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Sustainability of the pension system in Macedonia

Comprehensive analysis and reform proposal with MK-PENS – Dynamic Microsimulation Model

Authors:
Blagica Petreski
Pavle Gacov

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Authors
Blagica Petreski, PhD
Finance Think – Economic Research and Policy Institute, Skopje
blagica.petreski@financethink.mk

Pavle Gacov
Agency PROAGENS
p_gacov@proagens.com.mk

Reviewer:
Trajko Slaveski

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Content

Introduction

The deficit in the pension system in Macedonia - the difference between the original revenues and total expenditure of the Pension and Disability Insurance Fund - has a tendency to grow over time, and in 2016 it reached 26.6 billion MKD, or 43% of the Fund's total expenditure. This figure also represents 4.5% of GDP, while central budget transfers have increased 1.8 times over a period of ten years. This pension deficit trend is caused by several factors. Firstly, structural changes were made in the pension system design: a transition was made from a mono-pillar system (Pay as You Go) to a three-pillar system in 2006, and the contribution rate was reduced from 21.2% to 19% in 2009 and then to 18% in 2010, which all together led to a decrease in the Fund's original revenues. On the expenditure side, between 2006 and 2016, pensions were increased on several occasions in amounts that usually exceeded the amount envisaged by the statutory adjustment. In addition, the expert debate frequently emphasises the increased amount of pension claims based on early retirement for workers in arduous or hazardous jobs (hereafter: reduced years of service), and the pressure that will be put on the Fund by subsidised employment in the future. However, there is no more detailed information about either of these aspects. The multiple ad-hoc pension increases in Macedonia have been noted as one of the factors undermining its fiscal consolidation (European Commission, 2016). Similarly, the International Monetary Fund, in its annual report for 2017, argues that the increased budget deficit in recent years is also partly due to the great increase in pensions, creating the need for pension reform aimed at fiscal and pension consolidation (IMF, 2017).

The literature identifies several key factors affecting the sustainability of the pension system, namely: demographic changes, labour market movements, and pension adjustment to the potential of the economy. The aging of the population , the decrease in the fertility rate, and the increase in life expectancy are some of the factors putting pressure on the pension systems, designed in a traditional manner and for a different socioeconomic context, to be sustainable, fair, and efficient (Verbic, 2007). Blake and Mayhew (2006) suggest that from now on, each generation will be smaller because of lower fertility rates and population aging. According to the United Nations report, the number of persons aged over 60 will double by 2050 globally compared to 2017; in Europe, 25% of the population is already over 60 years of age (World Population Prospects: The 2017 Revision). Such trends place a more significant and heavier burden on the pension system, which was designed as a Pay-as-You-Go (PAYG) system, which has a tendency of imposing an even greater burden on future generations who will be in employment. However, Blake and Mayhew (2006) argue that the combination of population aging and declining fertility creates benefits through the so-called "demographic dividend," where there is a lower number of young dependants and, at the same time, a higher number of persons in the mature stage of productivity. But, these benefits are enjoyed by approximately one generation only, and specifically at the beginning of this trend. Japan is an example of a country affected in the highest degree by the problem of an aging population, but in the last several decades it used this "dividend." Labour market movements is the second group of factors affecting the sustainability of the pension system. One dimension of labour market movements are the sectoral shifts connected with changes in labour demand. The trend of these shifts demonstrates an increase in the size of the service sector and a slowing down in the traditional industries, such as

agriculture and industry. These shifts could impact wages and prices in the sectors (Kakes and Broeders, 2007), as well as the imbalance between the supply and demand in the labour market (Bonin, 2009). Another dimension of these labour market movements is the decrease in labour supply in the labour market, which is principally driven by demographic changes. However, the labour force figures do not only depend on the population structure, but also on the labour market activity rate (in particular, that of women), the average retirement age, and the average age of labour market entrance (a number that usually increases because of spending a greater number of years in education). Decreases in the working age population increases the dependency ratio, leaving each worker with a higher number of retirees that he/she has to support.

Other than the labour market demographic characteristics and structure, imbalance between the amount of pensions and the potential of the economy to finance those pensions is the third factor for the unsustainability of the pension system. The pressure for higher pensions is mainly driven by the power of retirees to impact policies, due to their increasing numbers and their importance as an electorate (Kruse, 2010). Higher pensions increase the replacement rate (the share an average pension has in an average wage) and the need to make larger contributions in order to ensure the payment of pensions. According to the Pension Sustainability Index, developed by Allianz (2017), the pressure exerted by the pension system on public finance is one of the four key aspects required for the sustainability of the pension system (Allianz, 2017).

The models assessing the sustainability of the pension systems and making projections for fiscal implications and development indicators are mainly developed by the key institutions in pension systems (such as the Pension and Disability Insurance Fund), but also by international organisations. The common component in these models is the possibility to make microsimulations; hence, they are also known as microsimulation models. They simulate changes in a representative sample of individuals, usually collected through surveys or obtained from administrative data (Gal et al. 2009). These models are divided into static and dynamic categories. The dynamic models have the possibility of modelling the changes over time (Dekkers, 2007). Thus, the dynamic models create a theoretical life path for each person in the sample, including their probability of death, a change in their economic status, their year of retirement, their earnings, etc. (Emmerson et al. 2004).

Considering the current design of the pension system in Macedonia and the pressure that the pension system deficit exerts on the central budget, the sustainability of the pension system in Macedonia has become a burning issue, and it emphasizes the critical need for reform. Analysis of the pension systems' sustainability is encouraged mainly by international organisations, pension insurance funds, and those in charge of reforms. Empirical and scientific studies are rarer. Therefore, the purpose of this paper is to examine the fiscal effects of potential pension reform in Macedonia and its effects on development indicators such as, unemployment and poverty. . To that end, we created the MK-PENS dynamic microsimulation model, and we simulated several scenarios of pension reform. In the scenarios simulated, we proposed two types of reforms: reforms that will mainly affect one concerned party (pensioners or insured persons i.e. contributors), and reforms with a shared burden.

The paper is organised in the following manner. Section 2 presents stylised facts about demographic developments, the design and financing of the pension system, and also provides an overview of a pension sustainability index. Section 3 explains the simulations for potential pension reform, including a description and methodology, input information, and scenarios for pension reform. Section 4 presents the results of the model, including fiscal implications and effects of the simulated pension reform scenarios on the poverty and unemployment rates. Section 6 provides the conclusion and summary of the main recommendations.

Stylised facts: Structure and financing of the pension system and demographic developments

The pension system design, the dependence on public finances, and the demographic changes are three of the aspects that must be taken into consideration for the sustainability of the pension system, and they will be described for the case of Macedonia in the following three sections.

The pension system design

The Macedonian pension system is based on the principle of inter-generational solidarity, i.e. pay-as-you-go (PAYG), where the current contribution payments are used to finance the current pensions. Hence, until 2006, the pension system of Macedonia had only one pillar. In 2006, there was a reform of the system's design that introduced the principle of fully-funded pension insurance, where in addition to the first pillar, two more pillars were added, a mandatory and a voluntary private pension pillar in 2008. As a result, today, the pension system structure in Macedonia consists of three pillars, where: the first pillar (mandatory) is still based on the principle of inter-generational solidarity, while the second (mandatory[1]) and third pillars (voluntary) operate on a fully-funded basis. The first pillar provides a portion of the old-age pension, disability and survivor pensions, and the minimum pension (PDIF, Actuarial Report for 2014, 2015). The second pillar provides an additional portion of the old-age pension for those pensioners paying contributions in this pillar. Meanwhile, the third (voluntary) pillar provides additional material security.

The rights from pension and disability insurance depend on the funds invested (determined by a person's average wage during their working life), length of service, and manner of investment (whether the contributor made payments in the first pillar only – for old contributors before 2003 and who decided to remain in the first pillar only, or in both pillars – for contributors after 2003 and those before 2003 who decided to join the two-pillar system). Rights arising from this type of insurance are: old-age pension, survivor pension, disability pension, occupational rehabilitation and entitlements to adequate monetary allowance, entitlement to monetary compensation for a bodily injury, and entitlement to a minimum pension. 99.4% of the beneficiaries are based on old-age, survivor, and disability pensions. Table 1 gives a summarised overview of the main requirements[2] for obtaining these rights and how they are established.

[1] For contributors who were employed after 1 January 2003, joining the two-pillar system is mandatory. For contributors in employment before 2003, joining the two-pillar system was voluntary.

[2] This table includes only the general criteria for acquiring and establishing the rights for the needs of this paper's simulations. The detailed and specific requirements for acquiring and establishing the rights are explained thoroughly in the Law on Pension and Disability Insurance.

Table 1: Types of rights from pension and disability insurance and eligibility requirements

Pension type	Acquiring and establishing the rights	Pension amount
Old-age pension	• 64 years of age (man) and 62 years of age (woman); • Minimum 15 years of service;	The pension base is determined by the average monthly valorised wages that the contributor has earned in his/her working life. The pension amount is defined by the pension base in a percentage determined by the length of the pensionable service. Depending on whether the contributor is in both pillars, or only in the first pillar, different replacement rates apply.
Survivor pension	Members of the family of a deceased contributor: spouse, children and dependent parents. They acquire the right to a survivor pension if the deceased contributor: • has a minimum five year-period of insurance or minimum ten years of pensionable service; or • has met the requirements for an old-age or disability pension; or • was a beneficiary of an old-age or disability pension. The spouse shall be entitled to use the survivor pension upon reaching 50 years of age. A child shall be entitled to the survivor pension until he/she reaches 15 years of age, and if the child is attending school until he/she reaches 26 years of age.	The pension amount is determined by the percentage of the old-age or disability pension that the contributor would have had at the time of death, namely: • 70% for one family member; • 10% for each next member, but not more than 100% in total.
Disability pension	• Disability caused by an injury at work or occupational disease – regardless of the length of pensionable service. • Disability caused by an injury outside of work or by a disease, provided that on the date when the disability occurred the person met specific requirements in terms of age and years of service completed.	• 80% of the pension base when the disability is caused by an injury at work or by an occupational disease. • The pension base depending on the length of pensionable service and years of age when the disability is caused by an injury outside of work or by a disease.
Source: Law on Pension and Disability Insurance.		

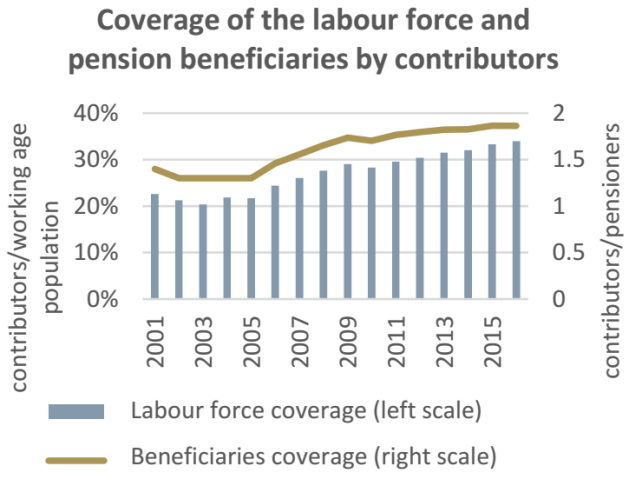
The statutory retirement age is 64 for men and 62 for women. However, the effective retirement age is lower, namely, 62 for men and 61 for women (PDIF). The lower effective rate of retirement is due to early retirement, which is allowed by the legislation for specific groups of contributors and survivor and disability pensions, and due to reduced years of service in certain occupations.

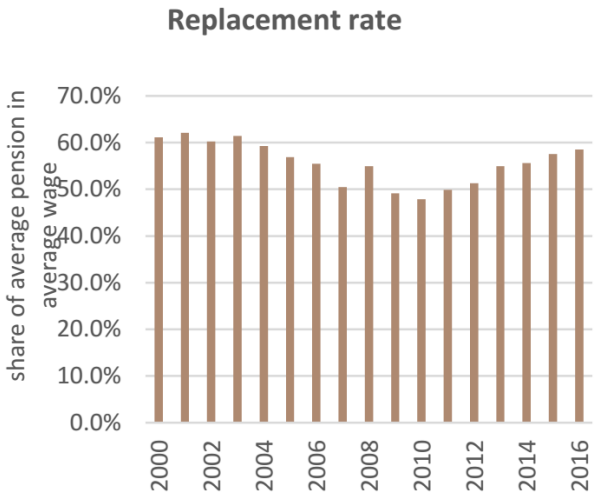
Two indicators that particularly affect the current condition of the pension system and its future sustainability are the coverage of current pension beneficiaries by contributors (rate of insured employed persons vis-à-vis pensioners) and coverage of working age population by contributors (rate of insured employed persons vis-à-vis working age population). The decrease in these indicators worsens the condition of the pension fund and vice versa. The indicator for contributors' participation in the labour force points to two aspects of pension system sustainability: first, the potential for fulfilling the needs of the pension system; and second, the extent to which the working age population has ensured their financial security after retirement. The second indicator is more important for countries with more developed voluntary pension systems. But, on the other hand, the current design of the social protection system in Macedonia is such that adults lacking financial security are covered at the expense of the system, which has fiscal implications.

Graph 1 shows the coverage indicators (left figure) and the replacement rate (right figure). In Macedonia, the contributors' participation in the labour force has increased by more than 10 percentage points (pp) over the period under analysis (from 23% in 2001 to 34% in 2016[3]). The indicator for the pension beneficiaries' coverage also experiences an upward trend (from 1.5 contributors for every pensioner in 2001 to 1.86 in 2016). This is due to the increase in employment, which in recent years was mainly driven by the entry of foreign direct investments into the country and active employment measures, which were not always compensated by payments in the PDIF because of the exemptions and subsidised contributions for pension insurance in some of these recruitments.

[3] This rate is not to be confused with the employment rate, because it only covers those employed persons for whom funds are paid in the PDIF. Therefore, this rate is lower than the total employment rate.

Graph 1: Coverage of the labour force and pension beneficiaries by contributors and replacement rate





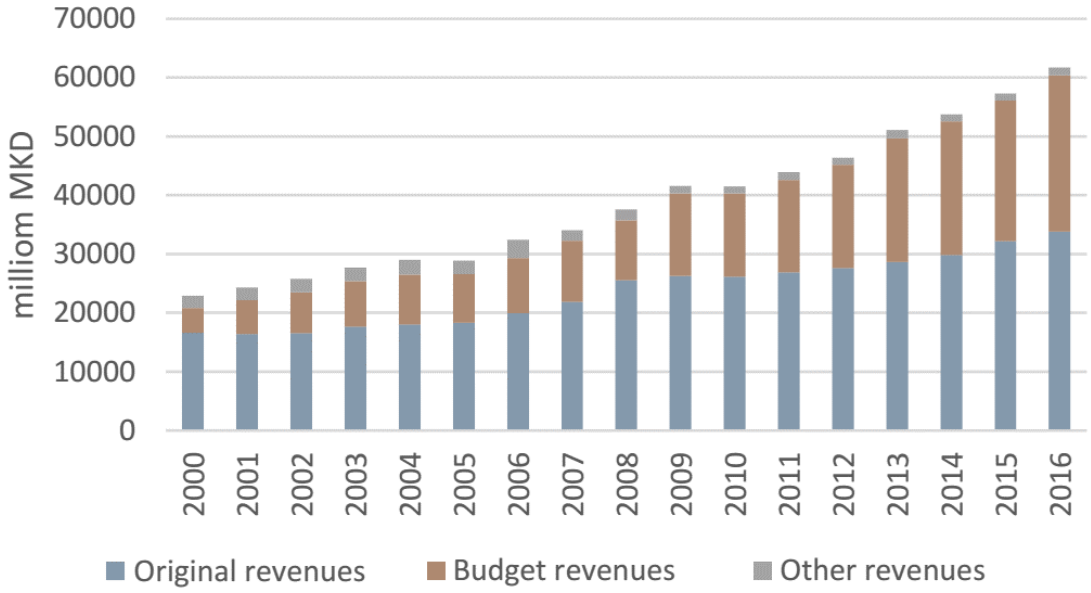
Source: PDIF, State Statistical Office of the Republic of Macedonia, estimate by the authors

In parallel with the increase in the number of contributors and the coverage of pension beneficiaries, there was an increase in the replacement rate. This indicates that the growth in the beneficiaries' pensions was higher than the average wage growth. Also, the replacement rate experiences a decrease until 2008, and then an accelerated growth, which corresponds to the ad-hoc pension increases. In this context, in the circumstance of there being a considerable risk of population aging and low coverage of working age population, such a trend of growth in the replacement rate is a risk that could have a significant negative impact on the pension system's sustainability.

Financing and expenditure of the Pension and Disability Insurance Fund in Macedonia

The main financing of the Pension and Disability Insurance Fund is provided through the contributions of the wages of insured persons, which are paid by employers. The pension contribution rate for the first pillar is 18% of the gross wage (for contributors insured in the first pillar only), and 6 percentage points of those (6% of gross wage) are transferred to the second pillar (for contributors insured in both pillars). Smaller revenues in the PDIF are provided by the Employment Service Agency from payments by natural persons and excise revenues, and the dividends and sale of stocks. The difference between these revenues and the pension expenditures is offset by utilizing the central budget. PDIF's total revenues have been trending upwards, and nearly tripled between 2000 and 2016 (Graph 2). However, in the same period, the original revenues from contributions doubled, mainly due to economic growth (and hence the growth in wages) and growth in the number of contributors. Consequently, the revenues from the Budget of the Republic of Macedonia increased six-fold between 2000 and 2016. This brought about a significant change in the PDIF's revenue structure, where the original revenues remained prevalent (55% in 2016), but their share dropped significantly when compared to 2000 (73%). On the other hand, the budget revenues increased their share from 18% in 2000 to their maximum, 43%, in 2016.

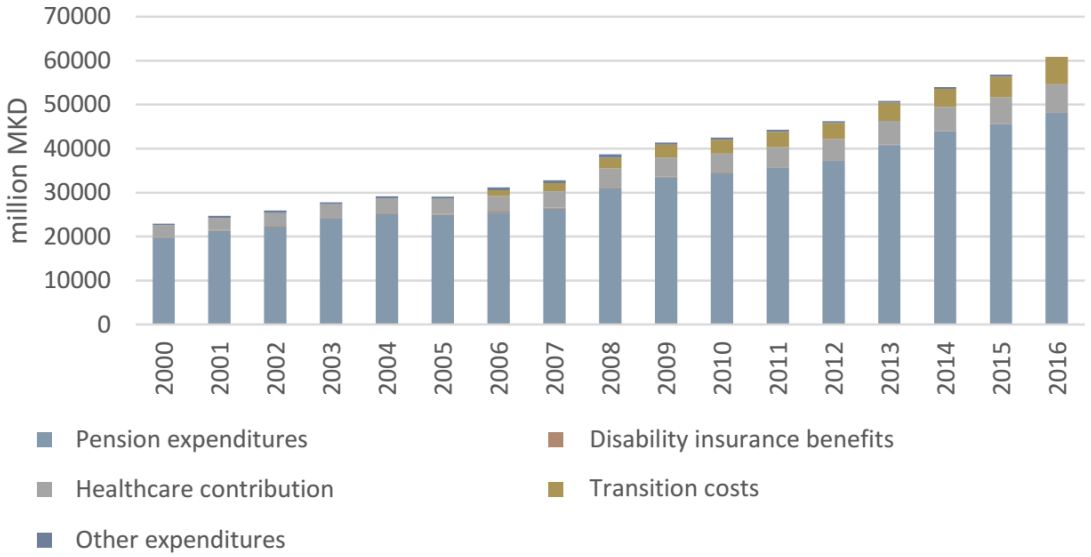
Graph 2: PDIF's revenue structure, 2000 - 2016



Source: PDIF

The Fund's expenditures were also growing over the period analysed, and at a faster pace after 2008 (Graph 3). In part, the Fund's expenditures grew as a result of the introduction of the second pillar (in 2006) and the costs incurred during the transition from one system to the other (so-called transition costs). However, these transition costs account for 10% of the Fund's total expenditures. In the Fund's expenditure structure, the pension expenditures are dominant, with 78%, and they experience a relatively insignificant decrease in 2016 compared to 2000 (86%), mainly due to transition expenditures.

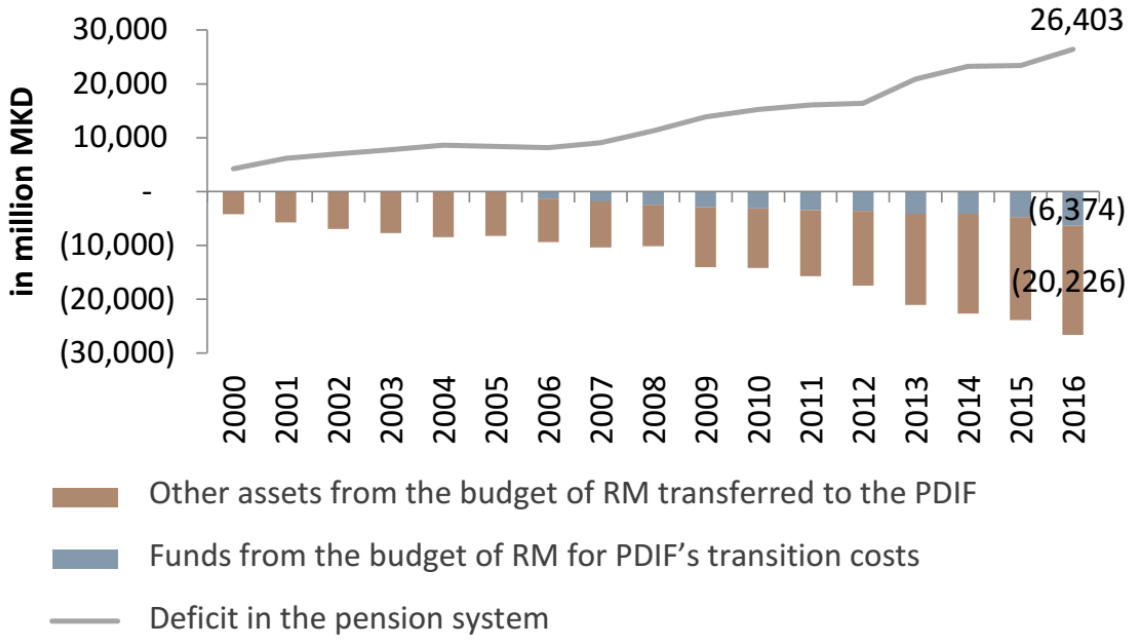
Graph 3: Fund's expenditure structure, 2000-2016



Source: PDIF

The faster growth in pension expenditures as compared to the original revenues of the PDIF increased the Fund's deficit from MKD 4.2 billion in 2000 to MKD 26.4 billion in 2016 (Graph 4). This deficit growth is due to several factors that caused a faster increase in expenditure than in revenue. On the one hand, the increase in expenditure was mainly driven by: i) the introduction of the second pillar in 2006 and the transfer of assets from the first to the second pillar; these expenditures account for 25% of the total deficit in 2016; and ii) the increase in pensions on several occasions, which usually exceeded the amount envisaged for adjustment and exceeded the national economic growth rate. This trend of "imbalance" began in the period after 2008, when besides the one-off increases in pensions, almost all regular pension adjustments were higher than the economic growth and the wage growth of that year. Before 2008, the economy, on average, experienced growth of 3.1%, and the pensions of 2.9%; whereas after 2008, the economy grew by 2.4%, on average, and the pensions saw their growth almost triple by growing by 6.5%. In addition, in circumstances of low inflation rate, the increase in pensions is even higher than the need for adjustment to the cost of living. On the other hand, the lower revenue growth was mainly driven by the decrease in the social contributions rate from 21.2% to 19% in 2009 and to 18% in 2010.

Graph 4: Pension fund balance

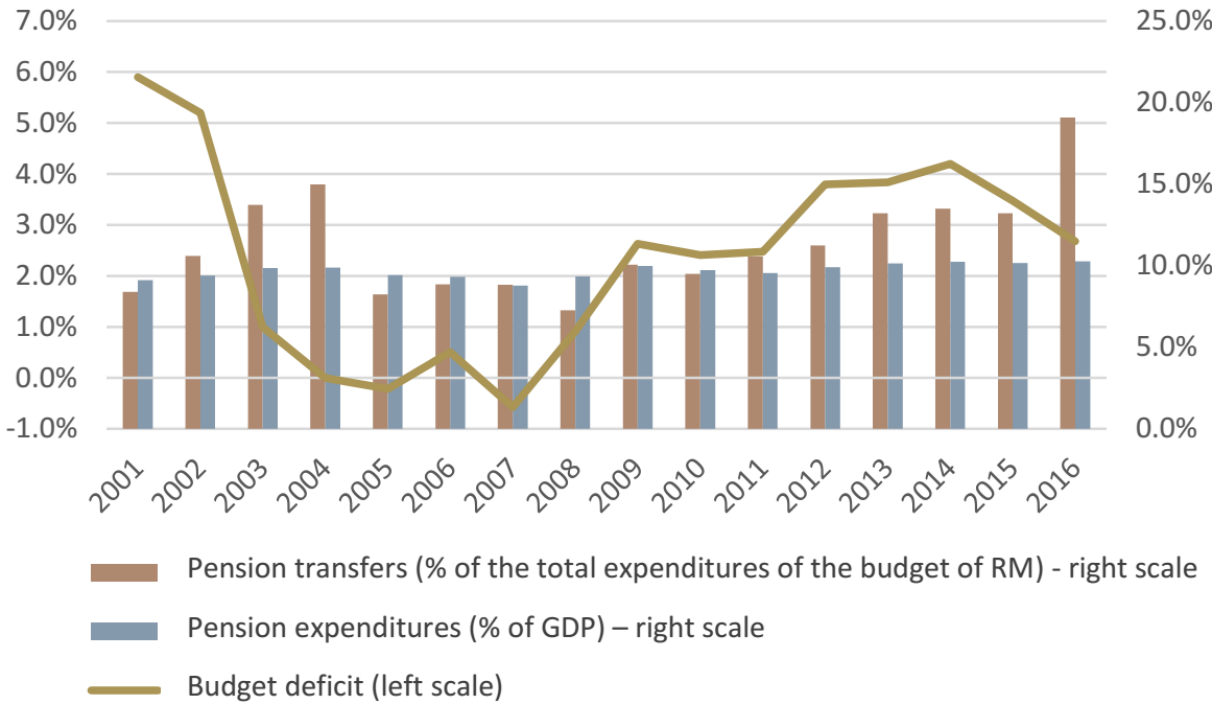


Source: PDIF

The pressure that the pension system exerts on public finances is the third aspect of the system's sustainability. Three indicators are used to measure this pressure: transfers from the budget of the Republic of Macedonia to compensate for the shortfall in assets in the pension fund, pension expenditure as a share of the gross domestic product, and the budget deficit (Graph 5). Pension expenditure accounts for 10% of the gross domestic product and has grown by two percentage points during the period analysed. But, at the same time, the transfers from the budget of the Republic of Macedonia for compensating for the shortfall in assets in the pension fund have doubled, and reached 19.1% of the central budget in 2016. From 2001 to 2004, budget transfers were increasing as a result of the decreased number of contributors and a parallel increase in

the number of pension beneficiaries. From 2004 to 2009, the number of contributors was increasing, and this contributed to the decrease in budget transfers. After 2009, the transfers were again growing rapidly. This period overlaps with a decrease in the contribution rate and in the ad-hoc increases in pensions. The amount transferred from the central budget is 1.5 times greater than the system's deficit. Therefore, the pressures on public finances were increasing in the analysed period and public finances are faced with the challenge of sustainability.

Graph 4: Sustainability of public finances

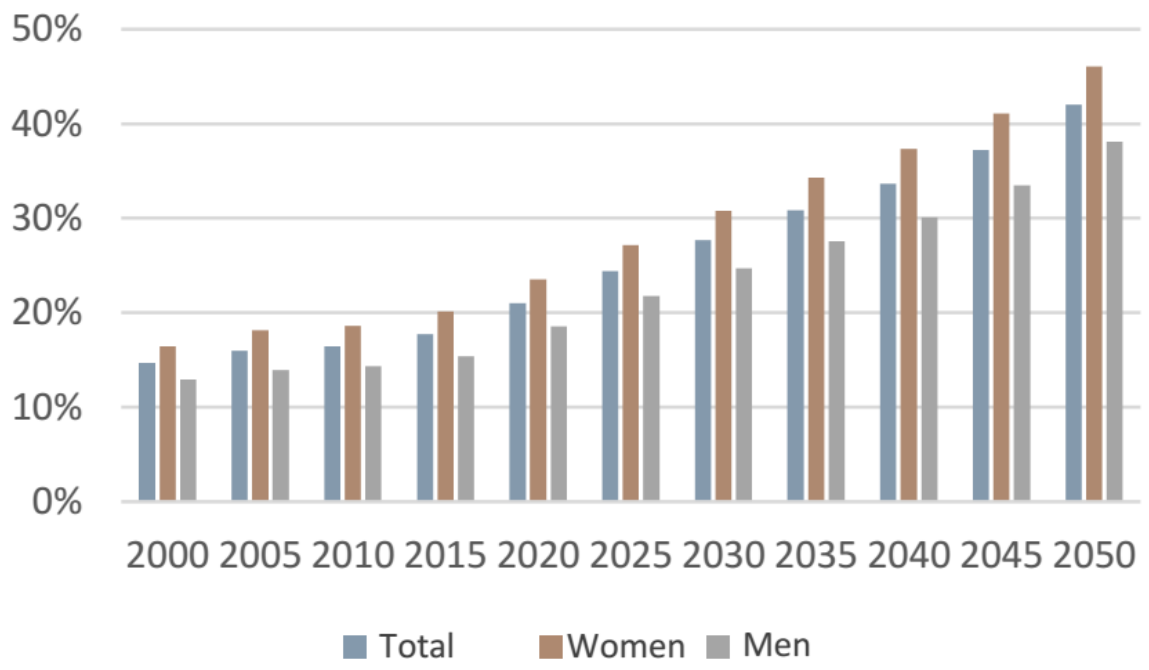


Source: Final account of the budget (2001-2016), Ministry of Finance, PDIF

Demographic changes

According to the projections of the United Nations, the population in Macedonia is aging (Graph 6). In 2000, the population aged over 65 accounted for 15% of the total working age population. Until 2050, it is expected that the old-age dependency ratio will reach a record high of 42%. In addition, this ratio is higher among women: in 2000, it was 16% for women compared to 13% for men, and the expectations are that in 2050 this gap will widen and the ratios will reach 46% and 38% respectively.

Graph 5: Old-age dependency ratio 65+/ (15-65)



Source: United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, custom data acquired via website.

Pension sustainability index

Based on the three aspects of pension system sustainability (demographic developments, pension system design, and the sustainability of public finances), in this section we will construct a sustainability index. The index was constructed according to the methodology of Allianz Pension Sustainability Index (Allianz, 2004)[4] and it includes: the selection of indicators, normalisation, and the weighting and aggregation of the indicators into one index. Allianz's index has been published for 54 countries worldwide, but not for Macedonia, and this is the gap in the research that this piece fills. The purpose of the index is to assess the trends of the pension system's sustainability over the analysed period, and to make a comparison of the Macedonian pension system with the pension systems of other countries. Hence, this index will serve as a

[4] The index covers all construction steps proposed in the methodology, the three pillars and the majority of indicators. However, due to lack of information, some of the indicators were replaced by alternative indicators providing the same or similar information.

good basis for comparison for any country's pension system with the pension systems of other countries. The index ranges from 1 to 10, where one means complete unsustainability, and 10 means complete sustainability of the pension system[5]. Table 2 summarizes the information that serves as input for the index.

Table 2: Pension Sustainability Index in Macedonia - elements

Sub-index	Weighting	Indicators	Weighting of the sub-index indicators
Demographic characteristics[6]	0.3	Old-age dependency ratio in 2010	0.2
		Old-age dependency ratio in 2050	0.4
		Change 2010-2050	0.4
Pension system design	0.35	Legal retirement age for men	0.05
		Effective retirement age for men	0.075
		Legal retirement age for women	0.075
		Effective retirement age for women	0.075
		Replacement rate	0.35
		Coverage of working age population	0.35
Public finances[7]	0.35	Pension expenditures (% of GDP)	0.333
		Public debt (% of GDP)[8]	0.333
		Transfers from the central budget for pensions (% of total expenditures)	0.333

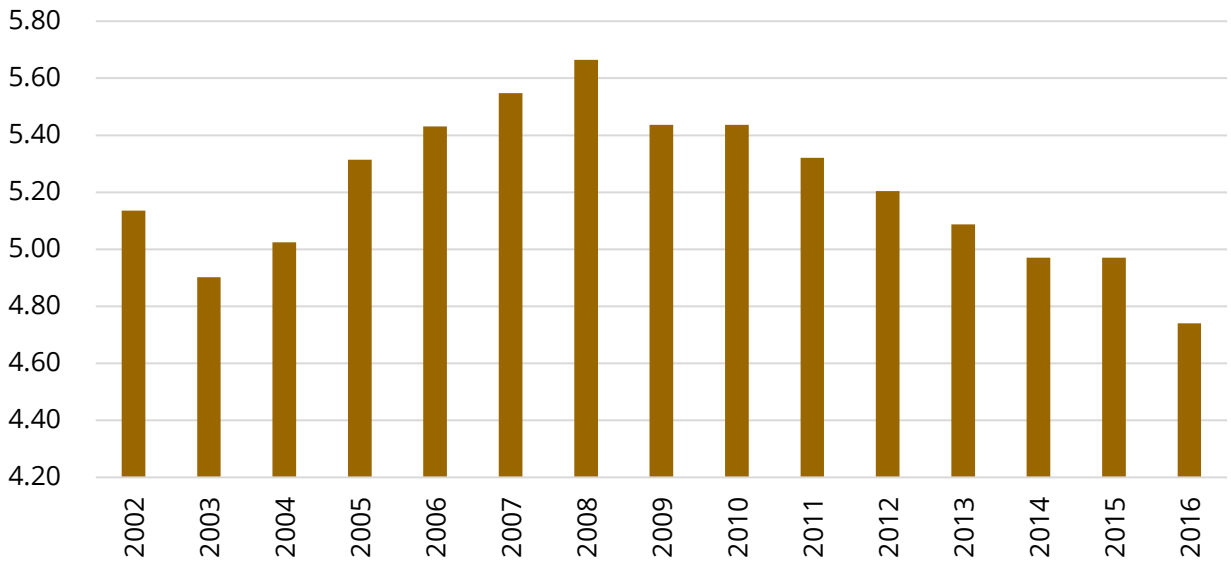
Source: Author's estimate based on the methodology of Allianz Pension Sustainability Index (Allianz, 2004)

Graph 7 presents the composite index for measuring the sustainability of the pension system in Macedonia. In the period under analysis, the index ranges from 4.7 to 5.7 ranking and is designed similarly to the indices of Slovenia and Greece[9]. Additionally, the index categorizes the

[5] All indicators have been categorised for each year from one to ten, according to the matrix of the Pension Sustainability Index proposed by Allianz.
[6] The sub-index does not include assumptions about the projections of the change in pension benefits until 2050.
[7] The sub-index does not include assumptions about the projections of the pension expenditures as a share of GDP until 2050.
[8] The categorisation was made for a scale of the public debt ranging from zero to 60% of GDP, as a critical level identified in the study "Sustainability of Macedonian General Government Debt" (Finance Think, 2017).
[9] In the comparison, the indicator's adjustments to the public debt are to be taken into consideration, relevant for Macedonia, and the absence of available data about indicators with a forecasting component.

Macedonian pension system in the group of countries with low pension system sustainability and urgent need for reform. The index notes a continuous improvement of the sustainability until 2008, and then there is significant deterioration from one year to the next in all the years following. The deterioration is mainly driven by the sub-index for the sustainability of public finances: increases in the pension expenditures as a share of the economy, increases in the share of pension transfers from the central budget in total expenditures, and increases in the public debt.

Graph 6: Pension sustainability index



Source: Ministry of Finance of RM; PDIF; State Statistical Office of RM; UN Population; author's estimate.

Simulations for a potential reform of the pension system

Methodology and data

The starting point for the methodology of this paper is MK-MOD, the tax and benefit microsimulation model within the EUROMOD family (Petreski and Mojsoska Blazevski, 2017). It is a static model where individual behaviour (labour-market activity, employment, childcare, saving, etc.) is assumed to be exogenous to the tax-benefit system. It belongs to the family of "standard" static models where individuals/households choose to supply labour (hours of work) until the point where the "marginal disutility of work equals the marginal utility of disposable (net-of-tax) income." (Saez, 2010, p.180). In this setting, taxes and social transfers affect labour-market behaviour by changing the relative value of work versus leisure. The model allows, in the starting year, the simulation of taxes, benefits and contributions of pension, health and unemployment insurance, social transfers, and the replication of pensions on a system level. Despite the extensiveness of the static model for simulations and replication of indicators in the system as a whole, the simulation of the pension system and the projections of future developments require dynamic components as well. Hence, this model was upgraded by the MK-PENS dynamic microsimulation model based on individual data about Macedonia.

Dynamic models have a possibility of modelling changes over time (Dekkers, 2007). Microsimulation models simulate all foreseen changes on a representative sample of individuals, usually collected through surveys or administrative data (Gal et al., 2009). Our MK-PENS model has a dynamic form and includes the movement of individuals from the sample in a time range, enabling the individuals to be followed as they age, considering the interpersonal (family) relations of the individuals in the sample, their behavioural responses, and the effects from the changes in their labour market status on development indicators (mainly, poverty and unemployment). Thus, dynamic models create a life path for each individual in the sample, including the probability of death, change in economic status, time of retirement, earnings, etc. (Emmerson et al. 2004). In the following section we briefly address each of these dynamic components.

The first component of the MK-PENS dynamics is population flow over time. This flow can be determined by both static and dynamic components. In models with static population aging, projections are given exogenously and the groups are only re-weighted, without changing the individual characteristics over time (age, change in economic status, mortality etc.) (Merz, 1993; 1994). On the other hand, in models with dynamic population aging, individual characteristics change endogenously over time (Caldwell, 1990), considering that there is some probability of the characteristics changing. The number of variables that could be foreseen in a dynamic way depends on the availability of data, risks, and the ability to predict the probabilities (Dekkers, 2003). In our model, the projections of fertility and total population are given exogenously, i.e. they are taken from the projections in UN-Population (static component), while the total mortality is a residual and is scaled to replicate the mortality rate published by the State Statistical Office of Macedonia. However, the mortality of individuals in the sample was derived from the health function (dynamic component), and we used the following two equations for that purpose:

For persons aged from 25 to 62 (women) and 64 (men)

$$\Pr(Health_i = 1) = \alpha_1 + \gamma_1 age_i + \gamma_2 gender_i + \gamma_3 education_i + \gamma_4 hhincome_j + \gamma_5 hronic_i + u_{1i} \quad (1)$$

For persons aged over 62 (women) and 64 (men):

$$\Pr(Health_i = 1) = \alpha_2 + \gamma_{11} age_i + \gamma_{12} gender_i + \gamma_{13} pension_i + \gamma_{14} married_i + u_{2i} \quad (2)$$

Where: $Health_i$ is a binary variable obtaining a value of 1 if a person *i* is in good health (where the self-reported health condition is good, very good or excellent) and 0 when the person is in ill-health (the self-reported health condition is poor or very poor); age_i denotes the age of person *i* in years; $gender_i$ denotes sex, and has a value of 1 for men and 0 for women; $education_i$ is a categorical variable about the level of education (primary education being the referent category) of person *i*; $hhincome_i$ is the household income level j in MKD; $pension_i$ is person's i pension amount, in MKD; $married_i$ denotes marital status, and obtains a value of 1 for married individuals, and 0 for all others. u_{1i} and u_{2i} are the usual idiosyncratic errors that are assumed to be well-behaved. In the model, the life status (alive-dead) changes over time based on the probability of health defined in these two functions. The predictions of both functions (1) and (2) are used to determine what person will die after a given period. Hence, persons aged over 62/64 whose predicted probability of good health is under 0.15 die according to the model, and this value in the working are population is 0.53. The total mortality rate published by the SSO is replicated according to these dynamics of dying.

The second dynamics component is the change in the individuals' economic status as it concerns their behavioural responses. The purpose of behavioural microsimulations is to assess the behaviour of individuals as a function of variables that directly depend on the change in the policy being simulated (Spadaro, 2007). Pension reform has different effects and will cause different behaviours among different groups in the sample. Therefore, the assessment of individual behaviours to the policy change is important for later simulations of the taxes, benefits, and expenditure. Individuals in the model are classified into the following economic status categories: unemployed, employed, inactive working-age persons, pensioners and persons without pensions aged over 62/64. The main assumptions about the transfer from one economic status to another are the employment rate, which is an exogenous variable, and the assumption about the employment growth. This assumption is that employment growth is on average, 4 percentage points in a five-year period, according to the average annual growth in recent years. Individuals obtain an employed -person status according to the derived function of employment probability, regressed from a vector of variables. The equation calculates the probability that individuals with an unemployed and inactive status will transition to employed persons-status[10]. The equation has the following form:

$$\Pr(Emp_i = 1) = \alpha_3 + \gamma_{31} age_i + \gamma_{32} gender_i + \gamma_{33} education_i + u_{3i} \quad (3)$$

[10] We leave the possibility for an easy transition from an inactive to employed status, considering that inactivity in Macedonia is not a particular constraint to employment.

Where Emp_i takes a value of 1 if the person is employed and 0 otherwise, regressed on a vector of explanatory variables: age_i denotes the age of person i in years; $gender_i$ denotes sex, and has a value of 1 for men and 0 for women; $education_i$ is a categorical variable about the level of education (primary education being the referent category). u_{3i} denotes the error. Hence, the likelihood of transition of inactive working age individuals and unemployed individuals from their status to the status of employed individuals is established by a dynamically-determined probability of employment, calculated through the equation given in (3). Function (3)'s predictions are used to determine which individuals will be employed after a given period. Hence, individuals whose predicted employment probability is over 0.7 are employed. The average employment rate of the previous 5 years is replicated according to these employment dynamics.

However, this transition from unemployment and inactivity is problematic. Namely, for individuals transitioning to employed persons status, wage is unknown, and it is key for determining the increase in contributions driven by the increase in employment. To determine the wage, we use the following Mincer earnings function:

$$lnw_i = \alpha_4 + \gamma_{41} age_i + \gamma_{42} gender_i + \gamma_{43} education_i + \gamma_{44} experience_i + \varepsilon_i \quad (4)$$

Where lnw_i is the logarithm of monthly earnings of employed person i; $experience_i$ is person *"s* experience, and the other explanatory variables are the same as in (3); ε_i is the idiosyncratic shock to the wage. The predictions from equation (4) are used to estimate the income from the work of the unemployed-inactive individuals, who it is assumed will be employed according to the predictions in equation (3).

Children, students, and pensioners change their economic status in a static way by aging over time. Children transition to the status of students when they reach the age of 6 ; students transition to the status of inactive working age individuals when reach the age of 15 ; and employed individuals transition to pensioners after meeting the retirement requirements defined in Table 1. After a change in status, the model re-weights the individuals in the sample according to their new status. This re-weighting is done only for the statically determined statuses (children, students, inactive working age population, and persons in the age of retirement without a pension).

Being designed in this way, the model is able to replicate the initial level of the number of contributors, pensioners, and the average pension amount (per pension type), original contributions and benefits for pension, health and disability insurance, the amount of original pension expenditures, poverty rates and unemployment (Table 3).

Table 2: Validation of the model's results by official statistics

	Official figures	Replicated figures according to the model	Deviation
Original revenues and expenditures for the pension system			
Pension insurance contributions (million MKD)	35,475	36,456	3%
Original pension expenditures (million MKD)	55,789	57,852	4%
Deficit (original, million MKD)	(20,314)	(21,396)	5%
Deficit (% of GDP)	-3.2%	-3.4%	5%
Number of pensioners and average pension			
Number of pensioners (old-age)	191,592	191,592	0%
Number of pensioners (survivor)	76,052	76,052	0%
Number of pensioners (disability)	37,465	37,465	0%
Total pensioners	305,109	305,109	0%
Average pension (old-age)	15,321	15,105	-1%
Average pension (survivor)	11,336	10,648	-6%
Average pension (disability)	12,788	12,354	-3%
Employment and poverty			
Employment rate	44.1%	44.5%	1%
Unemployment rate	22.6%	22.4%	-1%
Poverty rate (before pensions)	41.6%	41.1%	-1%
Poverty rate (after pensions)	25.7%	23.7%	-8%

Source: Ministry of Finance of RM; PDIF; State Statistical Office of RM; own estimates based on the 2017 Quality of Life Survey

The results show that the model fully replicates the official data, with a maximum deviation of -6% in the case of an average survivor pension and of -8% in the poverty rate after pensions. In the first case, the deviation could be caused by two underestimations: underestimation of the deceased person's pension base (which is very hard to estimate adequately, due to lack of information on the deceased person) and the underestimation of the number of beneficiaries in one family.

The model's dynamic component allows for microsimulations and projections of future developments regarding these indicators under simulated assumptions about policy changes. As an advantage, the database allows the gathering of all the information on the individual characteristics of persons (age, education, economic status, health status, revenues on different grounds, etc.), information about household composition, and information about socioeconomic status. The Quality of Life Survey in Macedonia - 2017 was the data source used in this paper, and it was answered by a random sample on a national level of 1,200 households, covering 4,071 individuals.

Input information and assumptions about the simulations of pensions and benefits

For future projections, as inputs, we take the assumptions about the eligibility requirements to be entitled to a pension as well as its type, amount of the pension, the number of benefits, and the adjustment rate.

In the simulations, we modelled the following pension types: old-age, survivor and disability[11] pension. The number of pension beneficiaries is defined as the sum of the number of existing pensioners in the baseline year, for each type, increased by the number of new pensioners and decreased by the number of deceased pensioners (previously identified by health equation 2).

The eligibility requirements to be entitled to a pension are in accordance with the conditions set out in the Law, listed in Table 1, namely:

- For an old-age pension, the beneficiary has a minimum 15 years of service and has reached 62 years of age for women and 64 years for men. In the old-age pension, individuals with reduced years of service due to having worked in military occupations[12] have been simulated separately. The eligibility requirements for an old-age pension beneficiary with reduced years of service are: the person had a military occupation, has reached 50 years of age for women and 55 years for men, and has a minimum 25 years of service;
- For survivor pension, the beneficiaries are members of the deceased person's family: a spouse with the status of a widow(er), whose economic status is unemployed, having reached 50 years of age; all children being under the age of 15 or between the age of 15 and 26 years if they have the status of students. For future beneficiaries of survivor pensions, the pension right is acquired by members of the family, under the previously identified criteria, for a person whose status has transitioned from alive to deceased, according to the health function (2).
- For a disability pension, we considered the current disability pension beneficiaries regardless of the reason for the disability, and for future disability pension beneficiaries, we simulated only beneficiaries whose disability is caused by a disease. The disease is derived from the health function (1), when the person has a probability of ill health, within limits that replicate the current rate of disability pension beneficiaries.

The pension amount is determined by a person's earnings during their career and the length of their service. Career earnings are approximated to the average net wage earned in the last three years for individuals that are still in employment, or the last three years before retirement for pensioners, adjusted to the wage growth from a five-year average. The length of service refers to the years spent in work for which contributions and benefits have been paid. Depending on the length of service, we applied the replacement rates, as defined in the Law on

[11] It is difficult to predict the injury at work for future beneficiaries, therefore we simulate only a disability triggered by disease.

[12] We did not simulate the reduced years of service in other occupations, because the survey contains information of the main occupation groups only, such as military occupations.

Pension and Disability Insurance, to the average earnings. For contributors covered by the mandatory pension and disability insurance before 2001, the replacement rate is: for 15 years of pensionable service, 35% for men and 40% for women, for each following year of pensionable service this rate increases by 1.8 percentage points for men and 2.6 percentage points for women until the 20th year of service, and 1.8 percentage points for each year following 20 years. The maximum replacement rate is 80% for 40 years of service completed for men and 35 for women. For each additional year of pensionable service completed after 1 January 2013, the pension is calculated in the amount of 1.84 for women and 1.61 for men from the pension base. The amount obtained in this manner is the total pension, which is received in the case of an old-age pension. The maximum old-age pension amount is limited to MKD 45,000. In the survivor pension, the pension amount is obtained as a percentage amount from the old-age pension to which the contributor is entitled, 70% for the first member, 10% more for each next member, but the maximum is 100%. The disability pension amount is 70% of the calculated old-age pension to which the contributor is entitled.

In calculating the pension, we included the pension adjustment in recent years, and we considered the assumption for future adjustments. For pensioners retired in the period between 2007 and 2016, we calculated a cumulative pension adjustment according to the actual annual pension adjustments in that period (maximum 40%). For pensioners retired before 2007, we included a fixed cumulative adjustment in the amount of 51%. Future adjustments were made in accordance with the legal provisions, 50% of the wage growth and 50% of the cost of living, and in our case, this adjustment was set at 1.5% annually.

The wage benefits and taxes were calculated through the net wage identified. The gross wage is calculated based on the net wage, which is reduced by tax exemptions, which is the basis for the calculation of taxes and benefits and depends on whether the person has full-time or part-time insurance. For pensioners, we only calculated the health and disability insurance[13] in the amount of 13% of net pension.

Scenarios for potential pension reforms

Once the basic parameters have been identified (the number of contributors and beneficiaries, original benefits, and original expenditures), the paper continues with the dynamic simulations over a time horizon of five and ten years. In this context, the simulations have a dual purpose: 1) to estimate the future developments of the basic parameters if there are no reforms in the pension system; and 2) evaluate the fiscal effects and effects on poverty and unemployment of the potential reforms in the pension system. In the simulated scenarios, we proposed two types of reforms: 1) reforms wherein the burden will mainly affect one concerned party (pensioners or contributors), 2) reforms with a shared burden and 3) a reform where the burden is shared and the reform is cascading and gradual. Also, in the simulations, reforms concern the following:

[13] In accordance with the Law on Personal Income Tax, the pension income is subject to personal tax to be paid by the PDIF on behalf of the pension beneficiaries. The income tax calculated for the earnings based on pensions and disability benefits is transferred to the PDIF. However, the Fund only records this amount on an accrual basis, but it is not actually paid in the budget.

a change in the contribution rate and in the retirement age limit for different types of beneficiaries, including beneficiaries with reduced years of service due to having military occupations.

The reform scenarios are the following:

1) The burden is borne by the individual groups concerned:

- Increase in the contribution rate from 18% to 22%, thus the burden is borne by current contributors;
- Retirement age limit for old-age pension is extended by 2 years (from 62 years for women and 64 years for men to 65 and 67 years, respectively), thus the burden is borne by future pensioners;
- Retirement age limit for survivor pension is extended by 3 years (from 50 years for widow(er) to 53 years);
- Retirement age limit for pension beneficiaries with reduced years of service is extended by 3 years (from 50 years for women and 55 years for men to 53 and 58 years, respectively.

2) The burden is shared between the concerned parties:

- Increase in the contribution rate by 2 percentage points and extending the retirement age limit by 1 year for old-age pension, 2 years for survivor pension, and 2 years for pension-based on reduced years of service;
- Increase in the contribution rate by 3 percentage points and extending the retirement age limit by 2 years for old-age pension, 2 years for survivor pensions, and 2 years for pensions based on reduced years of service;
- Increase in the contribution rate by 3 percentage points and extending the retirement age limit by 2 years for old-age pension immediately, and by an additional 1 year after five years, 2 years for survivor pensions, and 2 years for pensions based on reduced years of service.

3) The burden is shared between the concerned parties, and the reform is cascading and gradual.

- Increase in the contribution rate by 2 percentage points immediately and an additional 1 percentage point after 10 years; extending the retirement age limit, age limit for survivor pensions and reduced years of service by 1 year after five years and by an additional 1 year after 10 years.

In all scenarios, the pension adjustment is for the legally envisaged level only. Therefore, current pensioners also bear the burden of the difference for the higher adjustment than the one set out in the Law, which they were receiving in the past years.

Results

Results from the input equations for health, employment and wage

The estimates from the functions for health, employment, and wage are given in Table 4. Column (1) shows the results for the probability of pensioners' good health; column (2) shows the results for the probability of good health in the working age population; column (3) shows the results for the probability of employment; and column (4) shows the results for wage. All ratios are the reported marginal effects in the case of probit functions (1-3). The ratios also include the expected sign. Age, sex and income from pensions are statistically significant for the health of pensioners. As expected, each additional year of age reduces the probability of good health in pensioners. Men have a higher probability of good health, and higher pensions increase the probability of having good health. Education and marital status are statistically insignificant for the health of pensioners (and they are not used for the additional estimates).

The health of the working-age population depends on age, education and family income. As in the case of pensioners, an additional year of age reduces the probability of good health. However, in the working-age population, the magnitude of this ratio is drastically lower. This is to be expected, because in the older populations, an additional year of age has a higher adverse effect on health than in younger generations. Higher education and family income increase the probability of better health, while the existence of chronic diseases reduces this probability. Unlike the case of pensioners, sex in working-age population is not statistically significant.

The three wage explanatory variables of age, education and sex are important for the probability of employment. Older individuals, men, and individuals with higher education have a greater probability of employment. As in the probability of employment, age, education and sex are significant for wage amount. Older individuals have a higher wage. This is probably due to experience and to wage negotiation skills, which do not appear as observed variables in this equation. Men, on average, earn a higher wage than women by 18%, which confirms the results for the adjusted gender wage gap in Macedonia in the study by Petreski and Mojsoska-Blazevski (2015). As expected, individuals with higher education have higher wages.

Variables	Equation for the health of pensioners (conditional probability of good health)	Equation for the health of working age population (conditional probability of good health)	Equation of employment (conditional probability of employment)	Wage equation (conditional log. wage)
	(1)	(2)	(3)	(4)
Age	-0.0263***	-0.000715**	0.0131***	0.00527***
	(0.0031)	(0.0003)	(0.001)	(0.001)
Sex (1=male)	0.118***	-0.0015	0.257***	0.178***
	(0.036)	(0.0059)	(0.021)	(0.018)
Education	-0.00585	0.00328*	0.138***	0.0954***
	(0.0084)	(0.0018)	(0.007)	(0.0073)
Pensioner's marital status (1=married)	-0.0406			
	(0.0376)			
Pension income	0.0000065**			
	(0.000)			
Income in the family, on all grounds		0.0000006***		
		(0.000)		
Chronic diseases		-0.347***		
		(0.0393)		
Constant				8.786***
				(0.078)
Observations	895	2,087	2,422	1,280
R-squared				0.187

*Source: Author's estimate based on the **2017 Quality of Life Survey**.*
, ** and * refer to statistical significance of 10, 5 and 1 percent, respectively. Standard errors have been corrected for heteroskedasticity and are given in parentheses.*

Fiscal effects from the pension reform

Table 4 presents the fiscal effects if the pension system remains with its current design and if no reform is made. Column 1 shows the replications of official figures and the basic scenario for comparison with the results of the reforms proposed; column 2 shows the fiscal effects if the pension adjustment in the past period did not exceed the maximum stipulated in the Law for adjustment to the wage growth and cost of living; columns 3 to 5 show the results after 5, 10 and 20 years, respectively, if the system design remains the same and there is no pension reform.

The results indicate that if the pension increase in the past period was only within statutory adjustment, today, the original deficit (the difference between original revenues and original expenditures, without transition costs) would have been 35% lower, and the share in GDP would have been lower by 1.2 percentage points. If there is no pension reform in the next twenty years,

and the pension growth remains only on the statutory adjustment level, the original deficit will continue to grow in absolute amount, but at a slower pace, while its relative share in GDP will start to slightly decrease.

Table 4: Fiscal effects for 5, 10 and 20 years if there is no pension reform

	Basic scenario		**If there is no reform**		
	Replicated figures to the actual situation	If the pensions are adjusted to the statutory rate only	After 5 years	After 10 years	After 20 years
	(1)	(2)	(3)	(4)	(5)
Pension insurance contributions (million MKD)	36,456	36,456	42,331	47,561	59,521
Original pension expenditures (million MKD)	57,852	50,412	65,760	75,900	90,588
Deficit (original in million MKD)	**(21,396)**	**(13,956)**	**(23,429)**	**(28,339)**	**(31,067)**
Deficit (% of GDP)	**-3.4%**	**-2.2%**	**-3.1%**	**-3.0%**	**-3.3%**
Number of pensioners (old-age)	191,592	191,592	221,684	255,088	290,149
Number of pensioners (survivor)	76,052	76,052	62,532	59,152	51,546
Number of pensioners (disability)	37,465	37,465	38,185	37,465	24,496
Total pensioners	**305,109**	**305,109**	**322,401**	**351,705**	**366,191**

Source: 2017 Quality of Life Survey, author's estimate

Table 5 presents the fiscal effects from the simulated scenarios for pension reform in the next five and ten years. Columns 1 to 4 show the results from the scenarios of stronger individual shocks, when the burden falls on an individual group concerned, namely: (1) increase in the contributions to 22%; (2) extending the retirement age limit for old-age pension by 2 years; (3) for survivor pension from a spouse by 3 years; and (4) for old-age pension with reduced years of service by 3 years. Columns 5 to 7 show the results from the scenarios of a combined pension reform, with simultaneous changes in the contribution rate and retirement age limits. Column 8 shows the results from the combined cascading reform.

The effects of the simulated scenarios showed that the reforms proposed could significantly reduce the deficit in PDIF; and after 5 years, the deficit will range from 1.5% to 3.1% of GDP, or between 0.7% and 3.3% after 20 years. The increase in contributions to 22% reduces the deficit by 40% after 5 years, 38% after 10 years, and even by 49% after 20 years. It seems that the greatest reduction in the deficit occurs in this individual scenario. The increase in the retirement age limit by 2 years reduces the deficit by 18% after 5 years, 19% after 10 years, and 35% after 20 years. The effects of the change in the retirement age limit for survivor pensions and old-age pensions for the beneficiaries with reduced years of service are small, i.e. they reduce the deficit by one percentage point only. However, this is due to two facts: the number of survivor pension

beneficiaries is relatively smaller compared to the old-age pension beneficiaries, and the changes proposed concern only those cases where the spouse is the beneficiary; whereas, for the old-age pension beneficiaries with reduced years of service, we covered only the beneficiaries of people from military occupations and the effects are significantly underestimated. Nevertheless, the shortcoming of this type of reform with individual shocks is in the fact that the burden is borne by one generation and the shocks are stronger.

Table 5: Fiscal effects for 5, 10 and 20 years from the simulated scenarios about the pension reform

	Contributions are increased to 22%	Retirement age limit +2	Survivor pension, +3 years for eligibility	Reduced years of service, +3 years for eligibility	PIC + 2pp, limit +1, survivor pension +2, reduced service +2	PIC + 3pp, limit +2, survivor pension +2, reduced service +2	PIC + 3pp, limit +2 (until the 5th), +3 (after the 5th) survivor pension +2, reduced service +3	PIC + 2pp (until the 10th) + 3pp (after the 10th), limit +1 (after the 5th) +2 (after the 10th) survivor pension and reduced service +3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	After 5 years							
Pension insurance contributions (million MKD)	51,861	43,314	42,436	42,331	47,521	50,655		47,259
Original pension expenditures (million MKD)	65,760	62,424	65,196	65,760	63,864	62,172		65,196
Deficit (original, in million MKD)	**(13,899)**	**(19,110)**	**(22,760)**	**(23,429)**	**(16,343)**	**(11,517)**		**(17,937)**
Deficit (% of GDP)	**-1.8%**	**-2.5%**	**-3.0%**	**-3.1%**	**-2.1%**	**-1.5%**		**-2.3%**
Number of pensioners (old-age)	221,684	204,567	221,684	221,684	213,401	204,567		221,684
Number of pensioners (survivor)	62,532	65,067	59,152	62,532	59,997	63,377		59,152
Number of pensioners (disability)	38,185	37,465	38,185	38,185	38,906	37,465		38,185
Total pensioners	**322,401**	**307,099**	**319,021**	**322,401**	**312,304**	**305,409**		**319,021**

	Contributions are increased to 22%	Retirement age limit +2	Survivor pension, +3 years for eligibility	Reduced years of service, +3 years for eligibility	PIC + 2pp, limit +1, survivor pension +2, reduced service +2	PIC + 3pp, limit +2, survivor pension +2, reduced service +2	PIC + 3pp, limit +2 (until the 5th), +3 (after the 5th) survivor pension +2, reduced service +3	PIC + 2pp (until the 10th) + 3pp (after the 10th), limit +1 (after the 5th) +2 (after the 10th) survivor pension and reduced service +3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	After 10 years							
Pension insurance contributions (million MKD)	58,340	48,861	47,671	47,730	53,775	57,269	57,993	53,400
Original pension expenditures (million MKD)	75,900	71,676	75,504	75,900	73,308	71,412	70,212	74,406
Deficit (original, in million MKD)	**(17,560)**	**(22,815)**	**(27,833)**	**(28,170)**	**(19,533)**	**(14,143)**	**(12,219)**	**(21,006)**
Deficit (% of GDP)	**-1.9%**	**-2.4%**	**-3.0%**	**-3.0%**	**-2.1%**	**-1.5%**	**-1.3%**	**-2.3%**
Number of pensioners (old-age)	255,088	237,419	255,088	255,088	246,530	237,419	232,450	250,809
Number of pensioners (survivor)	59,152	60,842	56,616	59,152	57,462	59,152	58,730	57,039
Number of pensioners (disability)	37,465	37,465	37,465	37,465	37,465	37,465	37,465	37,465
Total pensioners	**351,705**	**335,726**	**349,169**	**351,705**	**341,457**	**334,036**	**328,645**	**345,313**

	Contributions are increased to 22%	Retirement age limit +2	Survivor pension, +3 years for eligibility	Reduced years of service, +3 years for eligibility	PIC + 2pp, limit +1, survivor pension +2, reduced service +2	PIC + 3pp, limit +2, survivor pension +2, reduced service +2	PIC + 3pp, limit +2 (until the 5th), +3 (after the 5th) survivor pension +2, reduced service +3	PIC + 2pp (until the 10th) + 3pp (after the 10th), limit +1 (after the 5th) +2 (after the 10th) survivor pension and reduced service +3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	After 20 years							
Pension insurance contributions (million MKD)	72,894	62,415	59,521	59,704	67,793	72,492	74,273	70,171
Original pension expenditures (million MKD)	90,588	82,560	90,588	90,588	86,604	82,560	80,538	84,582
Deficit (original, in million MKD)	**(17,694)**	**(20,145)**	**(31,067)**	**(30,884)**	**(18,811)**	**(10,068)**	(6,265)	(14,411)
Deficit (% of GDP)	**-1.9%**	**-2.2%**	**-3.3%**	**-3.3%**	**-2.0%**	**-1.1%**	-0.7%	-1.5%
Number of pensioners (old-age)	290,149	274,137	290,149	290,149	282,971	274,137	274,137	278,554
Number of pensioners (survivor)	51,546	47,321	51,546	51,546	48,166	47,321	47,321	47,744
Number of pensioners (disability)	24,496	24,496	24,496	24,496	24,496	24,496	24,496	24,496
Total pensioners	**366,191**	**345,954**	**366,191**	**366,191**	**355,633**	**345,954**	345,954	350,794

Source: 2017 Quality of Life Survey, author's estimate

The combined reforms, depending on the intensity of changes, reduce the deficit from 0.7% to 2.1% of GDP, which is a decrease from 30% to 57% compared to the situation where there is no reform. Fiscal savings from the reform range from EUR 10 to 193 million annually for up to 5 years, and to EUR 230 million after 10 years. Certainly, the greatest effect is produced by the reform where the contribution is increased by 3 percentage points, the retirement age limit is extended to 64/66 years immediately and to 65/67 years after 5 years for old-age pension, to 52 years for survivor pension, and to 53/58 years for old-age pension with reduced years of service. In this scenario, the deficit would come down to 1.3% of GDP after 10 years and to 0.7% of GDP after 20 years, which represents a significant consolidation of the pension system. The combined reform takes into consideration burden sharing between generations, and the shocks are weaker, but all changes start immediately.

The third type of reform has similar effects as the individual changes, but with weaker fiscal effects than the combined reform that starts immediately. This reform reduces the deficit to -2.3% of GDP up to five and ten years, but in the long-term of 20 years, the gradual reform reduces the original deficit of the pension fund from 31 billion MKD to 14 billion, which is 1.5% of GDP, compared to 3.3% of GDP if there is no reform. The combined gradual reform has the following advantages: the reform burden is shared between generations, and the changes are gradual and allow concerned parties to adjust.

Effects on poverty and unemployment

Table 6 presents the results of the effects on unemployment and poverty rate. The assumptions are that the employment rate will increase, on average, by 1 percentage point annually over the next 20 years, and would reach an employment up to 60% after 20 years, which is derived from its average increase in the previous period. Therefore, unemployment is a residual in the model. The simulations indicate that the pension reform will not have an adverse effect on unemployment. The unemployment rate will decrease insignificantly or will remain the same compared to the basic scenario where there is no reform, except in the scenario for increasing the eligibility limit for the survivor pension of the spouses, where the unemployment rate insignificantly increases. The greatest decrease in the unemployment rate is seen in the scenario that increases the retirement age limit and the combined reform with contribution growth by 3% and increases the retirement age limit by two years.

At the same time, there are no significant changes in the poverty rate as a result of the pension reform. It increases insignificantly only in the scenario that increases the contribution rate in the simulations for a five-year period. This development is expected because contributions directly affect the lower net earnings of workers. Meanwhile in the simulations of effects over a 10-year period, the poverty rate is in decline or remains the same. However, at the same time, this is the scenario where the pension effects on reducing poverty are the greatest. This is due to the fact that the main burden in this scenario falls on the current contributors and working-age population. On the other hand, the increase in the retirement age limit reduces the poverty rate before and after pensions, as a result of the increased income of the individuals that remained in employment compared to the income that these individuals would receive from their pension, but this reduces the effect of pensions on poverty. The greatest effects are achieved in the combined scenarios, i.e. the poverty rate after pensions is the lowest.

Table 6: Effects on poverty and unemployment

	Replicate of official figures	No changes	Contributions are increased to 22%	Retirement age limit +2	Survivor pension, +3 years for eligibility	Reduced years of service, +3 years for eligibility	PIC + 2pp, limit +1, survivor pension +2, reduced service +2	PIC + 3pp, limit +2, survivor pension +2, reduced service +2	PIC + 3pp, limit +2 (until the 5th, +3 (after the 5th) survivor pension +2, reduced service +3	PIC + 2pp (until the 10th) + 3pp (after the 10th), limit +1 (after the 5th) +2 (after the 10th) survivor pension and reduced service +3
	After 5 years									
Employment rate	44.5%	48.1%	48.1%	48.2%	48.2%	48.1%	48.2%	48.3%		48.3%
Unemployment rate	22.4%	17.6%	17.6%	17.4%	17.7%	17.6%	17.6%	17.4%		17.6%
Poverty rate (before pensions)	43.2%	42.7%	42.9%	40.9%	42.7%	42.7%	42.1%	40.9%		42.9%
Poverty rate (after pensions)	26.6%	26.5%	26.6%	26.3%	26.7%	26.5%	26.4%	25.9%		26.8%
Effect of pensions on poverty	38.4%	37.9%	38.0%	35.7%	37.5%	37.9%	37.3%	36.7%		37.5%
		After 10 years								
Employment rate		51.5%	51.5%	51.7%	51.7%	51.6%	51.8%	51.7%	51.9%	51.7%
Unemployment rate		12.3%	12.3%	12.2%	12.4%	12.3%	12.3%	12.3%	12.1%	12.3%
Poverty rate (before pensions)		42.9%	42.0%	42.0%	42.9%	42.9%	41.8%	42.1%	41.6%	41.9%
Poverty rate (after pensions)		24.7%	24.4%	24.4%	24.7%	24.5%	24.3%	24.1%	23.9%	24.2%
Effect of pensions on poverty		42.4%	41.9%	41.9%	42.4%	42.9%	41.9%	42.8%	42.5%	42.2%
		After 20 years								
Employment rate		59.1%	59.1%	59.9%	59.1%	59.1%	59.6%	59.5%	60.1%	59.9%
Unemployment rate		6.9%	6.9%	6.3%	6.9%	6.9%	6.7%	6.3%	6.0%	6.3%
Poverty rate (before pensions)		42.0%	42.0%	40.3%	42.0%	41.9%	41.6%	40.2%	39.8%	40.2%
Poverty rate (after pensions)		21.4%	21.2%	21.0%	21.4%	21.2%	21.2%	20.9%	20.8%	20.9%
Effect of pensions on poverty		49.0%	49.5%	47.9%	49.0%	49.4%	49.0%	48.0%	47.7%	48.0%

Source: 2017 Quality of Life Survey, author's estimate

Conclusion and recommendations

The purpose of this paper is to propose a pension reform design and to examine the fiscal effects and effects on the development indicators of unemployment and poverty from the potential pension reform in Macedonia after 5, 10 and 20 years. To that end, we constructed the MK-PENS dynamic microsimulation model, which simulates scenarios for reforms in the pension system in Macedonia. The model has a dynamic form and includes the movement of individuals from the sample over a period of time as they age, considering the interpersonal relations of the individuals in the sample, the behavioural responses and the effects from a change in their labour market status on development indicators (such as poverty and unemployment). Thus, the dynamic model creates a life path for each individual in the sample, including probability of death, change in the economic status, time of retirement, earnings, etc. As the data source, we took the 2017 Quality of Life Survey in Macedonia, which was conducted on a representative sample on a national level of 1,200 households covering 4,071 individuals.

The results show that the model fully and quite robustly replicates official data, with a maximum deviation of -6% in the case of average survivor pension and -8% in the poverty rate after pensions. For future projections, as inputs, we take the assumptions about the eligibility requirements to be entitled to a pension and its type, amount of the pension, amount of the benefits and the adjustment rate. In the simulations, we modelled the old-age, survivor and disability pensions. The simulations have a dual purpose: to estimate the future developments of the basic parameters if there are no reforms of the pension system; and to evaluate the potential reforms of the pension system's fiscal effects and effects on poverty and unemployment. In the scenarios simulated, we proposed three types of reforms: reforms whose burden affects one main concerned party (pensioners or contributors), reforms where the burden is shared between the generations, and a reform where the burden is shared and the changes are cascading and occur gradually in a time horizon of 20 years. In addition, in the simulations, the reforms concern a change in the contribution rate and in the retirement age limit for different types of beneficiaries, including beneficiaries with reduced years of service based on having a military occupation.

We simulated the following reform scenarios:

1. Reforms where the burden is borne by individual concerned parties
    - Increase in the contribution rate from 18% to 22;
    - The retirement age limit for old-age pension is extended by 2 years (from 62 years for women and 64 years for men to 64 66 years, respectively);
    - The retirement age limit for a survivor pension is extended by 3 years (from 50 years for widow(er) to 53 years);
    - The retirement age limit for pension beneficiaries with reduced years of service is extended by 3 years (from 50 years for women and 55 years for men to 53 and 58 years, respectively);
    - The retirement age limit for survivor pension beneficiaries based on reduced years of service is extended by 3 years.

2. Reforms where the burden is shared between the concerned parties, but the changes occur immediately
    - Increase in the contribution rate by 2 percentage points and extending the retirement age limit by 1 year for old-age pensions, 2 years for survivor pensions, and 2 years for pensions based on reduced years of service;
    - Increase in the contribution rate by 3 percentage points and extending the retirement age limit by 2 years for old-age pensions, 2 years for survivor pensions, and 2 years for pensions based on reduced years of service;
    - Increase in the contribution rate by 3 percentage points and extending the retirement age limit by 2 years for old-age pensions immediately, and by an additional 1 year after five years, 2 years for survivor pensions, and 2 years for pensions based on reduced years of service.
3. Reform where the burden is shared and the changes are gradual and cascading
    - Increase in the contribution rate by 2 percentage points immediately and an additional 1 percentage point after 10 years; extending the retirement age limit, the age limit for survivor pensions and reduced years of service by 1 year after five years and by an additional 1 year after ten years.

The results indicate that if the pension increase in the recent period was only within the statutory adjustment, today, the original deficit would have been 65% lower, and its share in GDP would have been lower by 1.2%. If there is no pension reform in the next period, and the pension growth remains only on the statutory adjustment level, the original deficit after 5, 10 and 20 years will continue to grow in absolute amount, but at a slower pace, while its relative share in GDP will start to slightly decrease.

The effects of the simulated scenarios showed that the reforms proposed could significantly reduce the deficit in PDIF; and after 5 years, it would range from 1.5% to 3.1% of GDP, from 1.3% to 3% after 10 years, and from 0.7% to 3.3% after 20 years. The increase in contributions to 22% reduces the deficit in PDIF by 40% after 5 years and by 38% after 10 years. The increase in the retirement age limit by 2 years reduces the deficit by 18% after 5 years, 19% after 10 years and up to 43% after 20 years. The combined reforms with the changes that would occur immediately reduce the deficit from 0.7% to 2.1% of GDP, which is a decrease from 30% to 80% compared to the situation where there is no reform. The combined cascading and gradual reform moderately reduces the deficit by 26% over up to 10 years, but the effects on the long-term period of 20 years are stronger and halve the original deficit.

Fiscal savings from the reform range from EUR 10 to 193 million annually up to 5 years, and to EUR 403 million after 20 years, in the best scenarios. The combined cascading reform will result in fiscal changes of EUR 89 million annually over up to five years, EUR 119 million over up to 10 years, and EUR 271 million over up to twenty years.

The effects of the simulated scenarios on poverty and unemployment are favourable, but the intensity differs. In the scenarios where some of the individuals remain in the labour force due to late retirement, and the combined reform with increases in contributions by 3% and increases

in the retirement age limit by 2 years, unemployment reduces insignificantly. The effects on poverty are maximised in the combined scenarios. Besides the reduction in poverty after pensions, in these scenarios, the pension effects on poverty are greater than in the scenario where there is no reform.

This paper gives the following recommendations to policy makers:

- The pension adjustment in the upcoming period should not be higher than the statutory maximum, 50% of the increase in cost of living and 50% of the wage growth;
- All types of additional measures affecting the decrease in the effective retirement age limit (increase in the advantages and facilitating the requirements for reduced years of service, old-age pensions, and similar advantages) and measures that will bring about additional burdens to the pension and disability insurance fund are to be avoided;
- The pension system has to be subject to a structural reform in order to achieve its fiscal consolidation in the next 5 to 10 years and to halve the original deficit, and so that the central budget savings would reach even up to EUR 403 million annually in 20 years. The first effect of the reform would be felt immediately; and after five years, the savings would reach around EUR 90 million annually.
- Although the fiscal effects of the stronger individual reforms (mainly increases in the contributions or increases in the retirement age limit) and the combined reforms yield similar results, the combined reforms give better results for unemployment and poverty, principally due to the fact that they distribute the burden of the pension reform among the concerned parties;
- The pension reform should be combined so as to split the burden between the current generations, while the implementation should be gradual and cascading. The reform addressing these aspects, and which is the proposed reform of the pension system in this paper, includes: an increase in the contribution rate by two percentage points immediately (from 18% to 20%) and increasing by an additional 1 percentage point after ten years, extending the retirement age limit by one year after five years and by an additional one year after ten years (including survivor pensions and pensions based on reduced years of service);
- The increase in the age limit should take into consideration and offer special benefits for the workers in labour-intensive sectors and workers whose length of service exceeds 35 years, or the later retirement for these workers should be on a voluntary basis;
- The cost of the increase in contributions should potentially be shared between the employer and worker;
- Until the time when the retirement age limit increases, stimulating programmes should be introduced for voluntary later retirement by introducing an additional premium, higher replacement rate or a one-off allowance.

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