, and takes off again around 2049, when the children of large 1960s cohorts enter their retirement age.

The magnitude and trend of pension cost dependency ratio strongly depend on the considered state pension reforms and are moderately affected by the varying migration patterns in different EU membership scenarios. In particular, the currently introduced state pension age reforms will lead to a considerable and permanent reduction of the ratio, almost reverting it back to the levels from before 2007. However, in the long term the ratio will increase under all considered scenarios and reforms owing to the population ageing.

![Pension cost dependency ratio under different state pension reforms and different post-Brexit demographic scenarios](Fig. 4. Pension cost dependency ratio under different state pension reforms and different post-Brexit demographic scenarios (as described in Sec. 4)

Source: author's own elaborations.

5. Conclusion

We have used our microsimulation model described in Ref. (Werpachowska and Werpachowski 2017) to calculate detailed forecasts of the pension cost dependency ratio for England and Wales population from 1991 to 2061, with and without taking into account the series of retirement age rises under the state pension system reforms initiated by the Labour and continued by the Conservative governments. Our microsimulation engine simulates stochastically the dynamics of births, deaths and international migration. To fully account for the increasing trends in life expectancies, we have implemented a custom extrapolation model for mortality rates, based on deep learning techniques. Our results show that the recent reforms, although politically controversial, can be expected to stave off the “pension crisis” and bring back the system on a sounder fiscal footing. At the same time, more workers can expect to spend longer share of their lifespan in retirement, despite the state pension age rises. If the same factors promoting
longevity also delay the disease processes in the lifespan, they can expect to live more years in good health, without putting an additional strain on the healthcare system. To a lesser degree, the future pension cost dependency ratio will depend also on the post-Brexit relations between the UK and the EU, with “softer” alignment lowering the relative cost of the pension system (due to the expected continued influx of young workers from the EU) and “harder” one raising it.

Appendix

1. Mortality rate extrapolation model

1.1. Data

The \( q_{t,i} \) mortality rate is the probability that a person alive at time \( t \) and of age \( i \) (measured in years) will die within the next year. The vector of historical mortality rates for all ages \( i = 0, \ldots, N \) is denoted by \( q_t \), with \( t = T_1, \ldots, T_f \) being time in years. In our case \( N = 100 \), \( T_1 = 1951 \) and \( T_f = 2014 \). We analyse data on the E&W population by age and sex (men or women).

1.2. Extrapolation model

For many age groups \( i \), the logarithm of the mortality rate \( qt,i \) is approximately linear in \( t \). Hence, we apply the extrapolation model to log-rates \( xt,i := \ln qt,i \). It has the additional benefit of imposing the constraint \( qt,i = \exp(xt,i) \geq 0 \).

We propose a recurrent neural network (RNN) extrapolation model which, given a vector \( \xi_{t,i} := [xt-M,i, ..., xt,i] \) of \( M \) consecutive log-rates, outputs the value of \( xt,i = f(\xi_{t-1,i}) \). To extrapolate beyond time \( T_f \), the model is applied recursively to \( \xi_{T_f,i} \) for each \( i \). We denote the result of applying \( f \) recursively \( k \) times by \( f^{(k)} \), with \( f^{(1)} \equiv f \). Thus, extrapolated log-rate \( xt+k,i := f^{(k)}(\xi_{T_f,i}) \). For example,

\[
xt+2,i = f^{(2)}(\xi_{T_f,i}) = f([xt-M+2,i, ..., xt,i, f^{(1)}(\xi_{T_f,i})]) .
\] (1)

The function \( f: \mathbb{R}^M \rightarrow \mathbb{R} \) is calculated by the cell of the RNN: a composition of linear and non-linear mappings between the input \( \xi_{t,i} \) and output \( xt,i \).

The cell used by our model is a fully-connected neural network consisting of \( K \) neuron layers \( z_k \in \mathbb{R}^{D_k} \), \( k = 0, ..., K-1 \). The input layer \( z_0 \) is equal to the argument of function \( f \), \( \mathbb{R}^M \leftarrow z_0 = \xi_{t,i} \) and \( D_0 = M \). Every subsequent layer is a function of the previous one, of the following form \( z_k = h_k(W_k \cdot z_{k-1} + b_k) \), where \( h_k: \mathbb{R} \rightarrow \mathbb{R} \) is the \( k \)-th activation function, \( W_k \in \mathbb{R}^{D_{k} \times D_{k-1}} \) is the \( k \)-th weight matrix and \( b_k \in \mathbb{R}^{D_k} \) is the \( k \)-th bias vector. For \( k < K-1 \), \( h_k \) is the so-called ReLU (rectified linear unit) function, while \( h_{k-1} \) is the identity \( h_{1}(z) = \{\max(0, z) \text{ for } k < K - 1, \text{ and } z \text{ for } k = K - 1 \} \). The intermediate layers \( 0 < k < K-1 \) are called hidden layers and have dimension \( H \). The last, output layer is the extrapolated value, \( \mathbb{R} \ni z_{K-1} = [xt+1,i] \), with \( D_{K-1} = 1 \).
Training the network consists in minimising the training loss $c[f]$, the average $\ell^2$ error between training targets $y_{t,i} := [x_{t,i}, \ldots, x_{t+N_{\text{train}}-1,i}]$ and training outputs $\hat{y}_{t,i} := [f(\xi_{t-1,i}), f(2)(\xi_{t-1,i}), \ldots, f^{(N_{\text{train}})}(\xi_{t-1,i})]$ (cf. Eq. 1):

$$c[f] := \sum_{i=0}^{N_{\text{train}}} \sum_{t=T_f+N_{\text{train}}-1}^{T_f} \|y_{t,i} - \hat{y}_{t,i}\|^2_2 / N(T_f - T_i + 1 - M - N_{\text{train}} + 1),$$

for $N_{\text{train}}$. The loss $c[f]$ is minimised over the neural network weights and biases using the RMSProp (Hinton et al. 2014) variant of the Stochastic Gradient Descent method (Goodfellow et al. 2016). A crucial aspect of this method is that $c[f]$ is not calculated over all pairs of $y_{t,i}$ and $\hat{y}_{t,i}$, as in the formula above, but over a randomly sampled mini-batch.

1.3. Model configuration

The model parameters are as follows: input size $M = 25$, number of layers $K = 5$, Number of hidden neurons per layer $H = 128$, Training sequence length $N_{\text{train}} = 10$ (set relatively small in order to generate more training sequences).

1.4. Numerical results

The numerical code was implemented in Python (Werpachowska 2018) and TensorFlow (Abadi et al. 2016). We ran the training procedure with random mini-batch (Hinton et al. 2014) size $B = 16$ for 200,000 steps of the optimiser. We set the initial learning rate at $10^{-4}$ and decayed it every 10,000 steps if the average training loss over the last 10,000 steps did not decrease in comparison with the average over the previous 10,000 steps. This procedure reduced the average (over 10,000 steps) training loss $c[f]$ to $\approx 0.005$. All bias vectors elements were initialised to 0.1 and all weight matrix elements were initialised to random values drawn from $N(0, 0.1)$ distribution truncated at two standard deviations (larger values were discarded and re-drawn). The model has been re-trained for every dataset separately.

To validate our model, we performed additional training on a subset of the data. We split the age groups $i = 0, \ldots, 100$ into a test set containing every 5-th age group starting from $i = 1$: $I_{\text{test}} = \{1, 6, \ldots, 96\}$ and the training set $I_{\text{train}}$ containing the remaining age groups. We ran the training procedure for 300,000 steps, calculating $c[f]$ separately over $I_{\text{train}}$ (using mini-batches of size $B = 16$ sampled from the training set) and, every 10,000 steps, over $I_{\text{test}}$ (using all available data in the test set). The results are listed in Table 2.

Table 2. Training and test loss during model validation. The last column presents the number of steps at which the test loss reached its minimum value.

<table>
<thead>
<tr>
<th>dataset</th>
<th>final train. loss</th>
<th>final test loss</th>
<th>min. test loss</th>
<th>min. t. l. steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>0.0012</td>
<td>0.22</td>
<td>0.014</td>
<td>200,000</td>
</tr>
<tr>
<td>Women</td>
<td>0.0015</td>
<td>0.035</td>
<td>0.026</td>
<td>270,000</td>
</tr>
</tbody>
</table>

Source: author's own elaborations.
We have recorded at which stage of training the test loss reached its minimum value. The values for different datasets are spread within a wide range 200,000-270,000. We have chosen 200,000 steps as a reasonable compromise and used it to train the model used for extrapolation.

1.5. Sensitivity analysis

Sensitivities of the obtained forecast mortality rates to the historical ones are calculated as \( \partial q_t, i / \partial q_{t'}, i' \). Figure 5 shows typical examples for mortality rate forecasts from Fig. 1.

![Fig. 5. Examples of sensitivities of the forecast mortality rates to historical data: for 30-year-old women and 85-year-old men (in left and right panel, respectively) Source: author's own elaborations.](image)

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WHO OWNS STOCKS IN ENGLAND: A PANEL ANALYSIS

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Abstract
We analyse the determinants of the decision to enter the stock market in England through a panel analysis on data drawn from the English Longitudinal Survey of Ageing dataset, for years 2002-2012. For doing this we use several methodologies including a probit model controlling for both unobserved heterogeneity and serial correlation through Correlated Random Effects, Generalized Estimating Equations and Generalized Linear Models. Additionally, the endogeneity of financial literacy is controlled for by using the Control Function approach. Financial literacy is found to be a significant determinant of the decision to enter the stock market, with an average partial effect of 5.8%. The education quality (proxied by student-teacher ratios) and the financial incentives observed at early ages (captured by the sharpe-ratios observed by individuals at early adult life) play a significant role as well. As for individual variables, both financial resources and social interaction affect positively the probability to join the stock market.

Keywords: financial literacy, panel analysis, stock market participation.

JEL codes: C23, C26, G11.

1. Introduction
The present work analyses the determinants of stock market participation in England in the first decade of the present century. Although the issue of stock market holding has been largely analysed, there is still much concern about the low rates of participation throughout the world, even in the face of new financial services and products that should have facilitated a higher degree of portfolio diversification among households. In fact several contributions have pointed out that there can be considerable welfare loss in non-participation of individuals, in the form of reduced returns to household saving and lesser asset accumulation. Higher participation rates could also favor a greater breadth and depth of capital markets, which are important determinants of the equity premium and of the stock market volatility (Vissing-Jørgensen 2002; Brav et al. 2002). Moreover, reforms of pension systems are increasingly shifting the
responsibility for retirement saving from governments to individuals. Hence, unveiling the determinants of stock market participation has relevant policy implications, since it can help removing the barriers to efficient portfolio diversification.

By building on some consolidated findings of previous literature, the contribution of our work is twofold. First of all, we provide new empirical evidence on the determinants of stock market participation in England drawing the data from the panel component of the English Longitudinal Survey of Ageing (hereafter ELSA) for the years 2000-2012. To the best of our knowledge, this has never been done so far. In fact, earlier studies are either cross-sectional analyses at country level (Van Rooij et al. 2011; Yoong 2010) or cross-country analyses (Thomas and Spataro 2015; Christelis et al. 2010). By extending the analysis to a panel framework we can disentangle age and cohort effects on portfolio choice behavior, control for the time-invariant unobserved heterogeneity and model a dynamic relationship among the variables. The second contribution of our work is to apply to portfolio choices the methodology pioneered by Papke and Wooldridge (2008) for estimating fractional response models for panel data with a large cross-section and few time periods. More precisely, by this approach we can take into account possible endogeneity of financial literacy and allow for time-constant unobserved effects to be correlated with explanatory variables.

In fact, several studies have argued that financial literacy, while being a significant variable influencing the decision to join the stock market, is endogenous in nature. As pointed out, among others, by Kimball and Shumway (2006), Christelis et al. (2009), Van Rooij et al. (2011), on one hand, financial literacy helps alerting individuals about the excess returns on stocks/bonds, which in turn induces them to invest in risky activities; on the other hand, investing in advanced financial products could provide some kind of financial literacy training. Additionally, this positive correlation may reflect the fact that financial literacy is not distributed randomly in the population and those who possess high levels of literacy are likely to have certain characteristics, often unobservable, such as talent, ability, or patience that may lead also to “better” financial decisions.

Following these lines we find that endogeneity of financial literacy causes a negative bias of the associated average partial effect, which, after controlling for endogeneity, increases from 1.3% to 5.8%. Moreover, we find that the observed hump shape in the age profile of participation rates and discussed in previous works (Poterba and Samwick 2001; Gomes and Michaeides 2005; Alan 2006) is in fact the result of a variety of effects. Once controlling for these factors, the participation in financial markets turns out to be an increasing function of age. Cohort effects captured by the quality of education and sharpe-ratios observed at young ages play a role in explaining the attitude towards stock market of different cohorts. As for other individual characteristics, financial resources affect positively the probability of joining the stock market, pointing to the presence of entry costs, while marital status and gender are not significant in explaining stock ownership in England. Finally, the presence of social interaction, trust and self-satisfaction increase the probability to own stocks.
The paper is organized as follows: in Section 2 we review the existing literature on the topic of stock market participation and in Section 3 we present the data. In Section 4 we lay out the empirical strategy and in Section 5 we present the results. Section 6 concludes.

2. Review of the literature

Existing studies have highlighted several determinants of stock market participation. Empirical evidence of industrialized countries provided by Guiso et al. (2003) documents a relevant positive correlation between stock market participation and household financial wealth, supporting the entry costs thesis (see also Alan 2006). Other studies have suggested that participation depends on a variety of factors, including age and education (Bertraut 1998), risk aversion (Campbell and Cochrane 2000), trust in financial institutions (Georgarakos and Pasini 2011), social interaction (Hong et al. 2004), home ownership (Vestman 2013), and social capital (Guiso et al. 2004).

Other works have shown that education and financial literacy play a role in stock market participation. For example, Guiso and Jappelli (2005), Kimball and Shumway (2006) Van Rooij et al. (2011) find that lack of awareness of stocks is a primary reason for the limited participation.

As for the role of general education, several authors have shown that college educated are more likely to own stocks than less educated individuals (Haliassos and Bertaut 1995; Campbell 2006; Lusardi and de Bassa Schereszberg 2013). Cole and Shastry (2008) argue that one year of schooling increases the probability of financial market participation by 7-8%. On the same lines some empirical studies on stock holding have shown that including control for educational attainment does enhance the significance of the variable financial literacy (Van Rooij et al. 2011; Behrman et al. 2012; Lusardi and de Bassa Schereszberg 2013) underlying the fact that general knowledge (education) and specialized knowledge (financial literacy) both contribute for financial decision making, both in Netherlands and United States.

Among other individual characteristics, Arrondel et al. (2012) point out that stock ownership significantly correlates with both expectations and realizations of stock market returns. In fact, the recent research by Giuliano and Spilimbergo (2014) indicates that generations who grew up in economic recessions have systematically different socio-economic beliefs compared to generations who grew up during boom periods. On the same lines Malmendier and Nagel (2011) and Thomas and Spataro (2015) argue that households experiencing higher stock returns early in life are more likely to participate in stock market.

Another stream of literature has explored the gender bias in stock ownership. The pioneering work by Haliassos and Bertaut, (1995) provided the empirical evidence of limited participation of female workers, while others have gone one step ahead in explaining the reasons behind the phenomenon, resorting to women’s higher risk aversion (see, among others, Croson and Gneezy 2009 or Bertrand 2011 for reviews) and to differences in the production processes for
financial literacy across genders (Fonseca et al. 2012), due to the household specialization. The lack of social interaction and reduced general intensity of participation are also found to affect individuals’ decision to enter risky markets (Hong et al. 2004; Duflo and Saez 2003; Brown and Taylor 2007; Brown et al. 2008; Liu et al. 2014). For example, Hong et al. (2004) from HRS survey in U.S. find evidence that a “social” investor finds the market more attractive when more of his/her peers participate. Brown et al. (2008) find a positive link between individual’s decision to participate and the average level of stock market participation present in the individual’s social group/community.

Finally, there is a recent literature discussing the role of health status on the portfolio decisions of respondents. Rosen and Wu (2004) analyze the role of health status on household portfolio decisions using self-perceived health status data from the Health and Retirement Study (HRS) in the U.S. and find a positive relationship between better health status and portfolio choice. Edwards (2008) shows that retired individuals view their health status to be risky and try to hedge against it by decreasing their exposure to financial risk.

To sum up, it is a well-established fact that not all households participate in risky asset markets. The empirical studies mentioned above are cross-sectional analyses at either country or cross-country level. However, the respondents of different age vary in unobservables, which are correlated with age, and therefore the estimated age pattern may reflect only cohort effects. Hence, by using a panel framework, in the present work we aim to disentangle age and cohort effects. Moreover, we also take into account the endogeneity of an explanatory variable (financial literacy) and allow for time-constant unobserved effects to be correlated with explanatory variables.

3. Data

The data for the present analysis are drawn from the English longitudinal Survey of Ageing (hereafter ELSA) from year 2002 to 2012. This is a longitudinal survey on a large representative sample of men and women living in England, designed to understand the implications of ageing and containing information on demographic factors, economic circumstances, social and psychological variables, health, cognitive function and biology. The study began in 2002 and the sample was re-examined every two years. Our sample consists of 5064 individuals who were interviewed in all waves (for the sake of simplicity in estimation we focus on a balanced panel). Individuals who have exited the survey because of death or migration and new entrees are not included. Overall, the sample contains 30506 individual/year observations (all variables are summarized in Table 1).

As for the dependent variable, stockpart is a binary variable which takes value 1 if the individual participates in stock market and 0 otherwise. Figure 1 plots the age profile of the share of individuals participating in the stock market for five-years age groups and waves. Two features emerge: first, the age profile displays an inverse U shape, with peaks associated with the 50-54 and
55-59 age groups, at around 40%. Second, there has been a general drop in participation rates, after 2002, especially at the tails of the age-distribution.

**Fig. 1.** Fraction of individuals participating in stock markets by age-groups and waves
Source: authors’ calculations.

**Fig. 2.** Time path of fraction of individuals participating in stock markets by cohort-groups
Source: authors’ calculations.
Figure 2 presents the time path of the share of individuals participating in the stock market for selected two-years cohort groups and it confirms the general negative time-trend, with a recovery in year 2008. Moreover, negative cohort effects are particularly relevant for younger cohorts (born after 1959) and for individuals that were born before the II World War.

We try to capture such cohort effects through two variables. The evidence provided in previous works suggests that variations in experienced stock market returns can effectively capture the cohort effects. Following these lines, we use average sharpe-ratios observed between ages 18-25 as a proxy for cohort effects (i.e. five-years cohort groups) by using the data from historical stock returns of United Kingdom.

Moreover, following the insights contained in Thomas and Spataro (2015), we include a variable capturing the effectiveness of education (Education quality effect), proxied by the student-teacher ratio that a respondent experienced during her childhood (6-15). Indeed, as education quality increases in a country, both individual and social capital improve; given the positive effect of human capital on participation, there are higher possibilities for an agent to find individuals in the same cohort group that are engaged in stock markets (peer effect). Hence, from the International Historical Statistics on Education, the 10-year average student-teacher-ratio is calculated for each individual belonging to a specific five-year-cohort group.

![Image](image.png)

**Fig. 3.** Financial literacy scores and stock participation (pooled data)
Source: authors’ calculations.

Among other explanatory variables, financial literacy is of primary interest. By following Jappelli and Padula (2013) we use the index provided by ELSA, whereby each individual is presented with four financial and numerical questions
Who owns stocks in England: a panel analysis

and the answers are imputed to obtain a value ranging from 1 to 5. Details of the actual questions and the construction of this indicator are discussed in Christelis et al. (2010).

Interestingly, the age profiles of financial literacy and stock market participation show a similar pattern. From Fig.3 it emerges that both participation to stock market and financial literacy scores peak before the period of retirement and then fall with age. Hence, a higher financial literacy score also reflects a higher participation to stock market.

We also take into account financial variables like income and wealth quintiles, given that the latter are considered as good predictors of stock market participation (Van Rooij et al. 2011; Thomas and Spataro 2015), also due to the presence of entry costs.

The social interaction variables are also likely to have significant bearing over the decision to enter the stock market. Hence, we include a variable depicting the lack of social interaction (i.e. a dummy variable taking value 1 if the respondent is not taking part to any social, religious or organisational groups and 0 otherwise). We also include as a proxy for social capital, “trust”, which is a variable ranked from 1 to 7 depending on one’s perception of trust on others (1 means almost none in this area can be trusted). A higher trust among respondents is expected to have a positive effect on the decision to join the stock market.

Table 1. Sample statistics of all variables from ELSA balanced panel

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Obs</th>
<th>Mean</th>
<th>St dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock ownership (dependent variable)</td>
<td>30,372</td>
<td>0.316</td>
<td>0.465</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Financial literacy scores</td>
<td>30,372</td>
<td>3.199</td>
<td>1.253</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Age</td>
<td>30,368</td>
<td>66.50</td>
<td>9.842</td>
<td>20</td>
<td>99</td>
</tr>
<tr>
<td>Age^2</td>
<td>30,368</td>
<td>4,519</td>
<td>1,356</td>
<td>400</td>
<td>9,801</td>
</tr>
<tr>
<td>Dummy for married</td>
<td>30,372</td>
<td>0.602</td>
<td>0.489</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Dummy for female</td>
<td>30,372</td>
<td>0.578</td>
<td>0.494</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Income quintiles</td>
<td>28,343</td>
<td>3.104</td>
<td>1.396</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Wealth quintiles</td>
<td>28,343</td>
<td>3.269</td>
<td>1.375</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Dummy for no social interaction</td>
<td>30,372</td>
<td>0.338</td>
<td>0.473</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Trust</td>
<td>29,136</td>
<td>2.658</td>
<td>1.656</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Self-perceived social status</td>
<td>27,960</td>
<td>57.65</td>
<td>18.54</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Self-perceived health status</td>
<td>27,458</td>
<td>2.626</td>
<td>1.075</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Education quality</td>
<td>30,038</td>
<td>26.02</td>
<td>1.075</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Average sharpe-ratios at early adult life</td>
<td>30,017</td>
<td>0.198</td>
<td>0.0933</td>
<td>-0.0259</td>
<td>0.38</td>
</tr>
</tbody>
</table>

Source: authors’ calculations.

The measures of sociability (participation in social activities and trust) could reflect measurement problem. In fact, these variables may not only capture information on the degree of social interaction but also other personality traits associated with the propensity to invest in the stock market. For example, more socially interacting respondents may have traits like boldness, risk-taking and optimism, qualities which are likely to enhance financial market participation (see
also the discussion in Hong et al. 2008). Consequently, in order to pinpoint the effect of social interaction we also include a proxy for personality/psychological traits, namely self-reported life satisfaction (“self-perceived social status”). This variable can be linked to optimism, which has been studied in prior research. The link between these two characteristics is relatively obvious since optimistic persons are most likely to be more satisfied with their lives and more likely to take active steps to improve their current or future situation. Consequently, individuals reporting higher levels of life-satisfaction are expected to have a greater tendency to choose risky options (Weinstein 1980; 1984). Therefore, we include this variable which ranks from 0 to 100 in our analysis (100 is the highest level of reported life-satisfaction).

In line with previous literature, we also include self-perceived health status in our model as a potential predictor of stock market participation, with negative expected sign.

We are also interested in considering the effect of demographic variables like marital status and gender. The latter two variables are specified by dummies that equal to 1 if the person is married and if the person is a female, respectively. Finally time dummies are also included. Sample statistics of all variables are summarized in Table 1 (time dummies are omitted).

4. Empirical methodology

4.1. Overview

In this Section we discuss the choice of the estimation strategy that we adopted to investigate the determinants of portfolio choice outcomes of English individuals belonging to the panel component.

Panel data models usually are affected by such issues as unobserved heterogeneity and omitted time-varying variables, which cause biased estimations. Traditionally, unobserved heterogeneity is treated as parameters to estimate, when T (time periods) is large: in fact, under fairly weak assumptions, one could obtain consistent asymptotically normal estimators of average structural functions, provided suitable instruments are found. However, when T is small, such a methodology can lead to the incidental parameter problem (that is, lack of convergence of estimators) and additionally the bias could be higher when weak dependence or even independence is assumed across the time dimension (for an insight into these issues see Hardin et al. 2007; Wooldridge 2002).

To overcome these issues in this work we follow the methodology pioneered by Wooldridge (2002) which clarifies how to specify and estimate fractional-binary/response models for panel data with a large cross-section and few time periods (the so called correlated random effect model using the Chamberlin-Mundlak device) under strict exogeneity and serial independence. We further take insight from the works by Papke and Wooldridge (2008) and Wooldridge (2005), which provide a methodology, again under exogeneity assumption, to identify the average partial effects without the conditional serial independence assumption, by using the Bernoulli-quasi MLE and generalised estimating equation. Finally,
we relax the assumption of strict exogeneity and we resort to a Control Function approach employing the two stage probit QMLE proposed by Papke and Wooldridge (2008).

4.2. Estimation methods under strict exogeneity

We start with a standard specification of a static unobserved effects probit model for panel data, which can be written as:

\[ E(y_{it} | x_{it}, c_{i}) = \Phi(x_{it}\beta + c_{i}), \quad t = 1, \ldots, T \]  

(1)

where \( y_{it} \) is the binary variable (stock market participation in our case) and \( x_{it} \) is the vector of explanatory variables, \( \Phi \) is the standard normal cumulative distribution function and \( c_{i} \) are the unobserved effects. Note that the magnitude of partial effects not only depend on the value of covariates \( x_{it} \), but also on unobserved heterogeneity \( c_{i} \). Thus to identify \( \beta \) or the average partial effects (APEs) in presence of unobserved effects, we require some further assumptions. The first assumption is the exogeneity of \( x_{it} \): conditional upon \( c_{i} \), we assume that \( x_{it} \) remains exogenous, so that we can write the following:

\[ E(y_{it} | x_{i}, c_{i}) = E(y_{it} | x_{it}, c_{i}), \quad t = 1, \ldots, T \]  

(2)

The second assumption concerns the distribution of \( c_{i} \) given \( x_{i} \). We follow the Chamberlain (1980)-Mundlak (1978) approach by assuming conditional normality of unobserved effects as follows:

\[ c_{i} = \psi + \bar{x}_{i} \zeta + a_{i}, \quad a_{i} | x_{i} \sim \text{Normal}(0, \sigma^{2}a) \]  

(3)

where \( \bar{x}_{i} \) is the vector of time averages and \( \sigma^{2}a = \text{Var}(c_{i}|x_{i}) \) is the conditional variance of \( c_{i} \). Notice that assumptions in equations (1), (2) and (3) do not impose any additional restrictions on the distribution \( D(y_{it}|x_{i},c) \) nor on the serial dependence in \( y_{it} \) and allow to identify the average partial effects (APE). This setting is called a “Correlated Random Effects (CRE) probit” model, which we adopt in the first part of our empirical study. Under the assumption of exogeneity of explanatory variables, as a robustness check, we use other two models in which APEs are identified without the conditional serial independence assumption: first of all, the pooled Bernoulli quasi MLE model (or Probit QMLE model); second, also to possibly enhance efficiency, a generalised estimating equation approach (GEE). As for the latter approach, we report the results obtained by using an exchangeable working correlations matrix, given that the ones obtaining from independent correlation matrix are not significantly different.

4.3. Estimation methods with endogenous explanatory variables

We now briefly show how we treat endogeneity in the presence of unobserved heterogeneity and omitted time-varying variables. The Control Function methodology adopted by Papke and Wooldridge (2008) for the case of fractional response model is recast here under a binary response variable. As noted above, the results obtained from this approach are robust and comparable to the models shown in Section 4.2, where endogeneity is ignored.
Suppose yit2 is an endogenous explanatory variable; provided we have sufficient instruments, we can express the conditional mean model as:

\[ E(yit1|yit2, Z, ci1, uit) = E(yit1|yit2, zit1, ci1, uit) = \Phi(\alpha_1yit2 + zit1\delta_1 + ci1 + uit) \]  

(4)

where yit1 is binary, ci1 is the time-constant unobserved effect and uit is a time-varying omitted factor that can be correlated with yit2, the potentially endogenous variable (financial literacy in our case), zit is the vector of exogenous variables (See detailed methodology in Appendix 1).

4.4 Application of methodology to dataset

Analogous to equations (1) and (4) we build the econometric model

\[ \text{Stockpart} = \alpha_1 + \beta_1 FL + \beta_2 \text{Age} + \beta_3 \text{Agesq} + \beta_8 \text{MS} + \beta_9 \text{FE} + \beta_6 \text{WE} + \beta_7 \text{IN} + \beta_9 \text{SI} + \beta_1 \text{TR} + \beta_2 \text{SS} + \beta_3 \text{HE} + \beta_4 \text{EQ} + \beta_5 \text{SH} + \beta_6 \text{WEBAR} + \beta_7 \text{INBAR} + \beta_8 \text{TRBAR} + \beta_9 \text{SSBAR} + \beta_10 \text{HEBAR} + \beta_11 \text{DUM}_2002 + \cdots + \beta_22 \text{DUM}_2010 + \nu_i \]  

(5)

where FL is financial literacy scores and the usual demographic variables like age, age squared, marital status (dummy for married, MS), FE (dummy for female) and the self-perceived health status (HE) are included. The income and wealth quintiles variables IN and WL are also kept in the regression, together with self-perceived social status (SS), meant to capture psychological traits of individuals (such as optimism). The social interaction variables include trust (TR) and a dummy for the lack of social interaction (SI). EQ is education quality proxied by the average student/teacher-ratio at cohort level (five-year-cohort groups), when individuals were within their 6-15 age interval. SH is the average sharpe-ratio observed by respondents, grouped into five-year cohort groups, when they were between 18-25 years of age. The time averages of the time-varying variables (with subscript BAR in eq. 5): income, wealth, self-perceived social status, self-perceived health status and trust are allowed to be correlated with the individual unobserved effect. Finally, the time dummies for years 2002 to 2010 are added (2012 is the omitted dummy).

As anticipated, we aim to take care of endogeneity of financial literacy and of the unobserved heterogeneity, on one hand, and to compare such results with those emerging in the case of assumed exogeneity of financial literacy, on the other hand. Thus we augment the traditional instrumental variable approach by including the time averages of the time varying variables, allowing them to be correlated with the individual-level unobserved heterogeneity.

The reduced form of the financial literacy is:

\[ FL = \eta_t + \pi_1 \text{books} + \pi_2 \text{rooms} + \pi_3 \text{diMAedu} + \pi_4 \text{Age} + \pi_5 \text{Agesq} + \pi_6 \text{MS} + \pi_7 \text{FE} + \pi_8 \text{WE} + \pi_9 \text{IN} + \pi_10 \text{TR} + \pi_11 \text{SS} + \pi_12 \text{HE} + \pi_13 \text{EQ} + \pi_14 \text{SH} + \pi_15 \text{WEBAR} + \pi_16 \text{INBAR} + \pi_17 \text{TRBAR} + \pi_18 \text{SSBAR} + \pi_19 \text{HEBAR} + \pi_20 \text{DUM}_2002 + \cdots + \pi_24 \text{DUM}_2010 + \nu_i \]  

(6)

where books, rooms, diMAedu are number of books in the shelf at age 10, number of rooms of the house individual lived in at age 10 and mother’s education when
the individual was 10 year old, respectively (see Table 2 for summary statistics of the instruments). In using these instruments, which are indexes of family background and level of intergenerational cognitive ability, our identification assumption is that stock market participation depends on unobserved heterogeneity in a smooth fashion and the relationship between heterogeneity and the instruments is smooth (see Section 5.2 for details). Given the strength of the instruments, we then estimate equation (5) by instrumental variable and Probit QMLE approach.

Table 2. Sample statistics of instruments

<table>
<thead>
<tr>
<th>INSTRUMENTS</th>
<th>Obs</th>
<th>Mean</th>
<th>Standard error</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s education at age 10</td>
<td>30,372</td>
<td>2.309</td>
<td>1.159</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Number of rooms at age 10</td>
<td>27,834</td>
<td>2.915</td>
<td>0.935</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Number of books at age 10</td>
<td>27,834</td>
<td>2.490</td>
<td>1.210</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: authors’ calculations.

5. Results and discussion

5.1. Results and discussion of the empirical model with financial literacy is exogenous in nature

In this Section we present and discuss the results under the assumption of exogeneity of all explanatory variables. Table 3 contains the estimated coefficients and average partial effects (APE) of the correlated random effects model (CRE), the pooled QMLE and the GEE estimation models respectively. The three sets of estimates tell a consistent story: with the exception of three coefficients (i.e. dummy for female, the self-perceived social status and self-reported health), all other variables are significant with expected signs.

According to the CRE model, financial literacy has a positive and significant effect on the portfolio decision choice. One standard deviation of financial literacy increases the probability to invest in stock market by 0.7%. The financial variables like wealth and income quintiles have positive influence on the decision to participate in risky markets across the waves (marginal effects are 5.6% and 2.1% respectively). The cohort effect proxied by the sharpe-ratio observed between ages of 18 to 25 shows a positive influence on stock participation, suggesting that individuals who observed a bullish market during their earlier years have higher probability to own stocks (marginal effect is 18%). The school effect by which we measure the education effectiveness at cohort level (student-teacher ratio) has the expected negative sign and the coefficient of -2.6% implies that deterioration in education quality provides less impetus for individuals to participate in stock market, either directly or through peers effect. The social interaction variables, trust and dummy for lack of interaction are significant and with the expected sign, with marginal effects of 0.5% and -0.3% respectively.
Table 3. Estimates assuming Financial Literacy is conditionally strictly exogenous. Dependent (binary) variable: stock market participation

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Correlated Random effects</th>
<th>APE</th>
<th>Probit Pooled QMLE Coefficient</th>
<th>APE</th>
<th>Probit GEE Coefficient</th>
<th>APE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Literacy</td>
<td>0.0365***</td>
<td>0.0071**</td>
<td>0.0475***</td>
<td>0.0134***</td>
<td>0.0239**</td>
<td>0.0068***</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.003)</td>
<td>(0.009)</td>
<td>(0.001)</td>
<td>(0.014)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.0510***</td>
<td>-0.0103**</td>
<td>-0.0594***</td>
<td>-0.0168***</td>
<td>-0.0315**</td>
<td>-0.0089***</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.004)</td>
<td>(0.015)</td>
<td>(0.003)</td>
<td>(0.019)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Age^2</td>
<td>0.0003*</td>
<td>0.00006*</td>
<td>0.0001*</td>
<td>0.0001*</td>
<td>0.0004*</td>
<td>0.00006*</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Dummy for married</td>
<td>0.2125***</td>
<td>0.0429**</td>
<td>0.1147*</td>
<td>0.324*</td>
<td>0.1209***</td>
<td>0.0345***</td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td>(0.007)</td>
<td>(0.022)</td>
<td>(0.009)</td>
<td>(0.033)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Dummy for female</td>
<td>-0.0667</td>
<td>-0.0135</td>
<td>-0.0328</td>
<td>-0.0093</td>
<td>-0.0377</td>
<td>-0.0107</td>
</tr>
<tr>
<td></td>
<td>(0.0575)</td>
<td>(0.008)</td>
<td>(0.020)</td>
<td>(0.004)</td>
<td>(0.033)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Wealth quintiles</td>
<td>0.2808***</td>
<td>0.05647***</td>
<td>0.1873***</td>
<td>0.0527***</td>
<td>0.1873***</td>
<td>0.0473***</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.002)</td>
<td>(0.013)</td>
<td>(0.002)</td>
<td>(0.012)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Income quintiles</td>
<td>0.1071***</td>
<td>0.02160***</td>
<td>0.06179***</td>
<td>0.01743***</td>
<td>0.06179***</td>
<td>0.01808***</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.002)</td>
<td>(0.010)</td>
<td>(0.002)</td>
<td>(0.010)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Dummy for no social interaction</td>
<td>-0.1627***</td>
<td>-0.03278***</td>
<td>-0.1847***</td>
<td>-0.0519***</td>
<td>-0.1847***</td>
<td>-0.0275***</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.001)</td>
<td>(0.023)</td>
<td>(0.004)</td>
<td>(0.031)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Trust</td>
<td>0.0282***</td>
<td>0.0057***</td>
<td>0.0173***</td>
<td>0.00409***</td>
<td>0.0158***</td>
<td>0.0045***</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.002)</td>
<td>(0.006)</td>
<td>(0.001)</td>
<td>(0.036)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Self-perceived social status</td>
<td>0.00111</td>
<td>0.0002</td>
<td>0.0002</td>
<td>0.00001</td>
<td>0.0011</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Self-perceived health status</td>
<td>0.0062</td>
<td>0.00126</td>
<td>0.0055</td>
<td>0.0015</td>
<td>0.0055</td>
<td>0.0009</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.003)</td>
<td>(0.014)</td>
<td>(0.003)</td>
<td>(0.011)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Education quality</td>
<td>-0.1336***</td>
<td>-0.0265***</td>
<td>-0.0679***</td>
<td>-0.0192***</td>
<td>-0.1336***</td>
<td>-0.0219***</td>
</tr>
<tr>
<td></td>
<td>(0.060)</td>
<td>(0.009)</td>
<td>(0.021)</td>
<td>(0.004)</td>
<td>(0.002)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Sharpe-Ratio</td>
<td>0.8992***</td>
<td>0.1815***</td>
<td>0.5294***</td>
<td>0.1497***</td>
<td>0.5294***</td>
<td>0.1545***</td>
</tr>
<tr>
<td></td>
<td>(0.334)</td>
<td>(0.051)</td>
<td>(0.117)</td>
<td>(0.025)</td>
<td>(0.194)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.425</td>
<td>(1.329)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>23,068</td>
<td>23,068</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: authors’ calculations.
Among the demographic variables, age displays a positive sign, showing that the hump-shape of participation rates depicted in Figure 1 is a combination of different effects, while dummy for married shows a positive estimated coefficient. Results from the Pooled QMLE model reveal that the APE for financial literacy is 1.3% and is statistically significant (fully robust t statistic= 5.20). The estimate of the GEE approach is close to the one stemming from the CRE model (APE around 0.7%). Interestingly, as for the financial literacy coefficient, the fully robust standard error for the probit QMLE estimate (0.001) is lower than the fully robust standard error for the GEE estimation (0.002, column 5). Hence, in this work, using exchangeable working correlation matrix in multivariate weighted non-linear least squares estimation does not appear to enhance efficiency. The socio-demographic variables like age and civil status display a similar effect as in the CRE model and the estimated coefficients for female, self-perceived social status and self-perceived health status remain insignificant.

Wealth and income quintiles for the last two models also show a positive effect on stock market participation. The APEs of the income quintiles are 1.7% and 1.8% in the probit QMLE and GEE models, respectively, with a negligible change in the robust standard errors. The cohort effect proxied by sharpe-ratio observed between 18 to 25 years of age shows the same pattern with a lower estimated coefficient but with a lower standard errors too. The school effect (lower quality of schooling) also shows a negative effect (APEs around -2%).

All the social interaction variables (trust and dummy for no social interaction) display the expected sign, while self-perceived social status and self-perceived health status remain insignificant in these models.

All models contain year dummies for 2002-2012. (b) The pooled probit QMLE estimation includes time averages of the time-varying explanatory variables (c) The standard errors for coefficients in parenthesis are robust to general second moment misspecification (conditional variance and serial correlation).

### 5.2. Results and discussion of the empirical model with financial literacy is endogenous in nature

Table 4 provides the estimated coefficients obtained from a Two-Stage-Least-Squares model (Column 1) and a Control Function approach (“Probit pooled QMLE”, Column 2, and Average Partial Effects in Column 3), which is directly comparable with the cases in which all variables were treated as exogenous in nature (Column 4 in Table 3). Notice that the number of observation is lower due to missing values of the instruments used in this model.

As for the choice of the instruments for correcting endogeneity, we pick up the idea that childhood experiences may be a good predictor for financial literacy (Grohmann et al 2014). As these experiences clearly happened in the long past, their direct effect on financial decisions today should be of little concern. Thus we compile a set of possible (instrumental) variables, most of them suggested in the literature, and examine which ones may be important in explaining financial literacy. Among the various possible instruments we select number of rooms and number of books in the shelf at age 10, commonly used in the literature (Jappelli
and Padula, 2013; Thomas and Spataro 2015). Also education of mother at age 10 may be seen as proxy for positive early childhood experiences, which are important for favorable later outcomes (Carneiro and Heckman 2007; Heckman 2006; Carneiro et al. 2013).

The results of the first stage regression show that these instruments exert a positive effect on financial literacy acquisition and are significant at 1% level. As for the relevance of the instruments (signifying the fact that they influence the suspected endogenous regressor) we observe the F-statistics are high and above the value recommended to avoid the weak instrument problem (Staiger and Stock 1997) as reported in the first stage regression. Given that our instruments are strong and overcome the exclusion restriction (Hansen J statistic) we estimate the model using equation (9) in the first step and the estimated coefficients from the second stage regression (eq. 8) are reported in Column (1) of the Table 4. We also report the χ² to obtain the Hausman (1978) test for endogeneity; its fully robust t statistic is -1.92, providing evidence that financial literacy is endogenous in nature. Comparing the estimates in which financial literacy was considered exogenous, the financial literacy coefficient improves from 0.7% to 7.9%.

Table 4. Estimates allowing financial literacy to be endogenous. Dependent (binary) variable: stock market participation (Standard errors in parentheses)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Linear Instrumental Variables Coefficient</th>
<th>Probit Pooled QMLE Coefficient</th>
<th>APE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Literacy</td>
<td>0.0792** (0.019)</td>
<td>0.2041** (0.003)</td>
<td>0.0580*** (0.018)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.0126** (0.031)</td>
<td>-0.0467** (0.021)</td>
<td>-0.0133** (0.004)</td>
</tr>
<tr>
<td>Age²</td>
<td>0.00008* (0.000)</td>
<td>0.0032** (0.000)</td>
<td>0.00099*** (0.000)</td>
</tr>
<tr>
<td>Dummy for married</td>
<td>0.0128 (0.045)</td>
<td>0.0429** (0.007)</td>
<td>0.0197** (0.022)</td>
</tr>
<tr>
<td>Dummy for female</td>
<td>-0.0344 (0.0575)</td>
<td>-0.0732 (0.064)</td>
<td>-0.0208 (0.013)</td>
</tr>
<tr>
<td>Wealth quintiles</td>
<td>0.0474*** (0.003)</td>
<td>0.1790*** (0.013)</td>
<td>0.0509*** (0.002)</td>
</tr>
<tr>
<td>Income quintiles</td>
<td>0.0126*** (0.003)</td>
<td>0.0457*** (0.011)</td>
<td>0.0130*** (0.002)</td>
</tr>
<tr>
<td>Dummy for no social interaction</td>
<td>-0.0273*** (0.011)</td>
<td>-0.1656*** (0.033)</td>
<td>-0.0470*** (0.040)</td>
</tr>
<tr>
<td>Trust</td>
<td>0.0050* (0.002)</td>
<td>0.0187** (0.002)</td>
<td>0.0053** (0.002)</td>
</tr>
<tr>
<td>Self-perceived social status</td>
<td>0.00001 (0.000)</td>
<td>0.0002 (0.000)</td>
<td>0.00003 (0.000)</td>
</tr>
<tr>
<td>Self-perceived health status</td>
<td>0.0006 (0.003)</td>
<td>0.0020 (0.003)</td>
<td>0.00005 (0.002)</td>
</tr>
</tbody>
</table>
Finally, we estimate the effect of financial literacy using the Control Function approach described in Section 4.3 (results in Columns 2 and 3 of Table 4). We add $\nu_1$, obtained from first step linear regression to the pooled probit model, along with other explanatory variables. Again, we find evidence against the null hypothesis that financial literacy is exogenous in nature. The APE of financial literacy is 0.058, which is almost as 8 times higher as the case in which financial literacy was treated as exogenous. Hence, this finding suggests that the previous estimates were biased. With the exception of the dummy for female, self-perceived social status and self-perceived health status, all other estimated coefficients display expected sign and are significant.

The estimated APEs of income and wealth quintiles reveal that one standard deviation of these variables is associated with 1.3% and 5% increase in the probability to own stocks, respectively. These results are in line with previous findings on the relevant role of financial resources and points to the presence of entry and management costs for investors in financial markets.

Turning to the socio-demographic variables, results are similar to those stemming from the baseline model (Table 3, Column 4) and the changes are concerned with the magnitude of the partial effects of some variables, not even the sign. Married respondents have a higher probability to stock market participation and the estimated coefficient is around 1.9% (significance level 5%). Finally, age and age-square are both significant, showing that stock holding, when purged out from cohort effects, increases with age among English respondents. Self-perceived health status remains insignificant in these models too.

On the other hand, all specifications show that the intensity of social network proxied by the lack of social activities does negatively affects the decision of participating in financial markets, with a partial effect of 4.7%. Also the variable proxing social capital i.e. trust, is found to play a significant and differentiated role: interestingly enough, individuals who believe that more people in his/her area can be trusted are more prone to join the stock market (partial effect of 0.5%).

As far as the level of optimism is concerned, proxied by self-perceived social status results are similar to those shown in Section 5.1: in fact the estimated coefficient remains insignificant, although with the expected sign.

The cohort effect proxied by sharpe-ratios shows that a one unit change in sharpe-ratio observed at young ages is associated with 16% increase in the probability to own risky financial assets. Finally, as for the school effect proxied by student-teacher ratio (meant to capture the effect that a better education system exerts on
participation in stock markets through externalities at cohort group level), it has a negative sign, as expected, and its average partial effect is 2% (Table 4, Column 3).

6. Conclusion

In this work we analyse the determinants of the decision to enter the stock market in England through a panel analysis. Data are drawn from the English Longitudinal Survey of Ageing dataset for years 2002-2012. For doing this we use several methodologies including a probit model controlling for both unobserved heterogeneity and serial correlation through Correlated Random Effects, Generalized Estimating Equations and Generalized Linear Models. We find that financial literacy is a significant determinant of the decision to enter the stock market, with a partial effect of 5.8%. Not controlling for the endogeneity of the latter variable leads to a dramatic negative bias of the estimate (with a partial effect lower than 1%).

Among individual characteristics, financial resources affect positively the probability of joining the stock market, pointing to the presence of entry costs; interestingly enough, marital status and gender are not significant for explaining participation in stock markets in England. Finally, the presence of social interaction and higher level of trust increase the probability to own stocks.

The hump shape in the age profile of participation rates turns out to be the composite effect of several factors. Once purged out from the latter, age exerts a positive effect on participation. In particular, the cohort effects captured by the quality of education at young age (proxied by student-teacher ratios) and by financial incentives observed at early stages of adult life (sharpe-ratios) are found to play a significant role.

As for policy implications, our findings suggest that the enhancement of financial literacy is crucial for favoring higher participation in capital markets. Moreover, given that financial education is strongly affected by starting conditions, policies should be designed to restore equality in opportunities among young individuals. This goal could be addressed through specific education courses, possibly at compulsory school level.

Finally, in order to promote efficient portfolio diversification, much effort should be put in improving institutional factors such as the effectiveness of the education system and those affecting the performance of the financial markets (for example, by favoring the presence of institutional investors such as pension funds) and to reduce entry costs.

Appendix 1

Estimation under endogeneity:

The traditional instrumental variable method which could provide results by eliminating ci cannot be attempted here (as these common estimation methods eliminates ci along with any time-constant explanatory variables) and therefore the CRE approach of modelling the distribution of unobserved heterogeneity, D(ci1|zi), is again attempted. Additionally, one has to model how yit2 is related
to \( \text{uit1} \). Control Function approach allows to deal with both issues. More precisely, we model the unobserved heterogeneity as a linear function of all exogenous variables, allowing the instruments to be correlated with time-constant omitted factors. Hence, assuming \( a_{i1} \) to be independent of \( z_i \), we can write:

\[
c_{i1} = \psi_1 + z_i \zeta_1 + a_{i1}, \quad a_{i1} | z_i \sim \text{Normal} (0, \sigma^2 a_1) \quad (A)
\]

Plugging equation (5) into (4) we get:

\[
E(y_{it1}|y_{it2}, z_i, a_{i1}, v_{it1}) = \Phi(\alpha_1 y_{it2} + z_{it1} \delta_1 + \psi_1 + z_i \zeta_1 + a_{i1} + v_{it1}) = \Phi(\alpha_1 y_{it2} + z_{it1} \delta_1 + \psi_1 + z_i \zeta_1 + r_{it1}) \quad (6)
\]

Assuming a linear reduced form of the suspected endogenous variable \( y_{it2} \) we get:

\[
y_{it2} = \psi_2 + z_{it1} \delta_2 + z_i \zeta_2 + v_{it2}, \quad t = 1, ..., T \quad (B)
\]

with \( r_{it1} = a_{i1} + v_{it1} \). The addition of time averages of strictly exogenous variables \( z_i \) in eq. (B) follows a Mundlak (1978) device. As for the source of endogeneity of \( y_{it2} \), it stems from the relationship between \( v_{it2} \), the reduced-form error term and the new term \( r_{it1} \) in eq. (6). Thus \( y_{it2} \) is allowed to be correlated with unobserved heterogeneity and time-varying omitted factors.

Compared to the estimation method where every explanatory variable is considered exogenous as in equation (1), we explicitly allow contemporaneous endogeneity in equation (B), while also allowing for possible feedback from unobserved idiosyncratic changes in \( y_{it1} \) as captured by \( u_{it1} \). Finally, since we do not assume strict exogeneity of the endogenous variable, the GEE estimation is inconsistent and thus we employ the Pooled Probit method in the second-stage estimation. To sum up, the two-step procedure employed is as follow:

1) Estimate the reduced form of \( y_{it2} \) (pooled across \( t \)) and obtain the residuals;
2) Use the probit QMLE of \( y_{it1} \) on \( y_{it2}, z_{it1}, z_i \).

**References**


Who owns stocks in England: a panel analysis


AUTOMATIC ENROLMENT INTO OCCUPATIONAL PENSION SCHEMES – THE UK MODEL AND DIFFERENCES WITH THE PROPOSED POLISH PROGRAM

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Abstract

A new form of an occupational pension scheme is due to be introduced in Poland from January 2019. It will be a defined contribution scheme with automatic enrolment of employees. The setup is modelled after the autoenrolment program functioning in the United Kingdom since April 2012. However, there are some differences between the program which had been setup in the UK and the proposed Polish one. These concern aspects such as eligibility of workers for autoenrolment, levels of contributions payable by both employers and employees and incentives provided by the State. Aim of this paper is to analyse these differences by calculating contribution levels and replacement rates which can be achieved in the UK and in the proposed Polish scheme. This will allow to identify workers who can expect highest replacement rates in both countries, as well as those paying highest contribution rates. The input of the State in the form of additional contributions and tax incentives will also be assessed.

Keywords: automatic enrolment, contribution rate, pension schemes, replacement rate.

JEL codes: J32.

1. Introduction

Low pension replacement rates in some countries, as well as unsustainable public pension systems in others are leading to an increased interest in private pension provision (Antolin et al. 2012, p. 7). Participation in occupational pension schemes has been made compulsory in Australia, Chile, Iceland and Switzerland, and quasi-compulsory in the Netherlands, Denmark and Sweden. Another solution, an automatic enrolment into occupational pension schemes has been utilized in recent years. Employees are automatically enrolled into a pension scheme, and while it is possible to opt out, the system relies on workers inertia to cause them to stay in the pension scheme (Thaler and Sunstein 2003, p. 177; Kooreman and Prast 2010, pp. 104-105). First countries to introduce such

---

1 In a quasi-mandatory system participation is compulsory for some industries or groups of employees (Antolin et al. 2012, p. 11).
A program nationally were New Zealand and Italy in 2007. Research shows that participation rate had indeed increased in both countries, although not as much as expected in case of Italy (Law et al. 2011, p. 28; O’Connell 2009, p. 132; Rinaldi 2010, p. 8). Since then, automatic enrolment has been introduced in UK and Chile and is considered in Ireland.

A change to Polish occupational pensions is due to be introduced from January 2019. It will become mandatory for all employers to offer an occupational pension scheme to their employees. An automatic enrolment program, modelled on the autoenrolment program functioning in the UK since 2012, will also be introduced. Aim of this paper is to analyse differences between the proposed Polish program and the UK one. This is done by calculating contribution levels and replacement rates which can be achieved in both countries, allowing to identify workers who can expect highest replacement rates, as well as those paying highest contribution rates. The input of the State in the form of additional contributions and tax incentives is also assessed.

2. Automatic enrolment programs in the UK and in Poland

The proposed Polish program is modelled on the one which has been introduced in the UK. However, there are several differences with respect to employees who will be automatically enrolled and how the pension schemes will function. The first difference between programs in the two countries concerns categories of employees who are to be automatically enrolled into occupational pension schemes.

In the UK workers are divided into three main categories (TPR Guidance 2017a, pp. 12-18). These determine whether the worker needs to be automatically enrolled into an occupational pension scheme and what the duties of the employer with respect to that worker are. Automatic enrolment applies to a category referred to as “eligible job-holders”. These are employees aged between 22 and the State Pension Age (SPA) , who work in the UK and who have qualifying earnings above the autoenrolment trigger. The trigger is set by the government every year, and is at 10000 GBP for the tax year 2017/2018. These workers need to be automatically enrolled into a pension scheme, with an option of opting-out. They then need to be re-enrolled every three years. Employer has a duty to pay contributions into a scheme for such workers.

The second category is “non-eligible jobholders”. These are either workers aged between 16 and 74 who earn below the autoenrolment trigger but above the lower qualifying earning threshold, or workers who earn above the trigger but are aged 2 Automatic enrolment has become popular among some employers in the US after introduction of Pension Protection Act 2006, however it is still used on voluntary basis (Antolin et al. 2012, p. 21). Research confirms that automatic enrolment increases participation rates (Choi et al. 2004).

3 Qualifying earnings are defined as earnings that fall between two thresholds, lower and upper qualifying earning threshold. These are set by the government every year and are equal to 5876 GBP (lower) and 45000 GBP (upper) for the tax year 2017/18 (TPR 2017c).
between 16 and 21 or SPA and 74. There is no duty to automatically enroll them into a scheme, but they do have an option to opt into the scheme voluntarily. If they choose to do so, the employer needs to pay contributions in respect of these workers.

The final category is the “entitled workers”. Their earning are lower than the lower threshold and they are aged between 16 and 74. They have a right to join an occupational pension scheme, however, it need not be the same one as used for automatic enrolment. There is no obligation for employers to pay contributions in respect of entitled workers. Table 1 below summarises the three categories of workers.

Table 1. Different categories of workers depending on their age and earnings

<table>
<thead>
<tr>
<th>Earnings</th>
<th>Age (inclusive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower earning threshold or below</td>
<td>Entitled worker</td>
</tr>
<tr>
<td>More than lower earnings threshold up to and</td>
<td></td>
</tr>
<tr>
<td>including the earnings trigger for automatic</td>
<td></td>
</tr>
<tr>
<td>enrolment</td>
<td></td>
</tr>
<tr>
<td>Over earnings trigger for automatic enrolment</td>
<td>Non-eligible jobholder</td>
</tr>
</tbody>
</table>

* SPA = State Pension Age
Source: TPR 2017a, p. 15.

In contrast, automatic enrolment in Poland will apply to all categories of workers, independently of level of earnings. All employees aged between 19 and 55 will need to be automatically enrolled (with an option to opt out). For those aged over 55 participation will be voluntary. There are no details as to whether those who have opted out of the program will be re-enrolled in the future (Ministerstwo Rozwoju 2016). On the one hand, simpler automatic enrolment program will be easier to administer for the employers, as well as easier to monitor for the government. On the other, it does not allow to target specific groups of employees or take into account specific circumstances of workers, especially those with lower earnings. As a result of lower disposable income these workers may not be able to contribute as much into a pension scheme as higher earners.

The second difference between the programs concerns requirements that need to be satisfied by the pension scheme in order to qualify as automatic enrolment scheme. In the UK there are two main types of occupational pension schemes – defined benefit and defined contribution. In order to be used for the purpose of the
autoenrolment program, such schemes need to satisfy certain conditions, referred to as minimum requirements. For a DB scheme, the minimum requirement refers to the level of benefits provided (TPR 2017b, pp. 25-26). These need to be equivalent to, or better than, benefits set out in a so called “test scheme” – a hypothetical pension scheme used as a benchmark. Broadly, test scheme benefits consist of a pension payable for life from age 65 (this age is increasing in line with the State Pension Age), calculated as 1/120 of average qualifying earnings in the last three years of pensionable service for each year of pensionable service (up to a maximum of 40 years). If a DB scheme provides benefits at least equivalent, or better than those set out in test scheme, it qualifies for the purpose of automatic enrolment program. For a DC scheme the minimum requirements refer to levels of contributions payable (TPR 2017b, p. 19). Total contribution must equal at least 8% of qualifying earnings. Employer contribution must equal at least 3% of qualifying earnings. The charge cap is set at 0.75% of funds under management (DWP 2016). If employer does not provide an occupational pension scheme suitable for the purpose of autoenrolment, a NEST scheme can be used. It is a DC scheme set up by the government and administered by the NEST corporation.

In Poland all occupational pension schemes are defined contribution type. Starting from January 2019, contributions payable to such schemes will need to equal 3.5% of earnings, with 2% paid by the employee and 1.5% paid by the employer. A voluntary additional contribution can be paid, up to a maximum of 2.5% for the employer and 2% for the employee. If the employer does not provide an occupational pension scheme, a work-place capital plan administered by a Polish Development Fund can be used. The total cost should not exceed 0.6% (Ministerstwo Rozwoju 2016).

The two programs also differ with respect to State incentives for members to participate in occupational pension schemes. In the UK, the incentives are primarily tax-based. Contributions paid into occupational pension schemes, as well as investment returns achieved within such schemes are exempt from income tax. In Poland on the other hand contributions are taxed at normal tax rates. The incentives from State are to take form of additional contributions: 250 PLN welcome contribution (one-off), plus annual contribution of 240 PLN.

3. Comparison of contribution and replacement rates

Level of contributions that should be paid into pension schemes is a subject of much debate. It is particularly important in automatic enrolment schemes, as it has been shown that many workers will pay default rate (Benartzi and Thaler 2013, p. 1152]. Some countries raise the contribution rate, while others lower it or keep it constant. For example in Australia the mandatory contribution rate has been raised from 9% to 9.5% of earnings in 2014 and is set to increase further, reaching 12% in 2025 [OECD 2017b]. In New Zealand the default rate was decreased from 6% to 4% of earnings, before reverting back to 6% in 2013 (MacDonald et al. 2012, p. 62). In 2016 contribution rate in OECD countries where private pension contributions were mandatory varied from 4.5% in Sweden to 36.9% in the
Netherlands (OECD 2017a, p. 141). Such different contribution levels will naturally lead to different pension replacement rates. Choosing an adequate level of pension in relation to earnings has been subject to much research. World Bank suggested a replacement rate of around 50% (World Bank 1994). Other sources suggest rate of 75%-95% depending on the level of earnings (Palmer 2008, p. 24; MacDonald et al. 2012, p. 65).

In this section of the paper contribution rates and replacement rates in occupational pension schemes in the UK and in Poland will be investigated. Calculations were performed for a member of a scheme in each country with varying level of earnings. It was assumed that such a member joins the scheme aged 25, contributes to the scheme for 40 years and retires aged 65. Main assumptions used in calculations are summarised in Table 2.

Table 2. Main assumptions used in calculations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worker’s age at joining pension scheme</td>
<td>25</td>
</tr>
<tr>
<td>Retirement age</td>
<td>65</td>
</tr>
<tr>
<td>Annual rate of investment returns</td>
<td>2%</td>
</tr>
<tr>
<td>Annual rate of salary increase</td>
<td>1%</td>
</tr>
<tr>
<td>Technical rate of interest (used for calculating annuities)</td>
<td>1%</td>
</tr>
<tr>
<td>Annual charge (used for calculating annuities)</td>
<td>0.5%</td>
</tr>
<tr>
<td>Survival probabilities (used for calculating annuities)</td>
<td>GUS Life table for both sexes combined in 2016 (GUS 2017)</td>
</tr>
<tr>
<td>Employer contribution rate (UK)</td>
<td>3% of qualifying earnings</td>
</tr>
<tr>
<td>Employee contribution rate (UK)</td>
<td>5% of qualifying earnings</td>
</tr>
<tr>
<td>Annual management charge (UK)</td>
<td>0.75% of accumulated funds</td>
</tr>
<tr>
<td>Lower qualifying earnings threshold (UK)</td>
<td>5 772 GBP*</td>
</tr>
<tr>
<td>Upper qualifying earnings threshold (UK)</td>
<td>41 865 GBP*</td>
</tr>
<tr>
<td>Employer contribution rate (Poland)</td>
<td>1.5% of earnings</td>
</tr>
<tr>
<td>Employee contribution rate (Poland)</td>
<td>2% of earnings</td>
</tr>
<tr>
<td>Annual management charge (Poland)</td>
<td>0.6% of accumulated funds</td>
</tr>
</tbody>
</table>

* Levels applicable in tax year 2014/15 (TPR 2017c)

Source: own work.

Contribution rates payable in the UK were calculated for different levels of earnings. Deciles of income, as reported by ONS for tax year 2014/15 (ONS 2017), were used as starting earnings in the year when worker joins the scheme. Three different rates of increase for qualifying earnings threshold were then considered. Qualifying earnings thresholds for the tax year 2014/15 were used as a starting point.
Firstly, in scenario 1 it was assumed that the qualifying earnings thresholds increase in line with salaries, i.e. 1% p.a. Results of calculations are summarised in Table 3.

**Table 3.** Contributions (expressed as percentage of earnings) payable and replacement rates (ratio of pension to final earnings) in scenario 1 for different levels of earnings

<table>
<thead>
<tr>
<th>Annual earnings at start (GBP)</th>
<th>Annual contribution rate</th>
<th>Replacement rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 200 (1st decile)</td>
<td>4.22%</td>
<td>10.49%</td>
</tr>
<tr>
<td>14 400 (2nd decile)</td>
<td>4.79%</td>
<td>11.92%</td>
</tr>
<tr>
<td>16 700 (3rd decile)</td>
<td>5.23%</td>
<td>13.02%</td>
</tr>
<tr>
<td>19 300 (4th decile)</td>
<td>5.61%</td>
<td>13.95%</td>
</tr>
<tr>
<td>22 400 (5th decile)</td>
<td>5.94%</td>
<td>14.77%</td>
</tr>
<tr>
<td>26 200 (6th decile)</td>
<td>6.24%</td>
<td>15.52%</td>
</tr>
<tr>
<td>31 300 (7th decile)</td>
<td>6.52%</td>
<td>16.23%</td>
</tr>
<tr>
<td>38 500 (8th decile)</td>
<td>6.80%</td>
<td>16.92%</td>
</tr>
<tr>
<td>51 400 (9th decile)</td>
<td>5.62%</td>
<td>13.97%</td>
</tr>
</tbody>
</table>

Source: own work. Data on deciles of income from ONS (2017).

As shown in Table 3, contribution rate increases with earnings from around 4% for low earners up to about 6.8% for earnings equal to decile 8. The rate is slightly lower for those with highest earnings (higher than the upper threshold of qualifying earnings). Similarly, the replacement rate increases from 10% of final earnings to around 17% and falls slightly for the high earners.

Scenario 2 assumes the qualifying earnings thresholds increase faster than the salaries, at 2% p.a. Figure 1 presents contribution rates calculated for this scenario.

**Fig. 1.** Contributions (expressed as percentage of earnings) payable in scenario 2 for different levels of earnings in the 40 years of scheme service

Source: own work. Data on deciles of income from ONS (2017).
For workers earning below 8th decile the contribution rate decreases over their scheme service. It is at higher level for high earners – for workers with earnings equal to the 8th decile contribution rate decreases from 6.8% to 6.2%, whereas for workers with earning equal to 1st decile it decreases from 4.2% to 2.4%. For highest earners (9th decile) the contribution rate increases in the first 20 years of service, from 5.6% to 6.9%, and then decreases slightly to 6.7%.

The replacement rates follow similar pattern to scenario 1 – they increase from 8% for workers with earnings equal to the first decile up to 15.4% for workers with earnings equal to decile eight, and fall slightly to 15.3% for highest earners. Finally, scenario 3 assumes the qualifying earnings thresholds increase slower than the salaries, at 0.5% p.a. Figure 2 presents contribution rates calculated for this scenario.

**Fig. 2.** Contributions (expressed as percentage of earnings) payable in scenario 3 for different levels of earnings in the 40 years of scheme service

Source: own work. Data on deciles of income from ONS (2017).

As shown in figure 2, for most workers the contribution rate increases over their scheme service. For workers with earnings equal to the first decile it increases from 4.2% to 4.9%, and for those with earnings equal to decile 7 it increases from 6.5% to 6.8%. For workers with earnings equal to decile 8 contribution rates increase very slightly in the first 20 years of service from 6.8% to 6.9%, and then decrease to 6.2%. For highest earners the rate decreases throughout their scheme service, from 5.6% to 4.6%.

Replacement rates increase with earnings from 10.7% for workers with earnings equal to decile 1 to 15.7% with earnings equal to decile 8 and decrease for higher earners to 12.1%.

In summary, contribution rates and replacement rates in the UK depend on worker’s earnings, as well as the rate of increase of earnings and qualifying
earnings threshold. In all cases contribution rates payable by low earners are lower than those payable by high earners.

In contrast to the UK, the same contribution rate is paid with respect to all Polish workers equal to 3.5% of earnings. There is no differentiation between higher or lower earners. Replacement rates achieved by paying these contributions into a scheme (ignoring the input of the State) equals 8.5%, lower than the replacement rate which can be achieved in the UK program.

In both countries replacement rates from public pension are rather low. In the UK the rate is much higher for low earners (around 52%) than for high earners (around 21%). In Poland the rates are similar for all levels of earnings (38% for men, 34% for women) (OECD 2017a, p. 107). The additional pension which can be accumulated in occupational pension schemes increases the replacement rate by around 10-17 percentage points in the UK and only around 8.5 percentage points in Poland. The resulting replacement rate is still lower than what has been proposed as adequate in literature.

4. State incentives for joining occupational pension schemes in the two countries

The final difference between the two programs concerns the input of State. In the UK incentives are mostly tax-based, whereas in Poland extra contributions will be paid. As such, the impact of State in the two countries is not directly comparable. Assessment of this impact was therefore done in two parts. Firstly, the impact of tax incentives in the UK was illustrated by calculating the difference between the tax payable by worker each year on his earnings assuming that contributions are taxed, and assuming contributions are exempt from income tax. This difference was then divided by the earnings. Similar calculation was done for Poland. Results are summarised in Table 4.

Table 4. Impact of tax incentives in the two countries

<table>
<thead>
<tr>
<th>Country and level of earnings</th>
<th>Difference in income tax payable if contributions are taxed and are not taxed, expressed as % of earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK 1st decile</td>
<td>0.84% in all years</td>
</tr>
<tr>
<td>UK 2nd decile</td>
<td>0.96% in all years</td>
</tr>
<tr>
<td>UK 3rd decile</td>
<td>1.05% in all years</td>
</tr>
<tr>
<td>UK 4th decile</td>
<td>1.12% in all years</td>
</tr>
<tr>
<td>UK 5th decile</td>
<td>increasing from 1.19% in year 1 to 2.33% in year 40</td>
</tr>
<tr>
<td>UK 6th decile</td>
<td>increasing from 1.25% in year 1 to 2.50% in year 40</td>
</tr>
<tr>
<td>UK 7th decile</td>
<td>increasing from 1.43% in year 1 to 2.61% in year 40</td>
</tr>
<tr>
<td>UK 8th decile</td>
<td>2.72% in all years</td>
</tr>
<tr>
<td>UK 9th decile</td>
<td>2.25% in all years</td>
</tr>
<tr>
<td>Poland all deciles</td>
<td>0.63% in all years</td>
</tr>
</tbody>
</table>

Source: own work. Data on deciles of income from ONS (2017).

In the UK results shown in table 4 express savings made by worker due to contributions not being taxed. These savings (expressed as percentage of earnings)
vary depending on the level of earnings. For lower earners they remains constant in all scheme years. For middle earners they increases over scheme service, and for high earners are constant again. This is caused by workers moving between tax brackets and earnings thresholds. Overall, the incentives are regressive, with higher earners receiving slightly higher tax relief. In Poland, the results shows savings that could have been made if the contributions were not taxed. They do not depend on earnings and are lower than in UK for all levels of earnings. Secondly, the impact of State contributions in Poland was assessed by calculating increase in a replacement rate that can be attributed to these contributions. The two types of State contributions are a one-off welcome payment of 250 PLN, and an annual contribution of 240 PLN. Impact of these on the replacement rate is summarised in Table 5.

### Table 5. Increase in a replacement rate caused by additional contributions paid by State in Poland for different earnings levels

<table>
<thead>
<tr>
<th>Annual earnings (PLN)</th>
<th>Additional replacement rate due to State contributions</th>
<th>Total replacement rate from occupational pension scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>20616.00 (1st decile)</td>
<td>2.42%</td>
<td>10.94%</td>
</tr>
<tr>
<td>25090.68 (2nd decile)</td>
<td>1.99%</td>
<td>10.51%</td>
</tr>
<tr>
<td>29808.48 (3rd decile)</td>
<td>1.67%</td>
<td>10.19%</td>
</tr>
<tr>
<td>34437.96 (4th decile)</td>
<td>1.45%</td>
<td>9.97%</td>
</tr>
<tr>
<td>39498.72 (5th decile)</td>
<td>1.26%</td>
<td>9.78%</td>
</tr>
<tr>
<td>45150.60 (6th decile)</td>
<td>1.11%</td>
<td>9.63%</td>
</tr>
<tr>
<td>52338.36 (7th decile)</td>
<td>0.95%</td>
<td>9.47%</td>
</tr>
<tr>
<td>62318.76 (8th decile)</td>
<td>0.80%</td>
<td>9.32%</td>
</tr>
<tr>
<td>83006.76 (9th decile)</td>
<td>0.60%</td>
<td>9.12%</td>
</tr>
</tbody>
</table>


Extra contributions payable by the State increase the replacement rate slightly, by around 1 or 2 percentage points depending on earnings level. The increase in percentage points is progressive, being higher for low earners and lower for high earners. Even taking these increases into account, replacement rates in the UK are typically higher.

### 5. Conclusion

Despite the fact that proposed automatic enrolment program in Poland is modelled after the UK one, there are several differences in the setup of the two programs. They concern categories of workers who will need to be automatically enrolled, levels of contributions payable and forms of State participation. In general, the proposed Polish program seems to be much simpler, making it easier to administer and monitor. On the other hand, it does not allow the State to target specific groups of employees or take into account special circumstances of some workers. In the UK contribution rates are lower for low earners than for high earners. The aim here might have been to take account of lower disposable income of low earners,
which does not allow them to make big savings in pension scheme. This obviously results in lower replacement rates for low earners. The contribution rates in Poland are at the same level for all workers and lower still than those payable in the UK. The replacement rates available, even when taking into account State participation, are also lower.

**References**


Abstract
The Spanish pension system shows important gender differences both in the gap in non-coverage rate and in the gap of pension incomes. About 60 percent of women aged 65 years or over do not have a contributory retirement pension. Widowhood pensions play an important role to extend the coverage of contributory pensions and reduces the poverty of women. These gaps are the consequences of gender differences in employment such as salaries, working hours and duration of working life. Also, there is a strong cultural component which implies the traditional role of women as the caretakers of their families.

The Social Security system is currently undergoing changes which mainly affect retirement pensions. The main effect of the Spanish reforms on pensioners consists in lowering pensions and adds to the women's pensions some negative impacts such as the penalization of short work careers and careers with low intensity of time worked (part-time and others). Also, the sustainability factor based on the life expectancy will affect in greater proportion in women than in men.

It should be considered alternatives measures to reconcile finance sustainability and adequacy of pension systems in the context of ageing populations. Policies for reducing gender gaps in pay, working hours and career length are, likewise, active means of narrowing the gender gap in pensions which will contribute to lowering the risks of poverty in women.

Keywords: gender economics, pensions, public finance, retirement policy, social security.


1. Introduction

“Equality between women and men is a fundamental value of the European Union and one that has been enshrined in the Treaty from the very beginning, as the Treaty of Rome included a provision on equal pay. Over the last 60 years, societal changes and persistent policy efforts have established a trend towards gender equality” (European Commission 2017).

“Although women are successful in gaining qualifications, their subsequent careers are often more interrupted, they have lower pay and their careers are flatter. As a consequence, they earn less than men over their life cycle, and their pensions are lower”.
Spain is the ninth country in the European Union where the gender gap in retirement pensions is more accentuated and the AROPE (“at risk-of poverty or social exclusion”) rate remains higher in women than in men. The present figures of Spanish gender inequalities in pensions reflect the past policies on inequalities on education, in labour market and women’s role in duties of family caring. But, how will pensions in the future compare to those of today? This is one of the questions that this paper tries to put on the table.

1.1. The Spanish pensions system

The vast majority of Spanish pensions come from the public body of Social Security. Private pensions play a residual role in the global pensions System. The Social Security system provides a double level of protection: contributory (non-means tested) and non-contributory (means tested). The contributory modality follows a defined benefit scheme and covers the contingencies of old age, invalidity and survivors. The non-contributory modality covers the contingencies of invalidity and old age of those individuals who are not entitled to contributory pensions and find themselves in situations of need.

Public pensions have a guaranteed minimum amount. If the pension falls below the minimum amount set by the Government, then a supplement is added to it; however, there are certain limitations on receiving such supplement1. The Government also sets the maximum ceiling for pensions2, although there are exceptions for certain groups (persons with disabilities, victims of terrorism, among others).

The contributory Social Security pensions get financed through the social contributions paid by the working people and the employers, while the non-contributory pensions, as well as the “minimums supplement” of the contributory pensions, are financed with resources from the State budget.

The Social Security system distinguishes different types of legal relations with the persons registered with social security and classifies them into: General Regime and Special Regimes. The General Regime is the largest and includes employed workers over 16 years of age, regardless of the type of contract. Special Regimes are divided into: Self-employed, Seafarers, State civil servants and students. The contribution bases of different Social Security regimes can be integrated into the regime for which one retires.

1.2. Old age pensions expenditure

Public pensions are the main economic resource of older people. The number of old-age Social Security pensioners is approximately 6.17 million in 2017. To these

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1 In 2018, the amount of the minimum complement may not exceed the amount set by the government for non-contributory pensions (EUR 5178.6) and shall be incompatible with individual or familiar annual earnings higher to EUR 7133.97.

2 In 2018, the annual maximum contributory retirement pension is EUR 36121.82; the minimum is EUR 8949.98 (single person) and EUR 11043.61 (with an economically dependent spouse).
figures we should add around 255,000 beneficiaries of non-contributory pensions. The current public expenditure on old-age pensions is 8 percent of GDP, of which 7.5 percent are non-means tested and 0.5 percent are means tested. Spanish old age pension expenditure per inhabitant in ppc\(^3\) has always been below that of the other European developed countries if we compare since 2008 onwards as we can see in the graph, but there is a slight reduction through the years. For example, if we compare Spain to Germany, the difference in 2008 was of 35 percent and in 2015 it is of 25 percent. See Figure 1.

**Fig. 1.** Old age pension expenditure in purchasing power standard (ppc)
Source: Eurostat. Pensions.

The role of private pensions to supplement public pensions is limited because most of the salaries are low and the implementation of occupational pensions is not compulsory. Supplementary pension schemes are voluntary and structured into occupational funds and individual funds. The number of participants of supplementary pension schemes was 20 million, approximately, which means 7.5 percent of people 65 years or over. Of those, 3.3 percent comes from occupational pensions.\(^4\) With the recent labour market reforms (2012) and the economic crisis, the size of the occupational pensions has been decreasing. At present, only approximately 2% of the workers have an occupational pension plan. The majority of supplementary occupational schemes are linked to large firms (particularly in the financial and utilities sectors, as well as in multinationals), while small and medium companies have not developed these schemes so often.

Pension plans are the main product of supplementary pensions (60 percent of the total) and there is a high concentration of small contributions, 74.6 percent of contributions are below 300 euros, while only 5.5 percent exceed the amount

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\(^3\) Eurostat. Pensions. Data from 2008 to 2015.

\(^4\) *Dirección General de Seguros y Fondos de Pensiones.* “Insurance and pensions fund report, 2016”.

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of 3,000 euros per year. Most people subscribe to a private pension plan when they take out a mortgage loan. The average monthly income per beneficiary of retirement benefits, in the form of regular income, was 524 euros (2015).

1.3. Requirements for the retirement contributory pensions in 2018

The pensionable retirement age, is 65 years and six months or from the age of 65 if the person has made contributions for 36 years and six months. Some groups may be able to bring forward their retirement age, such as persons with disabilities as well as those in arduous or hazardous job.

To access the Social Security contributory pension, a minimum of 15 years of contribution is required, of which 2 years of contribution must be included in the 15 years prior to retirement. People with part-time contracts have a specific regulation in order to adjust the hours worked to the number of years contributed. 35 years and six months are required to receive the maximum pension otherwise a variable percentage is applied to the regulatory base according to the number of years (months) of contribution. In the case of workers with part-time contracts, the contribution period is artificially lengthened. There are specific conditions for early and partial retirement.

The amount of pension is a percentage of the average contribution bases of the previous twenty-one years before the date of retirement. In the event that there are contribution gaps in the period considered, they are filled by a percentage of the minimum bases of contribution of the corresponding moment. People with part-time contracts have a specific regulation. Also, there are certain peculiarities in the procedure for calculating the social contribution and the amount of the pension for people integrated in some special regimes of the Social Security system. For example, “self-employed workers” contributions are not determined by the income from their activity, but rather each person can choose their contribution base, which ranges between a minimum and a maximum base set by the government.

Pensions are annually revaluated according to an index annually established by the government (Pensions Revaluation Index – PRI). The value of this index since its introduction in 2013, as part of the “Pension reforms”, has been 0.25 percent. There are incentives to prolong the working life and some cases of compatibility between work and pension: active retirement, flexible retirement and flexible with self-employed retirement.

The total percentage is calculated by applying 50 percent for the first 15 years of contributions and additional percentages for the “following months” contributed which vary from 0.21 percent to 0.18 percent for each additional month.

A coefficient of 1.5 percent is applied to the equivalent days of contributions.

100 percent of the minimum base during the first 48 months and the rest of the gaps with the 50 percent of it.

It consists in adding a percentage between 2 to 4 percent per year worked to the pension, which varies according to the number of years of contributions.
A supplement on pensions for women with two or more children has been recently introduced. As from 1 January 2016, women who are entitled to a contributory\(^9\) pension and who have had at least two children will have an increase on their pension. The percentage varies according the number of children: 5 percent for two, 10 percent for three or 15 percent if they have had more than three.

2. Poverty and inequality on old age pensions

Eurostat Statistics show that, in 2016, old people in Spain are enjoying living standards close to those of the population below retirement age and face lower risks of poverty and social exclusion than those of working age. The AROPE rate of those aged 65 years or over was 14.4\% in 2016 (13.8\% in men and 14.9\% in women) and it is higher of people 75 years or over (15.4\%) but the relative median income ratio of people aged 65 years or over is slightly higher than the median income of those aged below 64 years (1.01). This situation is similar than others European Union Member States (EU_SILC).

The better situation of the elderly population compared to the younger population is mainly due to a strong wage devaluation during the economic crisis (2008-2014), while pensions maintained their purchasing power because were increased annually according to the consumer price index. But, this situation is changing from onward 2013 due the “Reform of Spanish pension system” The automatic revaluation through prices variation has been eliminated and replaced by a new “Pension Revaluation Index (PRI)” established by the government, which links the annual growth of pensions to the budgetary constraints of the system. PRI do not have any relationship to the consumer prices index (CPI). So, it turns out than if there is inflation, pensions lose purchasing power. This happens in 2016 when the PRI was 0.25\% and the CPI was 1.6\%.

Despite the better relative position of pensioners with respect to people of working age, the purchasing power of pensions is not high and emerges an important gender gap. In 2016, the relationship between the average (gross) pension and the MIS (Minimum Interprofessional Wage)\(^{10}\) shows that two thirds of women (67\%) have pensions below 1 MIS and only one-fifth (22\%) of men are below this threshold.

2.1. Poverty in old age women pensions

Women are more exposed to poverty in old age than men as they tend to have lower access to pensions and much lower pensions of their own. The “gender gap in coverage rate” and “gender gap in pension income” indicators shows the high economic dependence of women aged 65 years or over on their spouse or other family members.

The present figures of Spanish gender inequalities in old age pensions reflects the policy in the past on inequalities on education, in labour market and women’s role

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9 It excludes non-contributory pensions and voluntary early retirement pensions.

10 In 2016, the annual MIS was EUR 9,172.8.
in duties responsibilities of family caring. Women’s gender gap in old age pensions is emerging as a major policy concern since nearly one third of women (34%) have not reached the level of the minimum old age pension set by the government. The average monthly amount of the supplement is 203.09 euros, in 2016.

2.1.1. Gender gap on coverage old age pensions

About 60 percent of women aged 65 years or over do not have a contributory retirement pension while only 14 percent of men do not have one. Widowhood pensions play an important role to extend the coverage of contributory women pensions. In fact, nearly 25 percent of women aged 65 years or over receive a widowhood pension without any other pension. It allows to increase the coverage of pensions in women aged 65 years or over until reaching two third (66 percent) of those aged 65 years or over. On the contrary, there are only few males receiving a widowhood pensions as the only source of income. The gender gap of retirement pensions non-coverage is 46.1 percent and it reduces to 21.2 percent if we take into consideration both the widowhood pension and retirement pensions. See Figure 2.

Fig. 2. Gender coverage rate: retirement and widowhood pensions
Source: Social Security Statistics and INE population (2016).

2.1.2. Gender gap in pensions income

Spain is the ninth country in the European Union where the gender gap in retirement pensions is more accentuated. The gender gap in pensions of people aged 65-74 is high (37%) and it is even higher for those aged 75 years or over (about 40 percent). Widowhood pensions slightly alleviate poverty for women aged 65 years or over who have not access to retirement pension. See Table 1.
Table 1. Retirement pension income (euros/month)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>TOTAL</th>
<th>Males</th>
<th>Females</th>
<th>GAP (F/M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 65-74</td>
<td>1 157.82</td>
<td>1 325.78</td>
<td>870.15</td>
<td>-34.4%</td>
</tr>
<tr>
<td>From 75-84</td>
<td>916.56</td>
<td>1 082.08</td>
<td>633.99</td>
<td>-41.4%</td>
</tr>
<tr>
<td>85 onwards</td>
<td>778.16</td>
<td>946.97</td>
<td>569.31</td>
<td>-39.9%</td>
</tr>
<tr>
<td>Total</td>
<td>1 052.01</td>
<td>1 220.65</td>
<td>768.54</td>
<td>-37.04%</td>
</tr>
</tbody>
</table>


Non-contributory pensions (NCPs) alleviate the poverty of old people slightly. Around 255,000 people are beneficiaries (2.6% of the population aged 65+). The average pension is approximately 356 euros per month, earnings that are far from equaling the minimum contributory retirement pensions (636 euros per month). The gender gap is evident again as three quarters of beneficiaries are women.

3. How will the pensions be in the future?

The pensions in the future will be the result of what is happening, at present, in the pension system and in other transversal policies such as labour market, education, family care responsibilities and others. Women have to fight in two fronts: first, into the pension system to assure a retirement pension enough to live a decent life and, second, into the labour market policies and other transversal policies to assure a length of working life and enough social contributions to get the maximum of pension.

3.1. Spanish pension reform system

Spain is one of the countries whose reforms in the pension system have been aimed at guaranteeing the sustainability of the System. One of the main reasons for the reform in 2011 was the demographic projection between 2010 and 2060, with the foreseeable increase in the dependence rate and the estimate of the increase in people aged 65 and over, whose figures are estimated to double (from 7.7 to 14 million). The Government's objective was to introduce measures to reduce the expenditure in pensions. Thus, instead of going from 10.1% to 16.8% of GDP (expected for 2060), spend at 13% of GDP. So, the expenditure on pensions would increase 3.6 points of GDP against the 6.6 expected points in a scenario without reforms.

The implementation of the reforms is progressive and will be developed over a period of fifteen years (2013-2027) during which time the changes to the parameters will be gradually implemented. Present changes have already been reflected in the previous paragraph.

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11 The beneficiary of a non-contributory retirement pension is required to be a resident in Spain for at least 10 years, two of which must be immediately prior to the date of application for the pension.
The main changes introduced in the pensions reform (from 2013 to 2027) are the following ones:

- Increasing the age of retirement: From 65 to 67 years. But, it is possible to retire at 65 years if one has contributed 38 years and six months.
- Increasing the number of years of contribution to receive the 100 percent of the pension: From 35 to 37.
- Increasing the number of years considered to calculate the amount of pension: From 15 to 25.
- Strengthening the relationship between pensions and pensioner’s life expectancy through the “sustainability factor”. This measure will start in 2019.
- Tightening the requirements for early retirement and partial retirement.
- Limiting the increase in pensions through a new revaluation index set by the Government (PRI) which is capped between a minimum (0.25) percent and a maximum of the CPI (Consumer Price Index) increased in 0.5 percent.

Most of the measures are aimed at paying pensions for a shorter time and at reducing its amount. Especially important is the impact of the new pension revaluation and the sustainability factor.

In the long term, de-indexation of pensions to the CPI, tightening the conditions for determining the retirement pension and the “new” sustainability factor that will come into force in 2019 will cause a progressive decrease in pensions. According to the Ageing Working Group (AWG) estimates, Spain is one of the countries where retirement pensions will be affected by the most severe cutbacks as a result of the latest reforms (2011 and 2013), which will entail decreases of between 30 and 40 percent in the period 2013-2060 (Hernández de Cos and Jimeno 2017).

The sustainability factor will reduce women’s pensions in greater proportion than those of men due to the fact that the reducing coefficient is calculated on the increase of life expectancy of the new retirees, at the time of their retirement, in relation to the previous ones. At present, women’s life expectancy at 65 years is 23 while that of men is 19.

By comparison with the rest of the EU countries, Spain would experience one of the biggest decreases in the average replacement rate during the period 2013-2060. In 2016, the Theoretical Replacement Rate (net earnings) at the average career length case (AWG) is 85.3 percent for men and 91.3 percent for women. It is above the average rate in the EU-28 (71 percent) (OECD 2017). But, in a long term, it is foreseen that this rate will decrease significantly for those with shorter labour careers (51.9 percent) and early exit from labour market, especially when nearing the retirement age (73 percent).

3.2. The impact of labour market in the future of women’s pensions

As said in the Joint Report on Employment of the Commission and the Council of the European Union (COM 2016), women are still under-represented in the labour market and they are affected by a significant wage differential. The employment gap between men and women is still very large, especially in the case of mothers.
and women who have responsibilities as carers. The wage gap, combined with a shorter working life, often results in lower pensions for women.

In Spain, in 2016, the wage earnings gap is 20%. Among the causes of this gap there is the fact that women work, more than men, in part-time jobs and in temporary contracts as we can see in the difference on average hours per week. See Table 2.

**Table 2. Retirement pension income (euros/month)**

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
<th>Gap F/M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average monthly salary</td>
<td>2075.7</td>
<td>1661.0</td>
<td>-20%</td>
</tr>
<tr>
<td>Average hours per week</td>
<td>38.9</td>
<td>33.8</td>
<td>-13%</td>
</tr>
</tbody>
</table>


The recent report on equality between women and men (EU 2017c) that non-standard forms of employment are associated with lower hourly wages. This increases the gender pay gap, as women are more frequently employed in non-standard forms of work.

Stereotypes persist about the role of men and women in society and, by extension, whether they should be in the labour market or at home. This is one of the main causes of the wage gap between men and women. Men, on average, spend much less time caring for children or dependents, while women cannot devote that time to paid work, or to obtain an experience that will help them throughout their working life (COM 2017a). In Spain, the percentage of part time due to care responsibilities is 1.9% in males while in females it is 13.1%.

**4. Policy debates**

The 2011 and 2013 pension reforms have not yet been completed. The “Parliamentary Committee for the Monitoring and Evaluation of the Toledo Pact” (Toledo Pact) resumed its work on 28 September 2016 with the appearance of social and economic actors, experts and political leaders who debated, along with representatives of all political parties, the challenges of reforming the public pension system and the policies into which the reforms could be translated.

In a context of budget deficits of the public pensions system since 2012, debates on the sustainability of future pensions have tended towards an increasing polarisation. On the one hand, the experts and financial groups base the future sustainability of the pensions system hanging from a “defined benefits system” to a “defined contribution system”, especially on introducing the development of the notional accounts. In turn, other experts and social actors advocate the improvement of the current pay-as-you-go system by supplementing contribution revenues with general taxes or specific taxes to guarantee adequate pensions such as in France with a a specific tax (Generalized Social Contribution).

In Spain almost, the entire pension depends on social contributions but in the average of the OECD countries, this correlation is two thirds (OECD 2017b).
However, the demographic or ageing factor is not the factor par excellence that will affect the sustainability of the pensions system. It is also necessary to consider the problems of Spain’s economic and labour structure, characterised by some new labour relations (self-employment and non-standard work), relatively low productivity and low-skilled labour markets.

The challenges for the future adequacy of pensions will be to maintain a high rate of labour career length, to decrease the rate of non-standard work and to reduce the gender gap in wages, while promoting a high rate of employment and an increase in labour productivity, as well as promotion of social policies that favour work-life balance to enable the insertion and continuity of women in the labour market.

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DOES THE BUFFER STOCK MODEL EXPLAIN THE HOUSEHOLD SAVING RATE IN POLAND?

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Abstract
Household saving behavior is a key factor influencing the economic outlook. This paper contributes to a vast strand of the literature on the effects of uncertainty on households saving by addressing the issue of buffer stock saving in Poland. Following the reduced-form buffer stock saving model proposed by Carroll et al. (2012) three determinants of the household saving rate are identified: household net financial wealth, credit conditions, and the unemployment risk faced by households. An analysis of data for the period 2003-2016 finds that all three explanatory variables play a statistically significant and economically important role. Thus, it supports the hypothesis that the increased uncertainty causes greater savings in the presence of credit constraints and reveals that the buffer stock model explains substantial part of variation in the household saving rate.

Keywords: credit, household saving, precautionary motive, uncertainty, wealth.

JEL codes: E21, E44.

1. Introduction
The development of household saving is an issue of great interests to forecasters, policymakers, financial markets, and the business community. The vast strand of the literature addresses the effect of uncertainty on households saving behavior. This is a long-standing topic in research on household saving (e.g. Skinner 1988; Dynan 1993). In the seminal works of Carroll (1997) and Deaton (1991) assets play the role of a buffer stock, and a consumer saves and dissavves in order to smooth consumption in the face of income uncertainty. The precautionary motive ("to build up a reserve against unforeseen contingencies") has assumed an important place in the literature on household saving (e.g. Hubbard et al. 1994; Bertaut and Haliassos 1997; Carroll and Samwick 1997; Lusardi 1998; Cagetti 2003; Lee and Sawada 2007; Gunning 2010; Mody et al. 2012; Mishra et al. 2012; Bande and Riveiro 2013; Ceritoglu 2013; Chamon et al. 2013; Deidda 2014; Limosani and Millemaci 2014; Mastrogiacomo and Alessie 2014; Aizenman et al. 2015; Fulford 2015; Bouyon 2016). A fresh interest in precautionary saving as a potential explanation of the sharp increment in household saving rates during the Great Recession has emerged recently. For example, Bouyon (2016) using panel data for 13 European countries of the period 2007-2013 confirms the prominent role played by the precautionary motive during the financial crisis of 2008-2009, which is reflected in the strong impact of unemployment rates and
housing prices upon household saving rate. Bande and Riveiro (2013) using Spanish regional data for the period 1980-2007 reveals that part of the increase in saving rates is related to a precautionary motive and that increased uncertainty causes greater savings rates.

Carroll et al. (2012) argue that the long stability of the U.S. personal saving rate from the 1960s through the early 1980s, subsequent steady decline from the 1980s to 2007, and recent substantial increase in 2008-2011 can all be interpreted using a parsimonious buffer stock model of optimal consumption in the presence of labor income uncertainty and credit constraints. Their model's key insight is that, in the presence of income uncertainty, optimizing households have a target wealth ratio that depends on the usual theoretical considerations (risk aversion, time preference, expected income growth, etc.) as well as the degree of labor income uncertainty and the availability of credit. Their model's estimated coefficients imply that a substantial contribution to the decline in consumption during the Great Recession was due to the increase in precautionary saving. The perceived labor income risk is measured by the households' unemployment expectations using the Thomson Reuters/University of Michigan's Surveys of Consumers. The households' unemployment expectations are assumed to be a better proxy of labor income risk than the unemployment rate.

Broadway and Haisken-DeNew (2017), using household-level panel data, distinguish between ‘real’ income uncertainty the household is actually exposed to, and ‘perceived’ income uncertainty. They find that the latter substantially increases precautionary savings above and beyond the effect of ‘real’ income uncertainty.

Carroll (1992) and Carroll et al. (2012) show the dynamics of the saving rate adjustment to a permanent increase in uncertainty. In response to a permanent worsening in economic circumstances, consumption initially 'overshoots' its ultimate permanent adjustment. This reflects the fact that, when the target level of wealth rises, not only is a higher level of steady-state saving needed to maintain a higher target level of wealth, an immediate further boost to saving is necessary to move from the current (inadequate) level of wealth up to the new (higher) target. It means that an immediate jump in the saving rate is followed by a gradual decline toward a new equilibrium rate that is higher than the original one. Most studies investigating household saving at the macroeconomic level focus on developed economies. Studies of former socialist economies in Central and Eastern Europe (CEE) are sparse. However such an analysis is of great importance for the CEE countries, which have had at the same time both relatively low and fluctuating saving rates and also a very volatile macroeconomic environment with large fluctuations in growth rates, unemployment and inflation rates (Kukk and Staehr 2015). Liberda (2015) investigates Polish investment needs for domestic and foreign savings and reveals that an improvement of the net international investment position of Poland requires the domestic saving rate to be raised, while the share of households savings in domestic savings demonstrates a declining trend. In this context the research on determinants of Polish household financial behavior is particularly relevant.
This paper reveals a macroeconomic analysis of household saving in Poland in the period between 2003 and 2016. The period of analysis is determined by the availability of data. Some aspects of changes in Polish household saving behavior were discussed by, among others Dębski and Świderski (2016), Kłopocka (2017), Kolasa and Liberda (2015), Kośny (2013).

The aim of this study is to measure the relative importance of the precautionary, wealth, and credit effects on the Polish household saving rate using the model proposed by Carroll et al. (2012). This paper contributes to filling the gap in the literature by addressing the issue of buffer stock saving in Poland.

The rest of the paper is organized as follows. Section 2 briefly describes the data and the methodology of the research. Section 3 presents and discusses the empirical findings of regression analysis. Section 4 concludes with some remarks.

2. Data and Method

The gross household saving rate ($SR$) is calculated by dividing household gross saving by household gross disposable income, the latter being adjusted for the change in the net equity of households in pension funds reserves. The $SR$ published by Eurostat (ESA2010) is employed here. To smooth the series, the variables are calculated as the moving sum of the value of the quarter concerned and of the three preceding quarters. Therefore, the developments concern the past four quarters (“moving year”).

In general, the proxies applied in this paper follow up those used by Carroll et al. (2012). To capture the wealth channel, the ratio of household net financial assets to gross income ($FW$), published by Eurostat is used. To measure the credit supply conditions, the credit conditions index ($CC$) is constructed using the terms for new consumer credit offered to households taken from the question of the National Bank of Poland's Senior Loan Officer Opinion Survey. The survey-participating banks evaluate seven factors of consumer credit terms, as follows:

- spread on average loans (wider spread – tightened, narrower margin– eased),
- spread on riskier loans,
- non-interest loan costs (fees, etc.) (higher costs – tightened, lower costs – eased),
- security/collateral requirements,
- maximum size of the loan/credit line (smaller – tightened, larger – eased),
- maximum loan maturity (shorter – tightened, longer – eased),
- other terms.

Each factor is rated using the following scale:

-–– tightened considerably
-– tightened somewhat
= remained basically unchanged
+ eased somewhat
++ eased considerably
N/A not applicable
The so-called net percentage is calculated for each factor, that is the difference between the percentage of responses “eased considerably” and “eased somewhat” and the percentage of responses “tightened considerably” and “tightened somewhat”. A negative index indicates a tendency of tightening the credit standards. The credit conditions index (CC) is the arithmetic average of the indexes calculated for each of the above mentioned seven factors of consumer credit terms. To smooth the fluctuating series, a four quarter average is applied. Further information on Senior Loan Officer Opinion Survey methodology is included in (NBP 2017).

As a proxy for unemployment risk the unemployment expectations index (UE) is used. The index is based on survey data generated within EU Programme of Business and Consumer Surveys. The question applied to construct the index is: “How do you expect the number of people unemployed in this country to change over the next 12 months?” The index values range from −100 if all respondents choose the answer “fall sharply” (positive consumer sentiment, low unemployment risk) to +100, if all respondents choose the option “increase sharply” (negative consumer sentiment, high unemployment risk). Detailed information on consumer survey methodology is presented in European Commission (2016).

Moreover, in the robustness check phase the following variables that can provide an additional or alternative explanation for the household saving rate are used:
- the real gross household disposable income (IC) in billions (a thousand millions) of national currency (PLN) (current values are deflated by the HICP, published by Eurostat);
- the real 3-month interest rate (IR) (a representative short-term interest rate series for the domestic money market deflated by the HICP, published by Eurostat);
- the real GDP growth (GDPg), published by the Central Statistical Office;
- the all-items Harmonized Index of Consumer Prices (HICP) (moving 12-months average rate of change), published by Eurostat; and
- the unemployment rate (UR) as a percentage of the active population (seasonally adjusted), published by Eurostat.

The dataset covers quarterly observations from 2003Q4 to 2016Q2. The period under analysis is determined by the availability of data. The descriptive statistics of the variables are presented in Table 1.

Initially, Augmented Dickey-Fuller tests are performed in order to determine the order of integration of the variables. Most variables are found to be integrated of order one or I(1) (GDP growth is the exception as it is I(0)). Therefore, all variables are first-differenced and changes in household saving rate are modeled as a function of changes in other economic variables.
Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Symbol</th>
<th>Mean</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Household Saving Rate (percentage)</td>
<td>SR</td>
<td>4.01</td>
<td>3.61</td>
<td>1.49</td>
<td>10.36</td>
<td>2.08</td>
</tr>
<tr>
<td>Household Net Financial Assets to Gross Income Rate (percentage)</td>
<td>FW</td>
<td>86.47</td>
<td>85.43</td>
<td>58.94</td>
<td>109.79</td>
<td>12.36</td>
</tr>
<tr>
<td>Credit Conditions Index (points)</td>
<td>CC</td>
<td>2.22</td>
<td>2.33</td>
<td>-20.34</td>
<td>13.58</td>
<td>8.82</td>
</tr>
<tr>
<td>Unemployment Expectations Index (points)</td>
<td>UE</td>
<td>17.26</td>
<td>19.13</td>
<td>-17.73</td>
<td>50.13</td>
<td>16.94</td>
</tr>
<tr>
<td>Real Gross Household Disposable Income (billion PLN)</td>
<td>IC</td>
<td>849.19</td>
<td>866.26</td>
<td>606.48</td>
<td>1097.31</td>
<td>166.03</td>
</tr>
<tr>
<td>Real Interest Rate (percentage)</td>
<td>IR</td>
<td>4.13</td>
<td>4.23</td>
<td>1.68</td>
<td>6.57</td>
<td>1.39</td>
</tr>
<tr>
<td>Real GDP Growth (percentage)</td>
<td>GDPg</td>
<td>3.94</td>
<td>3.66</td>
<td>0.14</td>
<td>7.71</td>
<td>1.86</td>
</tr>
<tr>
<td>Harmonized Index of Consumer Prices (percentage)</td>
<td>HICP</td>
<td>2.25</td>
<td>2.60</td>
<td>-0.70</td>
<td>4.20</td>
<td>1.58</td>
</tr>
<tr>
<td>Unemployment Rate (percentage)</td>
<td>UR</td>
<td>10.99</td>
<td>9.70</td>
<td>6.20</td>
<td>19.80</td>
<td>4.02</td>
</tr>
</tbody>
</table>

Source: author's own calculations.

To investigate whether the determinants implied by a standard buffer stock model can explain the gross household saving rate in Poland, I estimate regressions along the lines of Carroll et al. (2012). To allow for the possibility that the impact of the regressors on household saving is not purely contemporaneous but is also lagging to some extent, models with the contemporaneous values and four lags of dependent variables are considered. The decision which of four lags to use is made based on the evidence provided by Akaike’s Information Criterion (AIC). The baseline specification takes the following form:

$$\Delta SR_t = \gamma_0 + \gamma_{\Delta FW_{t-i}} \Delta FW_{t-i} + \gamma_{\Delta CC_{t-i}} \Delta CC_{t-i} + \gamma_{\Delta UE_{t-i}} \Delta UE_{t-i} + \varepsilon_t$$ (1)

where $i = 0,1,...,4$, $t$ is a time subscript, $FW$ represents household net financial assets to gross income rate, $CC$ stands for credit conditions index, $UE$ symbolizes unemployment expectations index and $\varepsilon_t$ is the error term. In the second step of the analysis a robustness check is performed. For this purpose the baseline model is extended with additional variables as follows:

$$\Delta SR_t = \gamma_0 + \gamma_{\Delta FW_{t-i}} \Delta FW_{t-i} + \gamma_{\Delta CC_{t-i}} \Delta CC_{t-i} + \gamma_{\Delta UE_{t-i}} \Delta UE_{t-i} + \varepsilon_t + \gamma_{\Delta X_{t-i}} \Delta X_{t-i}$$ (2)
where the vector \( X \) collects drivers of saving that are outside the scope of the buffer stock model (i.e., income \( IC \), interest rate \( IR \), real GDP growth \( GDPg \), inflation \( HICP \), and unemployment rate \( UR \)).

3. Empirical Results

The following section presents and discusses the empirical findings of a regression analysis. Tables 2 and 3 reveal the results of several variations on equation (1) and equation (2), respectively.

Table 2. Preliminary Saving Regressions acc. to equation (1)

\[
\Delta SR_t = \gamma_0 + \gamma_{\Delta FW_{t-1}} \Delta FW_{t-1} + \gamma_{\Delta CC_{t-4}} \Delta CC_{t-4} + \gamma_{\Delta UE_{t-3}} \Delta UE_{t-3} + \varepsilon_t
\]

<table>
<thead>
<tr>
<th>Model</th>
<th>Financial Wealth</th>
<th>Credit Conditions</th>
<th>Unemployment Risk</th>
<th>Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \Delta FW )</td>
<td>( \Delta CC )</td>
<td>( \Delta UE )</td>
<td>Baseline</td>
</tr>
<tr>
<td>( \gamma_0 )</td>
<td>-0.154 (0.099)</td>
<td>-0.054 (0.089)</td>
<td>-0.085 (0.084)</td>
<td>-0.070 (0.064)</td>
</tr>
<tr>
<td>( \gamma_{\Delta FW_{t-1}} )</td>
<td>0.034** (0.016)</td>
<td></td>
<td></td>
<td>0.051*** (0.016)</td>
</tr>
<tr>
<td>( \gamma_{\Delta CC_{t-4}} )</td>
<td></td>
<td>-0.072*** (0.028)</td>
<td></td>
<td>-0.084*** (0.026)</td>
</tr>
<tr>
<td>( \gamma_{\Delta UE_{t-3}} )</td>
<td></td>
<td></td>
<td>0.030*** (0.008)</td>
<td>0.019*** (0.007)</td>
</tr>
<tr>
<td>R²</td>
<td>0.054</td>
<td>0.095</td>
<td>0.141</td>
<td>0.363</td>
</tr>
<tr>
<td>AIC</td>
<td>96.828</td>
<td>76.793</td>
<td>84.698</td>
<td>63.525</td>
</tr>
<tr>
<td>F stat p val</td>
<td>0.033</td>
<td>0.015</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>N</td>
<td>49</td>
<td>43</td>
<td>47</td>
<td>43</td>
</tr>
</tbody>
</table>

Notes: The table reports coefficients and their standard errors (in parentheses). Hypothesis tests were conducted using a heteroskedasticity and serial correlation robust covariance matrix. ***, **, * represent statistical significance at the 1%, 5%, and 10% levels respectively.

Source: author's own calculations.

The first three columns of Table 2 show univariate specifications in which the changes in household saving rate are in turn regressed on changes in each of the three determinants: wealth, credit conditions, and unemployment risk. Univariate regressions capture up to 14 percent of the variation of household saving rate changes. The highest explanatory power is found for the model with perceived unemployment risk that reflects precautionary effect. In the baseline model the three key variables of interest are significant at the 1% level and jointly explain 36 percent of the variation of the regressand.
### Table 3. Additional Saving Regressions – Robustness to Explanatory Variables acc. to equation (2)

\[
\Delta SR_t = \gamma_0 + \gamma_{\Delta FW_{t-1}} \Delta FW_{t-1} + \gamma_{\Delta CC_{t-1}} \Delta CC_{t-1} + \gamma_{\Delta UE_{t-1}} \Delta UE_{t-1} + \ldots \\
\ldots + \gamma_{\Delta IC_{t-1}} \Delta IC_{t-1} + \gamma_{\Delta IR_{t-1}} \Delta IR_{t-1} + \gamma_{\Delta GDP_{gt-1}} \Delta GDP_{gt-1} + \ldots \\
\ldots + \gamma_{\Delta HICP_{t-1}} \Delta HICP_{t-1} + \gamma_{\Delta UR_{t-1}} \Delta UR_{t-1} + \epsilon_t
\]

<table>
<thead>
<tr>
<th>Model</th>
<th>Baseline</th>
<th>Income</th>
<th>Interest Rate</th>
<th>GDP Growth</th>
<th>HICP</th>
<th>Unemployment Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \gamma_0 )</td>
<td>-0.070</td>
<td>-0.759***</td>
<td>-0.090</td>
<td>-0.067</td>
<td>-0.091</td>
<td>-0.049</td>
</tr>
<tr>
<td></td>
<td>(0.064)</td>
<td>(0.147)</td>
<td>(0.066)</td>
<td>(0.066)</td>
<td>(0.061)</td>
<td>(0.074)</td>
</tr>
<tr>
<td>( \gamma_{\Delta FW_{t-1}} )</td>
<td>0.051***</td>
<td>0.034***</td>
<td>0.044***</td>
<td>0.047***</td>
<td>0.045***</td>
<td>0.049***</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.010)</td>
<td>(0.016)</td>
<td>(0.015)</td>
<td>(0.015)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>( \gamma_{\Delta CC_{t-1}} )</td>
<td>-0.084***</td>
<td>-0.030</td>
<td>-0.081***</td>
<td>-0.075***</td>
<td>-0.076***</td>
<td>-0.086***</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.025)</td>
<td>(0.026)</td>
<td>(0.023)</td>
<td>(0.025)</td>
<td>(0.028)</td>
</tr>
<tr>
<td>( \gamma_{\Delta IC_{t-1}} )</td>
<td>0.019***</td>
<td>0.010**</td>
<td>0.016**</td>
<td>0.016**</td>
<td>0.019**</td>
<td>0.018**</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.005)</td>
<td>(0.008)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>( \gamma_{\Delta IR_{t-2}} )</td>
<td></td>
<td>0.064***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.010)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \gamma_{\Delta GDP_{gt-3}} )</td>
<td></td>
<td></td>
<td>-0.218</td>
<td></td>
<td></td>
<td>0.081 (0.085)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.163)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \gamma_{\Delta HICP_{t-0}} )</td>
<td></td>
<td></td>
<td>-0.153</td>
<td></td>
<td>-0.310**</td>
<td>(0.150)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.097)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \gamma_{\Delta UR_{t-3}} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.081</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.085)</td>
<td></td>
</tr>
<tr>
<td>( \bar{R}^2 )</td>
<td>0.363</td>
<td>0.615</td>
<td>0.365</td>
<td>0.401</td>
<td>0.385</td>
<td>0.353</td>
</tr>
<tr>
<td>( \text{AIC} )</td>
<td>63.525</td>
<td>42.783</td>
<td>64.307</td>
<td>61.734</td>
<td>62.904</td>
<td>65.117</td>
</tr>
<tr>
<td>( F \text{ stat p val} )</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>( N )</td>
<td>43</td>
<td>43</td>
<td>43</td>
<td>43</td>
<td>43</td>
<td>43</td>
</tr>
</tbody>
</table>

Notes: The table reports coefficients and their standard errors (in parentheses). Hypothesis tests were conducted using a heteroskedasticity and serial correlation robust covariance matrix. ***, **, * represent statistical significance at the 1%, 5%, and 10% levels respectively. Source: author's own calculations.

Table 3 presents a set of specification checks of the baseline model with other potential determinants of saving. Although the inclusion of changes in interest rate (\( IR \)), real GDP growth (\( GDPg \)), and unemployment rate (\( UR \)) does not substantially affect the estimates obtained under the baseline specification. The coefficient on the contemporaneous changes in \( HICP \) is statistically significant at the 5% level, still the estimated coefficients on the three key variables remain broadly unchanged compared with the baseline specification. The greatest improvement of the model is obtained when the contemporaneous changes in \( IC \)
are added. This is the only model in which one of the three pivotal regressors (i.e., CC) ceases to be statistically significant. In all remaining specifications the coefficients on the baseline series (wealth, credit conditions, unemployment expectations) remain highly statistically significant. To sum up, the analysis reveals the importance of the precautionary, wealth, and credit effects on saving behavior of Polish households. Thus, it supports the hypothesis that the buffer stock model explain substantial part of variation in household saving rate in Poland.

4. Conclusion

Following the reduced-form buffer stock saving model proposed by Carroll et al. (2012), three determinants of the household saving rate are identified: household net financial wealth, credit available for households, and unemployment risk faced by households. An analysis of the household saving rate in Poland (2003Q4-2016Q2) finds that all three explanatory variables play a statistically significant role. It reveals the importance of the precautionary, wealth, and credit effects on saving behavior of Polish households. Thus, it supports the hypothesis that the buffer stock model explain substantial part of variation in household saving rate in Poland.

Acknowledgements

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Does the buffer stock model explain the household saving rate in Poland?


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THE IMPACT OF CHANGES IN PENSION SCHEME
AFTER 2008 ON GENERAL GOVERNMENT SECTOR’S DEBT

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Abstract
Changes in the rules governing the Polish pension system, introduced in the last few years, aimed, on the one hand, at reducing the general government sector’s expenditure on account of social security benefits. On the other hand, these changes were to increase the sector's revenues from social contributions. Both social security benefits and social contributions mainly concern social security funds (subsector of the general government sector). The aim of this study is to evaluate the effects of individual legal acts concerning pension system in Poland (acts introduced on 25.03.2011, 11.05.2012, 6.12.2013). This evaluation is performed using a deterministic model consisting of a sequence of identity equations for each institutional sector, preceded by an input-output model. The sequence of equations takes into account all transactions included in non-financial national accounts, starting with the production account and ending with capital account. The model is supplemented by a pension sub-model, taking into consideration demographic structure changes, propensity to retire, replacement rate at retirement. The results of the simulation analyses show the isolated effects of changes in the pension system that are reflected mainly in the secondary distribution of income account and in the balancing item of non-financial accounts, i.e. the net lending/net borrowing of individual institutional sectors, paying particular attention to the deficit and debt of the general government.

Keywords: government deficit, national accounts, pension system.
JEL codes: E17, H55, H68.

1. Introduction
One of the principal roles of the general government is to manage and organize the process of income redistribution which means mainly the settlement or approval of the contributions and social benefits (European system ... 2013, pp. 44-45). These transactions are bilateral flows between households, social security funds (as a part of general government sector), financial institutions (subsector of pension funds) and to a small extent also the rest of the world. Since the time when each new working generation is more than the previous has stopped, the financing of pension expenditures only from current contributions ceases to be possible. Ensuring the financial balance of social security funds requires some kinds of pension system adjustments (Góra 2013, 2014; Holzmann 2013).
Changes in the rules governing the Polish pension system, introduced in the last few years (since 2008), aimed, on the one hand, at reducing the general government sector’s expenditure on account of social security benefits. On the other hand, these changes were to increase this sector’s revenues from social contributions simultaneously limiting the role of financial institutions (private part of the pension system). General extension of the relationships between national economy and the rest of the world also concerns pension transactions mainly due to the transboundary flows of labor force.

The paper aims at the evaluation of the effects of pension system adjustments, which were: restriction on early retirement since 2009, two-stage decrease in the share of social contributions transferred to financial institutions since 2011, gradual increase in the retirement age in 2013-2016. Effects of all changes in pension scheme are evaluated using a deterministic model consisting of a sequence of identity equations for all transactions distinguished in the system of national accounts. The model consists of identity sequences for each institutional sector (non-financial corporations, financial corporations, general government, households, non-profit institutions, rest of the world). The general idea of deterministic macro models construction was taken from multisectoral models made by Inforum Group – Interindustry Forecasting at the University of Maryland (Almon 2011).

Identity centered model based on non-financial national accounts by institutional sectors is supplemented by a pension sub-model, taking into consideration demographic structure changes, propensity to retire, replacement rate at retirement (Trębska 2015). It provides linkages between process of income circulation, the labor market and demographic structure.

The paper is organized as follows. The paragraph following the introduction presents the idea of a multi-equation deterministic model based on the sequence of non-financial national accounts. In accordance with the basic aim of the paper, the attention is focused on the sequence of equations for the general government sector and on the pension sub-model. The next paragraph contains a historical analysis of selected coefficients of the model with a comparison of some indicators describing the pension system in Poland and selected EU countries. Statistical analyses are based on data from Eurostat Database: Annual sector accounts ESA 2010 (non-financial transactions) and Population and social conditions (pensions beneficiaries) as well as on more detailed data about pensions in Poland published by Polish Central Statistical Office. In the subsequent part, which is the realization of the main goal of the paper, the estimations of the changes in the government sector deficit caused by the legal acts concerning pension system in Poland after 2008 are presented. The conclusions are contained in a brief summary.
2. Pension transactions in the sequence of equations for general government

The sequence of national accounts starts from an input-output table, which shows accounts of products and income generation for the entire economy. On the basis of this part of national accounts, the output and value added are determined by final demand. Value added for total economy is decomposed into compensation of employees, other taxes less subsidies on production and operating surplus. The first component is the sum of the costs incurred by employers from each institutional sector, which are primary income of households. Other taxes on production are general government’s primary income and operating surplus is an income of all institutional sectors. The following symbols are used for institutional sectors: \((G)\) for general government, \((H)\) for households, \((C)\) for non-financial corporations, \((F)\) for financial corporations, \((NP)\) for non-profit institutions and \((RW)\) for the rest of the world.

Thus, the balance of primary income of general government \(\text{primI}(G)\) is the sum of other taxes less other subsidies on production \(\text{otax}(G)\), taxes less subsidies on products \(\text{indtax}(G)\), operating surplus \(\text{ops}(G)\) and balance of property income \(\text{propI}(G)\):

\[
\text{primI}(G) = \text{otaxr} \times \text{vadd} + \text{indtaxr} \times (\text{ce} + \text{inv} + \text{exp}) + \text{ops}(G) + \text{propI}(G)
\]  

(1)

where: \(\text{otaxr}\) is the share of other taxes in value added, \(\text{indtaxr}\) is average indirect tax rate, \(\text{ce}\) is final consumption, \(\text{inv}\) is accumulation, \(\text{exp}\) is exports of goods and services.

Subsequent equations for general government refer to the transactions recorded on secondary distribution of income account which determine gross disposable income \(\text{dispI}(G)\) as the sum of primary incomes \(\text{primI}(G)\) and net of current transfers \(\text{Itax} – \text{current taxes on income, wealth, etc., socc} – \text{net social contributions, socb} – \text{social benefits other than social transfers in kind, ocur – other current transfers}):

\[
\text{dispI}(G) = \text{primI}(G) + \text{Itax}(G) + \text{socc}(G) - \text{socb}(G) - \text{Itaxp}(G) + \text{ocur}(G)
\]  

(2)

Current taxes on income, wealth, etc. that are obtained by general government \(\text{Itax}(G)\) are the sum of taxes paid by all institutional sectors (symbols of variables with the letter \(p\)) minus taxes obtained by the rest of the world \(\text{Itaxo}(RW)\):

\[
\text{Itax}(G) = \text{Itaxp}(H) + \text{Itaxp}(G) + \text{Itaxp}(C) + \text{Itaxp}(F) + \text{Itaxp}(NP) + \text{Itaxp}(RW) - \text{Itaxo}(RW)
\]  

(3)

Social contributions that are government’s revenues \(\text{socc}(G)\), in turn, are the sum of contributions paid by households and the rest of the world (non-residents employed in the country) minus contributions transferred to financial institutions and the rest of the world:

\[
\text{socc}(G) = \text{socc}(H) + \text{soccp}(RW) - \text{socc}(F) - \text{socco}(RW)
\]  

(4)

It is assumed in the model that the values of income taxes and social contributions depend on primary income of the sectors which are payers of these transfers. Moreover, the values of these transfers are determined in the model assuming that the rates of fiscal burdens are known for each institutional sector.
The ratio between the amount of social contributions constituting the revenue of general government and total social contributions is analyzed as the following coefficient:

\[ socc(G)r = \frac{socc(G)}{socc(H) + soccp(RW)} \]  

(5)

On the expenditure side of the secondary distribution of income account of general government the major transactions are social benefits. The amount of these transfers is determined on the basis of the pension sub-model, in which the retirements payments, disability pensions and survivors' benefits are distinguished separately, depending on the number of beneficiaries (based on forecasts of demographic structure changes) and average amounts of individual types of benefits (cf. Trębska 2015):

\[ socb = a_1(old \cdot pret_o + prod \cdot pret_e) + a_2\cdot pend + a_3\cdot pens + othb \]  

(6)

where:
- \( old \) – elderly population, \( pret_o \) - propensity to retire, \( prod \) – working age population, \( pret_e \) – propensity/possibility to early retire, \( pend \) – number of disability pensioners, \( pens \) – the number of survivors’ beneficiaries, \( a_1, a_2, a_3 \) – respectively average level of retirement payments, disability pensions and survivors' pensions, \( othb \) – other social benefits. The number of retirees (the largest group among pensioners) depends on retirement age, individual propensity to retire and options for early retirement allowed in the pension system. All of these three factors are taken into consideration in the empirical part of the paper. The changes of the rules of the pension system functioning after 2008, mentioned in the introduction, concern, among others, the number of elderly population and the possibility of early retirement. Since the analysis focuses on general government’s expenditures, it is important to determine what part of social benefits is paid by this sector (to a small extent these benefits are also paid by financial and non-financial corporation and the rest of the world):

\[ socb(G)r = socb(G)/socb \]  

(7)

On the expenditure side of the use of disposable income account is consumption, whereas the balancing item is gross saving \((sav(G))\), determined residually in this model as a difference between disposable income \((dispI(G))\) and consumption \((ce(G))\). Subsequently, gross saving opens the revenue side on capital account, which together with the net of capital transfers \((cap)\) and net borrowing \((bor)\) constitutes sources of the accumulation \((inv)\) financing. The balancing item of the capital account of general government is net borrowing (the excess of total expenditures over revenues):

\[ bor(G) = sav(G) – inv(G) + cap(G) = dispI(G) – ce(G) – inv(G) + cap(G) \]  

(8)

Including financial accounts to the analysis, net borrowing is simultaneously the excess of net incurrence of liabilities over net acquisition of financial assets.

3. Changes of the selected indicators of the pension system in Poland and in chosen European countries

Changes in the functioning of the pension system in Poland are analyzed on the basis of selected coefficients of deterministic model describing revenues and
expenses of the general government sector (cf. formulas (5), (6), (7)). In the period 2000-2016 (cf. Fig. 1), about 98% of social benefits were paid by general government (subsector of social security funds) with a slight downward trend (in 2002-2003 the socb(G)r ratio was equal to 98.5%, and in the years 2014-2016 – 97.7%). This was accompanied by a small increase in the share of the rest of the world sector (from 0.1% to 0.4%), non-financial corporations (from 1.4% to 1.5%) and financial corporations (from 0.1% to 0.3%) in the payment of social benefits.

In turn, the changes in the socc(G)r ratio, illustrating the share of social contributions paid to the general government in the total amount of contributions, clearly indicate the growing scope of the capital part of the Polish pension system until 2010. In 2000, 89% of contributions were paid to general government, whereas in 2010 only 82.3%. At the same time the share of contributions paid to financial corporations (subsector of social security funds) increased from 9% to 15%. The increase in socc(G)r in 2011 to 86.2% resulted from a reduction in the contribution rate transferred to open pension funds (OFE) from 7.3% to 2.3%. The next step to limit the share of financial corporations was the possibility of complete abandonment of saving in OFE. As a result of these changes, the share of contributions paid to the general government in 2016 amounted to 93.4% (the share of contributions paid to financial corporations was only 3.9%). By comparing the amounts of social contributions paid to general government (socc(G)) and social benefits paid by this sector (socb(G)), the efficiency of the public pension system (which systematically decreased in the 1990s) is assessed. The value of this relationship above 1 means the need to finance the payment of benefits from other sources than current transfers of contributions – e.g. from taxes or by incurrence of liabilities.

**Fig. 1.** Social contributions and social benefits – indicators for general government in Poland
The comparison of the ratios $socc(G)r$ and $socb(G)r$ in the selected EU countries (see Fig. 2) shows that the government sector in Poland is relatively heavily involved in the pension system, both in the collection of contributions (the EU28 average in 2016 was 0.78, only in Finland and Lithuania $socc(G)r$ ratios were higher than in Poland) as well as the payment of benefits (the EU28 average was 0.87, only in Greece, Bulgaria and Romania $socb(G)r$ ratios were higher than in Poland). In all analyzed countries, the government sector has a greater share in the payment of social benefits than in the collection of social contributions ($socc(G)r < socb(G)r$). The share of the government sector is particularly small in Sweden, Denmark and the UK. In Denmark and Sweden, the main sources of benefits financing are other transfers to government than contributions. In turn, in the UK, financial corporations account for a relatively large share in the payment of benefits (over 20%).

Fig. 2. Social contributions and social benefits – indicators for general government in selected EU countries in 2015

Changes in the number of the pension beneficiaries were caused by demographic changes – the growing number of elderly population and declining since 2011 number of working age population (Fig. 3). The number of retirees in relation to the number of elderly population grew up till 2009, exceeding even 100%, which resulted from a relatively large number of people using the option of early retirement (against the announcement of its limitation). In the period 2010-2016, this percentage decreased significantly because of two reasons. One of them was the limited early retirement after 2008 and the second reason was systematic increase in the retirement age started in 2013 (in 2017 it was returned to its previous level). However, the greatest impact on the drop in the number of
beneficiaries was the restrictions regarding the award of disability pensions (the number of pensioners decreased from 3 million in 2000 to 1.2 million in 2016).

**Fig. 3.** Pension beneficiaries and demographic structure changes in Poland

Poland is one of the few European countries where the number of beneficiaries as the share of total population decreased in recent years (see Fig. 4).

**Fig. 4.** Social contributions and social benefits – indicators for general government in the selected EU countries
*data for the years 2007 and 2012 (data for pension beneficiaries in 2015 is not available)
All of the above mentioned changes in the rules governing the Polish pension system had a positive impact on public finances – they contributed to the reduction of general government net borrowing. The estimated effects of particular changes are presented in the next section of the paper.

4. General government deficit declines caused by the changes in pension scheme after 2008

An attempt to estimate the isolated effects of individual legal acts introducing changes to the Polish pension system consists in carrying out a series of counterfactual simulations. The tool of these simulations is a deterministic model based on the sequence of national accounts by institutional sectors combined with the pension sub-model. The results of these simulations determine the hypothetical general government's deficit in the following years if the given legal act were not introduced. Four simulations were carried out, in which the following counterfactual assumptions were adopted.
1) Restrictions on the possibility of early retirement for women aged 55 and men aged 60 (after meeting certain requirements) were not introduced in 2009. This assumption means that the total number of retirees in subsequent years is estimated basing on the share of early retirees in the working age population observed in 2008 (based on disaggregated data on the number of beneficiaries by types of pension benefits available on Eurostat database). This share is reflected in the pension sub-model by the coefficient $pret_c$ (see formula (6)).

2) Dimension of social contributions transferred to the financial institution was not changed in 2011. The share of the contribution transferred to the general government ($socc(G)r$ ratio) in subsequent years remains at the level from 2010.

3) The process of systematic raise of the retirement age did not start in 2013. The share of retirees in the elderly population (coefficient $pret_o$) in subsequent years remains at the level from 2012.

4) The possibility of the total resignation from open pension funds was not introduced in 2014. The share of the contribution transferred to the government ($socc(G)r$) remains at the level from 2013.

The results of counterfactual simulations of general government deficit described above, compared with actual levels of deficit, are shown on Fig. 5, whereas the estimations of isolated effects of above mentioned four pension system adjustments are presented in Table 1.
Fig. 5. Net lending of general government (% of GDP) – actual data and simulated values
Source: elaborations based on own calculations and Eurostat Database; Annual sector accounts (update: 07.02.2018).

Table 1. Changes in general government’s deficit resulted from the Polish pension system adjustments

<table>
<thead>
<tr>
<th>No.</th>
<th>Adjustment</th>
<th>Percentage decline of actual deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td>sym1</td>
<td>Restrictions on the possibility of early retirement after 2008</td>
<td>0.7</td>
</tr>
<tr>
<td>sym2</td>
<td>Decrease in the dimension of social contributions paid to the financial institution after 2010</td>
<td>12.0</td>
</tr>
<tr>
<td>sym3</td>
<td>Systematic raise of the retirement age in the period 2013-2016</td>
<td></td>
</tr>
<tr>
<td>sym4</td>
<td>Possibility of the total resignation from open pension funds since 2014</td>
<td></td>
</tr>
</tbody>
</table>

Source: elaborations based on own calculations.

The results of simulation analyses indicate which of the four studied changes in the pension system caused the greatest declines in the general government deficit (in the national accounts deficit is recorded as a negative value). The comparison of actual values of the deficit and the simulated ones shows that the limitation of early retirement had a relatively low impact on the reduction of government debt (declines did not exceed 0.23% of GDP). Growing percentage decline of actual
The impact of changes in pension scheme after 2008 on general government...

deficit due to the limitation of early retirement resulted rather from decreasing
deficit than from the growing benefits of this adjustment.

The second of the analyzed changes in the pension system, which was the
reduction in the amount of contributions transferred to financial institutions,
caused the biggest effects until 2014. Due to the increase in the share of social
contributions paid to general government, disposable income of this sector
significantly increased. This change reduced the deficit by 12% (0.6% of GDP)
already in the first year after its introduction. In turn, the next legal act which
increased the share of social contributions paid to general government in 2014 due
to the fact that only about 14% of payers decided to continue saving in open
pension funds, reduced the deficit by 11.8% (0.4% of GDP) in 2014, and by about
31.5% (0.8% of GDP) in 2015 and 2016.

The effects of the gradual increase of the retirement age were increasing each year.
If the retirement age had not been raised, the number of pensioners in 2016 would
have been about 729,000 higher (assuming a propensity to retire at the level of
2012), which would have required higher government spending in the form
of social benefits by about 16.9 million PLN. The raise of the retirement age
caused a reduction in the government deficit by 36.8% (0.9% of GDP) in 2016.

5. Conclusion

The financial balance of social security funds and the entire government sector is
becoming threatened due to the unfavorably changing demographic structure of
the Polish society (as well as that of most European countries). Changes in
the demographic structure are difficult to retain, therefore the government
institutions’ actions focus on such changes in the pension system which would
reduce expenses and increase revenues related to pension transactions. Means of
expenses reduction were systematical declines in the number of people entitled to
benefits (limiting the possibility of early retirement after 2008, increasing the
retirement age in 2013-2016, tightening the rules for granting disability pensions)
and changes in the rules of retirement payment calculation. In turn, a way to
increase revenues of general government was a two-stage reduction in the role of
open pension funds (included in the sector of financial corporations).

The estimation of the effects of the introduction of four pension system
adjustments (see Table 1) shows that the general government’s deficit decreased
in analyzed period due to the increasing scale of benefits resulting from the
introduced statutory changes. However, due to the fact that contributions
transferred to social security funds as a subsector of general government are not
recorded in the sequence of national accounts as liabilities to households, they
constitute the hidden debt of this sector (Liberda 2006).

The decrease in the deficit in 2016 resulted to the greatest extent from the increase
of the retirement age. In the following years an increase in pension expenditure is
expected due to a return to the previous retirement age (60 for women and 65
for men). However, the scale of pension expenditure increase will depend on the
extent to which the elderly population growth rate will be compensated by
the decrease in the propensity to retire and the decline in the replacement rate at
retirement. The decrease in the propensity to retire immediately after reaching the retirement age as a consequence of individual retirement decisions (Góra 2008) may result from financial reasons, i.e. from the predicted decrease in the replacement rate at retirement resulting from the new rules for calculating pensions, less favorable for pensioners. At the same time, the forecasts of a drop in the replacement rate from the public pension system (c.f. The 2015 Ageing Report, 2015) should be a stimulus to increase the propensity to voluntarily save for retirement.

Acknowledgements

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References


TRANSITION FROM WORK TO RETIREMENT IN THE LIGHT OF CHANGES OF RETIREMENT AGE IN POLAND

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Abstract
On the break of 20th and 21st centuries many countries decided to increase the statutory retirement age to boost the working lives of current and future generations. Some also limited or abolished the early retirement or introduced flexible forms of retirement. Poland is an example of the country characterized by low activity and employment rates, especially among older workers. The purpose of the paper is to evaluate if the gradual increase in retirement age (since 2013) and phasing-out of early retirement had contributed to the increase in effective retirement age and what were the drivers of retirement decisions prior the statutory retirement age. As the analysis shows, the observed increase in effective retirement age was a consequence of rising the statutory retirement age for men and women and phasing-out the early retirement for women born after 1953 and men born after 1948. The drivers of transition from work to retirement have not changed in recent years. The very first outcomes of the reversal from the increase in retirement age (since October 2017) also suggest that workers in Poland are interested in receiving the old-age pension as soon as possible despite its amount or its progressive increase in case of the postponing of the retirement.

Keywords: effective retirement age, transition, work.

JEL codes: J32, J38, H55.

1. Introduction
Demographic ageing puts the pressure on public finance and creates concerns about the adequacy and sustainability of pension systems. Therefore it has the crucial impact on standards of living in the future (Smaliukiene and Tvaronaviciene 2014). Shrinking working-age population and the increase in share of inactive population (especially in older ages) requires the development of public policies, which should be concentrated on prolonging working lives and better balance between time in employment and retirement (Hamblin 2013). The process of inactivation of older workers is complex and influenced by different factors: individual features (health status, competencies, values and motivations) and institutional determinants of working live (Chłoń-Domińczak 2017). The retirement age is one of the factors influencing the length of the career. In Poland this age is relatively low, and gradual increase in the statutory retirement age (since 2013) combined with NDC formula was expected to keep people longer on
the labour market. The purpose of the paper is to analyse and evaluate effects of changing the retirement age in Poland on effective retirement age and reasons for the retirement decisions. The analysis is illustrated by the changes in this field in the European Union.

2. Effective versus statutory retirement age in Poland in and other EU countries

From the fifties of the 20th century, despite the demographic changes, effective retirement age in the developed countries had been decreasing. It was due to the reduction of statutory retirement age and the expansion of early retirement. In the late nineties this trend reversed as a pressure for public finance has significantly accelerated pension reforms aiming at strengthening the sustainability public pension system (Fig. 1).

![Fig. 1. Average effective retirement age: women (bottom line), men (top line)](source: OECD, 2016)

The gap between the statutory and effective retirement age during the last few years has been closing in many member states of the European Union, but still in most of them effective retirement age is lower than statutory retirement age both for men and women (Fig. 2 and Fig. 3).
Polish pension system consists of few subsystems\(^1\), of which the biggest covers non-agricultural workers, contractors and self-employed. This part of the system is operated by Social Insurance Institution (ZUS). Further analysis will be limited to this basic retirement system, which covers 16 million participants and 5 million

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\(^1\) There are subsystems for uniformed services, judges and prosecutors and farmers. In each of these subsystems conditions (including statutory retirement ages) are different.
pensioners (old-age pension) out of 7 million retirees in total as for the end of 2016. The reform of Polish pension system in 1999 had a structural character, as it switched from unfunded defined benefit scheme into NDC scheme (with transition period), initially accompanied with funded part\(^2\). The retirement age was 60 for women and 65 for men and broad range of early retirement was supposed to be eliminated after 2005 but finally it was postponed to 2008.

The retirement age for men and women in Poland had been increasing from the 2013, reaching the levels of 61 years and 3 months for women and 66 years and 3 months for men until the September 2017\(^3\). In case of women, the change in retirement age was accompanied with dimming rights for early retirement from 2009 (for women born after 1953). As for men, the process of rising the effective retirement age was slowed down by the judgment of the Constitutional Court of 2008, which required the abolition of discrimination in access to early retirement for men (5 years below the statutory retirement age) born before January 1, 1949 who had 35 years of covered periods of social insurance. It was the main reason for very high percentage of the old-age pensions granted by the Social Insurance Institution (ZUS) below the statutory retirement age for men\(^4\) (Fig. 4).

![Fig. 4](image_url)

**Fig. 4.** Percentage of men (black bar) and women (grey bar) who was granted the old-age pension below the statutory retirement age, 2005-2013

\(^2\) Since May 2011, the role of funding in the Polish pension system has been diminishing. For further reading see for example (Bielawska et al. 2015).

\(^3\) Then the process was reversed from October 2017. From October 2017 statutory retirement age for men is 65 and 60 for women.

\(^4\) The other significant reason for early retirement of men is a position of miners in the social insurance in Poland. It is the only group of professionals, who can retire in every age, having 25 years of mining works. The average retirement age of miners is below 50 years.
The changes in the retirement age and other rules for receiving the old-age pension contributed to the gradual increase in effective retirement age to 2016 (Tab. 1).

**Table 1.** Changes of effective retirement age for old-age pensions from social insurance in Poland, 2005-2016

<table>
<thead>
<tr>
<th>Effective retirement age – old age pensions from social insurance system</th>
<th>2005</th>
<th>2010</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>58.4</td>
<td>60.1</td>
<td>62.8</td>
<td>63.3</td>
</tr>
<tr>
<td>Women</td>
<td>56.0</td>
<td>59.5</td>
<td>60.1</td>
<td>61.0</td>
</tr>
</tbody>
</table>


In 2016, the ruling party voted for the decrease in retirement age and brought it back to 2012 levels – 60 years for women and 65 for men. This reversal made about 350 thousand people extra able to apply for the old-age pension in 2017 and most of them used this right. Overall number of new retirees in 2017 may exceed 0.5 million (the increase of persons receiving the old-age pension of 10% from year to year). The consequences of decreasing the retirement age in Poland have been widely discussed in the literature and are a serious concern in terms of adequacy of future benefits (as they are calculated on NDC basis). The average value of the new old-age pension for women at age 60 years was in 2017 60% of the value of the pension of the men respectively and accounted for 44% of the average wage in the economy. Representatives of the government argued that this change was positive as 40% of people who applied for the old-age pension were not economically active and therefore this decision had not deteriorated the situation on the labour market. Additionally it allowed people to get any social benefit and protect against poverty.

In this context it worth to mention, that the recent study on unemployment of the workers age 50+ in Poland proves, that being close to the point at which they are eligible to receive pension benefits leads individuals 'wait' to fulfil these eligibility criteria instead of making an effort to maintain and facilitate their competencies on the labour market (Galecka-Burdzjak and Góra 2017). Reversing the increase in retirement age may support this attitude and cause the serious consequences for further generations.

### 3. The attitude of workers 50+ in Poland to work and retirement

Economic activity of people in working age in Poland for years had been very low. Since the beginning of 21st century employment rates increased (Bielawska and Pieńkowska-Kamieniecka 2015), but still are relatively low, especially in the age group 55-64 (Tab. 2). It supports the thesis that there is a strong positive

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5 According to Social Security Institution (ZUS), at the end of 2017 395 thousand people applied for the old-age pension and 346 thousand people received an old-age pension due to decrease in retirement age.

6 See e.g. Szczepański 2017.
correlation between the employment rates of older workers and effective retirement age (Duval 2003, p. 2).

Table 2. Activity and employment rates in the EU and Poland, 2005-2016

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Active population (20-64) as % of population</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European Union (28)</td>
<td>74,3</td>
<td>75,5</td>
<td>77,1</td>
<td>77,5</td>
</tr>
<tr>
<td>Poland</td>
<td>70,9</td>
<td>71,1</td>
<td>73,2</td>
<td>73,8</td>
</tr>
<tr>
<td>Employment rate (20-64) as % of population</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European Union (28)</td>
<td>67,9</td>
<td>68,6</td>
<td>70,1</td>
<td>71,1</td>
</tr>
<tr>
<td>Poland</td>
<td>58,3</td>
<td>64,3</td>
<td>67,8</td>
<td>69,3</td>
</tr>
<tr>
<td>Employment rate (55-64) as % of population</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European Union (28)</td>
<td>42,2</td>
<td>46,2</td>
<td>53,3</td>
<td>55,3</td>
</tr>
<tr>
<td>Poland</td>
<td>27,2</td>
<td>34,1</td>
<td>44,3</td>
<td>46,2</td>
</tr>
</tbody>
</table>

Source: Eurostat.

The ability and willingness to work depends on wide range of factors. The individual features of working life are such as health status, competencies, values and motivation (Chłoń-Domińczak 2017). The other group may be called an institutional or external determinants of working live, what combines the work condition offered by the employers and the public policies addressing the active and economically inactive people. Some features combine both groups of factors, for example the material status.

According to the in depth study on transition from work to retirement conducted by Polish Central Statistical Office, based on the ad hoc module of Labour Force Survey by Eurostat (Eurostat 2014), more than 53% of the population aged 50-69 in Poland was economically inactive, and almost half of this population received social benefits (GUS 2013, p. 34). The structure of these social benefits is presented on Fig. 5.

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7 Assuming that individual features are of internal manner.
8 Employed persons represented 43% and unemployed persons 4% of the population.
The high share of disability pensions in the age group 50-54 is observed among groups with lower levels of education who perform manual work and live in rural areas (GUS 2013, p. 78). As evidenced in the case of Denmark, hard physical work during working life and exposure to several factors in the physical work environment, especially heavy lifting, were important for labour market exit and sickness absence (Sundstrup et al. 2018).

The reasons for the economic inactivity are primarily connected with meeting criteria of receiving the old-age or disability benefit (Tab. 3). Meeting conditions entitling to disability or old-age pensions was the most frequent reason for discontinuing work (57.6% of answers), followed by health conditions and inability to work (20% of answers). In comparison to the outcomes of this survey in other EU countries, the share of answers pointing out the meeting criteria to the benefits was significantly higher in Poland than on average in the EU (37%), but similar to the outcomes in other new member states, i.e. Bulgaria, Czech Republic, Hungary and Slovenia (Eurostat 2014). The other factors comprised the inability to continue working after reaching the retirement age (7.6%), difficulties with finding a job (5.6%), favorable financial arrangements to leave work (3.8%) and other job-related reasons (1.5%). What is interesting, the family or care-related reasons were pointed out only by 2.4% of respondents.
Table 3. Economically inactive persons aged 50-69 years by the reasons for discontinuation of work and willingness to its continuation after termination of the last employment

<table>
<thead>
<tr>
<th>Specification</th>
<th>Total</th>
<th>The reason for discontinuation of work</th>
<th>The share of persons who would like to continue work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in thous.</td>
<td>in %</td>
<td>in %</td>
</tr>
<tr>
<td>Total</td>
<td>2882</td>
<td>57.6</td>
<td>20.0</td>
</tr>
<tr>
<td>Men</td>
<td>1112</td>
<td>52.5</td>
<td>27.6</td>
</tr>
<tr>
<td>Women</td>
<td>1770</td>
<td>60.7</td>
<td>15.3</td>
</tr>
<tr>
<td>Urban areas</td>
<td>1920</td>
<td>57.6</td>
<td>18.3</td>
</tr>
<tr>
<td>Rural areas</td>
<td>963</td>
<td>57.3</td>
<td>23.4</td>
</tr>
<tr>
<td>Aged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td>83</td>
<td>24.1</td>
<td>48.2</td>
</tr>
<tr>
<td>55-59</td>
<td>472</td>
<td>43.6</td>
<td>26.7</td>
</tr>
<tr>
<td>60-64</td>
<td>1308</td>
<td>60.3</td>
<td>17.6</td>
</tr>
<tr>
<td>65-69</td>
<td>1019</td>
<td>63.1</td>
<td>17.6</td>
</tr>
</tbody>
</table>

The other research, which outcomes are significant for the analysis of the transition from work to retirement, is the Survey of Health, Ageing and Retirement in Europe (SHARE). The sixth round of this panel research was carried out in 2015 in 17 European countries, including Poland. The analysis of the causes and effects of switching from work into retirement is based on the Pull-Push model proposed among others by Barnes-Farrell (2003). The model assumes, that there are forces which “push” the worker into retirement (negative features of work and work environment) and forces which “pull” into retirement (positive features of the retirement role or environment).

According to the results of the SHARE, Polish workers relatively more often in comparison to other respondents, underlined the factors which may “push” into retirement concerning the work environment such as: the lack of promotion perspectives, requirement of heavy physical effort, time pressure caused by work (Chłoń-Domińczak 2017, pp. 70-71). In the same time the factors “keeping” in employment such as: support at work, recognition of the effects of the work, the possibilities of professional development or adequate remuneration were more rare in the answers of Polish workers in comparison to respondents from other countries (Ibidem, pp. 71-72).

The survey confirms the results of other before mentioned research in the field of the expectations to retire as quick as possible. Almost 60% of men and 50% of women aged below 60 years want to retire as soon as they meet the eligibility criteria. The second important outcome of SHARE in the field of relation between...
work and retirement is that a lot of Poles are afraid that the health status may limit their ability to continue working up to statutory retirement age. This threat may be influenced by the vision of working up to 67, as the survey was conducted in 2015, so relatively soon after the activation of the process of the increase in statutory retirement age.

4. Conclusion

The effective retirement age in Poland strongly depends on statutory retirement age. Over the last decade it was growing among both men and women. The main driver of that trend was the increase in statutory retirement age during January 2013 – September 2017 and phasing out early retirement for women born after 1953 and men born after 1948. In the light of the different panel research, the attitude of Poles to retire as soon as possible had not changed over last years. So it may be expected, that the current decrease in retirement age (to 60 years for women and 65 for men) will not support the significant increase in effective retirement age and in case of women may cause the decrease of the effective retirement age. The lower values of old-age pension for women resulting from the lower retirement age may not be in the short and medium term an efficient factor of postponing the retirement. Under condition of no (retirement) policy change, the crucial issue in the next years from the individual and societal point of view will be the behavior of quickly retiring population on the labour market. Continuing professional careers may be more attractive on the condition of strengthening internal and external factors of the attractiveness of working environment, what requires joint efforts of the employers and the state.

References


DEMOGRAPHIC CHANGES AND PENSION SYSTEM IN POLAND

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Abstract
The aim of the article is to present the phenomenon of aging of Polish society and discuss its consequences for the pension system. The article describes the aging process of the Polish society which is the result of decline in fertility and lengthening of life expectancy. Over the last few years we observe in Poland significant changes in the age structure of its inhabitants. Rapid progress in the field of medicine that allows earlier and more accurate diagnosis of diseases, and thus more effective treatment, as well as a healthier lifestyle, improves the health of Poles and makes their lives longer. The changes that occur in the structure of the population's age cause that the number of people receiving retirement benefits increases, while the number of people paying contributions decreases. What's more, extending the average life expectancy of a person means a longer period of receiving retirement benefits. From the point of view of the pension system, the phenomenon of lengthening the average duration of human life causes an increase in the number of beneficiaries, and thus the total amount of retirement benefits. Unfavorable demographic trends thus have a direct impact on the pension system leading to the undermining of its stability and adequacy.

Keywords: aging of society, demographic changes, pension system.

JEL code: J1.

1. Introduction
Nowadays the aging of the population is considered to be a severe problem of many countries. The first noticeable changes in the population structure appeared in the 19th century in Europe (Great Britain, France, Denmark, Sweden) along with socio-economic changes related to industrialization and urbanization. In about a hundred years the aging of the population has spread throughout Europe. In the 1960s, transformations called the second demographic transition began. Their characteristic feature was transformation in the sphere of family formation and breakdown, delaying the age of entering into relationships and childbirth, and the intensity of these processes. Changes in the attitudes and system of values of especially young people that took place after the Second World War found a bearing in the sphere of demographic behavior. At the end of the century, behaviors characteristic of the second demographic transition occurred throughout Europe (GUS 2014a, p. 125).
Over the last dozens of years also in Poland we observe significant changes in the age structure of its inhabitants. Demographic changes in Poland are directly related to the system transformation time, started in 1989. The political transformation has changed many economic and social factors that have influenced the demographic situation of the country. The implementation of democratic procedures and the creation of a free market based on private property have reduced social benefits, while the completion of full employment policies has led to difficulties in finding a job and increasing unemployment. The increasingly difficult economic conditions have influenced the decline in the number of births and the change in the female fertility pattern. The decline in the birth rate is one of the main reasons for the aging of Polish society. The ongoing aging of society is also the result of extending the average duration of human life.

Increased participation of older people in the society brings with it certain socio-economic consequences, which include the increase in public expenditure on health care and retirement benefits. This burden may pose a threat to the sustainability of public finances and, above all, to the sustainability of pension systems. The low birth rate and the prolonging life of Polish society brings with it significant changes for the labour market, social security system and the entire economy.

The aim of the article is to present the impact of aging Polish society on the pension system in Poland.

2. Demographic changes in Poland

In Poland, from the time of political transformation, a progressive aging process of the population can be observed, which is mainly the result of decline in fertility and extension of life expectancy.

The factors that contributed to the reduction of fertility in Poland include: changes in the economic functions of the state, increased household responsibility for their economic situation and changing conditions for participation in the labour market (caused by economic reforms, globalization and high unemployment). These factors also include those that affect the shape of the modern family, regardless of the economic situation of the state. Among them, mention is made of development of women's educational opportunities and their professional activation, conflict of gender roles in family relations resulting from equalizing the professional status of women and men and changes in the process of population reproduction (fertility control thanks to the development of medicine and pharmacology) (Grodzka 2016, p. 79). Transformation processes generally created new career opportunities and related changes to the socio-economic position of individuals and households. Household welfare became more dependent on household resources, such as personal income, skills, and the ability to act in new circumstances. Simultaneously, growing labour market competition resulted in growing job requirements. For these reasons, more effort had to be made by individuals to get and to maintain a job. Therefore, to find a job and to stay in the highly competitive labour market became of crucial importance for the younger generations.
Moreover, changes in the institutional setting made it more difficult for women to be flexible and mobile and to adapt to increasing employers’ requirements (Kotowska et al. 2008, p. 824).

Lowering the birth rate is one of the main reasons for the aging of Polish society. The low number of births does not guarantee – for 25 years already – a simple replacement of generations. Since 1990, the total fertility rate (TFR) has been below 2, while the optimal value – described as advantageous for stable demographic development – is 2.1-2.15, i.e. the average number of children per 100 women aged 15-49 vary from 210-215 in a given year. In 2016 the total fertility rate (TFR) was 1.36, which means that for every 100 women of reproductive age (15-49 years), there were about 136 children born. Initiated in the 90s of the last century the demographic transformations are the result of choice, which is often made by young people, to reach a certain level of education and economic stability firstly and then (about the age of 30) to start and expand a family. The observed changes caused a shift of the highest women fertility from the group aged 20-24 to the group aged 25-34 where there was a significant increase fertility rate. The consequence of all the changes in procreation behaviors (since the beginning of this century) is the increase of the median age of women giving birth to a child. In 2016 this was 29.9 years – compared with 26.1 years in 2000 (in 1990 it was slightly less – 26 years). During this period also increased the average age of the women giving birth to their first child from 23.7 years to 27.8 years (in 1990 amounted 23 years) (GUS 2017a, pp. 14-15).

In the first half of 2017, the natural increase (the difference between the number of live births and the number of deaths) was negative and amounted to 10.7 thousand (the rate was at the level of -0.6 ‰). This means that in the first half of 2017, as a result of natural movement, for every 10 thousand of the population has declined 6 people (GUS 2017a, p. 11).

The longer the fertility stays at a low level, the lower chance of increasing its level. Three components affects that situation (GUS 2014a, p. 53):
- demographic – lower fertility means a smaller number of born children, which in turn leads to a decrease in the percentage of young people in the population. The consequence of this is increasing social benefits for older people, worsening the economic situation of young people and, as a result, low fertility;
- sociological – low fertility causes that there are more and more families with a small number of children. This leads to a change in the ideal family pattern in relation to the number of children and increasing future consumer aspirations (the decisive impact on economic aspirations are the conditions in which the individual was brought up – in smaller families they are usually better);
- economic – when economic aspirations increase and the possibility of meeting them decreases, some potential parents do not decide to bear the costs of having children or postpone them for a later date.

The new demographic situation also results from the prolongation of the average life expectancy of the human being resulting from the following factors (GUS 2014a, p. 79):
- decrease in the intensity of deaths due to: cardiovascular diseases in all age groups, cancers among people under 45 years old and among men aged 45-59, as well as external causes, such as: accidents, injuries, poisoning,
- uninterrupted – throughout the post-war period – decrease in infant mortality,
- positive changes in health-related behaviors of the population: changes in the way of eating to limit the consumption of unhealthy food and alcohol, increase in physical activity,
- increasing access to medical and care services, as well as improving the quality of these services,
- constant development of medical technologies,
- greater popularity of prophylactic examinations, such as mammography, cytology, blood sugar tests,
- favorable changes in the level of education – people with higher education are more aware of the need to care for their health, and thus live longer than less educated people,
- an increasing number of effective and safe drugs to stop or slow down the development of many diseases.

The new demographic situation also results from the prolongation of the average duration of human life. As predicted by the Central Statistical Office, over the years, the aging of Polish society will systematically progress. In the following years, a significant increase in the percentage of people aged over 65 is forecasted. In the years 1990-2016, the number of people aged 65 and more gradually increased (by over 2.4 million). In 1990, the share of older people in the general population was 10.2%, and at the end of 2016, it increased by more than half – to 16.4%. Currently, the number of elderly people is about 530 thousand greater than the number of children (GUS 2017a, p. 25). By 2030, the share of people in the discussed age group will amount to 22.6%, while in 2050 – 29.7%. The demographic forecast prepared by Eurostat shows that in 2060 the percentage of people over 65 in society will amount to 36.18%, and their number will exceed 11 million (Giannakouris 2008, pp. 7, 10). This means that Polish society will be one of the fastest ageing societies in the European Union (Russel 2016, p. 2). Long-term forecasts show that by 2050 the percentage of people aged over 80 will also increase significantly. While in 2013 the share of people in the discussed age group accounted for less than 4% of the total population, in 2050 it will be 10.4% (GUS 2014a, p. 164). In 2050, men will live an average of 83 years, while women will live for 88.4 years – Table 1.

**Table 1.** The average duration of human life in Poland in the years 2015-2050

<table>
<thead>
<tr>
<th>Year</th>
<th>Men</th>
<th>Women</th>
<th>Year</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>73,5</td>
<td>81,5</td>
<td>2035</td>
<td>79,1</td>
<td>85,6</td>
</tr>
<tr>
<td>2020</td>
<td>74,9</td>
<td>82,5</td>
<td>2040</td>
<td>80,3</td>
<td>86,5</td>
</tr>
<tr>
<td>2025</td>
<td>76,3</td>
<td>83,6</td>
<td>2045</td>
<td>81,6</td>
<td>87,4</td>
</tr>
<tr>
<td>2030</td>
<td>78,0</td>
<td>84,8</td>
<td>2050</td>
<td>83,0</td>
<td>88,4</td>
</tr>
</tbody>
</table>

Source: own elaboration based on GUS 2014a, p. 78.
Among European countries, Poland is a relatively demographically young country. In 2013, the median age of Poles was 37.4 years for men and 40.9 for women, while in 1990 it was lower by 6.5 years for men and 7.2 years for women (30.9 and 33.7 years, respectively) (GUS 2014a, p. 81). Despite positive changes in the average life expectancy, Poland still performs unfavorably against the background of leading European countries. Men live an average of 73.8 years, i.e. by over 7 years less than in Cyprus (the highest parameter in Europe), and women – 81.6 years (less by 4 years than Spanish women – live for the longest time among European women) (GUS 2017b, p. 11). The unfavorable demographic situation also includes the foreign migration of Poles. The Central Statistical Office estimates that in 2016 around 2515 thousand inhabitants of our country stayed temporarily abroad, i.e. by 118 thousand (4.7%) more than in 2015. In Europe in 2016 there were about 2214 thousand people, the vast majority – about 2096 thousand – in EU member states. This number increased by 113 thousand compared to 2015. Among the EU countries, the largest number of Polish emigrants resided in Great Britain (788 thousand), Germany (687 thousand), the Netherlands (116 thousand) and Ireland (112 thousand). In 2016, there was a significant increase in the number of Poles staying in Great Britain and in Germany, that is in the main destination countries of emigration from Poland in recent years. In the case of the United Kingdom as compared to 2015 year an increase of 68 thousand (9.4%), while in Germany the number of Poles staying has increased by 32 thousand (about 5%). The increase in the number of Poles staying temporarily was also observed in other EU countries – Austria, Belgium, Denmark, the Netherlands, Ireland and Sweden. A slight decrease in the number of Polish emigrants compared to the previous year was recorded in Spain and Italy (GUS 2017c, pp. 1-2).

There are also apprehensions about the demographic development of Poland. As expected, by 2050 there will be a systematic decline in the population. In 2050, the population of Poland will amount to 33 million 951 thousand. In comparison to 2013, this means a reduction of the population by 4.55 million, i.e. by 12%. In addition to the negative birth rate, we will observe further unfavorable changes in the population structure by age and decrease in the number of women in childbearing age. People aged 65 and more will account for almost 1/3 of the population, and their number will increase by 5.4 million compared to 2013 (GUS 2014a, p. 109).

### 3. The consequences of demographic changes for the pension system

The pension security system in Poland before its reform was based on an intergenerational contract, according to which the contributions paid on a regular basis were distributed for payment of pensions. However, due to changes in the labour market and unfavorable demographic trends, it was necessary to conduct a thorough reform of the system (Leśna-Wierszolowicz 2016, p. 191). Since January 1, 1999 there has been a three-pillar pension system in Poland, which is characterized by: reducing the nurturing role of the state, increasing the individual contribution to retirement planning, diversifying sources of financing retirement.
income, and linking the pay-as-you-go system with the capital system (Ronka-Chmielowiec 2002, p. 121).

Currently, the pension system is facing a huge challenge related to the constantly deteriorating demographic trends. Changes that take place in the structure of the population's age cause that the number of people receiving retirement benefits increases, while the number of people paying contributions decreases. Extending the average life expectancy, with a simultaneous decrease in fertility, causes that the number of people at post-working age and the number of people of working and pre-working age is decreasing.

Over the years 1999-2016 the number of people of working age gradually decreased. In 2016, the number of people of working age was 23.8 million and was lower by 234 thousand compared to 2015. In recent years, an increase in the number of post-working age people has been observed. At the end of 2016, the post-working age population amounted to over 7.8 million people, and its share in the total population was 20.2% (in 2000: 5.7 million and almost 15%, and in 1990 almost 13%). Compared to 2015, the number of post-working age people increased by 237 thousand (0.6%) (GUS 2017a, p. 27).

Demographic burden by population at post-working age will increase from 28 people in 2013 to 52 in 2050 – Table 2.

<table>
<thead>
<tr>
<th>Demographic burden by population at age</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-working</td>
<td>57</td>
<td>57</td>
<td>57</td>
<td>60</td>
<td>63</td>
<td>63</td>
<td>62</td>
<td>62</td>
<td>69</td>
<td>78</td>
</tr>
<tr>
<td>Pre-working</td>
<td>29</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>26</td>
<td>25</td>
<td>24</td>
<td>25</td>
<td>26</td>
</tr>
<tr>
<td>Post-working</td>
<td>28</td>
<td>29</td>
<td>29</td>
<td>32</td>
<td>35</td>
<td>37</td>
<td>37</td>
<td>38</td>
<td>44</td>
<td>52</td>
</tr>
</tbody>
</table>

Source: GUS 2014a, p. 150.

Nowadays post-working age people live longer and therefore they use their benefits from the pension system longer. As a consequence, pension systems based on intergenerational solidarity, with declining contributory income and rising pension expenditure, will not be able to guarantee adequate pensions.

The aging of the population is a significant threat to the stability of the pension system and the guarantee of payment of future retirement benefits. Nowadays in Poland, the balance of the Social Insurance Fund from which pensions are paid

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1 As a non-working age most commonly is defined as the age 0-17 (pre-working age) and 60 years and more for females and 65 years and more for males (post-working age); working age refers to 18-59/64 years (18-59 – for females and 18-64 – for males).

2 Age dependency ratio is the ratio of the number of people in non-working age to the number of people in working age.
out is negative, and subsidies from the state budget guaranteeing the continuity of payment of benefits exceed PLN 50 billion (Szczepański 2016, p. 744). In order not to lower the pensions paid and not to increase debt, many countries decide to increase the retirement age. Decisions on raising the retirement age are met with resistance from the society, but according to experts, this is the only way to preserve the financial stability of the pension system. Population forecasts indicate that the phenomenon of aging will be deepening. This will further increase the demographic load of professionally active people. Such a dependence means that two solutions would be necessary to maintain a balanced pension system based on the principle of pay-as-you-go: the first is to increase pension contributions, the second to lower the amount of benefits (Jurek 2012, p. 102). None of these solutions is a suitable method to maintain a stable pension system, therefore in the future, thorough and radical transformations of the entire pension system will be necessary. The main directions of activities in the field of adaptation of pension systems to the new demographic situation were set in February 2012 by the European Commission in the White Paper: An Agenda for Adequate, Safe and Sustainable Pensions (European Commission 2012, p. 9). The most important goals of pension system reforms include: equalizing the retirement age of women and men, reducing early retirement, linking retirement age to a further average life expectancy, and developing voluntary pension schemes.

4. Conclusion

In Poland, along with the political transformation, a period of unfavorable demographic changes began, including the decline in the number of births and the extension of the average life expectancy. The main causes of low fertility rate include, above all: changing attitudes and the system of values among young people, increasing the importance of women on the labour market, delaying the age of getting married, postponing the decision on parenting and lengthening the age of first childbirth. Rapid progress in the field of medicine enabling earlier and more accurate diagnosis of diseases, and thus more effective treatment, maintaining a healthy lifestyle, changing the diet, as well as government actions leading to adequate living, working, education, physical culture and leisure and recreation, affect constant improvement of the health condition of Poles, and thus their longer life. Long-term forecasts show that by 2060 the percentage of people over 65 will increase to 36.18%. This means that Polish society will be one of the fastest ageing societies in the European Union. Long-term forecasts show that by 2050 the percentage of people aged over 80 will also increase significantly. While in 2013 the share of people in the discussed age group accounted for less than 4% of the total population, in 2050 it will be 10.4%. In 2050 men will live an average of 83 years, while women will live for 88.4 years.

The age structure of Polish society is changing to the disadvantage. The share of potential beneficiaries of the pension system grows with the decreasing number of people paying insurance premiums. With the increasing age, the average period of collecting pensions also increases. This means that the amount of funds
available to the Social Insurance Fund is decreasing, which makes it necessary to subsidize from the state budget. The consequence of population aging is an increase in public expenditure on retirement benefits. This burden may pose a threat to the sustainability of public finances and, above all, to the sustainability of pension systems.

Population forecasts indicate that the phenomenon of aging will be deepening. This will further increase the demographic load of professionally active people. If demographic trends do not change, then radical reforms of the pension system will have to be taken. It is necessary to take appropriate actions to ensure an appropriate level of benefits for the beneficiaries while maintaining financial stability of the state and avoiding excessive burden on people working with high contributions.

References


RETIREMENT AWARENESS AS A DETERMINANT OF THE CHOICE OF TOOLS FOR COLLECTING PENSION CAPITAL

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Abstract
The article deals with the problem of retirement awareness of adult citizens. Its purpose was to determine the level of this awareness and knowledge about the pension system, as well as to learn the motives of decisions related to the optional part of the pension system. In addition, the aim was to identify what voluntary forms of raising capital for the retirement are most often chosen, and which factors in particular make people to take action to secure their retirement future. The study established that the respondents negatively judge the effectiveness of the Polish pension system, do not have adequate knowledge about the functioning of the pension system and show little interest in additional, voluntary forms of building pension security.

Keywords: pension system, retirement awareness, voluntary forms of building pension security.

JEL codes: G41, D14, J14.

1. Introduction
Many developed and developing countries suffer the problem of societies ageing. Poland is one of them. This means that individual ability of foresight is getting more and more important. It is one of the competencies that are a part of retirement awareness. Due to the fact that in Poland there is a significant risk that the public pensions will decrease the possessed knowledge referring to the ways of increasing the pension gives an advantage over the people without the knowledge, and first of all it gives a chance to gain higher pension. Thus the aim of this paper is to determine the level of this awareness and knowledge about the pension system, to know the motives of decisions related to the voluntary part of the pension system. This aim is going to be achieved by the analysis of the results of surveys that were done in similar period of time (2016). In addition, there was the pilot survey done in 2017 to compare these results. Moreover, the aim is to identify what voluntary forms of raising capital for the retirement are most often chosen, and which factors in particular make people to take action to secure their
retirement future. The main two hypotheses stated at the beginning are that: (H1) Poles do not represent high level of retirement awareness and (H2) are little interested in voluntarily saving money for retirement.

2. What is pension awareness?

Pension awareness can be defined as a phenomenon of being aware of events and processes referring to the future and/or current pension and having abilities to analyze and evaluate them. Analyzing the issue from the psychological point of view it may be assumed that it is a complex psychological formation serving to control financial behaviours of an individual connected with shaping the future or current pensions. Dealing with pension awareness as the example of financial awareness we can assume that it is composed of three following elements:

- knowledge, including: formal knowledge based on formalized financial education including pensions (school, courses, trainings, workshops, etc.) and informal knowledge gained by various media or people (family, friends, colleagues, acquaintances, neighbours, etc.),
- objective understanding of financial phenomena including the ones referring to the rules of pensions shaping,
- practical skills to make rational financial decisions referring to pensions.

The possessed knowledge and skills should be reflected in understanding and perception of phenomena. However, it is not guaranteed that the person with broad financial knowledge will achieve financial success in the future or will avoid financial problems. It is not guaranteed that his or her decisions will be rational and the best. On the other hand, one can have some practical skills to deal with financial issues without understanding their complexity and rules. In the optimal situation there are all three elements simultaneously, that is knowledge, practical skills and understanding od financial phenomena. These elements compose general financial competence, in other words joining three attributes: knowledge, skills and emotions which allow a person to realize financial activities in a skillfull, effective and responding to qualitative expectations way (Cicharska et al. 2016, pp. 25-26). The analyzed topic primarily deals with the knowledge referring to the way of shaping the future pensions, what can be done and how one can achieve the best result, and what the effects of such activities can be.

Facing the progress of ageing processes of societies the pension awareness seems to increase in importance. Especially in the countries where it is not guaranteed to gain public pension or when the public pension is too low. Due to the fact that in Poland there is a significant risk that the public pensions will decrease (both the nominal as well as in relation to former remuneration) the possessed knowledge referring to the ways of increasing the pension gives an advantage over the people without the knowledge, and first of all it gives a chance to gain higher pension.
3. Pension awareness of the Poles in the context of current surveys

The research of pension awareness of the Polish was conducted by Czapiński and Góra\(^1\) (2016). It was shown that almost 80% of the respondents do not take any actions in order to prevent worsening of material life standard after retiring. Among those who take any action the biggest group is composed of individuals allocating means at bank deposits or in cash (61%), 14.6% invests in various investment goods, which can constitute safeguards for the future (e.g. property, noble metals, works of art), 13.3% possesses Protection and investment insurance, 8% possesses an Individual pension account, 1.6% use Employees pension schemes, and 0.5% Individual pension benefit account. It is interesting that as many as 12.4% of the respondents treats their children as a protection for the retirement and they try to raise them in a way so that they financially help.

According to the research, conducted by Węgrzyn\(^2\) (2016), which was more local, the result was similar. The majority (65.89%) declared that they do not accrue capital for the retirement. Individuals with higher education were more cautious as only (1) 53.73% of them did not collect capital for the future pension, in comparison to 78.57% of those with secondary education. The relation between the income level and collecting additional means for the retirement is shown in Figure 1.

![Fig. 1. Percentage of individuals not saving capital for the future retirement according to remuneration](image)


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\(^1\) This survey was conducted on a sample of 1006 persons in age of 18-67. The main criteria of including to the sample was work activity. Survey was conducted by the Social Surveys Lab (pbs.pl) as an direct interview with CAPI technique (computer assisted personal interview) on a representative sample for Poles in age of 15+. The aim of this survey was to check the knowledge on own retirement future and activities related to preparation, mainly economic, to retirement (Czapiński and Góra 2016, p. 6).

\(^2\) This survey was conducted on a sample of 129 persons. It wasn’t representative and responses were collected via website and paper questionnaires. The aim of the survey was to know opinions of respondents about the pension system, their knowledge of its construction, range of actions aimed at securing the future of retirement and their determinants (Węgrzyn 2016, pp. 72-73).
On the basis of this research the dependence between the received remuneration and pension forethought can be noticed. Up to 84.13% of persons earning up to 2000 PLN do not save capital for the future pension, whereas in the best earning group only 28.57% do not do it. On the basis of this rule, the economic factor can be assumed as the key one, which decides about abandoning actions leading to the increase of the Polish pension safety. Individuals who decide to save capital most often choose deposits (14.73% of all respondents). The individual pension account is chosen by 11.63%, whereas only 3.10% choose Individual pension benefit account which is recognized as the best in this paper. This phenomenon can be caused by the fact that Individual pension benefit account has been introduced after Individual pension account, what lead to shortening the period when the interested could join the program. None of the respondents indicated other tools by the means of which they would like to safeguard their pension future. The result is concurrent to the ones achieved by Czapiński and Góra in the scope of the main tool of saving pension capital. In both cases, these are the deposits which can and do have to be purposed for financing consumption during the occupational deactivation period. The deposits have a general goal and they are not purposeful as it is in case of capital gained by dedicated means such as Individual pension account or Individual pension benefit account.

In the analysis by Wegrzyn the lack of free means, which could be dedicated for the protection of the pension future, is the most popular factor indicated by the respondents who so far do not save the capital for the future pension (77.65%). The crucial fact is that only 9.41% of the respondents considers the pension provided by ZUS (The Polish Social Insurance Institution) as sufficient. It means that the other part which does not save capital, has not taken up any actions yet, despite the conviction that they will not receive pension from the state pension system at the proper satisfactory level. Simultaneously, as many as 92.68% of the respondents expects to receive pension causing lowering current life standard after retiring. The fact that almost a half (46.34%) of those who retire shall need additional means should be alarming. It means that in case of lack of such a source when retiring the said individuals may have problem to secure their living. 39.47% of respondents, who claim that the simulated pension is low or too low, does not save capital for the future pension. Besides, as many as 41.86% thinks that till their retirement Polish Social Insurance Institution ZUS will go bankrupt³, and only 3.88% believe that their pension will be at the level of their last remuneration. The fear for insolvency of Polish Social Insurance Institution ZUS is also present in the research results by Czapiński and Góra. According to them even 80% is afraid of such a situation. The results are surprising if they are compared to the percentage of individuals who declare not saving the capital for the future. Despite the fact that the majority have a negative attitude to the level of the future pension or the possibility to receive it at all, a significant majority of

³ 41.79% with higher education and 44.64% with secondary education believes that Polish Social Insurance Institution will go bankrupt so it can be assumed that the level of the education is not related to the bankruptcy of the institution.
Retirement awareness as a determinant of the choice of tools for collecting pension capital

individuals do not take any action to increase the pension in the future. It is a hard definable phenomenon as it means that the individuals foreseeing the negative situation in the future do nothing to change this perspective.

The degree of usage of financial instruments which allow to receive a higher pension in the future is the manifestation of pension awareness. In Polish conditions the basic choice refers to subaccount in Polish Social Insurance Institution ZUS and an account in Open Pension Fund. According to the research by Węgrzyn the option is chosen by only some individuals what is presented in Figure 2.

![Chart: Retirement awareness as a determinant of the choice of tools for collecting pension capital](image)

**Fig. 1.** Answers for the question: “What have you chosen, Open Pension Fund or subaccount in Polish Social Insurance Institution (ZUS)?”

Source: Węgrzyn 2016, p. 82.

![Chart: Retirement awareness as a determinant of the choice of tools for collecting pension capital](image)

**Fig. 2.** Answers for the question: “What was the main reason of allocation of means in Open Pension Fund or the subaccount in Polish Social Insurance Institution (ZUS)?” More than one answer was possible

Source: Węgrzyn 2016, p. 84.
It turns out that 54% of those who worked over 4 month since July 2014 did not take any action connected with the choice between Open Pension Fund and ZUS subaccount. These respondents were not interested in this possibility. The results can be judged as dramatic as it shows that about half of the Polish who could make such a choice, is not interested in the issue of their future pension at all. Despite the previously presented results which show the negative attitude to the future pension level these people have no interest in case of circumstances forcing them to make a choice influencing the level of their future pension. In this case, the choice should be made on the basis of the analysis Open Pension Fund return rates and subaccount valorization. The analysis could be broadened by information gained from the press and TV or friends. Such an action could allow to receive proper data constituting the basis of a rational decision. This type of analysis was declared by only 9% of respondents. Opinions of friends and family were much more popular (20%) as well as information from the press and TV (27%) as the decision making factors. Simultaneously almost a half of the respondents (47.29%) claims to have no knowledge referring to the pension calculation way by Polish Social Insurance Institution ZUS, 41.09%, of the respondents claims to have scarce knowledge whereas 11.63% is able to state which choice would be more profitable.

4. Polish pension awareness in the light of own analysis

The analysis, defining pension awareness of Polish society\(^4\), conducted in 2017 showed very low interest in the voluntary part of a pension system. The research was regional and it was mainly conducted among inhabitants living in Lower Silesia Province, Opole Province and Silesia Province. The research proved that over 56% of the society does not save in Pension Pillar 3, and 32% saves no more than 500 PLN per month.

**Fig. 3.** The amount of means saved per month by the inhabitants of Opole Province
Source: own analysis.

\(^4\) Pilot analysis conducted in October 2017, sample of 200 respondents.
The respondents indicated the lack of sufficient financial means, insufficient knowledge of investing, ignorance of Pillar 3 products as well as lack of trust in financial institutions as the main reason of not saving by the means of Pension Pillar 3 instruments. Figure 4 depicts the reasons of not saving by the inhabitants of Opole Province.

**Fig. 4. Reasons of not saving by using products of Pension Pillar 3**

Source: own analysis.

It is alarming that the lack of knowledge of investing and ignorance of Pillar 3 products are among the main reasons of not saving in Pillar 3. It proves the low pension awareness of Polish society and it reveals a very low propensity to save for the retirement. The financial crisis in 2017 definitely caused the low percentage of people saving for the pension by the instruments of the capital market. The crises escalated in 2008 and led to decrease of confidence in financial markets and it discouraged to invest in instruments linked to this market. Besides, the right information about the product being the subject of the contract is of crucial meaning while concluding contracts referring to programs of Pillar 3. The responsibility to inform the client lies on the person proposing concluding the contract – an insurance agent, a bank employee or a financial advisor. Unfortunately, mostly the given information is not precise and contrary to the contract conditions. Often the consumers in the moment of concluding the contract are being informed only about the profit height which can be expected when paying in their money (even few dozen of percent), whereas they are not informed about the investment risk and possibility of loss. It results in misleading the customers and consequently it causes a significant loss of financial means and it undermines the confidence in financial institution (Chorkowy 2013,
The low pension awareness of Polish society is confirmed by the fact that respondents numbered, apart from higher income of a household, also trainings raising awareness of investing in Pillar 3, more attractive bonuses in exchange for joining the program and wider assistance of financial advisors in the scope of management of means allocated in Pillar 3 products, as the main reasons forcing individuals to save means by Pillar 3 instruments.

The declared height of the amount saved per month by an ordinary Polish citizen is a crucial element which decides about future pension level. The research showed that 35% of society would be prone to save in Pillar 3 up to 200 PLN and 42% not more than 500 PLN. It means that despite considering possibility of joining the voluntary part of a pension system the Polish declare the amounts which do not guarantee saving a sufficient amount of means allowing to satisfy the maintenance of life level at retirement similar to the level during professional activeness.

Low popularity of Pension Pillar 3 is mainly caused by the low level of knowledge of pension system Pillar 3 instruments. More than 80% of society has no knowledge or has a basic knowledge of the issue. As a result, more than 50% of the respondents who had a choice of fund portfolio with various risk chose safe fund portfolio, when only 11% of respondents were ready to invest in the aggressive fund (Figure 5).

![Fig. 5. Tendency to take investing risk](source)

It has a direct influence on the form of savings investing. The majority of the respondents prefers bank deposits (over 57%). Another popular investing forms are bonds (34.5% of respondents) and investing funds (40% of respondents). The

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5 The respondents could choose 2 answers maximum, therefore the percentage total is over 100%.
aggressive forms of investing such as stock exchange and Forex so the ones with the potential highest return rate and investing risk are definitely less popular.

5. Conclusion

Analyzing the Polish respondents participating in the studies pension awareness on the basis of various research results, which was conducted in the independent way in a similar period of time, it can be assumed that individuals with negative attitude to the future pension from Polish Social Insurance Institution are in majority. Most of the respondents think that the future pensions will be low, even on the level forcing to look for external finance sources. Some of them even think that Polish Social Insurance Institution ZUS will go bankrupt and they will not receive pensions. Simultaneously, a considerable part of the respondents have a dismissive attitude to the future pensions as they are not interested in basic instruments enabling to gain higher capital for the retirement and they show a total decisive passivity in this issue. It is also shown by the fact that the voluntary forms of saving pension capital are not popular. The level of using them grows together with the wealth level. It means that the economic factor is the major determinant of pension foresight. The individuals with higher education declare to have the knowledge of the basis of the question more often than the ones with secondary education. However, when a concrete situation is described and professional knowledge is required e.g. about the way of quarterly valorizations, the knowledge level is similar in both groups. This means that both hypotheses stated at the beginning of this paper were confirmed as respondents participating in the studies have low retirement awareness and they are not interested in voluntarily saving money for retirement.

Summing up the considerations included in this paper, a big anxiety should be expressed as far as the level of Polish pension awareness is concerned and their low activity level to build pension capital. Although the problem also exists in more developed countries (see also: Hopkins 2018; van Rooij et al. 2011; Uppal 2016), it cannot be a justification. For the Polish future pensioners it means that they rely only on public pensions, believing that “someone else (“state” as an incarnation of the Santa Clause) will be responsible for the consumption of pensioners” (Czapiński and Góra 2016, p. 11). Unfortunately this faith can be pernicious.

References


THE INFLUENCE OF THE STATE ON PENSION IN COUNTRIES OF EASTERN EUROPE (BELARUS, MOLDOVA, UKRAINE)

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Abstract
A pension is a benefit that people usually think about when they are ending their career. In the early stage of the job people rarely behave responsibly in terms of security in old age. This is the reason why the country has to intervene to take care of the fate of its citizens. Financial situations of the future pensioners are relatively good due to the compulsory pension payments, which government can extort. The purpose of those contributions is to pay the minimal benefit when these people are unable to work because of their age. It is worth remembering that there are many possibilities for the individual to save money for old age. The purpose of this article is to indicate the country influence in shaping the benefits when the citizens are too old. This document could be helpful in creating future social policy in these countries, especially in terms of pensions. The comparative data analysis should indicate the best regulations for paying the contribution so that citizens do not live below the poverty line. Simultaneously the introduction of this system will result in smaller subsidies from the government budget. In addition, data on replacement rate and equivalence will be interpreted to determine the benefits received. In the article the critical analysis of the object was applied. The data sources are selected legal acts, regulations on pension systems in Belarus, Ukraine and Moldova. Analytical material comes from statistical office of individual states.

Keywords: Belarus, Moldova, pension, Ukraine.

JEL codes: J26.

1. Introduction
The state affects many areas of our lives. Government, among others cares for citizens’ education, their safety, health, and protects their financial situation when they are unable to work (Szarzec 2013). Among others unemployment benefits, disability pensions and old-age pensions are being created. However every action of the state should be based on a public trust. It causes that it is easier to conduct necessary reforms (Olejnik 2015, pp. 41-43). It gives citizens a sense of security and stability. Thanks to that, they do not have to worry about the future. As Perek-Białas (2017, p. 78) points out, depending on the state's activity and citizens' confidence in these activities, four attitudes can be distinguished:
- Citizens believe that they will receive the benefit. Yet according to the theory of Keynes they will save money for the future for a sense of security.
- Citizens trust that they will receive a benefit and will not save.
- Citizens do not trust that they will receive a benefit and will not save.
- Citizens trust that they will receive the benefit and will save.

Additionally in case of the full control of the pension scheme through the state there is a risk that citizens may feel exempt from the obligation to care for their future, and in addition require more from the state.

In view of the fact that the life expectancy is increasing and more countries have to reform their pension systems (Barr 2001). This indicator is confirmed by the United Nations projections of 2015 (see Table 1). All countries that are analysed in this work must change their social policy. Especially regarding their retirement pensions. It is caused by the fact that the number of old people will rise i.e. people who are 60 years old or older. At the same time, the share of people of working age will decrease. Probably Moldova will have the biggest problems in this issue because until 2050 the number of this people is supposed to double (from the 16.6% up to the 33.6%). It is worth paying attention that until 2100 the number of people over 60 will decrease (relative to 2050) in Belarus and in the Ukraine. However in this period the number of people over age 80 will increase. Such a phenomenon is more and more often called *The Silver Tsunami or Gray Tsunami*\(^1\) (Giddens 2006, pp. 177-183).

| Table 1. Population structure in selected age groups, in 2015, 2050, 2100 |
|---------------------------------|-----------------|-----------------|
| 2015                            | Belarus         | Moldova         | Ukraine         |
| 0-14                            | 16.1            | 15.7            | 14.9            |
| 15-59                           | 63.6            | 67.7            | 62.5            |
| 60+                             | 20.3            | 16.6            | 22.6            |
| 80+                             | 3.6             | 2.2             | 3.4             |
| 2050                            | 0-14            | 16.9            | 12.7            | 15.9            |
| 15-59                           | 53.5            | 53.7            | 52.6            |
| 60+                             | 29.7            | 33.6            | 31.5            |
| 80+                             | 6.0             | 4.8             | 5.5             |
| 2100                            | 0-14            | 16.4            | 14.4            | 16.2            |
| 15-59                           | 54.3            | 51.6            | 55.1            |
| 60+                             | 29.3            | 34.0            | 28.7            |
| 80+                             | 8.9             | 10.0            | 7.6             |


Analysing Table 2 can be seen that by 2030 median age of the population will increase in each analysed countries. A significant increase can be seen above all in Moldova (a grow of 7 years). In the long term, i.e. until 2050 this trend will continue only in this country. In case of Belarus and Ukraine according to the

\(^1\) More about *The Silver Tsunami*: Peterson P.
In projection the average age of the population will slightly decrease (for half a year in case of Belarus and 4 months in case of Ukraine). In 2100, the tendency in Ukraine will remain at a similar level. In contrast, in the case of Moldova, the average age will decrease by less than 2 years. On the other hand in Belarus, this age will increase by more than a year.

**Table 2. Median age of the population in years**

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2030</th>
<th>2050</th>
<th>2100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belarus</td>
<td>39.6</td>
<td>42.8</td>
<td>42.2</td>
<td>43.6</td>
</tr>
<tr>
<td>Moldova</td>
<td>35.6</td>
<td>42.6</td>
<td>49.3</td>
<td>47.6</td>
</tr>
<tr>
<td>Ukraine</td>
<td>40.3</td>
<td>44.1</td>
<td>43.7</td>
<td>43.6</td>
</tr>
</tbody>
</table>


These data confirm the fact that in these countries one should focus on pension system reform in order to secure the future of older citizens, whose number will increase. The first pension system reforms took place already in the 1990s (Barr 1994), when they regained their independence after the breakup of the Union of Socialist Soviet Republics2 (Barr 1994). More and more challenges caused by demographic changes will be posed before the rulers. They will have to adjust the budget structure, as according to M. Góra (2003, p. 13): Payment of pensions is always – regardless of the type of pension system – a transfer from those currently working, therefore those earning and paying contributions, to retirees who do not produce but consume part of the product produced by the working generation.

### 2. Retirement age

The retirement age in Belarus was determined in the act “About the pension security” from 17.04.1992 (Закон Республики Беларусь от 17 апреля 1992 года “О пенсионном обеспечении”). By the end of 2016, it was 55 years for women and 60 years for men. From 1 January 2017, the retirement age in Belarus increased (Указ № 137 от 11 апреля 2016 г.). Every year it will be raised by 6 months for both sexes. By default, men are to retire at the age of 63 and women at the age of 58. Table 3 presents the accurate schedule of the retirement. Simultaneously a work experience is required, which is 20 and 25 years respectively. An additional condition in order to receive the full pension is currently a minimum of 16 years and 6 months of paid contributions. This period will be also systematically increased, up to 20 years.

The government in Moldova, like in Belarus, decided to increase the retirement age. Ultimately for both sexes this age will be 63 years. Simultaneously a decision to extend the period of paying national insurance contributions up to 34 years was made. This process is presented in Table 3. The government of Moldova, in order to encourage citizens to stay longer in the labor market, offers higher pensions.

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2 In the USSR, men were granted the right to retire at the age of 60, women after the age of 55. The substitution rate was 55%.
For a year of work above 20 years of work experience, Moldavians receive a retirement pension higher by 1.2%, and for each year of internship above 35 years, the pension increases by 2% (Petroia and Cara 2015). At the same time for the later retirement (later than the statutory retirement age) it is also possible to receive a higher benefit – by 2% for each year.

**Table 3. The retirement age and the period of paying contributions for receiving pension in Belarus and Moldova**

<table>
<thead>
<tr>
<th></th>
<th>Belarus</th>
<th>Moldova</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>RA</td>
<td>PPC</td>
<td>RA</td>
</tr>
<tr>
<td>2016</td>
<td>60.0</td>
<td>15.6</td>
</tr>
<tr>
<td>2017</td>
<td>60.6</td>
<td>16.0</td>
</tr>
<tr>
<td>2018</td>
<td>61.0</td>
<td>16.6</td>
</tr>
<tr>
<td>2019</td>
<td>61.6</td>
<td>17.0</td>
</tr>
<tr>
<td>2020</td>
<td>62.0</td>
<td>17.6</td>
</tr>
<tr>
<td>2021</td>
<td>62.6</td>
<td>18.0</td>
</tr>
<tr>
<td>2022</td>
<td>63.0</td>
<td>18.6</td>
</tr>
<tr>
<td>2023</td>
<td>63.0</td>
<td>19.0</td>
</tr>
<tr>
<td>2024</td>
<td>63.0</td>
<td>19.6</td>
</tr>
<tr>
<td>2025</td>
<td>63.0</td>
<td>20.0</td>
</tr>
<tr>
<td>2026</td>
<td>63.0</td>
<td>20.0</td>
</tr>
<tr>
<td>2027</td>
<td>63.0</td>
<td>20.0</td>
</tr>
<tr>
<td>2028</td>
<td>63.0</td>
<td>20.0</td>
</tr>
</tbody>
</table>

Attention: RA – Retirement age, PPC – Period of paying contributions
Source: Own study based on: Ministry of Labor and Social Protection of the Republic of Belarus, Casa Națională de Asigurări Sociale a Republicii Moldova [Access: 5.02.2018].

According to the point 2 Law on pension help from 1992 (Закон України Про пенсійне забезпечення (Відомості Верховної Ради України (ВВР), 1992, № 3, ст. 10)) there are 3 types of benefits in the Ukraine about social security character:
- by age,
- due to disability,
- due to loss of family’s breadwinner.

Point 12 of the same Act contains information about the requirements for collecting pensions: retirement age – 60 years for men and 25 years of service. For women 55 and 20 respectively. There are number of exceptions defined in point 13. It says, among others, about people working in difficult conditions, farmers, mothers of 5 and more children, victims of the Chernobyl disaster.
3. Contribution and replacement rate

The contribution in Belarus is being paid both by the employer as well as the employee. The employee pays a 1% contribution. On the other hand, the employer pays a contribution of 34% (28% for pension benefits and 6% for other benefits). Self-employed people, including notaries and lawyers, are obliged to pay a pension contribution of 29% of income earned, as well as 6% for social insurance (Ministry of Labor and Social Protection of the Republic of Belarus). Usually, the retirement pension in Belarus is 55% of the basic salary before retirement. For every additional year worked, the benefit is increased by 1 percentage point. In the case of working in harmful conditions, the benefit is also increased by 1 pp. This supplement is calculated for men for every year above 10 years, and for women above 7.5 years.

The compulsory social security contribution in Moldova is paid by both the employer and the employee, it is respectively 23% and 6% of the remuneration. The maximum remuneration from which it is calculated is 5 times the average monthly salary. In case of people employed in the agricultural sector, the employer pays a preferential rate of 16% of remuneration, and the employee of 6%. An additional 6% is subsidy from the government (Ministry of Labor, Social Protection and Family of the Republic of Moldova 2015). Self-employed people pay a flat rate. The annual fee is 6732 lei. For owners of agricultural land it is 1584 lei (Casa Națională de Asigurări Sociale a Republicii Moldova 2018).

In Ukraine, since 2004, the pension system is based on three pillars: the base system, the State National Pension Fund of Ukraine, as well as voluntary insurance. All workers as well as self-employed are covered by the mandatory system. In the first pillar, contributions are transferred to the Pension Fund of Ukraine, which are automatically distributed among current pensioners. The system does not expect individual accounts for individual citizens. Funds transferred to the Pension Fund are not invested. They are also not inherited – in case of death, the collected money is transferred to the Pension Fund (Starosta 2015). The employer pays a contribution of 32.2% of the employee's social security contribution. From employees’ remuneration 2% is deducted. On the other hand, people who run the sole proprietorship pay a fee of 33.2% of the minimum remuneration. A part of paid contribution of 7% of the salary goes to the second pillar. It is intended for the State National Pension Fund of Ukraine. These funds are invested, among others to protect against inflation.

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3 The base of contributions cannot be lower than the minimum wage.
4 Persons which worked in harmful conditions before 1.01.2009 can demand the compensation. In this case, the employee may get an early retirement or may require an employer to pay an additional salary or pay higher premiums that will result in a higher benefit in the future.
The amount of the pension in Ukraine is set at 55% of the average wage earned. In every additional year of the internship the retirement pension is bigger about 1 pp, to a maximum 75% of the remuneration. In case of people working in difficult conditions, the pension also increases to a maximum of 85% (Закон України Про пенсійне забезпечення «Відомості Верховної Ради України (ВВР), 1992, № 3, ст.10» Point 19). However, if the person entitled to the benefit does not have a specified length of service, he receives a proportionally lower benefit. Until 31.12.2017, the maximum pension could have been 10,740 hryvnyas.

4. Comparative analysis

Action of the state which were demonstrated earlier, i.e. the statutory retirement age, as well as the amount of paid contributions influence the number of senior citizens and the received benefit. These data will be presented in table 4 and in chart 1 for comparative analysis.

By analysing Table 4 it can be noticed that the largest number of retiree citizens are in the Ukraine. However, it should be noted that their number has been decreasing (over 12 years, the decrease was over 2 million people in absolute number). On the other hand, both in Belarus and in Moldova, the number of pensioners increased by 2 percentage points. This indicates the need to make a decision about pension system reform. Existing decisions to raise the retirement age may turn out to be not sufficient. Particularly because all analysed societies have a tendency to grow old.

In all three countries every year retirement pensions were increased which can be seen in Chart 1. The decrease in 2016 in Belarus is caused by the denomination, which took place on 1 July 2016. Then it is 1 BYN = 10 000 BYR. The highest benefits were received by pensioners in Belarus. The exception was 2016, in which the mentioned denomination was carried out. However, the lowest pensions were paid in Moldova. It was not until 2017 that it was higher than in Ukraine (more than 1 USD). Retirement in Moldova is not high enough. Despite the fact that within 12 years they have increased almost 3 times, they do not allow to cover the minimum subsistence level. In case of men the average pension is almost enough to satisfy the living conditions (99.7%). However in case of women this benefit allows only to cover 81.7%.
Table 4. Number of retirees in thousands of people and structure in population, in 2005-2017

<table>
<thead>
<tr>
<th></th>
<th>Belarus</th>
<th>Moldova</th>
<th>Ukraine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No of retiree, thsd</td>
<td>%</td>
<td>No of retiree, thsd</td>
</tr>
<tr>
<td>2005</td>
<td>2454.0</td>
<td>25.3</td>
<td>620.7</td>
</tr>
<tr>
<td>2006</td>
<td>2444.7</td>
<td>25.4</td>
<td>618.3</td>
</tr>
<tr>
<td>2007</td>
<td>2444.2</td>
<td>25.5</td>
<td>621.4</td>
</tr>
<tr>
<td>2008</td>
<td>2446.0</td>
<td>25.6</td>
<td>619.4</td>
</tr>
<tr>
<td>2009</td>
<td>2454.3</td>
<td>25.8</td>
<td>621.4</td>
</tr>
<tr>
<td>2010</td>
<td>2468.9</td>
<td>26.0</td>
<td>624.5</td>
</tr>
<tr>
<td>2011</td>
<td>2486.9</td>
<td>26.2</td>
<td>627.2</td>
</tr>
<tr>
<td>2012</td>
<td>2512.2</td>
<td>26.5</td>
<td>638.6</td>
</tr>
<tr>
<td>2013</td>
<td>2537.3</td>
<td>26.8</td>
<td>649.9</td>
</tr>
<tr>
<td>2014</td>
<td>2559.7</td>
<td>27.0</td>
<td>659.6</td>
</tr>
<tr>
<td>2015</td>
<td>2592.8</td>
<td>27.3</td>
<td>669.9</td>
</tr>
<tr>
<td>2016</td>
<td>2619.3</td>
<td>27.6</td>
<td>679.9</td>
</tr>
<tr>
<td>2017</td>
<td>2593.7</td>
<td>27.3</td>
<td>691.2</td>
</tr>
</tbody>
</table>


Fig. 1. Average monthly retirement pension in USD, in 2005-2017


^5 Excluding the temporarily occupied territories of the Autonomous Republic of Crimea, and the city of Sevastopol.
The AgeWatch index measures four important items from an older person's perspective. The income security is consists of four factors: the poverty rate of the elderly, the well-being of the elderly, GNI per capita and pension guarantee. Health indicators examine life expectancy at 60, the number of years that person will statistically survive 60 years without major health, as well as mental well-being. Another indicator examines the employment of older people and the level of their education. The last indicator examines the relation between the elderly and the environment. It consists of: personal freedom, access to public transport, as well as social networks and physical security.

Table 5. Position of Belarus, Moldova and Ukraine in the Global AgeWatch Index in 2013-2015

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall index</td>
<td>60</td>
<td>64</td>
<td>64</td>
<td>76</td>
<td>74</td>
<td>77</td>
<td>66</td>
<td>82</td>
<td>73</td>
</tr>
<tr>
<td>Income security</td>
<td>44</td>
<td>50</td>
<td>50</td>
<td>53</td>
<td>63</td>
<td>50</td>
<td>39</td>
<td>43</td>
<td>42</td>
</tr>
<tr>
<td>Health status</td>
<td>80</td>
<td>84</td>
<td>84</td>
<td>71</td>
<td>90</td>
<td>90</td>
<td>77</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>Capability</td>
<td>57</td>
<td>64</td>
<td>66</td>
<td>43</td>
<td>50</td>
<td>50</td>
<td>35</td>
<td>85</td>
<td>44</td>
</tr>
<tr>
<td>Enabling environment</td>
<td>52</td>
<td>44</td>
<td>44</td>
<td>89</td>
<td>76</td>
<td>76</td>
<td>86</td>
<td>85</td>
<td>85</td>
</tr>
</tbody>
</table>

Source: own study based on: Global AgeWatch Index 2013, Global AgeWatch Index 2014, Global AgeWatch Index 2015.

Examing Table 5 we can see that among analysed countries the best situation of elderly people is in Belarus and now it is 64th position, despite the fall from 60th position in 2013. The worst situation is in Moldova, which has also deteriorated in the analysed years. The government must first and foremost improve health indicators, as they have a significant impact on the outcome. In addition, the results of these low satisfaction with public transport services, as well as a poor sense of security. Ukraine is taking the last place among Eastern European countries, despite improving its position by 9 places compared to 2014. Responsible for this are, as in the case of Moldova, a poor state of health, and a sense of security. In addition, the elderly in Ukraine state that they have too little personal freedom (only half were satisfied). Belarus, although it is in the 64th position, also has major problems with the health condition of older people. The best results were obtained in the environment of older people (44th place, the same as in 2014).

6 The life expectancy for a 60-year-old was 17 years on average. However in the Ukraine and of Belarus it was appropriately 18 and 19 years.
5. Conclusion

All three countries must make more thorough reforms to the pension systems that apply to them. Raising the retirement age, as well as increasing the payment period of due contributions may not be enough. Bearing in mind the projections made among others by the UN the structures of pension system should be modified so that every citizen would be aware of the fact that the contributions they pay for during their working life will be transferred to them in the form of a pension. Therefore the state should make citizens more aware of their future. Tax incentives for participating in voluntary pension schemes can be too little incentive, especially in the 30-40 year perspective. Young people should start thinking about their fate by looking at the situation of their parents and grandparents. If more and more people in the society receive their pension the state should provide a minimum of social security, so as not to be overly indebted. Contributions that are collected in analysed countries are relatively high, so their additional increase may result in employees escaping to gray economy or fraud in the recording of remuneration. The increase in labour is likely to result in an increase of unemployment, because employers will have less incentive to hire another person.

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(IN)EFFECTIVENESS OF THE LATVIAN PENSION SYSTEM IN ADDRESSING THE PROBLEM OF POVERTY AMONG THE ELDERLY

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Abstract
Against the EU background, Latvia demonstrates extremely high rates of the at-risk-of-poverty or social exclusion among the population in older age groups 65+ and 75+, as well as the highest levels of income inequality (S80/S20) among the elderly. The country is consistently among the bottom three performers in respect of these indicators, lagging behind its neighbours in the Baltic Sea region. The authors demonstrate what specific elements of Latvian pension system make it an inappropriate instrument in poverty alleviation. In the absence of redistribution mechanisms in mandatory NDC and FDC pension pillars accompanied by relatively high tax burden on pensions, the only systemic element aimed at alleviation of poverty in the old age is the statutory minimum pension, which is not equal to the task.
Delay with the introduction of the minimal income level (proclaimed in 2014) and termination of subsistence minimum calculation since 2014 have also contributed to the deterioration of the situation of the receivers of small amount pensions. Since fundamental changes in mandatory pension pillars (I and II) are hardly practicable, the solution may be found in development of the so called pillar 0 (social assistance) and pillar IV (housing programs, healthcare programs, other formal and informal forms of financial and non-financial support to the elderly), which are also drastically underdeveloped in Latvia.

Keywords: basic protection, NDC, poverty alleviation, public pension.
JEL codes: H55, H75, I32.

1. Introduction
Along with many other countries that undertook fundamental pension reforms in 1990s, Latvia went through an essential reform of its old-age pension system in 1995 by introducing the notional defined contribution scheme, later complemented by mandatory and voluntary private pension funds.
It was anticipated that the modern multipillar system would strengthen the social security of the elderly and bring decent pension benefits to the population. In
reality, after twenty years of the reform being effective, the pensioners in Latvia are among the poorest in the EU.

2. Poverty among the elderly in Latvia

Elderly age in itself places a person at risk of social exclusion (fewer social contacts, deteriorating health, rigidity of thinking, ageism and other prejudices from society, etc.). Similarly, poverty itself makes an individual exposed to this risk, reducing their ability to acquire the goods and services necessary for active social life. The combination of these two factors – poverty and old age – aggravates this risk.

The EU countries assess their progress in the field of social inclusion using Eurostat statistical instruments. The main tool is the aggregate indicator “People at risk-of-poverty-or social exclusion” (AROPE) (Eurostat 2014) – measured in thousands persons or in percentage (as a share of the total number of inhabitants). AROPE rates are calculated both for the total population of a country, and for separate age groups. The rates for older age-groups in Latvia and the average EU rates are reflected on Figure 1.

![Fig. 1. People in the older age groups at risk of poverty or social exclusion in Latvia and EU in 2008-2017, in %](image)

Source: Eurostat.

It should be noted that in the vast majority of EU countries – in 21 out of 28 (i.e. ¾) – the proportion of people exposed to the risk of poverty or social exclusion (AROPE) in the age group 65+ is lower than for the population under the age of 65. The average difference in the ratios is minus 6.5 percentage points: 24.7% in the younger age groups compared to 18.2% among those above 64.
As a rule, the elderly have a stable income in the form of old-age pension, no dependent minors, accumulated some savings and have no mortgages. Only in seven countries the picture is reversed: persons in the age group 65+ are more exposed to the risk of poverty or social exclusion. These are the three Baltic countries (Latvia, Lithuania and Estonia), the European "anti-champion" in the sphere of poverty – Bulgaria, two more countries of Eastern Europe – the former Yugoslav republics of Croatia and Slovenia, and Malta. Of these countries, the biggest gap between groups below and above 65 years is in observed Estonia (20.9 percentage points) and Latvia (18.2 percentage points), while the smallest in Slovenia (1.8 pp).

The relative median income ratio (65+) is the second lowest in the EU (trailing only Estonia, again): 0.63 compared to 0.93 in EU-28 (2016). The highest historical rates were observed in 2011-2012 (0.86 and 0.80 respectively), which was not the sign of fast improvement of pensioners’ wellbeing, but of rapid deterioration of working population incomes. Thus, although the average European indicator showed stable growth by 0.01-0.02 per year, in Latvia in the last decade we see an increase from 0.64 to 0.86 from 2007 to 2011, and then roll back to 0.63 by 2016.

Likewise, as was shown on the Figure 1 above, the share of pensioners exposed to the risk of poverty was also decreasing in 2010-2011. However, the Figure 2, where the poverty threshold (set at the 60% of the median disposable income) is juxtaposed with the average pension level in respective period clearly reveals the nature of the “improvement”.

![Fig. 2. Dynamics of the average old-age pension amount and poverty threshold in Latvia in 2007-2016](image)

Source: Eurostat, Central Statistical Bureau of Latvia.

Considering the two components of AROPE indicator for the elderly: rate of severe material deprivation and at-risk-of-poverty rate (AROP), the following
inferences can be made – material deprivation is decreasing much more successfully than relative poverty risk. While the number of the elderly experiencing severe material deprivation has decreased by 78 thousand from 2007 to 2016, the number of relatively poor seniors with incomes lower than 60% of the median has risen by 11 thousand conversely. This is definitely due to the fact that the very threshold has grown almost twice during the decade: from €168 to €318 per m (rapid growth before the crisis followed by with a sharp dip and then by recovery), whereas the average pension was increasing slower albeit constantly.

Should we attribute the incidence of poverty among the elderly only to the deficiencies in the Latvian pension system? In our opinion, predominantly yes. In 2017, the other social transfers (except for the pensions) helped to reduce the poverty among the elderly by 3.1 percentage points – from 43.0% to 39.9%; in 2016 – by 3.2 percentage points, in 2015 – by 2.8 percentage points. As a matter of fact, the Latvian system of social transfers is among the least effective ones in the EU – see Figure 3 below, which shows the effectiveness of social policies in all age groups in total.

![Fig. 3. Impact of social transfers (other than pensions) on poverty reduction in Latvia and EU in 2007-2016, in %](source: Eurostat)

The underdevelopment of the social protection system is a repetitious subject of the country specific recommendations (CSR) that Latvia receives annually from the EC via Country Reports. Social assistance system is one of the policy areas where the wordings of Commission’s recommendations are repetitious and the reforms are stalled.

Year on year since 2012 the CSR wording remains almost unchanged: “Tackle high rates of poverty and social exclusion by reforming the social assistance system to make it more efficient, while better protecting the poor” (2012), “Tackle high rates of poverty by reforming social assistance for better coverage, by

The Commission’s assessments are absolutely precise, because Latvia has announced some measures but did nothing for their implementation. Therefore in the year 2017 Country Report the EC draws the attention of the authorities in Latvia to the necessity of making actual steps: “Implementation of the recommendations has slowed down in the recent years. Over 2012-2014, Latvia made ‘some’ progress with the overall implementation of the country-specific recommendations, due to reforms initiated under the financial assistance programme, post-programme surveillance and the euro adoption process. More recently, as the economic situation has normalised and external pressure has decreased, the urgency of policy measures has abated, leading to a slowdown in the reform process to ‘limited’ in recent years” (EC 2017, p. 10).

While the coverage of the mandatory old-age pension system is very wide (close to 100%) and in the near absence of other social transfers (as shown above), the key role in the poverty incidence among the old age groups is played by the pension system itself, which is unable to deliver decent standard of living to its participants. Although some of the old-age pensioners are still working and receiving wages in addition to their pensions and some are receiving their pensions from more than one state, nevertheless, to the majority of Latvian old-age pensioners public pensions are their only source of income (except for the financial support from their family members).

3. General description of Latvian pension system

The old-age pension system consists of a state administered mandatory notional defined contribution (NDC) scheme, a mandatory statutory funded scheme (FDC) and voluntary personal pensions. Pillar I is a pay-as-you-go NDC scheme. The amount of the individual pension from pillar I is determined by lifetime contributions paid into the scheme thus accumulating the individual’s notional pension capital. For years of service prior to 1996, notional capital is calculated on the basis of the wage history in 1996-1999 (for those who had low wages in 1996-1999 but have at least 30-year insurance record, the basis is the country’s average insured wage in the reference period).

To calculate the individual amount of annuity at retirement, the aggregate individual pension capital is divided by the gender-neutral average life expectancy at the age when the pension is claimed (G-factor). In this manner Latvian pension formula automatically links the amount of the assigned pensions to changes in life expectancy. That means that persons of the same age and with the same amount
of accumulated pension capital who retired later receive lower monthly pensions. The notional pension capital is annually valorised based on the national wage bill growth, meaning it is affected by the size of the labour force, i.e. fewer working people mean lower valorisation. Pension entitlements are thus affected by demographic changes twice: through valorisation of pension rights during accrual and through benefit calculation upon claiming a pension.

The pensionable age in the mandatory pension system is set to increase from 62 to 65 by 2025 by 3 months every year (starting from 2014). The minimum insurance period to qualify for an old-age pension is set at 15 years and from 2025 it will be raised to 20 years. Early retirement is possible 2 years before statutory pensionable age provided the applicant has minimum 30-years’ insurance record. During early retirement (i.e. before reaching the statutory pensionable age) the pension is paid at the level of 50% of the calculated pension amount. According to the data of State Social Insurance Agency, each fifth newly granted old-age pension is an early one; this option is especially popular among women: 21.3% in 2015 and in 2016, compared to 16.1%-16.6% of early pensions among men. Pensioners, except early retirees, may combine receiving the full pension and income from work that also gives entitlement to periodic recalculation of pension benefit based on additional contributions. Many Latvian pensioners are using this opportunity: 33.6% of all old-age pensioners below 70 y.o. are still working – 36.0% of men and 32.0% of women. In the age group 70-74 the share of working pensioners is more than twice lower – 14.6%, and at the age 75+ continue to work only 4.6% of pensioners (SSIA 2017).

Pillar II is a statutory funded defined contribution scheme, launched in 2001. Pillar II is mandatory only for those born after 01/07/1971. The vast majority of all those born between 01/07/1951 and 30/06/1971 who had right to join the pillar voluntarily have exercised this right. On October 30, 2017, there were 1.272 mln members of the state funded pension scheme and the total worth of assets was ca €3.200 billion. At the same time, a significant part of the members are inactive, i.e. have not made a single payment into the scheme throughout a year: in 2016 inactive members made 22.2% (2015 – 21.8%, 2014 – 20.4%) (SSIA 2016). Since 2009, the proportion of active participants has not exceeded 80%, but before the 2008 economic crisis it was at 87-89%. The large proportion of non-active participants is due to the fact that a large part of Latvia’s population has emigrated abroad and makes no new contributions any longer. The benefit is accrued by transferring part of the social insurance contributions to one of 9 mandated asset managers offering 23 pension plans of three various risk profiles: active, balanced and conservative. At the time of retirement the accumulated capital can be converted into an annuity either by adding it to the first-pillar notional capital or by purchasing a life pension insurance policy.

Pillar III is voluntary, any person and employers can make contributions to a private pension fund: 6 funds offer 18 pension plans. In June 2017, pillar III covered 28.5% of economically active population and predominantly financed from own contributions, with less than 20% of all contributions made by employers and the assets made €410 mln (7.8 times less than pillar II assets). The
share of inactive members is higher than in mandatory funds: 29.5% made no contributions in 2016 (30.3% in 2015, 33.5% in 2014) (Financial Capital and Market Commission). 16% of all assets belong to one pension plan covering just 4.6% of participants: this is the only closed pension fund in Latvia, whose participants are employees of the three state-owned shareholding companies, and contributions are made by the employers, therefore it can be considered as a sort of occupational pension.

The majority of today pensioners are receiving their pensions from pillar I only.

4. A ‘bug’ or a ‘feature’?

We have already studied the reasons why the share of small amount pensions is so substantial in Latvia (Rajevska and Rajevska 2018), and have demonstrated that in the near absence of redistribution mechanisms in mandatory pension pillars accompanied by high tax burden on pensions, the only systemic element aimed at alleviation of poverty in the old age is the statutory minimum pension, which is not equal to the task, being set at disconcertingly low level: €70 - €109 per month (depending on the length of the insurance record). This is the lowest minimum pension level in the EU. The other reasons include the unfair conversion of pre-reform employment record into pension formula, as well as the pronounced income inequality in the working age which is not counterbalanced by any kind of non-contributory (basic) pension component.

But why is the situation exactly what it is? All the above answers provide only “technical” sort of reasoning, pointing to specific features of the design of the pension system is Latvia. But does the today outcome complain with the designers’ vision of pension system? In our opinion, the answer is positive. The right-wing parties that form the Cabinet in the last 25 years continuously, do not consider pension system as an instrument of combatting poverty.

Political elites in Latvia share the individualistic type explanations of poverty, characteristic to liberal and neo-liberal paradigm: the major cause of the poverty is seen in bad behaviour, laziness, lack of will power, lack of thrift nad proper money management and poor moral of the needy individuals (van Oorschott 2000).

Let us consider the definitions of pension system objectives in the political documents of the EU:

The White Paper on Pensions formulates in the following way: “the basic purpose of pension systems is to deliver adequate retirement incomes and to allow older people to enjoy decent living standards and economic independence” (EC 2012, p. 4).

The newly proclaimed European Pillar of Social Rights also contains a special paragraph on the subject: “15. Old age income and pensions. A) Workers and the self-employed in retirement have the right to a pension commensurate to their contribution and ensuring an adequate income. Women and men shall have equal opportunities to acquire pension rights. B) Everyone in old age has the right to resources that ensure living in dignity.”

Similar approach can be found also in the documents of the OECD (OECD 2017), in the articles and books published by the World Bank (Holzmann 2000;
Holzmann et al. 2008; Holzmann 2012), IMF (Shang 2014), ILO (2014), in the works of Barr and Diamond (Barr 2002; Barr and Diamond 2006; Barr and Diamond 2008; Barr 2014), Ebbinghaus (2011), and others. The Latvian Law on Pensions does not enunciate the purpose of the pension system as though considering it as something self-evident. However, the way of understanding the role of old-age pensions by the policy-makers can be derived from the words and deeds of the governmental bodies and officials.

Illustrate, the Latvian Ministry of Welfare, sees the objectives of the pension system in the “provision of long-term financial sustainability” (in the first instance) and in the “adequate replacement rate in accordance with individual contributions” (Alliks 2016; Ministry of Welfare of the LR 2016). Thus, the sustainability of the instrument is supposed to be the main purpose of its existence, as if a pension system has its own inherent value beyond its societal role. Yet “NDC systems [are] in principle automatically sustainable with respect to population aging because the expected changes in the demographic and macroeconomic environment will automatically lower benefits” (Börsch-Supan 2014, p. 146).

Further on, the term “adequate” is applied not to the amount of pension benefit, but to the replacement rate. However, according to the dictionary definition “adequate” means “sufficient for a specific need or requirement”, and a rate itself cannot be adequate or inadequate, when it is not juxtaposed to some real measurand. Until we see changes in the thinking of politicians, Latvia’s pension system will continue to be ineffective in combating poverty.

The masterminds of Latvian pension reform in 1990s, the World Bank pension expert team leaders, have reassessed their then vision of the policy approach to pension system reform, pointing out the necessity to refocus on basic protection for the vulnerable elderly and more realistic views about the capacity of funded schemes to manage risks and about the achievable rates of return (Holzmann 2014, p. 87). While the basic objectives of pension systems – poverty alleviation and consumption smoothing – have remained unchanged, the focus of attention between the two has re-shifted or at least broadened. “The move towards a tighter contribution-benefit link that has characterized many recent reforms of earning-related schemes has limited the capability to redistribute income towards low-income groups within the schemes” (Holzmann 2014, p. 89).

5. Conclusion

Dangerously high rates of the population of Latvia aged 65+ at risk of AROPE – very high on the European background and consistently higher than in neighboring Lithuania and Estonia – are largely explained by the design of the pension system in our country that does not provide for virtually any redistribution mechanisms from the rich to the poor. Thus, the existing risks of poverty and social exclusion, which the individual is exposed to during the working period, are not compensated in old age, but are preserved and aggravated. Low

1 https://www.merriam-webster.com/dictionary/adequate
replacement rates lead to a risk group of those who before retirement were relatively well-off: unlike the absolute majority of European countries, where the risk of poverty and material deprivation in old age is less than before retirement, in Latvia, retirement is associated with a significant increase of these risks. The share of pensioners exposed to the risk of poverty and social exclusion is constantly high and growing. Statutory minimum pensions and old-age social security allowances are very low and not tied to wage levels. Since fundamental changes in mandatory pension pillars (I and II) are hardly practicable, the solution may be found in development of the social assistance programs, as well as housing programs, healthcare programs, other formal and informal forms of financial and non-financial support to the elderly, which are also drastically underdeveloped in Latvia. However, the improvement of social safety nets is retarding, despite of persistent reprimands from the European Commission in the Country Reports. Until we see changes in the thinking of politicians, Latvia's pension system will continue to be ineffective in combating poverty.

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References


THE FINANCIAL ILLITERACY OF LATVIANS UNDERMINES THEIR WELL-BEING IN OLD AGE

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Abstract
An extremely individualized NDC + FDC pension system in Latvia assumes the individuals’ overall responsibility for the amount of their future pension, both in pillar I and II. Meanwhile, specific tax regimes – for the self-employed, for seasonal workers, for workers of the so-called microenterprises – with low social contributions have gained popularity, and the share of the shadow economy is large, eventually leading to the situation when more than a third of all taxpayers pay social contributions from the base lower than the statutory minimum wage. In many cases they do it without realizing that their future pensions will also be minimal. For the pillar II, this is aggravated by the fact that more than three-fourths of the participants do not control the profitability of their savings in pension plans. Although Latvian legislation allows changing pension plan and fund manager, more than 90% do not use this opportunity, and almost half of those who use it have done so under the influence of advertising, rather than rational thinking. The pillar II share in public old-age pension benefits in the course of time will constitute an increasingly significant part. In Latvia, all persons born after June 1971 are mandatory participants of pillar II pension funds, as well as the majority of those who were given the opportunity to join them voluntarily. Having shifted responsibility for their future pensions entirely to workers, the state and fund managers could take a more serious part in their financial education.

Keywords: financial literacy, insured wage, mandatory funded pensions, NDC.
JEL codes: H55, H75, J32.

1. Introduction
Pension reforms in the second half of 1990s in Eastern Europe to a large extent were inspired by the World Bank path-breaking publication "Averting the Old Age Crisis" (The World Bank 1994), that introduced the concept of multi-pillar pension system and actively propagated the substantial shift to privatisation of mandatory pensions. It was anticipated that this shift would bring along higher rate of return under individual accounts and better labour market incentives. Mandatory funded pillars (II pillars in the World Bank terminology) based on financial defined contribution principle (FDC) have been introduced in many countries, including Latvia (since 2001).
The scholars had warned, however, that “individual funded accounts leave the individual facing most of the risk, in particular from differences in pension fund performance” (Barr 2002, p. 31) and that the majority of individuals are not fully aware of the risks, as they “can be myopic and/or imperfectly informed, giving a justification for compulsion” (Barr 2006, p. 65).

In the case of Latvia, individual pension accumulation accounts exist not only in the funded pillars, but also in the pay-as-you-go public pension pillar that is built as a notional defined contribution (NDC) scheme. Lack of any flat rate component in pension formula, where the benefit is depending fully and completely on contributions, deprives the lower-income groups of population (who at the same time are less informed and less educated groups) of the traditional safety net mechanisms of conventional pension systems.

A knowledge-based welfare state presupposes participation of enlightened individuals in social security schemes, including public and private pensions. Such individuals should be able to make informed decisions with long-range planning horizon. Although the average level of financial literacy among Latvians is relatively high (Rajevska and Stavausis 2015), their knowledge of the national pension system and long-term investment planning is not sufficient.

2. Retirement planning in Latvia

2.1. Pillar I (pay-as-you-go) – Notional Defined Contribution

The very concept of NDC, which imitates the FDC, roots in individualized accounts, where each participant accumulates their own notional pension capital. The role of annual interest rate is played by vaporization coefficients, calculated as the annual increase of the total insured wage in the country; and at the moment of taking the retiring, the accumulated capital is annuitized by dividing by the average remaining life expectancy. The insured wage is different from the “normal” salary (gross or net), since the first accounts also for sick leaves, unemployment benefits, maternity benefits, from which social contributions are made as well. And, which is even more important, for some categories of employed – the self-employed, patent workers, seasonal workers, employees of the small companies with special tax regimes (the so called “micro-enterprises”) – their insured wage can only be only a small fraction of their work income.

As a result, pension benefit depends on many factors, the most part of which are beyond control of a prospective pensioner, and if there is more than 5-10 years left to retirement, one can hardly make an accurate estimation of its size on their own.

Senior economist at the Swedish National Social Insurance Agency (the country where the NDC model had been elaborated), Annika Sunden pointed out that “individuals often have limited financial knowledge and know little about the characteristics of their public and occupational pension plans or how much to expect in retirement benefits. This could mean that many workers reach retirement with inadequate resources and as a consequence will need to postpone retirement or lower consumption in retirement.” (Sunden 2006, p. 325). The formulae used
in defined benefit schemes are, normally, quite straightforward, making it easy for a worker to estimate the expected benefit and to compare the replacement rate with the advice provided by financial planners about how much of preretirement earnings should be replaced to maintain living standards in retirement. Even when more complicated formulae are applied, it is easy for pension administrators to calculate replacement rates and communicate this information to beneficiaries. Sundén stresses, that, in defined-contribution schemes (both funded and notional), benefits are not defined but depend on contributions and it is difficult to express the expected benefit in terms of a replacement rate. It is also difficult to estimate benefits because they vary with the rate of return.

Yet when the state does its best to translate the formulae into “understandable” figures, the people seem not to be fully aware of their meaning. She instances a Swedish experience with so-called “orange envelopes” – annual account statements sent out to all participants of public NDC and FDC schemes starting from 1998, since the new pension system had been implemented. These statements include information on the account balance; pension credits earned during the year, and the indexation of the account balance – that is, the rate of return. The orange envelope also includes account information on the Premium Pension (pillar II – funded defined contribution scheme). In addition to providing information about expected (projections for three different retirement ages – early, normal and deferred retirement), the orange envelope summarizes how the reformed pension system works and promotes the main message that lifetime earnings determine benefits. In 2003, only about 10 percent of respondents looked at all of the information in the envelope and less than half of all participants look at the benefit projection. The level of complexity of the schemes implies that the costs associated with understanding the pension scheme could appear greater than the benefits, even if information is available. Moreover, “retirement is seen as something unpleasant and a cause for worry, which means that thinking and planning for retirement, can also involve psychological costs”. However, six years later she identified sufficient progress in Swedish respondents’ knowledge and understanding and attributes it to persistent educational campaign (Sunden 2013).

Information and education leading to improved financial literacy clearly is important, but perhaps equally important is to design pension plans that make it easy for participants to make decisions.”

Before 2009, State Social Insurance Agency (SSIA) in Latvia was also annually sending out notices on the accumulated notional pension capital by post, albeit those notices did not include information on pillar II as well as any pension benefit projections. In crisis years, postal dissemination of the notices was abolished for the sake of austerity budget, and had never been resumed. Presently, the inhabitants of Latvia are offered such notices on request free of charge, but only electronically. Therefore, the person ordering a notice should have either electronic signature or internet-bank electronic identification. The procedure is not intuitive for rare internet users, and few prospective pensioners are regularly checking their notional accounts.
And even though, there is no full information in one notice sufficient to make an estimation of the size of future pension. An interested person should take a number of further steps. The website www.manapensija.lv (“my pension” in Latvian language) maintained by the Central Depository of Latvia, from the end of 2013 contains pension calculator\(^1\), which asks users to input data from three different sources into empty fields (having previously received these data via internet-bank and on the portal of electronic government services), and then makes a forecast based on very optimistic assumptions:
- that a person shall not have breaks in income until retirement;
- that a person shall not have a fall in the wage level until retirement;
- that inflation rate shall be 2% per year, and salaries shall grow by 4.21% per year;
- that notional capital shall grow by 3.53% per year (that is, real growth by 1.53% taking inflation into account);
- that financial capital in pillar II and III shall grow nominally by 5.06% per year (i.e., 3.06%, taking inflation into account).

The calculator does not contain an option to make estimations in case of taking early or postponed retirement.

Current experience does not justify these assumptions: for the period from 2003 to 2016, the average annual yield in [mandatory] pillar II pension plans was 3.95% (and taking into account inflation in was even negative: -0.43% per year), the average nominal annual yield in [voluntary] pillar III pension plans in the period from 2011 to 2016 was 3.35% (the real one – 2.06%) (Better Finance 2017).

The historical rates demonstrated by pillar I (NDC) looks better: the average annual “yield” in notional capital from 2003 to 2016 was 10.6% (inflation-adjusted average rate – 6.54%), which is much higher than the figures projected for the future. However, such high rates were possible mainly due to the favourable demographic situation for capital valorisation indices: large generations born in the 1980s were coming to the labour market, while less numerous generations of war and post-war years were leaving it; and on top of this their retirement was slowed down constantly by gradual increase of the retirement age. Now the situation is turning upside down – not so many children were born in the 1990s and 2000s, and the retirement age of a large generation of baby-boomers is approaching.

Nevertheless, even such a highly optimistic calculator returns projections of the total pension (pillar I + pillar II) amounting to 45-48% of the (last) salary. More realistic calculations predict replacement rate at the rate of 35% of the last salary from the two mandatory pillars (Kreicbergs 2017).

The current aggregate replacement ratio in Latvia is the second lowest in the EU: 0.42 as opposed to 0.58 EU-28 (figures for 2016) (Eurostat), and is expected to decrease further.

The survey conducted by the author earlier showed that the majority of the inhabitants of Latvia have a poor idea of the pension replacement rate and are

\(^1\) http://www.manapensija.lv/en/pension-system/calculator/
unaware of how much would they have to earn in order for the desired pension amount to become reality. Most of the respondents supposed that their pension would be equal to 60-65\% of their net salary. This view is widespread among population irrespective of region, gender, educational level (Rajevska et al. 2014, p. 38).

This is common that the expected replacement rate exceeds the actual one estimated by mathematical calculations. Thus, a recent study in the Netherlands (van Dujn et al. 2013) demonstrated that the largest discrepancies were found for younger cohorts and for individuals with less education and working experience, and the mismatch is mostly related to poor institutional knowledge. Inflated expectations are characteristic also to Italians (Botazzi et al. 2006) and Estonians (Mattson 2014).

2.2. Insured wage – differences among employment and tax regimes

Another problem, associated with the Latvian NDC system, is the use of the „insured wage” amount, and not on the gross or net wage. For persons under a regular taxation regime (regardless of employment contract) the insured wage is equal to the gross wage, whereas it is significantly lower for the self-employed, patent workers and seasonal agricultural workers. In the long run, therefore, these special tax regimes dramatically undermine both the current and the future social security of those involved, as the amounts of old-age pension primarily depend on the paid contributions (which are, in turn, assessed on the base of the insured wage).

In 2017, the total rate of social insurance contributions for standard workers was 34.09\% of the gross wage (which, in their case, is also the insured wage). The largest part of contribution income is directed to pension insurance: in 2017, this represented 24.54\% of gross wages, with the remaining 9.55\% divided among five other social insurance areas.

The self-employed may freely select the fraction of income from economic activity from which they make social or make no mandatory social contributions at all if they prove that their income was lower than the minimum. Honoraria and royalties were not subject to social contributions until 2018. The insured wage of the employees of microenterprises could be several times lower that their net income from work, etc.

Since the self-employed, and natural persons paying patent fees pay social insurance contributions only on a fraction of their wage/income, their accumulated pension capital is meagre, which will result in very small pensions in due course. However, this will not affect individuals soon, since those retiring over the next 3-5 years, as a rule, will have sufficient rights acquired before the current system was introduced.

The director of the Direct Taxes Department of the Ministry of Finance has revealed that in 2016 31.2\% of social insurance contributors were making payments from a base below the minimum wage: these were part-time workers with monthly wages below the statutory minimum, patent workers, and most micro-enterprise employees. The majority of the self-employed prefer to make
contributions at the lowest possible level, which is the statutory minimum wage. This situation threatens the sustainability of the social security budget. The level of contributions paid by micro-enterprise employees was so low at that time that they would need to work three times longer than regular taxpayers to accumulate the notional pension capital sufficient for just the minimum statutory pension (Kalâne 2016).

Many of these people are not fully aware of the dramatic consequences of such type of tax avoidance for their future old age well-being, while in some cases it is a coerced choice under the pressure of the employer. The regulation of social insurance contributions base for the non-standard employment types and special tax regimes started to be revised in the last two years in order to strengthen the financial security of those groups, but still they are much more vulnerable to old-age poverty.

2.3. Pillar II (funded) – Private Pension Funds (Defined Contribution)

The population knowledge about functioning of pillar II is very far from an adequate one, as well. Participation in pillar II pension funds is mandatory for certain age groups: in 2018, all who are younger than 48 years are mandatory participants and almost all residents of working age above 48 are voluntary participants of one of the 23 private pension plans offered by 8 fund managers; voluntary participation cannot be terminated as there is no possibility to opt out of the scheme.

It is anticipated that individuals would take their own responsibility and choose:
- investment strategy: conservative, balanced, active or aggressive – depending on the permitted proportion of shares in the portfolio;
- pension plan manager – there is a possibility to change the fund manager for another once per year and to change the investment strategy (“pension plan”) within one fund twice per year);
- the ways of withdrawal the pension upon reaching the retirement age: buying a life insurance policy or adding the accumulated capital to pillar I pension.

It is also anticipated, that the choices made by the participants would be rational and based on their deliberate analysis of the market and after careful consideration. However, the previous international research has demonstrated that such assumptions are patently false (Brown 2014).

In Latvian practice, likewise, those assumptions prove unsounded: for instance, those who join the system for the first time are automatically allocated in a random manner to one of the conservative pension plans (i.e. those not having shares in their portfolios), which is the least effective way of building up pension savings in the start of working life. Despite of recommendations based on successful experience of other countries (Stavausis 2015), life-cycle investment strategies are not allowed by Latvian legislation.

Although change of the pension plan is not complicated in Latvia and no redemption fee is charged, more than 90% do not use this opportunity, and almost half of those who use it have done so under the influence of advertising, rather than rational thinking (SKDS 2015).
In spring 2016, SIA “Aptauju Centrs”, commissioned by the Advanced Social and Political Research Institute of the University of Latvia, conducted the public opinion poll “Mastery of Life and Information Literacy” for the country Human Development Report (Holma 2017). The author of this paper has specifically studied the answers of the respondents to the question whether they control the profitability of their pillar II pension savings – this question was a part of the “financial literacy” sub-group of questions (Rajevska 2018 [forthcoming]). The survey revealed, that 76.8% of those respondents who claim to have participated in pillar II pension funds do not control the profitability of their pension plans, and only 32.2% of those who control do it annually. The very breakdown of the answers demonstrates lack of financial literacy: 31.8% of the respondents aged 65+ have chosen the answers “I do not control” or “I control annually”, although the only valid answer for this age group would be “I do not have a 2nd pillar pension account” (because they were not even allowed to join pillar II). On the other hand, there are respondents of younger age groups (below 44 years), who are working and who have chosen the answer “I do not have a 2nd pillar pension account”, while they are enrolled in pillar II pension schemes automatically. The analysis shows no difference in answers of Latvians and non-Latvians, men and women, having and not-having minor children. There are statistically significant differences between the answers of respondents from different regions, of different educational level, age, working in public or private sector, etc. The respondents’ answers also correlate with their self-reported locus of control and ability to critically assess the information found and to compare information sources.

An international research (Lusardi and Mitchell 2011) has shown that persons with higher levels of education – who, as a rule, have higher incomes and therefore make larger contributions to pension funds, – are better informed in financial matters and are less vulnerable to risks of choosing an inappropriate investment strategy. Less educated persons, whose incomes are lower, are more exposed to the risk of making a wrong investment choice. In this context, funded pillars are rendering a disservice to lifetime poor, causing further distortion in income distribution in old age.

3. Conclusion

Pension system in Latvia imposes responsibility for the future pension on individuals, both in PAYG and funded pension pillars. Low interest demonstrated by the population to the performance of state funded pension plans demotivates fund managers from competition and undermines the future adequacy of funded pension component. Meanwhile, the complexity of pension formula in the public NDC scheme, existence of socially precarious tax regimes, and insufficient information not allowing individuals to make grounded estimations of the size of their future pensions lead to further loss of workers’ trust in the national pension system, preserving the background for tax avoidance.
Improving financial literacy in the field of pensions is needed to enable people make informed choice of financial services for their future wellbeing.

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The financial illiteracy of Latvians undermines their well-being in old age


EUROPEAN EXPERIENCE IN UKRAINIAN PENSION SYSTEM’S REFORMING

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Abstract
Global economic, social, demographic, scientific and technological changes influence the pension systems. Despite that current problems of Ukrainian pension system aren’t as deep as in some countries of East Asia and the Pacific region, India, several Latin America’s countries and Albania, Ukraine faces the need of pension system’s reforming. In this case, by the authors’ opinion, Ukraine has to focus on leading European countries’ experience. That's why, the aim of the article is to consider advantages and disadvantages of pension systems of Denmark, the Netherlands, Switzerland, the United Kingdom and Poland, to analyze the needs of Ukrainian pension system's reforming in current changing conditions, to discover its main problems and find the best possible ways of their solution, according to existing European experience. The article contains of introduction, three main chapters, in which history and current state of pension systems’ development are analyzed, several leading European pension systems are discussed, and Ukrainian pension system model is researched, and conclusion.

Keywords: old-age dependency ratio, pension index, pension scheme, pension system, professional system.

JEL codes: J26, J32.

1. Introduction
Global economy changes the sustainability of pension systems. Fast economic and social changes influence the demographic situation. Scientific and technological progress stimulates expected lifetime and quantity of the elderly. The aim of pension systems reforming is to restructure the existing schemes and to meet the needs of new social-economic situation. In order to investigate possible opportunities of best pension systems’ reforming application in Ukrainian reality the advantages and disadvantages of pension systems of Denmark, the Netherlands, Switzerland, the United Kingdom and Poland were analyzed.
The reasons for Ukrainian pension system’s reforming were outlined, its detailed analysis was carried out, main problems and the ways of their solution were identified.

2. History and Current State of Pension Systems’ Development

Modern pension system developed significantly during the last two centuries due to the provision of decent living standard for people after retirement age. Although elderly support institutions appeared long ago, they were isolated, provided the occasional support for a small part of the population and existed on the charity basis (free lunches in ancient Rome, organization of single elderly people settlements (Caesare 370), shelters for the elderly (Rome, VI century)). Other institutions were created only for a small part of the population: military pensions from Julius Caesar, pensions for special merits (champions of the Olympic Games), pensions for monarchs, wealthy individuals. Several countries had introduced social insurance schemes to cover the risks of workers' old age in certain sectors after the industrial revolution (Heijdra and Romp 2009).

The fundamentals of the modern pension system originated at the end of the 19th century and developed in two directions: the solidarity system and the support of pensioners on property status basis. Otto Bismarck introduced solidarity system in Germany in 1889. The arguments for solidarity system introduction were universality, self-sufficiency, lack of de-incentives to work and savings. In 1891, Denmark began to introduce the support for retirees on property status basis. The benefits of solidarity system were a small amount of retirement income and increased effectiveness in combating poverty (Kolmar 2007).

All state pension schemes, at the same time components of state pension systems, were moderate and provided income in the amount of 15-20% of the average salary, at the first half of the 20th century. Life expectancy after retirement was only a few years at that time. Such moderate income-based pension payments in Scandinavian countries and countries of the British Commonwealth of Nations reflected the true objectives of state pension schemes, which provided minimum funding to reduce poverty (Groezen et al. 2009).

The period after World War II was characterized by an increasing trend in population and real wages. Therefore, population coverage by state pension provision and the amount of benefits increased in the 1960s, due to pension system’s component addition, which depended on salaries’ amount. This was the case for many countries: the USA, Canada, Switzerland, the Netherlands and Sweden, where state pension programs in the 1960s and 1970s had significantly reduced poverty. Such enthusiasm for the improvement of state pension programs in the above-mentioned countries had rapidly spread to developing countries (Herce 2003).

At the beginning of the 21st century still there are countries with a significant population part not covered by pension provision. Coverage levels in South Asia are the lowest in the world. The fragmentary pension system of India gives hope for a pension for 12% of the population (Kaushal 2014).
Another 15-20% of people, who have reached the retirement age, can count on support through programs for the protection of the poor. Pension insurance in the countries of East Asia and the Pacific region is heterogeneous. The lowest coverage rates for retirement benefits are in Indonesia (30%). Only recently, pensions have been introduced for the rural population of China. In Africa, the average retirement benefit covers less than 1/5 of the population. Others have to rely only on their own resources and informal support in the elderly. Low levels of retirement benefits are also typical for some Latin American countries – Bolivia, El Salvador, Peru (10-15% of able-bodied) (Williamson 2001). Even in Europe there is a pension system (Albania) with a coverage level of pension provision of 32% (Groezen et al. 2009).

In most developed countries, the size of public pensions is insignificant. For example, in the United States, Great Britain, Canada, Ireland, the state provides insufficient level of labor income’s replacement. In general, individuals with an average or slightly above average incomes can count on a state pension of 20-40% of their salary (Thomas et al. 2014).

Consequently, the people, who are not covered by the pension system, survive depending on the opportunities and circumstances. In agrarian countries, they mainly rely on their own resources and informal support in the elderly. Another old tool, which is actively used today, is savings. By examining developed countries’ pension system, especially with the small size of the state pension, it be seen, that incomes’ increase in the elderly is possible only at the expense of voluntary pension insurance (Creedy et al. 2015).

Modern pension systems are improved practically all over the world, and first of all in countries with highly developed social relations. This is due to the aging population trends. Therefore, together with retirement age raise fundamentally new pension systems, which disperse social risks and weaken their influence, are introduced (Alda 2017).

Consequently, multilevel pension system is widely used in the world practice. It has three components (levels) – solidarity (first level), compulsory cumulative (second level) and additional or voluntary cumulative (third level). Such combination ensures social guarantees and financial stability of the pension system. Solidary and cumulative systems are exposed to various risks. First one is vulnerable due to demographic risks and is fairly resistant to inflation. Second one conversely is weakened by inflation and stable to demographic risks. The reformed solidarity will take into account the interests of the poor, while the accumulation will stimulate the retirement savings of all citizens, especially higher incomes owners (Staveley-O’Carroll and Staveley-O’Carroll 2017).

3. Analysis of Several Leading Pension Systems of Developed Countries

It should be noted, when analyzing the world's pension markets, that researchers consider several pension markets to be progressive. These are the pension markets of Australia, Denmark, Japan, the Netherlands, Switzerland, the United Kingdom and the United States (Thomas et al. 2014).
Pension systems features from some of the above-mentioned countries will be reflected in detail.

At the beginning of 2018, Denmark's pension system has been a leader for more than 5 years in a ranking of pension systems in the world. Denmark has scored 80.5 points according to the latest study of “Melbourne Mercer Global Pension Index 2017” (MMGPI), which has already been conducted 9 times by the Mercer consulting firm in collaboration with the Australian Center for Financial Research (Melbourne Mercer Global Pension Index 2017).

Denmark's multi-level pension system includes a national old-age pension (people's retirement benefits) and a much smaller supplementary pension. The national retirement pension, the amount of which is almost two thirds of all retirement income, is compulsory, non-taxed and funded at the expense of the general taxation based on the “you pay” principle. The first pension level has a number of benefits, including the effective purchasing power of retirees, which increases with age-based tax reductions. At the second retirement level, there are professional pension schemes based on collective agreements. These schemes, in various sectors of the economy, cover about 90% of wage-earning workers with benefits reflecting contributions and investment returns (Thomas et al. 2014).

The second level involves Danish statutory pension schemes. These are supplementary pension insurance schemes, which are regulated by Danish legislation and governed by Danish Labor Market, where contributions are shared between the worker and the employer. Danish compulsory occupational pension schemes are based on collective agreements provided by social partners. The coverage of these schemes is almost universal. Denmark's pension system also includes private pensions – voluntary, supplementary pension schemes usually managed by banks or insurance companies.

At the third level, there is a wide range of voluntary, individual life insurance and retirement plans with ambiguous coverage and different scales. Savings schemes on the third level generally end with one-time payments without an annuity obligation.

The main feature of Danish pension system is stability, which includes general savings and pension security. The state retirement age is now 65 years old and will gradually increase to 67 years in 2019-2022, due to the improvement of living conditions and the aging of the population. The problems of the modern Danish pension system are following. Pension system is rather complicated, due to the targeting of income testing, which leads to high and differentiated marginal tax rates for various pension savings and reduces transparency. Part of people does not have their own savings. There is an insignificant state pension payments level (aggregate replacement rate is 0.44) (Melbourne Mercer Global Pension Index 2017).

Despite the above mentioned problems, Denmark’s pension system is considered to be the one of the best pension structures in the world. Mercer notes that Denmark has a “first-class and reliable pension system” that “is sustainable and has a high level of integrity” (Melbourne Mercer Global Pension Index 2017).
The Netherlands is known for the reliable multilevel pension system. According to MMGPI, the Netherlands scored 80.1 points from 27 countries in the world (Melbourne Mercer Global Pension Index 2017). Algemene Ouderdomswet (AOW), the principal Dutch state-funded pension, provides a generous payment of monetary compensation to all individuals, who have reached the statutory retirement age and have lived in the Netherlands for 50 years at the age of 15 to 65 years. A broad system of accumulated occupational pension schemes agreed by collective agreements covers 91% of eligible employees. Professional pension schemes usually provide benefits. These benefits combined with a public pension (AOW) represent around 70% of the average wage after 40 years of employment (Chen et al 2014). In general, the Dutch pension system is based on the AOW, which is the main state pension system funded by the “you pay” principle. The current retirement age is 65 and will increase to 67 years by 2021. The Netherlands pension system also provides nationwide pension schemes, company schemes and insurance contracts. Although legislation does not oblige employers to offer pension schemes to employees, employment contracts cover 91% of employees (Chen et al 2014). In addition, the Dutch pension system has won interest in recent years by individual savings schemes.

Hence, Dutch pension system is a genuine multilateral system that provides retirees with payments from all three levels, which include fixed-rate public pensions (AOW), professional pension schemes established under collective agreements and individual benefits established on the basis of individual savings. In our opinion, the Netherlands pension system will continue to work well in the future due to the active and timely actions of the government, despite a number of problems. The cost of pensions for the first and second pillars is increasing. It is forecasted that the dependence on old age coefficient (parity ratio of 65 years and older population to the share of 20-64 years population) will increase from 28 in 2013 to 52.5 in 2060, although these tendencies are slightly below the EU-27 average (Melbourne Mercer Global Pension Index 2017). There is a partial loss of confidence to the occupational pension system due to its vulnerability to financial market fluctuations and increased attention as well as resources to promote the employment of the elderly.

Swiss pension system consists of three levels. The first level is mandatory state pension insurance. The current statutory retirement age is 65 years for men and 64 years old for women. 65 years old retirement age for men and women is scheduled to be in 2020. The second level is high-paying professional system. It is obligatory for all employees, whose annual income exceeds the minimum level. The third level is voluntary individual retirement savings facilitated by tax regulation.

Swiss professional market is clearly regulated in terms of investment constraints and regulatory criteria. Legislation requires pension funds to return a minimum percentage of statutory minimum levels of contributions. The current minimum interest rate set by the Federal Council has been reduced from 1.25% in 2016 to 1% in 2017 (Thomas et al. 2014).
European experience in Ukrainian pension system’s reforming

According to MMGPI, Switzerland scored 67.6 points in total and belongs to the “B” group (Melbourne Mercer Global Pension Index 2017), which includes countries with good pension systems, but differs from group “A”, since some elements of the pension system have to be improved. Thus, Swiss three-leveled pension system, which is characterized by a highly paid professional system, is based on one of the leading pension markets in the world. In today’s dynamic conditions, the Swiss pension system is almost unchanged, although it requires close attention from the government in connection with the aging of the country’s population.

In the past, the United Kingdom was characterized by a pension position, which combines “one of the least generous state systems in developed countries” with the most developed voluntary agreements. Since that time, there have been many changes. The series of reforms increased the attention to the responsibility of a person for its pension’s future.

In general, British pension system can be summed up as follows. There is a state pension. It is based on “you pay” principle. The payment is made from today's income. Additional state secondary pension (S2P, formerly SERPS) provides income for those employees, who have not signed the contract. Also, there are professional pension schemes. They are financial arrangements provided by private companies and employers of the public sector. Since October 2012, the government has begun to apply an automatic enrollment of employees to retirement schemes. According to the schemes employers have to register qualifying pension schemes. Personal pensions include group personal pensions and stakeholders’ retirement benefits. The government introduced the reform of the state pension system together with the Pension Fund in 2013-2014, permitted by the Royal Decree of May 14, 2014. These changes meant the replacement of the current basic state pension and supplementary state pension by one higher-based level pension from April 2016.

The current retirement age (SPA) is 62-63 years for women and 65 years for men and will continue to change, while Britain continues to align the state retirement age for men and women. The 2011 Pension Insurance Act provides the establishment of a state retirement age for women up to 65 years by 2018 and for men and women up to 66 years from 2018 to 2020 (Chen et al 2014). In future, the state retirement age will be reviewed every six years and increased according to events and probable life expectancy.

Based on the results of MMGPI, the UK pension system gained 61.4 points and is part of the C + group (Melbourne Mercer Global Pension Index 2017), which means the existence of a number of good functions in the retirement system along with serious risks and disadvantages that need to be resolved. Researchers believe that without these improvements, the effectiveness and/or long-term sustainability of the British pension system can be doubted.

The United Kingdom belongs to a group of Member States, which predict an increase in the age dependency ratio below the EU-28 average. During the period 2013-2053, the ratio of this coefficient, depending on age, will increase by 16.4 points (EU-28: 24.6 points) (Melbourne Mercer Global Pension Index 2017).
Summarizing the review of the British pension system, we note that reducing the poverty of the elderly in the short term and efforts to increase pension loans should be a priority for the government and will enable to maintain leadership among the pension markets of the world.

While analyzing the reform of Polish pension system, we note that after the pension reform in 1999, the general pension system for people born after 1948 consisted of two levels. The first is the non-funded scheme of NDC, operated by the Institute of Social Insurance (Zakład Ubezpieczeń Społecznych, ZUS). The second level is the fully funded scheme of open pension funds (otwarte fundusze emerytalne, OFE) managed by private investment companies – general pension societies (powszechne towarzystwa emerytalne, PTE). Since 2014, membership in the second level has become voluntary. All members of the OFE have had the choice either to partially pay their contributions to the pension fund, or to direct the entire contribution to the NDC accounts in ZUS. Regardless of the choice, 10 years before the retirement age, the accumulation set in the second level is gradually transferred to NDC2 (so-called creeping mechanism), in order to protect it from the risk of the financial market. Thus, both public and private elements of the Polish pension system are based on the principle of defined contributions (Égert 2013).

In the ranking of pension systems, according to the results of MMGPI, Poland occupies 19th place with a total score of 55.1 and belongs to the C group of countries (Melbourne Mercer Global Pension Index 2017). Pension systems of these countries are characterized by good functioning pension systems and serious risks and/or disadvantages to be settled, due to the risks of long-term sustainability. Pension manager at Mercer in Poland Andrzej Narkiewicz says that the Polish pension system has not changed since the 1999 pension reform in a way that could improve the situation for future pensioners, according to international standards.

As of the beginning of 2018, the Polish pension system is in a transitional period. The analysis of indicators relating to the current situation of pensioners clearly shows that recently paid pensions provide adequate protection against monetary poverty. The average income of people in the age group of 65+ is similar to the income of people under the age of 64. The income of pensioners aged 75 and over is improved through care provided at the age of 75 to improve the adequacy of pensions for this group (Melbourne Mercer Global Pension Index 2017).

It is forecasted that in Poland the dependence on old age coefficient will rise from 22.3 points in 2013 (EU-28: 30.3 points) to 61.0 points in 2053 (EU-28: 54.9 points). Poland is also a member of the group of Member States, which predicts an increase in the age dependency ratio, which is higher than the average for the EU-28. During the period 2013-2053, the ratio of old age to age will increase by 38.7 points (EU-28: 24.6 points) (Melbourne Mercer Global Pension Index 2017). Thus, the Polish pension system is a two-leveled one and is still in the process of reforming, although it has made great success in ensuring decent retirement. The only condition for getting a pension is the age. The statutory retirement age is gradually increasing from 2013, starting with 60 years for women and 65 for men.
Every 4 months, it increases by 1 month to reach the age of 67: this will happen in 2020 for men and in 2040 for women. Such changes are due to such European tendencies as aging of the population and increasing life expectancy.

4. Ukrainian Pension System Model’s Research

Under the current conditions of market relations’ development and European integration processes Ukrainian socio-economic policy is required to be directed towards the achievement of European life quality standards.

Pension reform in Ukraine is a continuation and an integral part of country’s economic reforms. Also, it is a consistent implementation of previously adopted legislative acts. The analysis of the world pension systems gives the opportunity to analyze the advantages and disadvantages of each system and reform the pensions system, depending on the current conditions of the country.

In June 2017, the Government of Ukraine faced an acute problem of unpopular pension reform. The reform envisaged the formation of a three-leveled pension system. At the beginning of 2018, Ukrainian pension system consists of three levels. The first level is the solidarity system. Contributions are paid by all working citizens and their employers. In the current period these contributions are spent on payments to pensioners. State budget subsidies are provided. The second level is the accumulative system of compulsory state pension insurance. It is based on the principles of accumulation of insured person’s funds in the accumulation fund or in the corresponding non-state pension funds. The third level is the system of non-state pension provision based on the voluntary participation of citizens, employers and their associations in the formation of pension savings in order to receive pension benefits on conditions and in the manner prescribed by the legislation on non-state pension provision (Ptashchenko and Topol 2014).

The main problems of Ukrainian pension system at the present stage are the following. Low retirement age with early retirement opportunities is available to many citizens. In Ukraine, the average retirement age for men is about 58.5, for women it is 57.5 years. The average retirement age for the EU is 63.6 for men and 62.6 years for women.

In Ukraine, there are more than 12 million pensioners. It is about 30 p.p. of the population (Ptashchenko and Topol 2014).

There is a significant deficit of the Pension Fund. It is UAH 140 billion or 6 p.p. of GDP as of 2017, which is the second largest deficit of the pension fund in Europe compared to the size of the country's economy (Ptashchenko and Topol 2014).

The government is taking several steps to overcome the above-mentioned problems. In particular, new pension system is characterized by the distinction between the concepts of full employment experience and insurance experience. The latter is understood as a period of experience since 2000, when the introduction of a pension insurance system began in the country and a separate “pension history” was made on each citizen. From January 1, 2018, person needs to have minimum “new” insurance record of 15 years (with a general insurance
record of at least 25 years) to obtain a pension, with a gradual increase in a year until it reaches 35 years in 2028. Citizens, who have reached the age of 60 years and plan to retire, but have insufficient period of insurance, could make compensation of one to five years employment experience value by contributions to the Pension Fund, which should ensure social justice, in accordance to the current law. Such step will automatically increase the retirement age and accordingly reduce the number of retirees in the country.

The second step is to fill the Pension Fund of Ukraine (PFC), whose deficit in 2017 amounted to 140 billion UAH (Ptashchenko and Topol 2014). Based on the experience of European countries, the pension system of Ukraine should have a pension calculating depending on contributions made by a person throughout its life. If an individual does not make contributions to the pension system and then requires retirements’ payments from it, it is unfair to the regular payers. In our opinion, the problem of filling the PFCs can be solved by ensuring transparency of the economy and encouraging Ukrainians to participate in the pension programs of the second and third pillar of Ukrainian pension system.

It is impossible to analyze Ukrainian pension system by the Melbourne Mercer Global Pension Index 2017 because it has not been investigated in this rating.

5. Conclusion

Summarizing the above, we note that the Government of Ukraine, based on the experience of European governments, should ensure further reforming possibility of Ukrainian pension system through the following measures. Pension Fund of Ukraine should implement the investment activity and create cooperation conditions between non-state pension funds and insurance companies. European experts should be attracted in order to use the experience of effective pension programs. Public confidence strengthening conditions in non-state pension funds and insurance companies should be created due to their vulnerability to financial market fluctuations. Attention and resources amount to promotion elderly employment should be increased. Employers’ responsibility concluding labor agreements should be strengthened. Modern and accurate information about pension rights should be provided to the citizens. People should be assisted in making best financial pension decisions. Retirees’ electronic cabinets and online service to ensure transparency of pension payments and revenues should be created.

References


European experience in Ukrainian pension system’s reforming


THEORETICAL ASPECTS OF RESERVATION IN THE PENSION SYSTEM OF THE RUSSIAN FEDERATION

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Abstract
The purpose of this article is to offer the ways of overcoming the contradictions existing in a definitions framework by means of which the reserves in the Russian pension system are described nowadays. At present some of its large financial flows are not designated as reserves at all in spite of the fact that they are reserves in fact. Besides, the purpose of the article is the need of introduction justification of such typological characteristic of reserves as an "effective" or "nominal" reserve. The main characteristic of an effective reserve is the obligation of its placement in profitable assets for the purpose of raising or preservation of its cost. Nominal reserves, as a rule, are not used in an investment turnover, i.e. are not placed. The article proves that all the types of Russian pension system reserves belong to effective reserves, moreover, after author's adjustment of their names, their structure and composition in 2016 is depicted.

Keywords: Financial reserves of Russia, pension fund reserves, pension reserves.
JEL codes: G230.

1. Introduction
It has not yet been possible to formulate either theoretical or practical approaches to the construction of a balanced system of current and future pension reserves in modern Russia. In the current paper the reserves that can be created and are created in the Pension Fund of Russia (PFR) are described. Taking this into account, the works of such scientists as Chybalski, Markinciewicz, Shestakova, Bule and Leitane were considered. Fig. 1 depicts the reserves that have been allocated in the Russian pension legislation.

Some accumulated financial resources, which have the majority of reserves characteristics, are not stated in the pension legislation as “reserves”. They are names as “Pension savings funds”, “Pension savings sources of insured persons who are guaranteed an urgent pension payment”, “Guaranteeing pension savings fund”. In addition, it can be noted that the regulatory system governing the functioning of the reserve system of PFR is not collected in a single document. It is a collection of laws, norms and rules, concentrated in numerous acts of pension legislation.
Simultaneous description of qualitative (regulatory and legal) and quantitative characteristics of pension system reserves faces quite serious difficulties. Attention is drawn to the fact that in the public annual report of PFR, published on its website, there is no information connected with reserves. Nevertheless, the description of formation and different types of reserves of PFR usage specifics, even in the absence of a full-fledged statistics of their flow, does not lose its scientific relevance, especially as it reveals some inaccuracies, including terminology, that require their adjustment.

The list of reserves presented in Fig. 1 in PFR reports on budget execution are not included either in its revenues or in its expenditures, but are declared in Appendix 3 “Sources of Budget Deficiency Domestic Financing of the Russian Federation Pension Fund by Classification Codes for the Sources of Budget Deficits Financing”. In this section such a structural unit as the “financial reserve of the Russian Federation Pension Fund budget” can be depicted, which is not described in any of the laws regulating the work of the pension system, but which, according to the report, includes pension savings, and data on the payment reserve flow, and investments in favor of insured persons who are assigned an urgent pension payment, as well as a reserve for obligatory pension insurance.

The conducted analysis of the legislative norms and regulations governing the formation of various reserves in the pension system, as well as the Reports of the PFR connected with the execution of the budget in different years, including 2016; Conclusions of the Russian Federation Accounts Chamber on Reports about the budget of PFR in the relevant years execution; data of the RF Ministry of Finance on the value of assets in which pension savings were invested (“Survey of pension savings investment in 2016”), allowed to summarize their quantitative and qualitative assessment presented in Table 1.

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**Fig. 1. Pension Fund of Russia Reserves**

Source: compiled by the author.

**2. Pension Fund of Russia Reserves**

Simultaneous description of qualitative (regulatory and legal) and quantitative characteristics of pension system reserves faces quite serious difficulties. Attention is drawn to the fact that in the public annual report of PFR, published on its website, there is no information connected with reserves. Nevertheless, the description of formation and different types of reserves of PFR usage specifics, even in the absence of a full-fledged statistics of their flow, does not lose its scientific relevance, especially as it reveals some inaccuracies, including terminology, that require their adjustment.

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### Table 1. Basic reserves indexes in the PFR system

<table>
<thead>
<tr>
<th>Reserve type</th>
<th>Law description</th>
<th>Amount in 2016 (mln, rub)</th>
<th>Additional characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pension savings</td>
<td>No description as a reserve № 75 – FL № 111 – FL № 167 – FL № 360 – FL</td>
<td>2 011 200,0</td>
<td>Can refer to the type of completed internal reserve, regulated by the pension legislation and the Russian Federation Central Bank</td>
</tr>
<tr>
<td>2. Payment reserve</td>
<td>№ 75 – FL № 167 – FL № 360 – FL № 111 – FL</td>
<td>7 307,02</td>
<td>Perfect internal reserve regulated by the pension legislation, the Russian Federation Central Bank. Main functions – co-saving of funds for the funded pension payment, guarantee</td>
</tr>
<tr>
<td>3. Pension savings sources of insured persons who are guaranteed an urgent pension payment</td>
<td>No description as a reserve, mentioned in Federal Laws № 167 – FL № 360 – FL № 111 – FL</td>
<td>1 888,61</td>
<td>Can refer to the type of perfect internal reserve, regulated by the pension legislation and the Russian Federation Central Bank. Main function – funds saving for urgent pension payments</td>
</tr>
<tr>
<td>4. Obligatory pension savings reserve</td>
<td>№ 410 – FL № 218 – FL № 421 – FL № 422 – FL</td>
<td>41 340,75</td>
<td>Perfect internal reserve, regulated by the pension legislation and the Russian Federation Central Bank. Main function – self-insurance, represents the first level of the guaranteeing the preservation of mandatory pension savings system</td>
</tr>
<tr>
<td>5. PFR budget reserve</td>
<td>№ 167 – FL № 216 – FL</td>
<td>Was not created</td>
<td>Perfect internal reserve, regulated by the pension legislation and the Russian Federation Central Bank. Main function – the medium and long-term provision in the of financial sustainability of the mandatory pension insurance system</td>
</tr>
</tbody>
</table>

Source: compiled by the author.
Besides, a scheme of internal financial flows, which are separated in the PFR, and with the help of which the basic reserve capacities are formed, has been drawn (Fig. 2).

**Fig. 2.** Inner financial flows, formed in the PFR system
(* reserve of PFR budget has not been formed from 2003 up to 2007;
** investment of the Guaranteeing Pension Accumulations Fund is carried out by the DIA)
Source: compiled by the author.

It follows from Table 1 that all reserves within the FIU budget, except for the Pension Accumulation Guarantee Fund, are perfect, internal reserves, the investment of which is regulated by the pension legislation, the Russian Federation Central Bank and some Russian Federation Government acts. The guarantee pension savings fund is a perfect external reserve managed by the Deposit Insurance Agency (DIA). It is believed that in the course of the next stage of the domestic pension system reforming, when the idea of introducing individual pension capital (IPC) and transferring the responsibility for their pension savings directly to citizens is discussed, some types of reserves may gradually disappear (pension funds, payment reserve, the reserve of urgent pension payments), but the reserve of compulsory pension insurance, the pension savings Guarantee Fund should be preserved. The reserve of the PFR budget will be gradually created and it will function as an effective internal reserve aimed at self-insurance.

2.1. Retirement Savings Funds
The means of pension savings (hereinafter – PSM) do not have the status of a reserve in the pension legislation. The PSM structure, which is described in the
law from July 11, 2002 “On investing funds to finance a funded pension in the Russian Federation”, is quite contradictory if its provisions are considered simultaneously with the data of the RF Ministry of Finance “Pension savings investment in 2016 survey” (hereinafter – Survey). The contradictions are as follows. First, in accordance with Art. 3 № 111 – FL in the structure of pension savings the funds of the payment reserve, as well as the means of pension sources of insured persons who are guaranteed an urgent pension payment, and which are transferred to management companies are also included. However, the funds of these reserves are managed by the means of a pay-as-you-go reserve of State Management Company (SMC MPR). In the Review of the RF Ministry of Finance, the flow of the funds of the payment reserve and its main characteristics are not included in the table of the market value of assets in which pension savings were invested in 2006 – 2016. This data is given in a separate section. Secondly, such items as the amount of insurance contributions to finance a funded pension, as well as the amount of additional insurance contributions to a funded pension, the amount of the employer’s contributions to the insured person under Law № 56 – FL from April 30, 2008, “On Additional Insurance Contributions on the accumulative pension and state support for the formation of pension savings”; the amount of contributions to co-finance the formation of pension savings; means (part of the funds) of the maternity (family) capital, aimed at the formation of a funded pension, are also included in the structure of the payment reserve. It means that in the structure of pension savings, the payment reserve is taken into account twice – first in the form of the basic elements that form it, and then in the form of an independent paragraph of Section 1, Art. 3 of the Law № 111 – FL. The data on investments from pension savings and to the PFR and to the APF convincingly show that, if these funds are called a reserve, they will rightly refer to effective reserves. Besides, this reserve can be attributed to internal reserves, which are under the control of the Russian Federation Central Bank.

2.2. Payment reserve

Between them, the means of pension savings and the funds of the payment reserve function in constant interrelation. The funds used to replenish the payment reserve are taken from the means of pension savings, and already from it the funded pensions and other payments are funded. In the vast base of pension legislation, there is only one definition of the payment reserve – in Law № 75 – FL from May 7, 1998 “On Non-State Pension Funds”, in Art. 3, where payment reserve is considered as “a separate part of pension savings, formed <...> for the purpose of paying a funded pension”. In the law itself, the is no any specification of the payment reserve and its sources structural parameters. In accordance with another law – No. 111 – FL, Art. 3 funds of the payment reserve should be formed and invested on the basis of the law from November 30, 2011, № 360 – FL “On the procedure for pension savings financing payments”. In Act № 360 – FL, the description of the sources from which a funded pension is accumulated, for which there is a payment reserve, is absent. To find the answer to this question, a person should turn to another law – № 424 – FL
Theoretical aspects of reservation in the pension system of the Russian Federation

“On funded pension”. In item 1 of Art. 7 of Law № 424 – FL, a structured description of the funded pension is given. It follows that the accumulative pension includes: additional insurance contributions to the funded pension; contributions paid by the employer to the insured person; contributions to co-financing the formation of pension savings, as well as the result of their investment; means (part of the funds) of the maternity (family) capital, aimed at the formation of a funded pension, as well as the result of their investment.

Note that in the composition of all the above-mentioned elements there is no basic element of the funded pension, the source of which is the employer's insurance contributions in compulsory pension insurance in accordance with the Law № 167 – FL from December 15, 2001. “On compulsory pension insurance in the Russian Federation”. Today, employers pay insurance premiums to the mandatory pension system at a tariff of 22% of the employee’s wage fund. 6% of which can be used for the formation of pension savings (i.e., a funded pension), and 16% – to form an insurance pension, and can, at the choice of the citizen, at the amount of 22% go to the formation of an insurance pension. From 2014 to 2019, all insurance premiums for compulsory pension insurance paid by employers for their employees are sent (and will be sent) to the formation of an insurance pension only. Basing on the analysis of legislative norms, it can be assumed that the payment reserve, at the most of its life cycle, represents the funds that are in the investment turnover of the PFR. In Resolution of the Russian Federation Government № 550 from June 4, 2012, “On the approval of investment declarations of the state managing company by means of a payment reserve”, the goal of its investment is stated: the increase in the funds of the payment reserve.

A characteristic feature of the payment reserve is that for its management a special means of a pay-as-you-go reserve state management company (MPR SMC) is selected, which invests its funds in a special way. As part of the payment reserve, the main structural unit is the pension savings funds recorded in a special part of the individual personal account of an insured person. Additional elements are the so-called adjustments.

2.3. Means of pension accumulation of insured persons who have an urgent pension payment

According to the same bases and principles that form the basis for the formation and investment of a pay-as-you-go reserve, the formation and investment of pension savings funds of insured persons that have an urgent pension payment is preserved. However, these funds do not have the word “reserve” in their official name, although we are convinced that they need to be described in the law using this very term.

An urgent pension payment is a pension that is paid within a certain period. Unlike an indefinite method, in the appointment of which the term is presumed and is established annually by the Russian Federation Government depending on the average length of life of pensioners, the period of urgent payment is determined by the applicant himself. However, it must be at least 120 months (10 years). When calculating and establishing an urgent pension payment, insurance
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contributions to the funded pension that are payable under the compulsory pension insurance system are not taken into account. They can be taken into account when calculating a funded pension, i.e. a non-urgent payment. All contributions to the insured person’s account are not indexed, unlike insurance coverage. However, they are increasing due to the financial market investing.

Obviously, urgent pensions are formed at the expense of the same funds that form a funded pension. The only difference between a funded and an urgent pension is the term of its payment to a future pensioner. The Opinion of the Accounting Chamber of the Russian Federation can also be considered as a confirmation of the correctness of conclusions— that the collection of funds for urgent payment is still a reserve – made that these funds are exactly called the “reserve for a term pension payment” (see, for example, “Conclusion of the Accounts Chamber of the Russian Federation on the report on the execution of the budget of the Russian Federation Pension Fund from 2014 of August 27, 2015). And this happens for a single reason – as, in fact, these funds work as a reserve.

2.4. The Pension Fund of the Russian Federation Reserve (the reserve for compulsory pension insurance – CPIR)

This type of reserve is created on the basis of the law “On investing funds for financing the funded part of labor pension in the Russian Federation”, Art. 31.1, which was introduced by the Federal Law from December 28, 2013 № 410 – FL, and entered into force on January 1, 2014. The legal norms for the formation of the CPIR are established not only by the Law № 410 – FL, but also by the Law № 218 – FL from July 21, 2014 “On Amending Certain Legislative Acts of the Russian Federation”, as well as the Law № 421 – FL from December 31, 2015 “On Amending Certain Legislative Acts of the Russian Federation”. The multiplicity of additions to the original regulatory framework of the CPIR shows that it absorbed the changes that emerged in the process of practical application of previously approved legal provisions. In addition, it is noted that all the above norms appeared and were approved only after 11 years of operation of the basic law № 111 – FL, which may indicate an underestimation by the legislator of the nature of the reservation, and the creation of a reserve as a necessary element of an insurance pension fund at the early stages of reforming the domestic pension system.

CPIR funds are a separate part of pension accumulations and are subject of separate accounting by the Russian Federation Pension Fund. CPIR is formed due to a number of sources, such as deductions from investing pension savings funds income based on the results of the reporting year; deductions from the funds of pension savings (with insufficient or no income from investing the funds of pension savings by the end of the reporting year); means of pension savings not received by the successors of deceased insured persons; and so on. The Bank of Russia determines the rate and procedure for calculating the contributions to the CPIR from the investment income of pension savings funds deductions based on the results of the reporting year and from pension savings deductions. At the expense of RPS funds, a guarantee payment is made to the account of the insured
person in the following cases provided for by Federal Law № 422 – FL from December 28, 2013. “On guaranteeing the rights of insured persons in the mandatory pension insurance system of the Russian Federation in the process of formation and investment of pension savings, establishment and implementation of payments from pension savings”, and in particular: replenishment of the funds of the payment reserve and (or) funds pension accumulations of insured persons who have an urgent pension payment established to the level ensuring compliance with the adequacy standards established by the Bank of Russia; payment of pension savings to successors of the deceased insured person.

CPIR refers to effective reserves. In the PFR budget, it fulfills the function of self-insurance and represents the first level of the system of safety of mandatory pension savings guaranteeing. It is formed within the PFR. The second level is the accumulation of all non-state pension funds.

2.5. Reserve of the Pension Fund budget

The Art. 19 of the Federal Law № 167 – FL from December 15, 2001 “On Compulsory Pension Insurance in the Russian Federation” establishes that in order to ensure the financial stability of the mandatory pension insurance system, a reserve of the budget of the PFR is created. Its order of formation and expenditure should be determined by the Federal Law. Sources of formation of the reserve of the PFR budget in the law № 167 – FL are not defined. It should be emphasized that by 2017 the independent Federal Law on the procedure for the formation and expenditure of the reserve of the PFR budget has not been created, but the annual laws on the PFR budget necessarily include a norm describing the specifics of budget execution in an article.

The Art. 19 is included in the Law № 167 – FL in 2014 by the Federal Law № 216 – FL from July 21, 2014 “On Amending Certain Legislative Acts of the Russian Federation and Recognizing the Invalidation of Certain Legislative Acts (Provisions of Legislative Acts) of the Russian Federation in connection with the adoption of federal laws “On insurance pensions” and “On funded pension”. After finding its initial interpretation in the early drafts of the law, as well as in the comments to it, it can be found out that the Payment Reserve of the PFR was created to ensure the financial stability of the mandatory pension insurance system in the medium and long term. However, as the analysis of the dynamics of the PFR budget for a number of years shows, the last time the surplus of the PFR budget was noted only in 2003. There are different points of view on calculating the deficit (pro-fitsite) of the PFR budget methods (Andreeva and Sukhoveeva 2007; Bazanova 2015; Protkin and Protkina 2016). In the course of the recent analyses it can be agreed that since 2007, the PFR has always had a budget deficit. Therefore, the reserve of the Fund’s budget in this part was not created.

It is considered that the existence of Art. 19 in the Law № 167 – FL on the possibility of forming a reserve of the budget of the FPFR with the aim of regulating a budget deficit creates legal prerequisites in the future to apply this tool to ensure the balance of expenditures and budget revenues and ensure its
2.6. Reserve of the PFR in the Deposit Insurance Agency (DIA)

Pension Savings Guarantee Fund (PSGF) is separate from the capital of each individual fund and is managed by the Deposit Insurance Agency. The Russian system guarantees full co-preservation of insurance premiums for the formation of a funded pension. The PSGF, despite its name, is essentially a reserve fund, but in relation to the financial system of the PFR, it is an external reserve fund, which is managed and ruled by the DIA. The main task of the DIA is to guarantee the pension savings of individuals who form and receive a funded pension in the Pension Fund, or in one of the non-government pension funds.

PSGF belongs to DIA on the right of ownership. It is detached from its other property; its funds are accounted for on a special account opened by the DIA in the Bank of Russia. The Bank of Russia does not pay interest on the balance of funds in this account. At the expense of the PSGF, recovery of the obligations of the RF, RF subjects, municipalities, PFRs, APFs or other third parties cannot be made. The only case when such a penalty can be imposed is a court decision that will establish that the DIA has not fulfilled its obligations to pay a guarantee compensation.

The sources of contributions to the PSGF may include: guarantee fees paid by insurers; penalties for untimely and (or) incomplete payment of guarantee fees; monetary funds and other property that are obtained from satisfaction of the rights of claim of the Agency acquired as a result of payment of a guarantee compensation; and so on.

The analysis of the PSGF features operation allows to draw the following conclusion. PSGF refers to the category of effective reserves, performing the insurance function.

3. Conclusion

All types of reserves that are formed and used in the Russian pension system are classified as effective reserves. Except the external reserves that are created in the Deposit Insurance Agency for the formation of the Pension savings Guarantee fund, all effective reserves are internal for the pension system.

The following types of financial reserves are created within the PFR: pension savings, a payment reserve, pension savings sources of insured persons who are guaranteed an urgent pension payment, an obligatory pension insurance reserve, an PFR budget reserve, and a pension savings guarantee fund. It is necessary to legislate the status of reserves for them (excluding those that already have this status).

To classify the PFR reserves, it is sensible to allocate a reserve for compulsory pension insurance as an effective internal self-insurance reserve, PSGF – as an external insurance reserve, pension savings, a payment reserve and funds for financial stability. However, without an intelligible methodology for determining the budget deficit of the PFR, this article may not start functioning.
urgent pension payments – as reserves that are under the Russian Federation Central Bank control.

Up to 2017, the regulation of the formation and usage of all types of reserves in the pension system was carried out by numerous federal laws, regulatory acts of the Russian Federation Government and the Russian Federation Central Bank. It is advisable to combine the legal regulation of the pension system in a single law.

References


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Abstract
Life insurance is one of the most essential security products. Unexpected and unforeseen events can occur at any time, so it's always important to have a Life Insurance policy.
The paper analyses the life insurance market in Albania to show how it is evolved and focuses mainly on the level of economic and social development of this voluntary insurance in relation to compulsory insurance.
The main purpose of this study is to understand and evaluate the perception of Albanian consumers for life insurance, to recognize if they are willing to pay for insurance policies and to discover the reasons for this low level of development.
Various observations have been made for this topic and the results revealed that the most used insurance policies are mandatory and the level of knowledge about the importance of life insurance is low.
Studies also indicate that the life insurance market in Albania is still in the early stages of development and we can say it is underdeveloped in comparison with the region countries. Therefore, it is very important to propose recommendations to stimulate the economic development of this market and to create a sustainable culture for voluntary life insurance.
Keywords: consumer perception, insurance market, life insurance, living culture, voluntary insurance.
JEL codes: G22, G32.

1. Introduction
Life insurance sector is one of the most important sectors of the economy. Life insurance is a financial protection form of the human being in different life hazards. The life insurance market in Albania is still in his early development stages and we can say it is undeveloped compared to other countries in the region. Based on these problems our paper aims to achieve the following objectives:
1) To explain the importance of life insurance and available alternatives for Albania.
2) To understand the life insurance market development in Albania.
3) To understand the Albanian consumer perceptions in relation to this market.
4) To explain factors that influence consumer perception to this market.
5) To analyse various opportunities to stimulate further market development.

2. What does life insurance represent and its importance

The meaning of life is a slow and attractive process and we feel its mystery, but never giving up, everyone lives and earns. Everybody wants to insure his life from every day risks. Life insurance is one of the oldest insurance activities in the world. At the beginning, the government provided compensation for the soldiers killed in the battlefield later the solidarity schemes preceded life insurance. For more than 200 years, life insurance has been sold in the form of a genuine financial product, life insurance as a combination of savings and insurance. With the term savings we mean long-term savings for a better future, which is distinguished from other insurances. Life insurance is included on the insurer's obligation to pay the insured amount. The insurer performs this payment in case of death or survival, based on the premium insurance paid by the insured. Life insurance as a financial product has as many insurance product features, as an investment. Compared to other insurance products, in life insurance we cannot speak about damage, because usually we are dealing with long-term contracts and the beneficiary may not be the insured.

Life insurance is one of the activities that is developing recently due to the growing uncertainties that a person may have in life as well as the accidents they may face. For this reason, there is a kind of insurance that would cover most damages in cases of a disaster or accident within his county or abroad.

2.1. The importance of life insurance

During one's life may occur unpredictable events which have serious economic consequences for the family. Here we can mention natural and accidental deaths, illnesses that cause disability to work, burn, theft of property, etc. Insurance can cover economic consequences of these events.

Life is threatened by several factors:
1) Physiological factors: here are included illnesses and epidemics, mother's risk during pregnancy, loss of work skills because of old age, and other illnesses that may prevent a life activity.
2) Natural factors: earthquakes, tsunamis, floods, thunderclaps, frosts, storms, low and high temperatures are events of natural origin that threaten, destroy, and often cause great damages and catastrophes.
3) Factors from useful human activity: they are risks caused by daily work, human errors, negligence, lack of workplace protection rules, or intellectual mistakes.
4) Aggressive factors: here we can include terrorism, war, criminal activity, etc.

These phenomena are provoked and cased by human conscience are products of a criminal, sick and abnormal mind. We should bear in mind that the greatest human asset is the ability to generate incomes from honest work. Depending
on the years left for work, this skill has greater value than the wealth that the individual has created during his lifetime. When someone dies, the family must afford many expenses which in some cases reach considerable sums. These expenses include funeral expenses, medical treatment and medications, documentation costs, loans or unpaid loans to financial institutions or individuals, property transfer taxes such as transfer to homeowners, bank accounts, investments etc.

Family difficulties can be caused by accidents at work which may lead to a person's inability to work because, apart from the fact that this individual cannot generate more incomes, he/she also requires higher and additional costs compared to the members of the family. Another case is the fact that over the years, the ability to work is reduced, because age influence the ability to work and the provide incomes. According to (Bundo and Lito 2014, p. 262), these situations have a major impact on a family, as they have such consequences:

1) Psychological consequences: the loss of a family member creates a very difficult psychological situation for other family members.

2) Social consequences: in case of a family member death, its social status changes. The children’s life as orphan and the spouse loss are social problems.

3) Economic consequences: the loss of life or the reduction of work ability brings the decrease of income sources.

It is difficult to avoid psychological or social consequences, but economic consequences can be reduced through financial products that today constitute the life insurance industry.

From a broader perspective, life insurance fulfils one of the financial objectives in human life, which is to leave wealth to successive generations. Thus, life insurance is equivalent to other inherited assets such as home, accounts in financial institutions, businesses etc.

2.1.1 Defining the premium on life insurance

Life insurance premiums are mortgage tables, from which premium calculations begin. The insurance premium is directly related to the age of the insured. The older the age, the higher the premium. The premium for men is also higher than women. It is clear that the greater the amount insured, the higher the premium that the insured has to pay. At the same time, life insurance premiums may increase from the charges applied to the individual's characteristics. So, a sick person may have a much higher premium than a healthy person.

As a conclusion, we can say that life insurance is very important and the premium we have to pay as well as the amount we need to insure is calculated by taking into account all the above-mentioned factors.

2.2. Risks that threaten our lives

People consider their life and the lives of their loved ones as very important. Life is always exposed to risks. Risks that can affect life are of various origin and background.
Some risks that threat people's lives are:
- **Risk of early death**: This concept means death during the main life cycle stages.
- **The risk of disability (temporary or permanent)**: There are risks that cause health damage, damages that causes temporary or permanent disability. In addition to the loss of working ability and capacity to generate incomes, these risks are also associated with medical expenses.
- **The risk of life expectancy**: People want to live long, but long life has its own risks. With passing of age, job ability is lost. Also, old age is accompanied by the increased need for medical care, and this has its cost.

3. Life insurance and lifestyle

An important aspect of human’s life and evolution, since ancient times, has been the anxiety for the future. Our life events occur rapidly and are unpredictable. We need to be insured, in order that our family become safe and have the necessary financial support. Life insurance is a form of human protection toward various types of risks. On the other hand, consumers are considered as a very important part of the company shareholders. This paper aims to bring together these two parts of the insurance market, by analysing the insurance company performances on one side and the consumer perception on the other side.

Life insurance serves as a guarantee to regular incomes or insurance holder (his/her spouse or children and in some cases any other person) in case of death or the person himself if he survives.

Life insurance has three features:
1) insurance for a long period of time,
2) the insurance is realized for a fixed amount,
3) capital accumulation.

Regarding Albania, we can say that it is still in the early stages of insurance market development. The Albanian insurance market is a diversified market with companies dealing with life and non-life insurance, with domestic and foreign capital operating in Albania and abroad. This insurance market is poorly developed compared to other countries in the region and is dominated by compulsory insurance. Despite the problems that this new market faces, there are opportunities for growth, development and perfection.

Life insurance is a mentality issue in all developing countries. Often, we think of the life insurance necessity, only when happens an accident, or when this accident occurs in our family. So, it is good for people to start thinking about life insurance with imagining what happens if the person who provides family incomes dies, or if this person loses work due to an accident or illness. Perhaps, later, they may also consider using life insurances as an alternative savings plan. Most developed countries have established tax benefits to make insurance products more attractive, by combining them with investments. According to three life insurance companies in Albania, Sigal Unica, Sicred sh.a, Insig sh.a, the premiums are affordable and people should think to start saving. The increase of consumer awareness for these products is very important. Major insurance companies,
should provide easier understandable products, and should make their products usable.

At first people tend to make insurance only for the debtor's life, because this is mandatory by the banks. But then, people realize that they have to start saving due to the pension problems faced by most countries. They can understand that insurance combined with investment can really be a very good alternative investment for those who are conservative.

Consumer protection and public awareness are very important in this process. Perhaps with the passing of time, Albanians would be ready to invest even in more complex products, in products that are related to investment funds, which are used in most developed countries for retirement planning.

Life insurance is a good way to ensure the future of your family. In developed countries, insurance and life insurance has become a good necessity for the daily activity of each citizen.

The development of insurance has improved the people opportunities to choose among the most appropriate forms of life insurance and general insurance. Its role in saving and financial mobilization is of particular importance. Life insurance is a good way to ensure the future of your family. In developed countries, life insurance has become a necessity for every citizen's daily activity. Also, a country with a strong private security sector indicates the economic development of that country.

3.1. Classification of life insurance

The main products of life insurance are as follows (Bundo and Lito 2014, p. 287):

- **Individual life insurance** is the most widespread insurance that occupies the main place in the world life insurance market. It is about all the types of insurance that can be sold to an individual. Usually this type of insurance is sold through agents or other forms of marketing but always through direct contact to the insured.

- **Life insurance in group** is that type of insurance that is mainly provided by companies in favour of their employees. Enterprises can choose to provide life insurance as a form of employee benefit. In developed countries, this is a very widespread practice and companies compete each-other to attract skilled workers through this kind of benefit.

- **The life insurance of the debtor** is closely related to the lending activity. This type of insurance is usually sold by commercial banks and non-bank lending institutions. It intends to protect the creditor from the earlier death of the borrower. In this case, it is not insured the beneficiary or his/her family, but the lending institution.

- **Student life insurance** is a type of insurance product for young people. In addition to promote security and the creation of a culture for young people safety, this type of product is often combined with health insurance.

- **Second death insurance** is a life insurance scheme which pays the compensation when the second spouse dies. The advantage of this insurance is its lower cost compared to two insurances purchased separately by each spouse.
Life insurance and living culture

and therefore may be appropriate for some families, especially in cases when they leave a considerable inheritance to their children.

- **Life insurance in travel** is a temporary insurance, with reduced period of time, a few days or a few weeks, which is used as security for vacations or business trips.

- **Marriage or maternity insurance** is a special insurance provided by the Albanian insurance legislation categorized in life insurance, which covers the costs of marriage and childbirth within a certain time.

- **Life insurance with reduced premiums** is a form of insurance used in industrial developed countries and with long term statistic data, which offers reduced premiums to individuals whose life risk is lower than the average.

### 3.2. The development of life insurance in Albania. Market in transition

According to OECD (2016), life insurance is relatively undeveloped in European's emerging markets, since 1998 the life insurance introduction (gross direct premiums/GDP) was only 0.43% in Central and Eastern European countries. In contrast to them, during the same year, OECD countries dedicated to life insurance 4.58% of the total GDP. Although the insurance in Albania, started late in comparison to other developed countries, it holds its own characteristics and history. The history of insurance market in Albania begins before the Second World War, when the insurance activity was led by the English, French and later Italian insurance companies. Insurance in Albania is a relatively a new industry, although they originated in the 1900s. In developed countries almost everyone has life insurance, while in Albania we can say that this is still a luxury. It is not known yet that life insurance is a form of saving and saving investment. The Albanian insurance market is a diversified market with life and non-life insurance companies. The insurance market is still not very developed, 40 Euro/capita compared to developed countries $600/capita (1USD = 0, 9474 €) and is dominated by compulsory insurance. Albania is a country that has made significant improvements during the transition period, from the communist regime to the market economy (AFSA 2016).

Actually, there are three insurance companies in Albania that are certified to sell life insurance products, INSIG sh.a (established in 1991), SIGAL UNIQA (established in 1999), and SICRED SH.A (established in 2003). They have played a significant role in the creation, development and consolidation of the Albanian insurance industry, especially life insurance. The Albanian Financial Supervisory Authority (AFSA) serves as a regulatory institution in Albanian security market. It is established in 2006, and is a public independent institution. The AFSA is responsible for the regulation and supervision of non-banking financial system and the operators of the sector. Albanian Financial Supervisory Authority in its periodic publications about insurance market introduces the structure of this market for life insurance and market performance in terms of gross written premiums for 2017 compared to 2016.
Table 1. Gross written premiums 2016-2017 \((1€=132.950\text{ALL})\)

<table>
<thead>
<tr>
<th>Aggregation type</th>
<th>Year</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Insurance</td>
<td></td>
<td>977,851</td>
<td>1,204,267</td>
</tr>
<tr>
<td>Non-Life Insurance</td>
<td></td>
<td>14,305,843</td>
<td>14,907,715</td>
</tr>
<tr>
<td>Reinsurance accepted</td>
<td></td>
<td>83,946</td>
<td>81,696</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>15,367,640</td>
<td>16,193,678</td>
</tr>
</tbody>
</table>

Source: AFSA, December 2017, p. 4.

According to these statistics, gross written premium incomes for 2017 reached over 16,193 million ALL, or 5.38% more than in 2016. The market continued to be oriented to non-life insurance, which occupied 92.06% of the total premium volume and Life insurance 7.44% respectively. While the number of life insurance contracts was 173,917, by marking an increase of 53.08% compared to 2016. Below it’s the life insurance structure specified according to its main sectors.

![Life insurance structure](image)

Fig. 1. Market structure – Life insurance
Source: AFSA, December 2017, p. 4.

It is noticed that debtor life insurance, which is a compulsory insurance, demanded by the lending institutions, occupies the major part that is 60%, followed by other voluntary insurance, life insurance 12.53% and others 27.47%.

So once again it is confirmed that Albanian consumers first of all use debtor life insurance as it is compulsory by the banks. Then, they start saving because of the pension problems they may face in the future and finally they realize that combined insurance may be a very good investment alternative, by using even other products that Albanian life insurance market provides.
3.3. Albanian consumer perception and culture to life insurance

In our study, we aim to reflect the cultural level of Albanian consumers related to life insurance in Albania and how do they perceive it. For this purpose, we have used some of the results obtained during a detailed research conducted by AFSIA in 2014. Albanian insurance companies supported this study by providing necessary data and materials.

The target groups of the questionnaire were students, employees as well as members of families with different backgrounds.

In this research, the involved individuals were divided in these categories regarding demographic characteristics: 46% males and 54% females. Most of them were 26-34 and 35-50 years old (with 32 and 31%), followed by groups of 51-64 years old (10%), and only 2% were older than 65.

Among them 23% had postgraduate degrees, 53% hold a diploma degree and 22% has been graduated in high school. 50% were married and have children, 25% were single, 20% were married without children and 5% were divorced. In terms of employment, 20% were employed in public sector, 50% were employed in private sector, 25% of them were students and 5% unemployed. Regarding the level of incomes, about 55% had 50,000-100,000 ALL incomes, 35% had 20,000-50,000 ALL 5% more than 100,000 ALL and less than 5% had less than 20,000 ALL income per month.

The questionnaire was elaborated as follows:

1) **Have you ever bought an insurance premium?**
- 70% answered Yes and 30% answered No.

2) **What type of insurance have you bought?**
- Most of the interviewed had purchased life and health insurance for traveling (45%), life insurance as debtor (35%) and life insurance with savings (15%).
- Other types of insurances occupied a very small percentage.

3) **Which company did you choose for your insurance?**
- Most of them had preferred SIGAL LIFE (55%), INSIG LIFE (30%) and SICRED (15%).

4) **Another question was how did they pay the life insurance?**
- The majority of the insured had bought the insurance through bank (35%) or through an insurance agent (29%).

5) **Where did you find the information on life insurance?**
- 39% of them had this information through electronic media (internet), 33% from TV and newspapers, 17% from other sources (colleagues, friends and relatives) and 11% have never heard such information.

6) **Is life insurance a life necessity or not?**
- 64% of the participants estimated life insurance as a necessity, which in some way may be reflected in the development level of this market in Albania during recent years. 25% of them do not see it as a necessity and 11% estimate it as complementary insurance.

7) **Have you ever thought of buying a life insurance for yourself or your family?**
- 75% of the answers were Yes and 20% No.
8) *What factors have a negative impact on the decision to buy a life insurance?*
About 40% of answers emphasised that the most influential factors in buying an insurance policy was the financial aspect.
The second listed factor was the lack of confidence and trust in insurance companies (35%). This lack of confidence appears to be very significant. It means that insurance companies should apply persuasive practices to clients in order to increase their credibility. Other important factors, even though in a low percentage were: 10% do not think life insurance is necessary, 10% have no knowledge on its importance, and 5% do not easily accomplish such coverage.

9) *Which is the best way to convince people to buy a life insurance?*
Since the level of insurance is low it is very important to find some ways to increase customer confidence in the future. The best way was people awareness about its importance (40%), followed by information on the benefits of life insurance (35%). Education of the new generation is ranked third (15%), followed by the creation of facilities during the insurance process (5%) and promotion of life insurance companies (5%).

From the point of view of our study, the questionnaire summarized results show that the perception of Albanian consumers to life insurance is very positive and it is noticed that they appreciate its importance but still have lack of information about its advantages and disadvantages.
At the same time, Albanians think that this kind of investment is necessary but expensive and has not well defined and clear benefits.
However, from conclusions provided by researchers and specialists in this field, we realize that life insurance is a profitable investment both socially and financially. Promotion, sufficient consumer information and mitigation policies of insurance companies and government for life insurance may improve the people cultural level and will simultaneously expand this market in Albania.

3.4. *Expected difficulties for the perspective of life insurance in Albania*

From the individual’s perspective, life insurance offers many advantages (UNCTAD 1982):
1) Life insurance guarantees to pay a stated sum to a family on the death of its income earner(s). In so doing, it affords families a measure of protection against the adverse financial consequences of premature death, gives individuals a greater sense of economic security, and can help reduce worry and distress and thereby increase initiative. No other privately purchased financial instrument can perform this function.

2) Cash value life insurance can serve as a means through which individuals save. Many persons who might not otherwise save consistently will, nonetheless, regularly pay their life insurance premiums; thus, life insurance might constitute a type of quasi-compulsory savings.

3) Life insurance products, especially annuities, provide a convenient, if not unique, means by which individuals can make financial provisions for retirement.
Despite the advantages that life insurance offers, in the case of Albania there are also some problems that make it difficult to understand and to use this insurance, which can be listed as follows:

- Albanian businesses and companies, as well as the individuals, recently are indisposed to spend more on insurance. This is due to lack of information, absence of education in this regard or financial inability resulting from low income levels.
- Products and life insurance services are offered to customers on optional basis, the premium of life insurance is not compulsory.
- Albanian investors were more interested in short-term investments than long-term investments because of the economic instability during the 1990s which made it difficult to forecast inflation and interest rates.
- Absence of classification agencies, which are specialized in risk assessment and classification, is even more visible in this sector of the economy.

With all the difficulties, the insurance market in Albania continues to grow. It is a highly diversified market, in which operate a number of companies that have a wide geographic distribution within the country. There is an interest in the growth of foreign capital to invest in domestic insurance market as well as for the expansion of this market abroad.

These facts express optimism for the future of life insurance market in Albania and further development of the Albanian people's culture in this sector.

4. Conclusion

People consider their life and the lives of their loved ones as very important. So life insurance is the necessary form of human protection in case of various risks such as accidents, illness, disability or death. Considering the importance of life insurance we have made a study about this part of insurance market in Albania. Even in Albania, the life insurance is relatively a new activity, the consumers are not aware of its benefits compared to other countries in the region. The culture of life insurance in Albania is not developed compared to other countries. In this point of view the main purpose of this paper is to understand and define Albanian consumer perception for life insurance, if they are ready to pay for it and to discover the reasons for this low level of its development.

Increasing the public awareness of these products is very important. The big insurance companies should make products easily understandable by people, they should make their products usable, and with clear language. In Albania there are three certified companies that sell life insurance products: SIGAL UNIQA, INSIG sh.a. and SICRED sh.a.

In this situation a question arises: Which are the factors that affected this low level of the market development?

This paper revealed exactly three of the main factors. The first factor is that life insurance is included in the voluntary insurance group, it is not compulsory, as the vehicle insurance is. The second factor that affects the culture of insurance in Albania is the low level of salary, and as result of it, they are not motivated to pay monthly or annual premium for their life. The third factor that negatively
influences life insurance in Albania is the mentality or culture of Albanian consumers that don’t precedes their health problems or other accidents that threaten their lives.

However, these results can contribute to the future work in order to ensure the further development of this market, although Albanian consumers are becoming aware of life insurance importance and this awareness will be further strengthened over the time, as there is a lack of information in this regard.

Also there is a growing interest from foreign capital to invest in domestic insurance market as well as for the expansion of this market abroad. An important role will play the information and customer concerns about its importance in the future.

In this sense, insurance companies need to expand more promotional activities by informing consumers about voluntary insurance, and life insurance in particular, how important they are and why they should buy it.

References


Insurance Information Institute, www.iii.org


