MODELING THE ESTIMATED PROJECTION OF IMPLICIT PENSION DEBT IN HUNGARY

IS THE SYSTEM SUSTAINABLE?

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Abstract

In my thesis I am examining the sustainability of the Hungarian pension system after the complete elimination of the second pillar and estimating the future balances of the Pension Insurance Fund in the next decades. My results show that the system works very well until around 2040, when it starts to have more and more deficit. It means that contributions from the active workers do not cover the expenses of the Pension Insurance Fund fully. The main reasons for this phenomenon are related to demographic reasons (population aging, emigration, low activity ratio, etc.). Even though the previous funded system needed significant changes, the current state pension system also has many structural problems that need to be solved. The main task of the Hungarian government now is to find a solution for these controversies and make the system sustainable for the future.

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1. Introduction

In my thesis I present different aspects of how the implicit pension debt of a country can be estimated for the next few decades and I observe the advantages and disadvantages of a multi-pillar pension system compared to a pure pay-as-you-go system in Hungary.
In the first chapter I introduce the main changes of the Hungarian pension system in the last years. In the second chapter after examining its advantages and disadvantages, I provide a SWOT analysis of the mixed pension system, existing before 2011, highlighting the fact that the system needed significant changes and the reform was not totally unfounded. In the next part I present different models (including my own) for observing the sustainability of pension systems in different countries, especially in Hungary.
The Freiburg model was created for the members of the European Union and specifically to the Hungarian National Bank (MNB) to make calculations about the implicit pension debt (IPD) of these countries and to assess the sustainability of their pension systems. The Hungarian National Bank is currently working on a model for estimating the implicit government debt after the introduction of the single-pillar state pension system. So far only experimental calculations have been prepared for the year 2010, so the effects of the significant changes in 2011 are not quantified yet. This is the reason why I made my own calculations about assessing the sustainability of the Hungarian single-pillar pension system for the next few decades.
I estimated future balances of the Pension Insurance Fund for each year by making predictions about the annual future contributions of active workers and expenditures of the Fund. The calculations only cover estimations for old-age pensions, not disability and survivors' pensions. The data needs of these calculations are extremely complex, even in the case of a simplified model like this. For relevant estimations it is necessary to have demographic predictions, the cohorts' current pension payments, the retrospective

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contribution series of the currently active workers - because this forms the base of the future pension calculations. As I had to deal with a significant lack of data availability and accuracy, the final results are not fully relevant, but still useful for demonstrating the main idea behind the calculations of future state pension system's balances.

According to my calculations about the future balances of the Pension Insurance Fund the system works efficiently until 2040, mostly because of the growing amount of pension contribution going into the first pillar and not to the second one anymore. After that the system starts to work with huge deficit, contributions from the active workers do not cover the expenses anymore. The main reasons for this phenomenon are closely connected to the negative demographic trends (population aging, emigration, low activity ratio, etc.) in the country. Based on my results the currently existing pure state pension system is unsustainable, so significant structural changes need to be done to improve its performance and to make it able to fulfil the pension promises in the future.

There are many relevant articles about the strengths and weaknesses of the existing fully funded system before the significant reform taking place in 2011. Most of the literature highlights the fact that changes were inevitable as the multi-pillar system was proved to be unsustainable. Examining the advantages and disadvantages of the mixed, fully funded pension system in the articles of Orbán-Palotai (2005, 2006), Mosolygó (2010), Ágoston Kolos – Kovács (2007) and the Report of the Pension and Old-Age Round Table on its activities (between 2007 and 2009),

the results can be summarized in the followings: The most significant problems of the system was the high scale of pensioners relative to the working population, the huge number of pensioners under retirement age, low pensions and the unfairness of redistribution. The second pillar mitigates the negative impacts of an aging population on the budget and the imbalance between the generations, but the introduction of the pillar only transferred the

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burdens and wasn't a solution for the existing sustainability problem of the system. The introduction of mandatory private pension funds is an advantage in eliminating the negative trends of aging only if international risk sharing is implemented. Transition to a mixed system has serious fiscal difficulties, the protection and management of the assets was accompanied by significant additional cost. Economic policy decisions, taken after the reform of the pension system, increased expenses and decreased revenues at the same time, eliminating the system's self-financing nature. Transition to a mixed system caused serious fiscal difficulties, but it promoted self-care and encouraged the growth of long-term household savings in parallel with the development of the domestic capital markets. The mentioned facts show that the funded system undoubtedly needed some changes. According to some MNB calculations from 2006, with the unchanging nature of the pension fund performance, members of the mixed system would have got lower benefits than members of a pure PAYG system. Less radical solutions exist besides the elimination of the mandatory second pillar, but they would also have been very risky.

Even though the previously existing funded system needed significant changes, the current state pension system also has many structural problems that need to be solved to become sustainable.

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2. Hungarian pension systems before and after the reform in 2011

The pension issue in Hungary is in the centre of policy discussions in the last few years. The system was legislated with both parametric and paradigmatic reforms throughout these years. In 1998a mandatory second pension pillar was introduced, and then in 2011the fully funded component of the system was abolished. The most important aim of the reforms was to minimize the long-term burden for the Hungarian budget implied by the pension system. As the Hungarian pension system was the first one going under such significant changes in the region in 1997, it was considered to be an example and to be sustainable. The problematic issues left open by the reform were first noticed around 2002. It was also realized that successive governments were continuously underdoing the initial achievements of the reform with their opposing decisions. The contribution rates were declined over the years and additional long-term spending commitments (13th month pensions) were introduced by the government. These actions were not consistent with the sustainability of the pension system and also created financing problems in the short-term.

The question whether the introduction of the funded pillar increased sustainability of the system or not became the centre of policy discussions in the context of the European Union's Stability and Growth Pact. One of the central topics of the debate was whether to allow the debt-financing of the transition costs (the reduction of revenues because of the introduced second pillar) or these costs should be covered through budgetary adjustment (higher taxes or lower spending in other

Areas). The final solution allowed for partial debt-financing and also the deduction of these costs from the deficit figure.

The poor performance of the pension funds was also a significant reason for the reassessment of the Hungarian pension system. The sustainability of the replacement ratios for pension benefits was queried by the low yields on the funds' investments. The main problem was

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whether those people, who were forced to contribute to a private pension fund in all their lives which is not working effectively, would have expectations on government compensation for their loss or not. It is important to mention that today no government guarantees exist for pension benefits or returns provided by the second pillar.

In the recent decades, not just Hungary, but the majority of European countries have had serious problems with the sustainability of their pension systems. The common reasons for this situation are the labour market problems and eminently the problem of social aging that is a main demographic trend in most of EU countries. As I already mentioned, in 2011, the Hungarian mixed, multi-pillar system has undergone a massive transformation. The social PAYG system was re-introduced, which resulted in an almost complete elimination of the mandatory private pension pillar. The government's decision faced plenty of criticism for this decision.

The key idea of the state pay-as-you go pension system is that the state pays the pensions of current retirees from the contributions of current employees, so with their deposits they are not saving money for themselves, but also these revenues are dedicated to serve the livelihood of the current retirees by the state. So this is a promise that can change at any time according to the changes in law and market conditions (e.g. demographic and economic conditions). In Hungary, for example, from 2009 the 13thmonthpension was abolished, retirement age increased to 65 and the rules of the pension indexation changed as well.

The pay-as-you-go system is working effectively until the sum of contributions excess the pension payments. If there are more active contributors than retired people, the system works very well. This was the case of the XX .century, when the pay-as-you-go systems were introduced. However, in the eighties and nineties it became clear that the financing of the growing shortage of the unified, mandatory social insurance based on pay-as-you-go system by the national budget is more and more difficult. It was obvious that significant changes are

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needed, therefore, on the legal foundations of the voluntary pension pillar (referred to as the third pillar) a mandatory, fully-funded system of pension funds was introduced in 1998 as the second pillar of the new pension system. The active population had to choose between staying in the pure PAYG system and moving to the multi-pillar system.

The operation of these pension funds are based on the, so-called, capital contribution principle, meaning that the members are saving money for themselves while paying the membership fees, which can gain some additional profits by being invested on the capital markets. The retirement fund provides pension from the collected member fees and their profits in addition to the state pension. This is considered a predictable system, since the contributions and changes in yields can be observed continuously. In a fully funded pension pillar system, future pensioners receive their allowances from two sources, so their one-sided risks are divided (they are not exposed only to the operation of the Hungarian state or only to investment market operations).

The most important goals of the reform were to diminish the state's long-term pension payment obligation and to improve the interest in paying contribution. So the pension fund members shared their mandatory contributions between the social insurance and the private funds. (Workers' pension contribution was 9.5 % of their gross income, but in the case of pension fund members, 8% went to private pension funds and the social security got only 1.5% of it.) These contributions were given no special tax treatment. Private pension funds became closely connected to social security, therefore they were considered to be the second pillar of the pension system, while the voluntary pension funds have become the third pillar of the system.

Retirement rules in the mixed system including indexation were the same as in the single-pillar system but benefits from the PAYG were much less. Individuals choosing to be members of the mixed system automatically gave up around a quarter of their pension claims

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(including past claims) in the state pay-as-you-go without any compensation and it was mandatory for them choose a private pension fund (i.e. the second pillar). Before 2013 members of the multi-pillar system receive 75% of the benefits they would get from a pure PAYG system, as of 2013 they receive 1.22% of their individual average wage multiplied by their number of contribution years (instead of 1.65% as in the pure PAYG system). However, the benefits acquired at retirement from the accumulated funds in the second pillar should balance the decreased benefit coming from the PAYG. But since the second pillar is a defined contribution system with no declared guarantees, the future benefits of the system are considered to be very uncertain. As it depends on the performance of these funds, it isn't sure whether the benefit received from the second pillar complements the lost PAYG pension claims.

Those workers in the multi-pillar system who become handicapped and therefore started gaining disability benefits before retirement age had to return to the simple PAYG and their accumulated funds in the second pillar were sent to the Pension Insurance Fund. (Orbán-Palotai, 2005)

2.1. Key issues and legal background of the reform

Before the crisis, the Hungarian pension system was based on three pillars:

- First pillar: state system (pay-as-you-go)
- Second pillar: compulsory private pension fund system
- Third pillar: voluntary private pension fund system.

According to the Hungarian Ministry of National Economy, the multi-pillar system couldn't operate effectively because it had significant structural problems. In the last few years, the financing of the state pension pillar has become questionable in Hungary. In 2011 budget

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revenues of the first pillar were only 2100bn HUF, while the benefit payment obligations were over 3000bn HUF, which represents the huge deficit of the system. As there were both solidarity and social care type obligations in the state pension pillar, the system was not transparent. (Solidarity items were related to old age pension liabilities and social items to disability allowance and early retirement benefits.)The Hungarian pension system gave insufficient incentives for voluntary pension savings, resulting in sub-optimal accumulation of long-term savings in the voluntary private pension funds. The last but most important problem of the Hungarian pension system is that there was a shortage of one million legally employed workers paying contributions in the short and medium term, and one million children who could make the system sustainable in the long run.

Experiencing the mentioned unfavourable processes, the Hungarian Parliament decided on the reform of the two-pillar statutory pension scheme which was gradually implemented in 2010-2012. The major decisions were the following:

From November 2010, career starters are no longer obliged to access to the private pension funds and membership fee payments were suspended for 14 months (between October 1, 2010 and November 30, 2011). In December 2010 the Parliament accepted the provisions of the step-back from the private pension funds. Members could choose to sustain their membership at any pension fund until 3 January 1, 2011. If there were no initiation for staying a fund member, membership ended automatically on 1 March 2011. The former members' assets were reimbursed for the Hungarian State. At the same time, former members became entitled to full social security pension, thus their future benefits will not be reduced because of the membership. (They are regarded as if they had never been fund members.) Besides, former members were entitled to the non-obligatory additional membership fee paid during the membership and to the investment yield noted on the individual account which was gained by exceeding the inflation rate (they could also receive it in cash). All the normatively regulated

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obligatory contribution payment was diverted into the Pension Insurance Fund from 2012 i.e. into the pay-as-you-go pillar of the Hungarian pension system. Since August 1, 2012 an act is in force on obtaining social security pension rights for those sustaining their memberships. Accordingly, since the date of suspension of the payment of statutory fund membership fees i.e. since October 1, 2010, fund members are fully entitled in the social security pension scheme as well.

As a result of the implemented changes, the Hungarian statutory pension system became a one-pillar system since 2012. The private pension scheme continues to operate as a voluntary pillar with a considerably reduced number of members (from 3,115,000 persons in 2010 to 74,000 persons). 97.6% of fund members decided on taking a step- back into the purely social security pension system. (Official website of the Hungarian Central Administration of National Pension Insurance-*http://beta.onyf.hu/hu/*)

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3. Strengths and weaknesses of the multi-pillar pension system in Hungary

From the start of the mixed system there have been serious discussions whether a funded pension system like that is needed in Hungary or not. The supporters say that a well-implemented system can meet the long-term expectations, reduces the one-sided risk of future pensioners, so it is worth to carry the transition difficulties and costs. According to the opponents, by contrast, the mixed system does not mitigate the existing problems, is unable to respond to the demographic problems, turns the previously implicit public debt to explicit and it increases the budget deficit.

In this chapter I am introducing the advantages and disadvantages of the system, highlighting that the criticisms of the second pillar are justified.

For a better understanding of the situation, we need to know about the current and future demographic trends in the Hungarian society.

The number of the inhabitants is constantly decreasing, and this tendency will not change in the future. The new phenomenon of shrinking labour force also poses new challenges on the society. The problem of aging population is becoming a more and more significant issue, as latest projections indicate that the population aged 60+ is expected to grow by about one million up to the middle of the century, which is expected to make up 33.6 percent of the total population. Population ageing has a very strong impact in many domains since it changes the dependency ratio.

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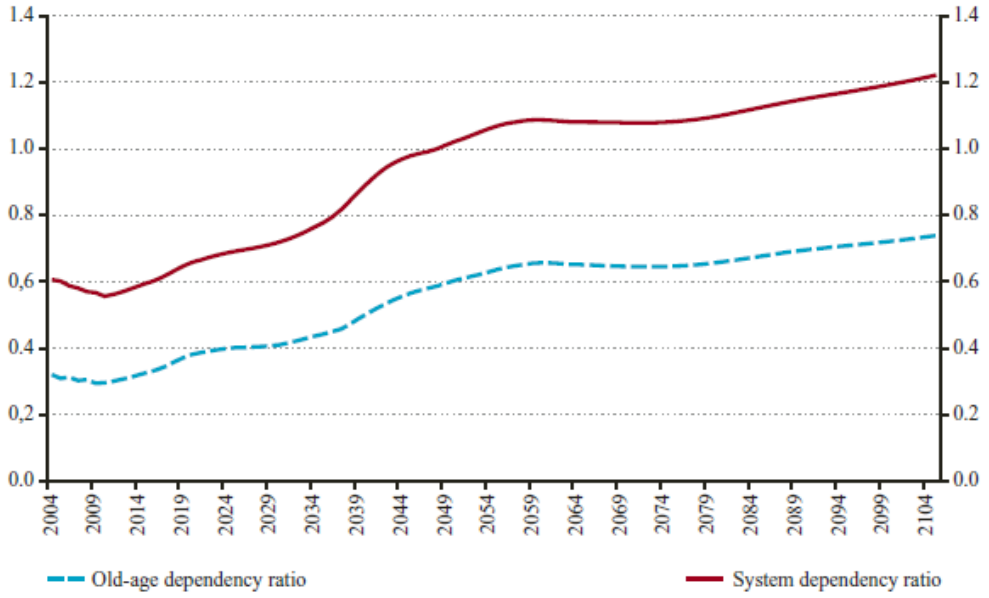

Figure 1: Dependency ratios implied by the baseline demographic assumptions
***Source**: Orbán-Palotai, 2006*

In Hungary, old age dependency ratio almost doubled in the 20th century and it will happen also during the next 50 years. Life expectancy at birth for males will increase from 68.2 years to 76.5 years and for females from 76.6 years to 82.6 years. Concerning international movement, there will be a net migration gain of 12,000 persons per year. Fertility also is assumed to increase to the medium level of 1.6 children per women.

According to the projections by level of education the number of medium and high-educated people will grow very significantly, while the number of people with primary education or less falls. The educational change has great importance concerning almost all topics of ageing. Higher educated people have better chances for longer life and it indicates higher participation rates. (Hablicsek, 2004)

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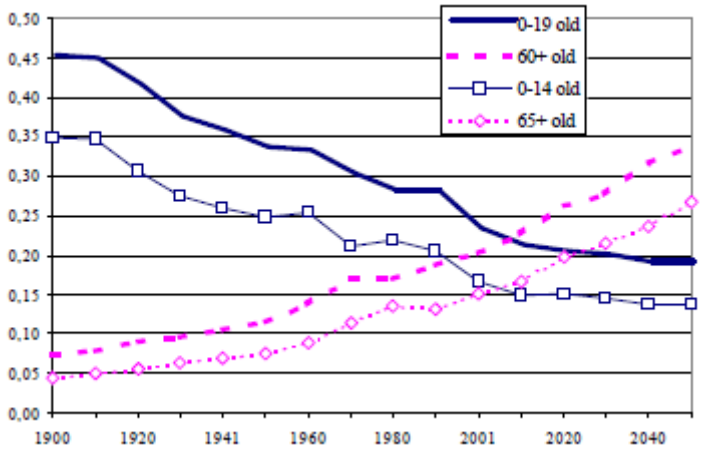

Figure 2: Proportion of young and elderly population in Hungary
Source: *Demographics of population ageing in Hungary, Hablicsek Laszlo, 2004*

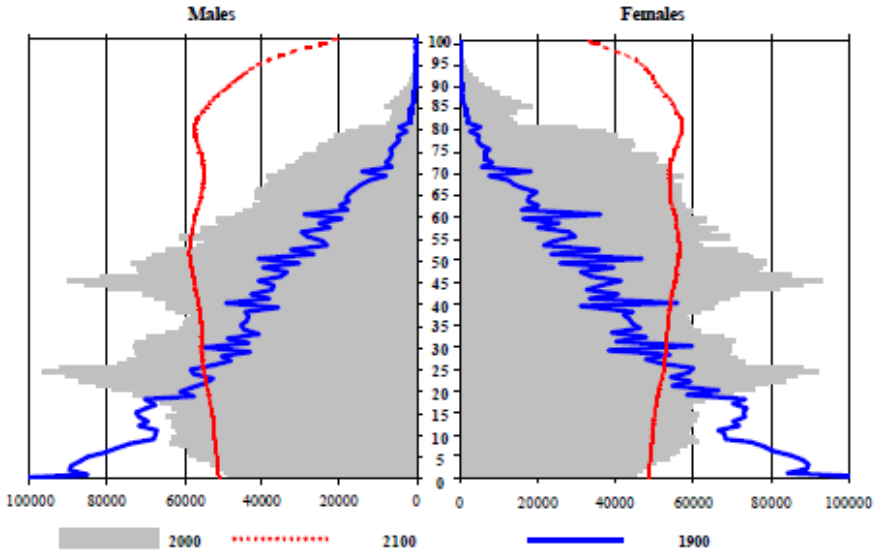

Figure 3: Age pyramid of the population of Hungary. 1900, 2000 and 2100
Source: *Demographics of population ageing in Hungary, Hablicsek Laszlo, 2004*

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In a European comparison, the economic activity in Hungary is at a very low level. Less than 50% of the 15 + population are active, which rate should be much higher to balance the negative impacts of the aging population. The combined effect of the pending retirement age increase and the educational expansion, a temporary increase in the number of economically active population is expected, however, this has not offset the demographic impact on the longer term. With intense immigration, the number of workers may persist at the level of 4 million until the 2070's, but there will be further decrease among the working population due

to modest emigration.

Results of forecasts about marital status show that in the coming period the number of married and widowed will decrease, and the number of not-married and single people will rise.

The fast increase in the number of Roma population continues. The aging population is also a basic phenomenon in the Roma population. The number of people aged 60 and older will increase to 83,000 by 2025, and 380,000 by 2100, starting from 30,000 in 2001.

The number of people with disabilities will also rise in the next decades. As a result of the observed demographic aging and other structural changes, people with disabilities will also become older; the central age of them will be nearly 90 years by 2050. (Report of the Pension and Old-Age Round Table on its activities between March 2007 and November 2009, Budapest, December 2009)

During the existence of the multi-pillar system, among the paradigms of the Hungarian pension system, which have developed during decades, only a few have been fulfilled.[1]

Full coverage wasn't achieved because from the members of the currently active age groups many were entirely missing from the system or didn't acquire the necessary minimum rights.

Financing from contributions was only achieved partly as contribution incomes didn't provide full coverage for benefits, and the pension insurance needed support from the Central Budget every year. Despite the high contribution rate, contribution incomes were less than expenditures. However, *national level risk sharing* was maintained in the system, so it can be considered as the strength of the system. *Benefits, allowances were better proportioned to earnings and/or contributions* in the system, because of the involvement of pension funds and changes in the social insurance pension formula as well. As a consequence, however, increasing number of people with not appropriate contribution history was left out of the

[1]"Paradigm shall mean assumptions, concepts and value choices that determine the philosophy of the community that confesses and acknowledges them." (Report of the Pension and Old-Age Round Table on its activities between March 2007 and November 2009, Budapest, December 2009)

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contributory pension system and was forced to rely on other transfers. Under the mentioned situation, numerous elderly people in the future should have been got allowances that were not funded by any kind of contribution. (Report of the Pension and Old-Age Round Table on its activities between March 2007 and November 2009, Budapest, December 2009)

The way of conversion of the capital into allowance was not determined properly, and the solidarity circle between women and men wasn't clarified either. The so-called insurance redistribution from men to women belongs to the nature of the system. The same trend is observed in the case of the rich and the poor.

The main point of the Swiss indexation operating in the Hungarian pension system is that pensions are increasing by taking into account the price and wage growth in the proportion of 50-50%. This system intends to prevent pensioner poverty since it's able to raise annuities to a greater extent than inflation. The funds, however, imposed additional charges on members (because they have to adjust to the uncertain wage increase), which reduced the level of initial benefits. (Ágoston Kolos–Kovács, 2007)

In the case of open economies, funded pension systems have the opportunity to keep yield level by streaming capital into countries with younger-composition population. The outflow of capital increases future yields, but decreases the current income (GDP and wages). In addition, excess savings in countries with young-composition population are not enough to purchase the assets of aging countries. The role of foreign investments can diversify investments and mitigate domestic risks, but they are also more costly due to the transactional and analytical fees, as well as due to the exchange rate and political risk. Yields achieved by the allocation of capital reflect only the microeconomic element of the accumulation of wealth. If we observe the total effects from the macroeconomic point of view, for a country in need of long-term funding (e.g. Hungary), the deposits impair the financial stability and further increase the need for external funds . In terms of aging, none of the pension systems

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differ from each other, so it is considered to be better which produces higher long -term growth at the macro level. The idealized funded system has positive effects on real growth, as it promotes the efficient allocation of capital and contributes to economic growth and development of the capital markets.

The weakness of the funded system is that the pension funds invest almost exclusively in government securities. This is partly explained by the fact that Hungarian investors are too sensitive to short -term changes in yields. In theory, in the course of transition to a funded system that only invests in government securities, explicit government debt increases by the exact same amount as the implicit decreases. In reality, due to transaction costs, market information problems and the short sight of the market operators, explicit debt can grow faster than the implicit decreases. Thus, also in the best case, a funded system that purely invests in government bonds pays the same amount as the social security would. While due to the low level of domestic savings the country needed foreign funds, a large part of their savings were invested in pension funds abroad, thereby increasing the country's gross foreign debt.

The problem with introducing a funded pension system in Hungary was that a system like this only works effectively with a developed capital market. They tried to transfer a model which builds on effective and developed market into home practice. Ideally, if funds are investing in equities, it leads to interest rates growth and share price increase, which makes it easier to finance investments by the capital market. However, due to the low absorptive capacity of emerging countries' (such as Hungary) equity markets, the stock-index increases indicated only price increase and not capital financing. (Mosolygó, 2010)

From a macroeconomic point of view, the second pillar is regarded as an implicit debt repayment program. During the reform, the explicit public debt grows by the amount of credit the state takes to replace the lost revenues from the first pillar, however, the implicit public debt decreases due to the lower pension promises.

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The implicit state debt is more favourable in financing terms, as it can be seen as charge-free purchase of secondary market government securities, which is repaid by the state in the form of annuity. In contrast, the explicit state debt represents the country's vulnerability.

The reform in 1997 is considered to be wrong because although it was supposed to reduce the implicit debt, the state could have used the same effort to reduce the explicit debt as well. The market price of the second pillar is basically the interest payable on bonds, which were issued by the state in order to replace the revenue loss from the first pillar. It would be beneficial for both the state (decreasing explicit debt) and the contributors (e.g. operating costs of pension funds would not reduce the interest) if they (contributors) get this interest. Pension privatization is therefore not beneficial for the state and it can only be a good deal for the contribution payers, if they have the chance to achieve higher yields in the privatized pension system. (Orbán-Palotai, 2006)

3.1. Demonstration of the characteristics of the mixed, funded system with a SWOT analysis

Strengths	**Weaknesses**
• Implementation of the national risk community, • Pension care based on earnings and contributions, • Reduction of implicit debt, • The development of domestic capital markets, • Mitigation of the one-sided risk of pensioners,	• Dependence on the calendar year of retirement, • Lack of Full Coverage: outage of increasing number of people from work-based pension, • Poor implementation of contribution-financing: the need for budget support, • High transition and transaction costs,

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• The possibility of a higher total pension, • Promoting self-care, • Expansion of long-term household savings ratio.	• Conservative portfolio of funds, • Market information problems, • Increasing explicit debt, • Unclear male-female solidarity circle, • Additional costs due to Swiss indexation.
Opportunities • (Foreign) capital allocation: –increasing future yields –investment diversification – mitigation of domestic risks –development of the capital markets • Investments in economic and social infrastructure •Decreasing expenditure on pensions (by 2040, the entire population would belong to the mixed system).	**Threats** •Economic policy decisions after the reform: revenue-reducing and expenditure-raising effect •Foreign investments: –currency and political risks –decreasing present income: deteriorating financial stability, increasing foreign source demand •Weak capital absorption capacity of Equity Markets • The first pillar's increasing need for budgetary resources.

Table 1 (own): SWOT analysis about the mixed, funded pension system in Hungary before 2011

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4. Models used for IPD calculation

In this section firstly I will present the pension model used by MNB to assess the sustainability of the Hungarian pension system in the early 2000s. It presents the future balances of the Pension Insurance Fund for each year and summarize these flows in a single indicator, the net implicit public liabilities (IPL) of the pension system, which is the present value of its future deficits (the present value of expenditures that are not covered by contributions).

After that I introduce the Freiburg model, which method is applied for public pension schemes and to the group of existing retirees and current contributors. It projects per capita future pension benefits based on today's existing retirees' benefits.

4.1. The MNB pension model

The program for modelling the Hungarian Pension Insurance Fund was developed initially by the World Bank and its aim was to help the decision-making process and measure the effects of the pension reforms. Then the Ministry of Finance further developed this model and made it more specific to the Hungarian pension system.

The MNB pension model is a revised and updated version of the Ministry of Finance's model. As it is able to provide simulations and calculations both for a single-pillar and a mixed system up to a hundred years, it provided accurate estimations about the sustainability of the system after the reform. To make the model more transparent, the makers extended the range of parameters that can be inputted instead of being hard coded in the program at a given value. Also, estimated inputs and data generated by the program were replaced by factual data.

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The model is based on user-friendly VBA for Excel. Input and output data are on different spreadsheets and simulations can be run based on user preferences in making different assumptions.

One of the biggest advantages of the model is that users can run it in single and also in multi-pillar mode. In the first case all people belong to the first pillar (pay-as-you-go). In the second case the model takes into account the "opt-out rates", which is "the share of pensioners and employees in each cohort receiving part of their benefits from and paying contributions to the second pillar". (Orbán-Palotai, 2005)

These opt-out rates played significant role in examining the effects of the introduction of the secondary pillar on the balance of the Pension Insurance Fund in 1998. The model assumed that all the entrants to the labour market at the age of 18 join to the mixed system. About future entrants to the system in older cohorts, the user could choose to divert all new labour entrants to the mixed or opt for a technical solution that increases the "opt-out rate".

As the model can run in single-pillar and multi-pillar mode, it can calculate the break-even return of the second pillar, the improvement in sustainability (the change in IPL) after introducing the second pillar and it shows the difference between the two simulations.

Users have a choice between five different demographic scenarios with different assumptions about migration effects and between baseline and optimistic activity scenarios. A third activity scenario (used by the European Commission's Ageing Working Group) is also built into the model, so if selected, the model can use the European Commission's projection on employment, real GDP and labour productivity growth rates.

The user can also determine the time horizon for the simulation, except for the "base year" (the first year of the simulation), because extensive factual data is provided on initial conditions on a separate worksheet. The final year of the simulation can be entered with the only limitation that all input time series have to be given values on the input sheets.

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The model carries out deterministic calculations. It reads the values of some of the variables from the input worksheet for the base year. Calculations are cyclic and the main cycle is performed from the base year till the final year, chosen by the user. The model performs calculations about a wide range of variables based on their values in the previous years or on other rules and assumptions.

The major calculations can be demonstrated in three groups. Firstly, calculations connected to the base year only, then operations done in the future years (but not in the base year) and finally the aggregations across generations, carried out in all years.

First, the program reads the number of each type of pensioners detailed by cohorts, their nominal benefits, some other data on the pension system necessary for further calculations and also projected paths for regulatory parameters, macro and other variables. Demographic developments (population and survival tables) are exogenous data, the user can choose between five scenarios.

After the base year the program carries out two operations in every year. First, it "advances" every pensioner in each cohort who was already a pensioner of the same type in the previous year, in a younger cohort. Pension benefits of these "continued" pensioners are also advanced, for example rose according to the Swiss formula. Then the model calculates the number of new entering pensioners based on detailed eligibility criteria and calculates their benefits. All other (disability, survivor) entry pensioners are computed according to simple rules and their pensions are indexed to the change in old-age entry pensions.

New old-age pensioners are calculated in the following way: firstly, the model calculates the cohort's average number of service years by using past activity and employment rates. Based on the service years and additional data on people's willingness to work longer than the official retirement age or retire earlier, the model estimates their pension benefits. Pension calculations cover all regulations effective in Hungary, including pension multipliers and

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adjustment factors for service years, valorisation of past earnings to the second year before retirement and degressive income brackets.

For every year, the program sums up the total revenue of the pension system across cohorts. The model acquires the aggregates detailed as revenues from employers and employees, both for the first and the second pillar and sums them up. It then accumulates benefits for each type of entitlement which sum up to all the benefits the pension system is due to pay out. Finally, the results are generated depending on the user's choice.

4.1.1. Assumptions used by the model

Demography is one of the most determining factors of the future balances of the Pension Insurance Fund. As the Hungarian population is declining and life expectancy is becoming higher, the old-age dependency ratio will increase rapidly (see Figure 1). From 2012 a quick population aging has started, as the members of the large cohorts born in the 1950s have started to retire, and the situation will only get worse by 2035-2040, with another large generation reaching the retirement age.

While counting the activity ratio of different cohorts, the model uses two scenarios, both consistent with the model's baseline demographic projection. In the baseline and optimistic activity scenarios it is assumed that younger generations spend longer time in the education system (which means lower activity ratio), but the older generations become more active at the same time. The active labour force will decrease significantly in the period of the forecast because of the diminishing population, despite the growing aggregate activity rate. The model was also broadened with a third scenario, used by the Aging Working Group of the European Commission.

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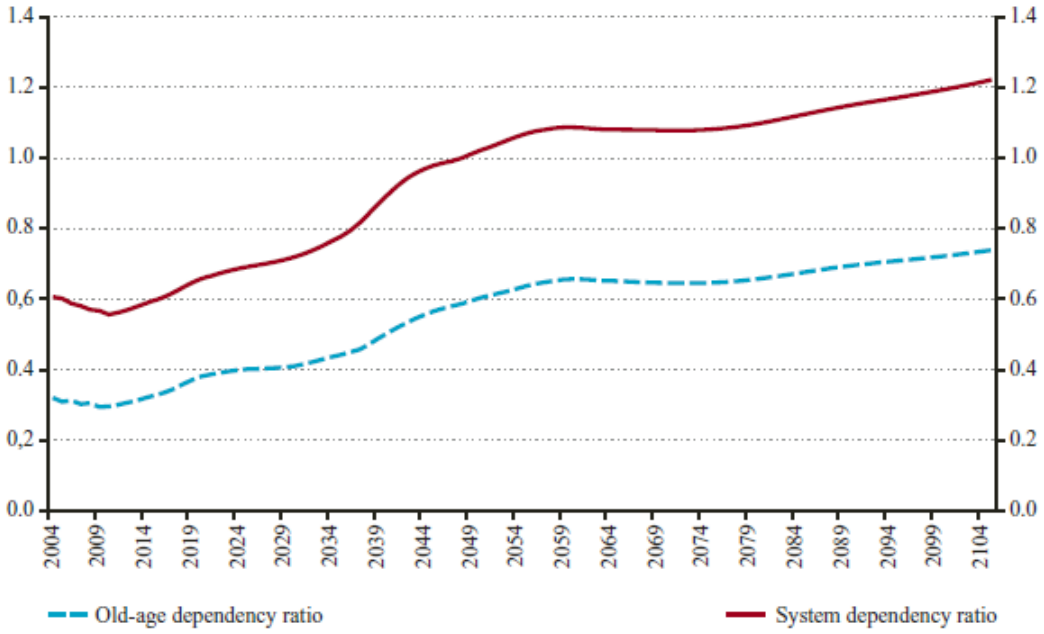

Figure 4: Dependency ratios implied by the baseline demographic assumptions
***Source**: Orbán-Palotai, 2005*

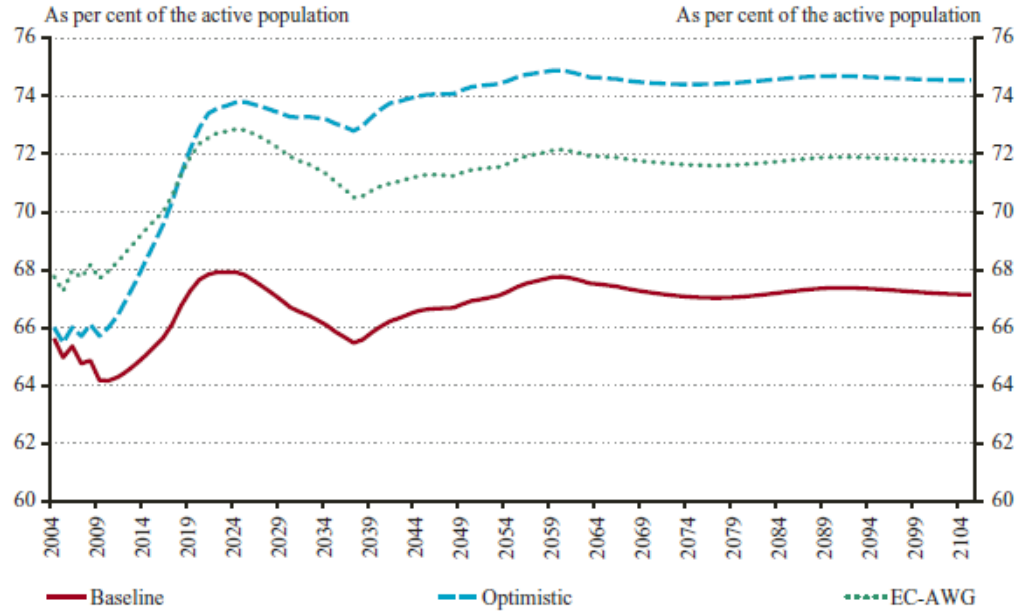

Figure 5: Aggregate activity rates in the three scenarios
***Source**: Orbán-Palotai, 2005*

The model uses macroeconomic assumptions (see Table 2), which says that the inflation rate decreases in the next decades to the ECB's definition of price stability, and also the long-term

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GDP growth of the country will be slower than in the base year. One of the reasons for this prediction is the declining Hungarian population. The model uses also microeconomic assumptions used by the European Commission for calculations related to Hungary.

		2005–2010	2010–2020	2020–2040	2040–2105
Inflation		3.1	2.0	2.0	2.0
Real GDP growth		3.5	2.8	1.8	1.5
Real wage growth		3.0	3.2	2.4	1.7
Pension increase (real Swiss index)		1.5	1.6	1.2	0.8
Unemployment rate	Men	6.8	6.4	6.5	6.5
	Women	6.1	5.8	5.9	5.9

Table 2: The baseline macroeconomic assumptions
***Source**: Orbán-Palotai, 2005*

4.2. The future balances of the one-pillar and the mixed pension system based on calculations by the MNB model

In the followings I introduce estimation results about the future balances of the one-pillar and the mixed pension system, based on the MNB model described above, then I present a thought experiment about the amount of received pensions in a mixed and a pure PAYG system.

The performance of private pension funds was far behind expectations, due to the conservative structure of the portfolio (75 % of the portfolio in government bonds), the lack of market competition and inadequate regulations.

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Figure 6: The yield performance of the pension fund sector (second pillar)
***Source**: Orbán-Palotai, 2005*

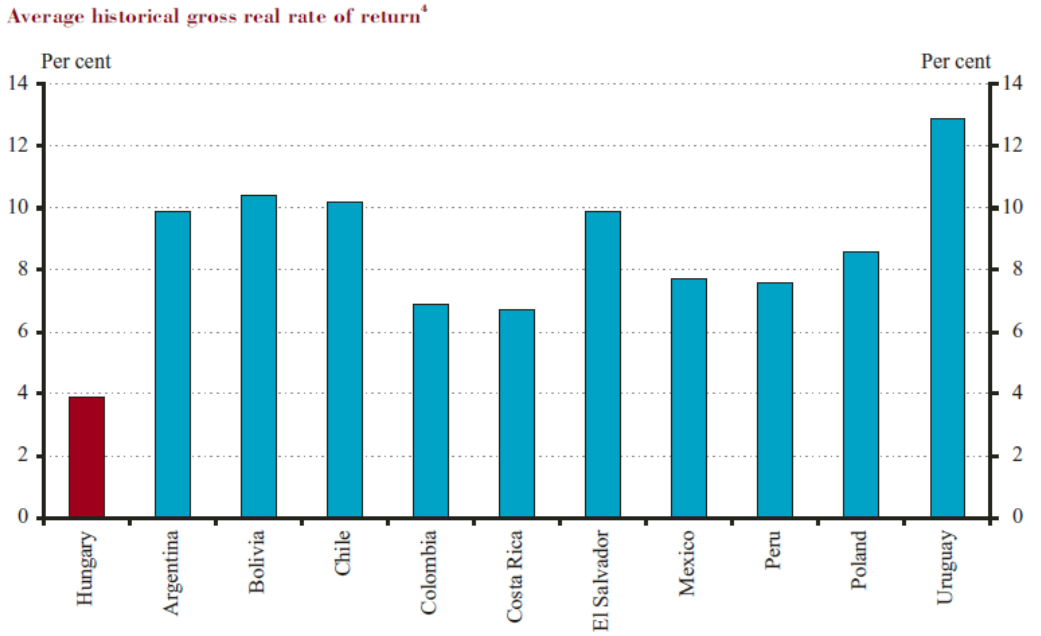

Figure 7: Average historical gross real rate of return
***Source**: Orbán-Palotai, 2005*

However, there must be other factors at play because mandatory pension funds in other countries have provided considerably higher returns. Certainly, comparison across these

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countries may be problematic for a number of reasons including possible methodological differences. According to fees, Hungary didn't perform badly compared to many countries, but in the future it would have considered as a high-cost system under the current fee structure. Parametric reforms after 1998 helped to stop the growth of pension expenses, but annual deficits did not fall in the short term, as income was also reduced by the successively reducing contributions.

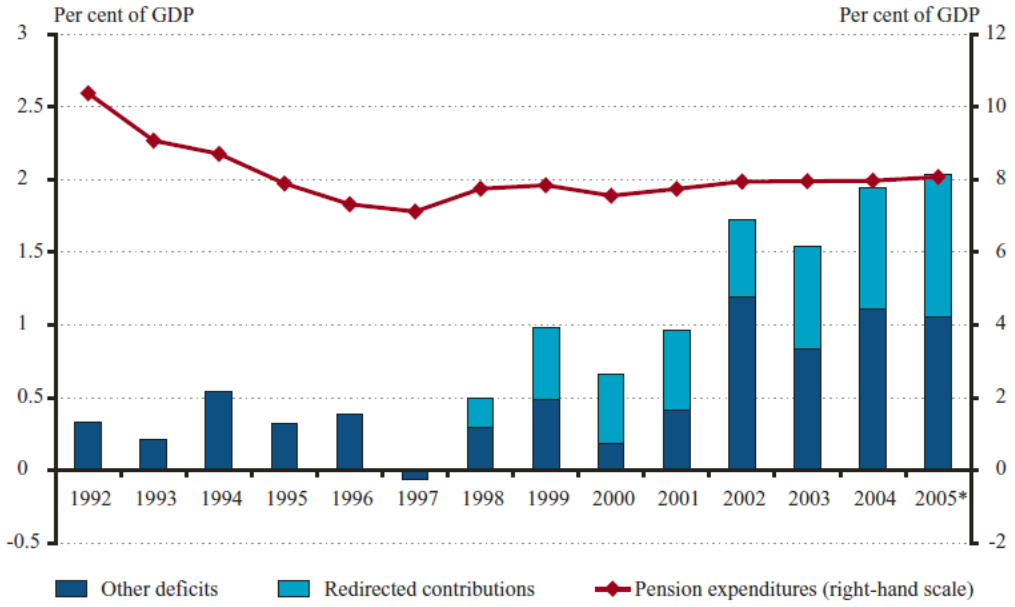

Figure 8: The short term fiscal impact of the reforms
***Source**: Orbán-Palotai, 2005*

The Figure 12 compares the future balances of a one-pillar and a mixed system. The balance of the one-pillar system will not deteriorate significantly by 2015, despite the reducing contributions, which is the result of short -term demographic trends. In the future, deficit will rise and will be multiplied by 1.5 over a decade due to the retirement of the baby-boom generation around 2040. As population aging continues, by 2105, the deficit of state pension fund will be around 4 % of GDP.

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The mixed system in reality follows the pattern of the pure PAYG system till 2045, just on different level: in the first decades of the gap between the two curves shows the income of the fund. This gap widens first, but around 2025, when recipients of reduced benefits start to retire in great numbers, it begins to narrow again. After 2040 every employee has been a member of the mixed system, so it would have been observed loss of revenue stabilization. After 2050 there are no new retirees in the pure PAYG system, which reduces the pension costs. From that point where the two curves intersect each other the second pillar begins to be remunerative from a fiscal point of view. Comparing the two systems we can conclude that the introduction of the second pillar alleviate the impact of population aging on the budget and reduce the imbalance between the generations. But the introduction of the second pillar only transfers the burdens, but it is not a solution to the problem of sustainability in itself. One of the objectives of the pension reform was to restore the self-financing nature of the system. In a well- functioning system, pension contributions to cover pension payments, so the system can operate as a real pension insurance, in which the present value of expected payments doesn't exceed the present value of expected revenues. However, economic policy decisions made since the reform (reducing contribution rates, the 13th month pensions, adjustment steps to eliminate the differences between annuities in successive years, contribution reductions provided in law) increased the pension expenses and reduced income at the same time, with the result that the system's self-financing nature was eliminated, the insurance principle was weakened. Thus, such a trend could be observed, which is not compatible with the long-term sustainability objectives.

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4.2.1. Thought experiment

The pensions are expressed as a replacement rate: the entry-age pensions divided by the non-specific net average career- average earnings, on which contributions are paid. On figure 13 it can be seen that in the early years of the pure PAYG system replacement rates are relatively high, but then they begin to decline. The reasons for this are taking into account the income court, lower activity and higher unemployment rates than before, and the large number of people announced to be on minimum wage. Replacement rates provided by the mixed system do not follow this trend. The reason is that from the beginning, annuities from the second pillar are very low and the constant accumulation of wealth can offset the amount of PAYG benefits only on the long run. The figure shows that, with the unchanging nature of the pension fund performance, members of the mixed system get lower benefits than members of the pure PAYG system.

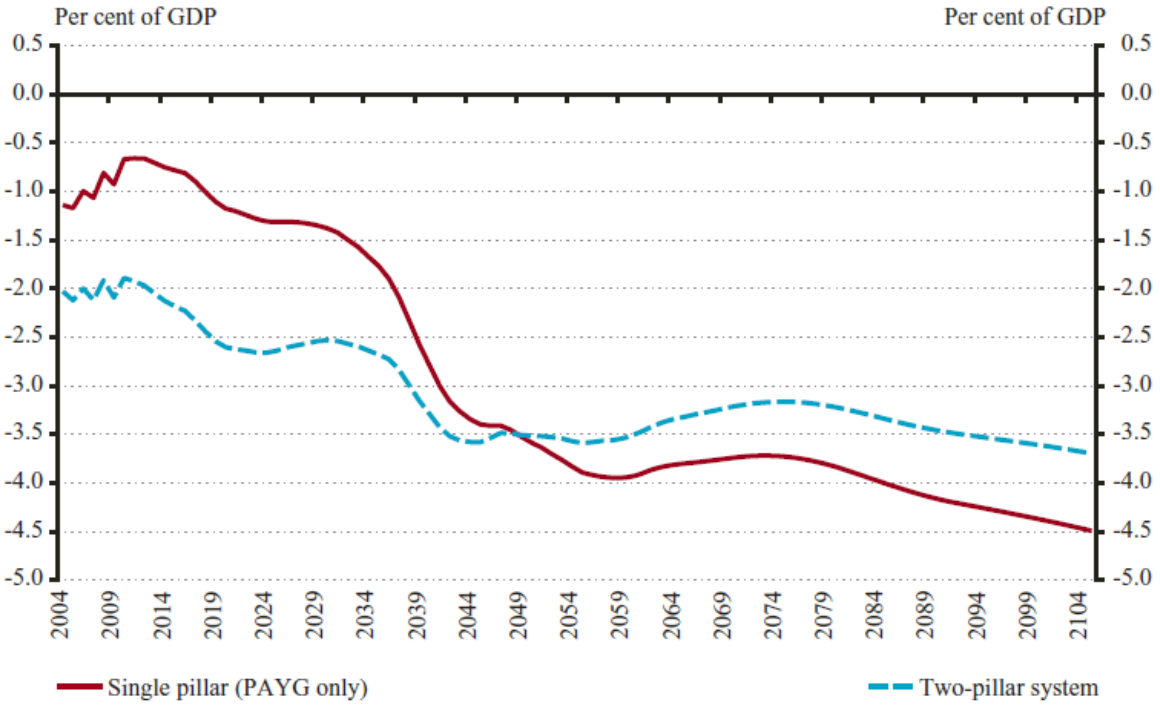

Figure 9: Future balances of the Pension Insurance Fund
***Source**: Orbán-Palotai, 2005*

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After 2050, only 3.2 % net real return would provide pensions at about the same level as the one-pillar system, and only for those who have paid contributions to the mixed system in all their lives.

Although, the law did not impose an age restriction for transition, but the information sought to draw attention to the fact that over the age of 40 you should consider the transition. Despite this, many people also switched, who had been expected to have about 20 more years (or even less) in the mixed system. This brief period is more risky for their capital market investments from long-term perspective and losing a quarter of the acquired rights also questioned the correctness of the decision.

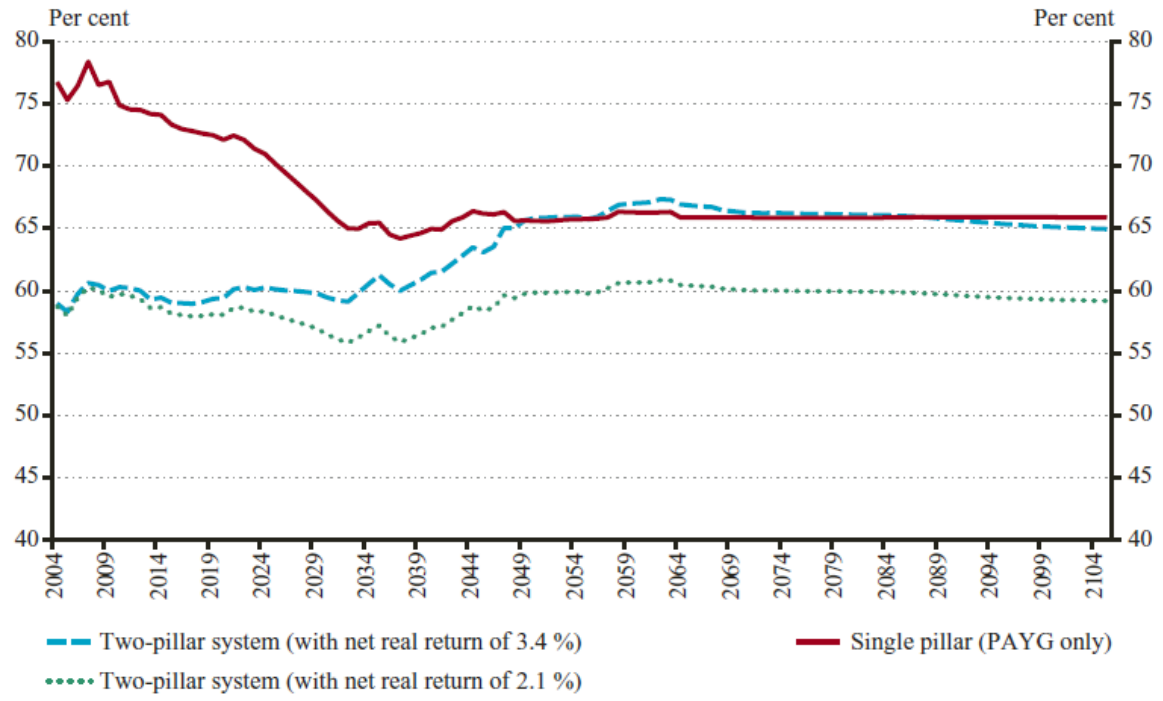

Figure 10: Old-age entry replacement ratios
***Source**: Orbán-Palotai, 2006*

Many researchers didn't understand why so many people switched to the multi-pillar system voluntarily, giving up 25% of their pension claims from the PAYG after paying to the simple state system for many years. One possible explanation is that accumulated funds could have

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been inherited before retirement, so in the case of the death of an active individual, orphans and widows get the mentioned funds. However, as the pay-as-you-go pillar also pays benefits to widows and orphans, this argument is not fully convincing. The second explanation is that higher income-earners were better-off moving to the mixed system because there is no redistribution element in the funded pillar as it exists in the single-pillar system. The third explanation for the situation is the fact that members expected the market risk involved in accumulating savings in a pension fund to be lower than the policy risk of participating in a pure pay-as-you-go system. This negative image was used by pension funds for tempting new clients for acquiring more and more members. Another reason for switching from the pure state system to the multi-pillar system was the initially existing guarantees in the form of a minimal benefit. As there is no explicit state guarantee for minimum benefits or returns, this approach is understandable.

4.3. The Freiburg model

According to the European System of Accounts, liabilities are established when debtors is obliged to provide a payment or a series of payment to the creditor. There are several boundaries of this definition according to the instruments included. Equity instruments, for example, are included for statisticians, but not for accountants, while derivative liabilities are excluded from Maastricht debt and external debt. Provisions, guarantees and contingent liabilities are not considered as liabilities.

Valuation of financial liabilities can be based on fair or nominal value. According to the different needs of the users, different types of indicators are used: gross versus net, stock or flow and macro versus micro. It depends on the question which indicators are used in the answer, for example if a country is able to repay its obligation (solvency and liquidity), if the

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level of indebtedness is sustainable, or what is the impact of indebtedness on the vulnerability of a country.

Pension promises represent payment obligation due to past events. Individuals entitled to future pension benefits and their employers do contribute to their future pension benefit in the form of pension contribution. "Future pension entitlements are either determined by a private pension contract of a pension plan (defined contribution or defined benefit plan) or by government regulation". (Sisak-Tardos, 2013)

In statistical term pension obligations are included in financial liabilities for private of funded pension schemes but not for funded pension schemes. "Pension contributions received by the government are treated as tax-type revenue and pension obligation are recorded as financial liability only in the period for which the pension entitlement is related to". (Sisak-Tardos, 2013)

As different pension models lead to different financial liability measurement, financial liabilities of different countries are not internationally comparable. The justification of the current statistical model can be explained by several facts. Firstly, government regulation on pension obligation can be modified without mutual consent of all parties involved. Secondly, political leaders have an incentive to postpone unpopular measures and the measurement of pension obligations involved complex modelling. And finally, results are extremely sensitive to assumptions used by the model.[2]

To differentiate unfunded pension liabilities from financial liabilities, it is called as implicit pension liabilities. There are three main definitions of pension liabilities that we need to know before calculating implicit pension debt (IPD). These definitions differ in the type of liability they refer to and to degree entitlements from private households are included.

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[2]Sisak-Tardos, 2013

Accrued-to-date liabilities contain the actual pension payments and the present value of pensions to be paid in the future on the basis of accrued rights (neither present nor future workers can accrue rights after the base year).

In the case of **current workers and pensioners' liabilities**, allowance is made for the pension scheme to continue its existence until the last contributor of today dies, while no new entrants are allowed.

Open-system liabilities also include the present value of pensions of new workers under current rules. The range of options extends from including only children not yet in the labour force, to an infinite perspective.[3]

This table summarizes the main differences between the three definitions how future pension benefits are determined:

Liabilities		Definition of liabilities
1)	Accrued-to-date liabilities	Present value of pensions in disbursement; Present value of future pensions due to **past** contributions of **current** workers
2)	Projected current workers' and retirees' liabilities	1) + Present value of future pensions due to **future** contributions of **current** workers
3)	Open-system liabilities	1) + 2) + Present value of pensions due to contributions of **future** (worker's) **generations**

Table 3: Definitions of pension liabilities
***Source**: Müller- Raffelhüschen- Weddige, 2009*

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There are new statistical reporting requirements for European countries. Starting from 2017 these countries all have to report their accrued date liabilities according to the newly approved European regulation European System of Accounts (ESA 2010). The assets and liabilities of

[3]Müller- Raffelhüschen- Weddige, 2009

pension schemes have to be measured in general government and it has to cover all years starting from 2015. These required data sets will significantly change the indebtedness ranking of individual member states in Europe.

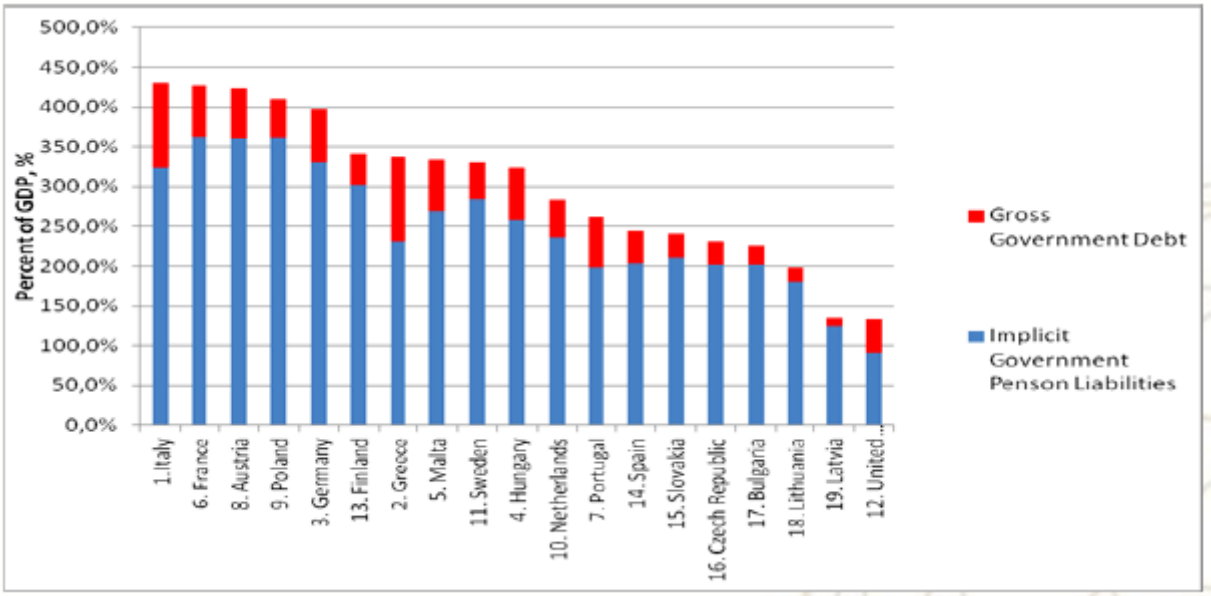

Figure 11: How indebtedness ranking change if implicit pension obligation is added to gross government debt data (2006)

***Source**: Sisak-Tardos, Debt Indicators -The Missing Links -Plausibility of Pensions Liabilities, 2013*

Accrued to date pension liabilities (ADL) can be calculated in two ways. The first (and preferred) method is the so-called **projected benefit obligation approach** (PBO), which uses the final salary level of the workers for the calculations. The other method is called **accumulated benefit obligation method** (ABO), in which only the salary level up to the reporting date is involved into the estimation, so no future wage increases are reflected. PBO entitlements will be in most of the cases higher than ABO entitlements, because ABO does not consider the future personal or general wage increases.

The Freiburg model uses generational accounting for calculating accrued-to-date liabilities. The standard method was changed to only account for the accrued-to-date amount of benefits and not for considering future pension benefits in total. The main assumption of the model is

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that projection of per capita future pension benefits based on today's existing retirees' benefits.

4.3.1. General assumptions

The calculation of the accrued-to-date liabilities requires two projections. First, a population projection needed, secondly, the average pension benefits received as well as the accrued-to-date future retirees benefits need to be estimated by age and sex. A standard growth rate needs to be set, which is suitable to uprate base year per capita pension benefits, and also the appropriate interest rate for discounting future payments.

All population data is taken from Eurostat in the model.[4] Data regarding age- and sex specific pension payments have been supplied by the members of the Contact Group, i.e. the national statistical bodies or national central banks of the participating countries. This is also true for data regarding aggregate pension payments. It is to some extent up to the members of the Contact Group from the various countries, whether they would like to have old-age pensions or disability and survivor pensions as well to be integrated in the calculations.

Most EU member states publish population projections conducted by their national statistical bodies. As these estimates usually cover only a time period of 30 to 50 years, they are not far-sighted enough for the calculation of accrued-to-date liabilities. Therefore, it is necessary in the model to conduct projections which can prolong official forecasts. The starting point of these projections is the population structure (by age and sex) observed at the beginning of the respective base year. The age composition of the population is updated every year firstly by subjecting the initial population structure to age-sex-specific mortality and then the respective age specific birth rates are applied for every projection year. The implementation of this method requires assumptions with respect to the future development of age-specific mortality.

[4] See http://www.ec.europa.eu/eurostat.

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The estimation of the base year average existing retirees' benefits by age is the main part of the projection. It is done by aggregating a benefit profile by age and sex over the base year population and then re-evaluating it in a way that the aggregates based on micro-profiles and population data correspond to the respective government budget aggregates in the base year.[5] The estimation of relative age-profiles thus requires household or individual micro-statistics. The necessary data is received from micro-data surveys provided by national central banks or national statistical bodies. The construction of relative age-profiles from these sources depends on data accuracy and availability. Theoretically different profiles for different types of pensions (old-age, disability and survivor pensions) as well as for the different pension schemes (social security or government employer scheme) should be available and used accordingly.

The projection of future age-specific pension benefits needs an assumption about the annual rate of wage growth. As long-term forecast of future growth are usually arbitrary, a supposedly constant rate of wage growth is applied in all future periods, which approximate the average long-term rate of productivity growth observed in the past. As the correct value of the growth parameter is uncertain, the model has not attempted to design specific growth patterns for the individual EU member states, it rather uses a growth rate of 1.5 per cent per annum in real terms for the base calculations in all country studies of the survey.

Similar to the growth rate parameter, forecasts regarding the prospective interest rate development are uncertain, so the model applies a single uniform discount rate to take all pension spending back to the base year. A reasonable range of interest rate assumptions is determined by the fact that public expenditures are significantly more uncertain than non-risky long-term government bonds on the one hand, but not as volatile as the return on risky

[5] „Since the projection method does not correct aggregates for business cycle effects, base year economic performance is perpetuated indefinitely, which may lead to a bias. But this effect is not as critical in case of considering pension expenditures because they are for the most part dominated by demography." (Müller-Raffelhüschen- Weddige, 2009)

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assets on the other hand. For the calculations, a standard real discount rate of three per cent per annum is used, which reflects the ten-year average of Euro area ten-year government bond yields. It is important to mention, that the use of a constant discount rate implies a serious simplification. It assumes that risk attitude is identical for all generations, and remains constant over their life cycle.

4.3.2. Supplementary table

The supplementary table should be presented in the updated System of National Accounts (SNA). As it includes all flows and stocks of all pension schemes, it represents all the pension assets of households. In the Final Report by Müller- Raffelhüschen- Weddige (2009), only general government pension scheme liabilities and social security pension are calculated, so the columns G and H of the table are important.

The rows of the table describe the balance sheet positions, transactions and other economic flows connected with pension entitlements of the scheme.

4.3.2.1. Results of the model about Hungary

Applying the Freiburg model, the following results were calculated for the year 2006, firstly by using the PBO approach.

			Non-core national accounts (figures in bn. HUF)	
			General Government	Social Security
			G	H
		Opening Balance Sheet		
	1	Pension entitlements		58,815.52
		Changes in pension entitlements due to transactions		
Sum 2.1 to 2.4	2	**Increase in pension entitlements due to social contributions**		4,514.29
	2.1	*Employer actual social contributions*		1,186.00
	2.2	*Employer imputed social contributions*		
	2.3	*Household actual social contributions*		327.00
	2.4	*Household social contribution supplements*		3,001.29
	3	Other (actuarial) increase of pension entitlements		3,464.85
	4	Reduction in pension entitlements due to payment of pension benefits		2,314.50
2 + 3 - 4	5	**Change in pension entitlements due to social contributions and pension benefits**		5,664.65
	6	Transfers of entitlements between schemes		0.00
	7	Changes in pension entitlements due to other transactions		-3,243.94
		Changes in pension entitlements due to other economic flows		
	8	Changes in entitlements due to revaluations		0.00
	9	Changes in entitlements due to other changes in volume		0.00
		Closing Balance Sheet		
	10	Pension entitlements		61,236.23
		Pension entitlements (% of GDP 2006)		257.46
	11	Output		
	12	Assets held at the end of the period to meet pensions		

Table 4: Supplementary table Hungary 2006 (PBO, in bn. HUF)
***Source**: Müller- Raffelhüschen- Weddige, 2009*

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Pension entitlements in the beginning of 2006 were 58,815.52 bn. HUF. They are increased by social contributions, and decreased by pensions paid in 2006. Row 7 presents the effect of a pension reform, which reduced all pension payments from 2008 by nine percent compared to the legal status before. This reform caused a decrease in entitlements, so the final pension entitlements amounted to 61,236.23 bn. HUF (257 per cent of GDP) in 2006. The same calculations were carried out by using the ABO approach. The respective results are the following:

			Non-core national accounts (figures in bn. HUF)	
			General Government	Social Security
			G	H
		Opening Balance Sheet		
	1	Pension entitlements		50,604.97
		Changes in pension entitlements due to transactions		
Sum 2.1 to 2.4	2	**Increase in pension entitlements due to social contributions**		4,104.80
	2.1	*Employer actual social contributions*		1,186.00
	2.2	*Employer imputed social contributions*		
	2.3	*Household actual social contributions*		327.00
	2.4	*Household social contribution supplements*		2,591.80
	3	Other (actuarial) increase of pension entitlements		3,108.34
	4	Reduction in pension entitlements due to payment of pension benefits		2,314.50
2 + 3 - 4	5	**Change in pension entitlements due to social contributions and pension benefits**		4,898.64
	6	Transfers of entitlements between schemes		0.00
	7	Changes in pension entitlements due to other transactions		-2,436.77
		Changes in pension entitlements due to other economic flows		
	8	Changes in entitlements due to revaluations		0.00
	9	Changes in entitlements due to other changes in volume		0.00
		Closing Balance Sheet		
	10	Pension entitlements		53,066.85
		Pension entitlements (% of GDP 2006)		223.11
	11	Output		
	12	Assets held at the end of the period to meet pensions		

Table 5: Supplementary table Hungary 2006 (ABO, in bn. HUF)
***Source**: Müller- Raffelhüschen- Weddige, 2009*

The results using the ABO approach are noticeably lower that the results presented above. This is true for the opening pension entitlements, the social contributions and the other increase of pension entitlements. The changes due to other transactions in row 7 are almost 25 per cent less than under PBO approach, because the pension reform influences only new pensions.

The closing balance of pension entitlements was 53,066.85 bn. HUF (223.11 per cent of GDP) in 2006, which is nearly 14 per cent less than with the PBO approach.

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4.4. Pension modelling of the central bank of Hungary (MNB) based on the Freiburg model

According to the mandatory ESA 2010 requirement for all EU member countries, the central bank of Hungary (MNB) in collaboration with Freiburg University Research Centre for Generational Contracts (RCG) started to develop the model for ADL calculations in 2010. This model is strictly for statistical purposes, not for observing fiscal sustainability and also not for long term vulnerability analysis.

The ADL calculations are based on Freiburg model. First, it estimates the pension entitlements for current retirees. For this, it forecasts the cohort sizes in future years and sets also the indexation rules. Then, the model estimates the individual pension entitlements for current contributors. PBO (projected benefit obligation approach) is used during the calculations. The model uses heterogeneous contribution careers (cohort-specific employment careers) and calculates different estimation for old age, disability and survivors' pensions.

The results of the model are extremely sensitive to the core assumptions of the model. It is important, that in the case of transition countries, labour market trends vary after the transition period, and transition matrices reflect the employment rate. A lot of assumptions have to be made during the calculations because of missing data or the lack of data accuracy. For example, history data about the working days profile are not proper for the future estimation, and also pension possibilities can change by time. As I already mentioned, a lot of data is missing, so the estimation of the data gap is at disaggregated level by cohort, sex and education level.

The model can use different scenarios for the calculations, which means different discount rates or wage growth assumptions can be chosen. The results depend highly on the scenario used, for example changing the life expectation to 1.5 times higher for males means 7% higher ADL. Behavioural changes in retirement decisions only slightly affect the ADL

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indicator. This latter result is highly dependent on pension regulation (subsidize or penalize early and late retirement).

		discount rate						
		0	1	2	3	4	5	6
wage growth rate	0	156,0	127,3	105,7	89,5	77,5	67,5	59,8
	0,5	164,1	132,5	109,6	92,8	79,4	69,4	61,2
	1	172,7	138,8	114,4	95,7	81,8	71,3	62,7
	1,5	182,8	145,5	119,1	99,5	84,7	73,2	64,1
	AWG	184,2	146,9	119,6	100,0	84,7	73,2	64,1
	2	193,8	153,1	124,4	103,3	87,6	75,1	65,6
	2,5	205,7	161,7	130,6	107,7	90,4	77,5	67,5
	3	237,3	184,2	146,9	119,6	100,0	84,7	73,2
	3,5	257,4	198,1	156,5	126,8	104,8	88,5	76,1
	4	313,4	236,8	184,2	146,9	120,1	100,5	85,2

Table 6: Sensitivity analysis – ADL as % of GDP

***Source**: Sisak-Tardos, Debt Indicators -The Missing Links -Plausibility of Pensions Liabilities, 2013*

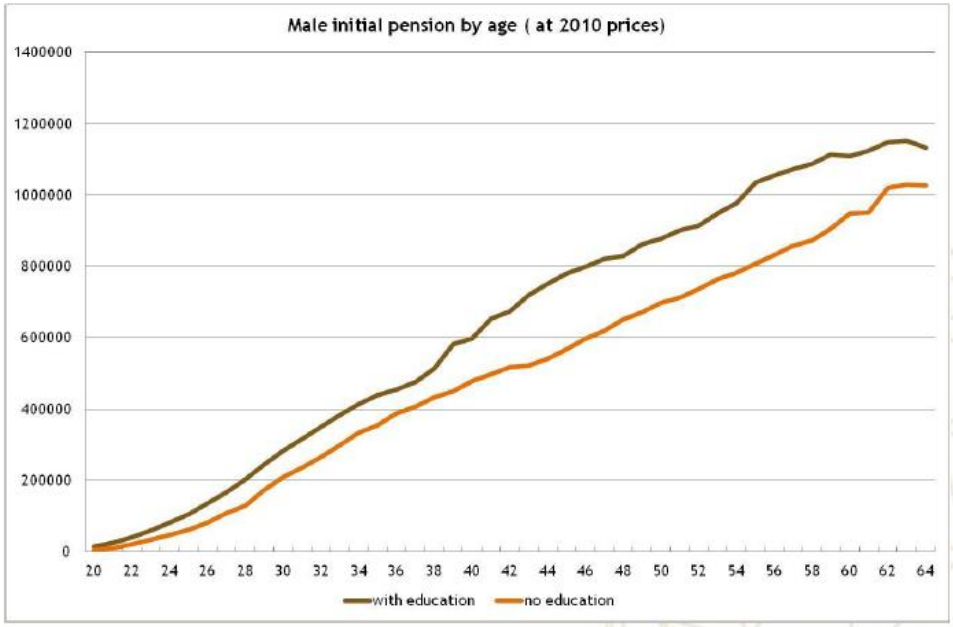

Figure 12: Example of sensibility: results of initial pension estimation – different assumptions

***Source**: Sisak-Tardos, Debt Indicators -The Missing Links -Plausibility of Pensions Liabilities, 2013*

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New actual data will help more accurate modelling. It is a very time and resource consuming process, as comprehensive data collection and preparation is needed for the calculations. The back and forward estimation of „ actual" data can solve data gaps and using a sound panel of micro data is a good tool to start modelling. The complete historical micro database of the Central Administration of National Pension Insurance will be completed by 2014, and the result of the new 2011 census and a new the demographic forecast is based on it.

There are a lot of dilemmas about the plausibility of ADL. The initial pension depends on future carrier estimations, which are based on historical data, but the new generations carrier paths can be different from the previous ones. Different future carrier assumption should be used by age, gender and education level. It is an important issue to decide whether stable discount rate should be used for the whole period or not, and also whether the same discount rate should be applied for each country or not.

The new ESA 2010 supplementary table is welcomed by the Hungarian statisticians as ADL is a good „proxy" for pension obligation and its changes can visualize the effects of the government measures. However, the new reporting requirement will encourage government agencies to reflect sustainability criteria in their decisions, the modelling process needs a very comprehensive data collection and preparation, which it is time and resource consuming. Data gaps and different approaches to overcome this issue will seriously hinder the international comparability of the first results of ADL indicator. (Sisak-Tardos, 2013)

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5. Own calculations about the future balances of the Hungarian Pension Insurance Fund

In this section I present my own calculations about assessing the sustainability of the Hungarian single-pillar pension system from 2014 until 2060. The future balances of the Pension Insurance Fund are estimated for each year by making predictions about the annual future contributions of active workers and expenditures on pension promises of the Fund. The calculations only cover estimations for old age pensions, not disability and survivors' pensions.

I would like to emphasise the fact that it is a very simplified model, and its main goal is to show the basic logic behind the calculations on pension systems sustainability. As I had to deal with a significant lack of data availability and accuracy, the final results are not relevant, but still useful for demonstrating the main idea behind the calculations of future state pension system's balances.

The data needs of these calculations are extremely complex, even in the case of a simplified model. For relevant estimations it is necessary to have demographic predictions, the cohorts' current pension payments, the retrospective contribution series of the currently active workers - because this forms the base of the future pension calculations. The Hungarian Central Statistical Office recently published data about demographic estimations, based on the last census. The other two needs are more difficult to receive. There is data available on the website of the Hungarian Central Administration of National Pension Insurance about the different cohorts' Old Age Security pension benefits for 2013. I used them as a base for the future benefit predictions. About the contribution series of the currently active workers, unfortunately there is no public data available. The Hungarian National Bank is currently working on a model for estimating the implicit government debt after the single-pillar state

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pension system was introduced in 2011. They have only prepared experimental calculations for 2010, so the effects of the significant changes in 2011 are not quantified yet.

I started my own counting by making estimations about the annual predicted Old Age Security pension contributions paid by active workers. I used exogenous data from the website of KSH (Központi Statisztikai Hivatal) on demographic predictions until 2060, on the cohorts' past activity ratios and monthly average gross wages. I checked the activity ratios of different cohorts in the active-age population (age 15-74) from 1998 till 2013, then took their average value, multiplied them with the number of people according to demographic predictions and used these results for further calculations. I checked the growth rates of gross monthly wages from 2000-2013, took their average value (nearly 8%) and used it as a standard growth rate for the average wage predictions. The monthly pension contribution rate is 10%, the social contribution rate is 27%, so an active worker pays around 37% of his/her monthly gross average wage to the Pension Insurance Fund. Based on these numbers, the annual income of the Pension Insurance Fund from Old Age Security pension contributions is counted in the following way:

Estimated annual Old Age Security pension contributions =

Estimated number of active workers among cohorts * Estimated monthly average gross wage * Contribution rate (37%) * 12

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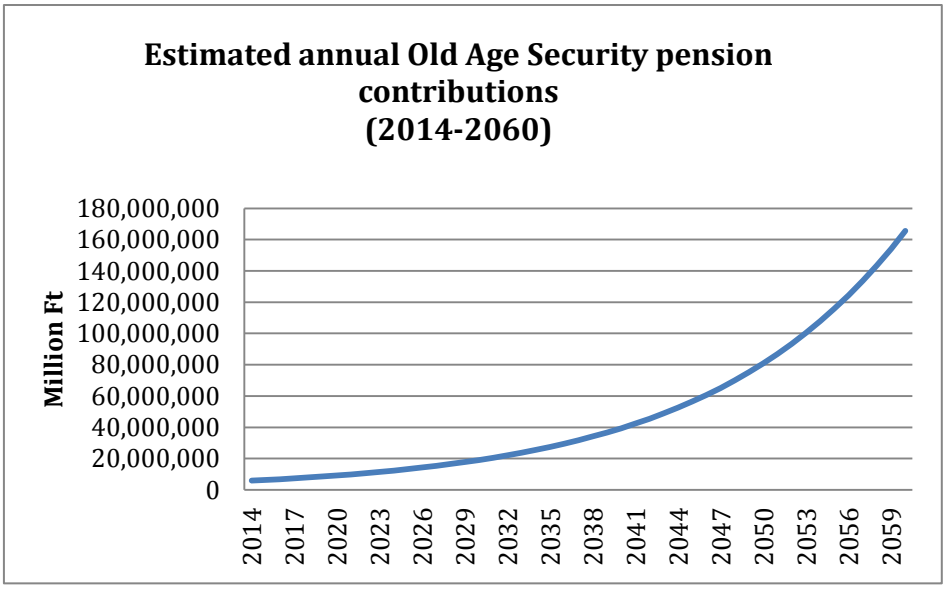

Figure 16 (own): Estimated annual Old Age Security pension contributions

According to my calculations, the sum of contributions at the end of 2014 will be nearly 6,000,000 million Hungarian Forints and in 2060 around 165,580,865 Forints.

I continued my calculations with estimating the annual pension benefits paid by the Pension Insurance Fund to retirees. As a starting point, I used the pension benefits in different cohorts of elderly people (age 55-90+) in 2013 and then took the average value of them, and used the previous 8% standard growth rate for the future estimations. I searched data on the percentage of people in this age-group being eligible for the benefits in the system. Based on these numbers the annual estimated expenses of the Pension Insurance Fund are calculated in the following way:

Estimated Annual Old Age Security pension benefits=

Number of people eligible for the benefits * Monthly average pension benefit * 12

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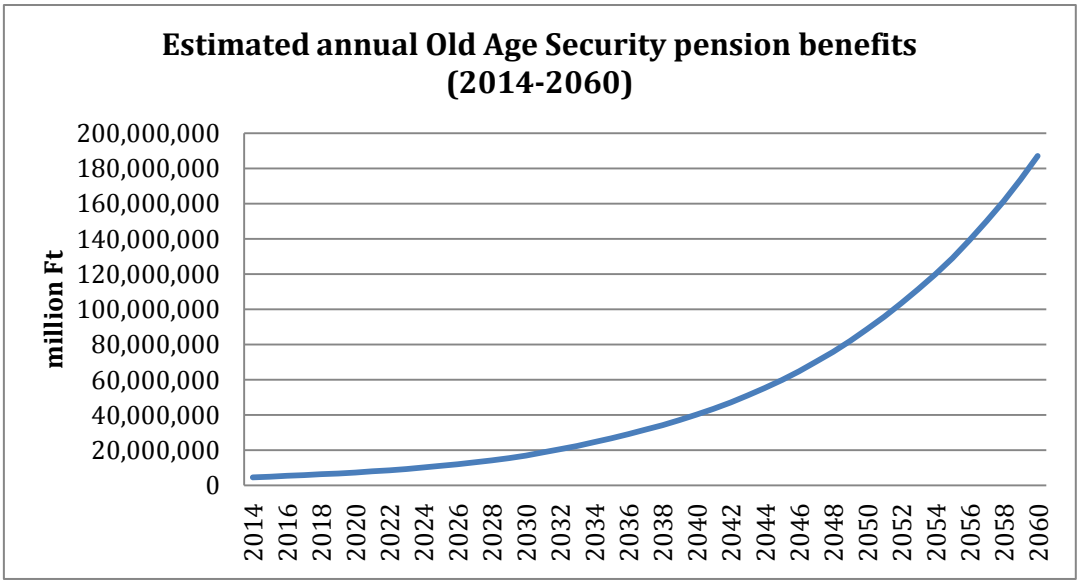

Figure 17 (own): Estimated annual Old Age Security pension benefits

According to my calculations the sum of benefits at the end of 2014 will be 4,674,176 million Hungarian Forints and 187,074,533 Forints at the end of 2060.

After computing the Old Age Security pension contributions and benefits, the predicted annual balances of the Pension Insurance Fund can be easily presented by subtracting the Fund's obligations from its income flows.

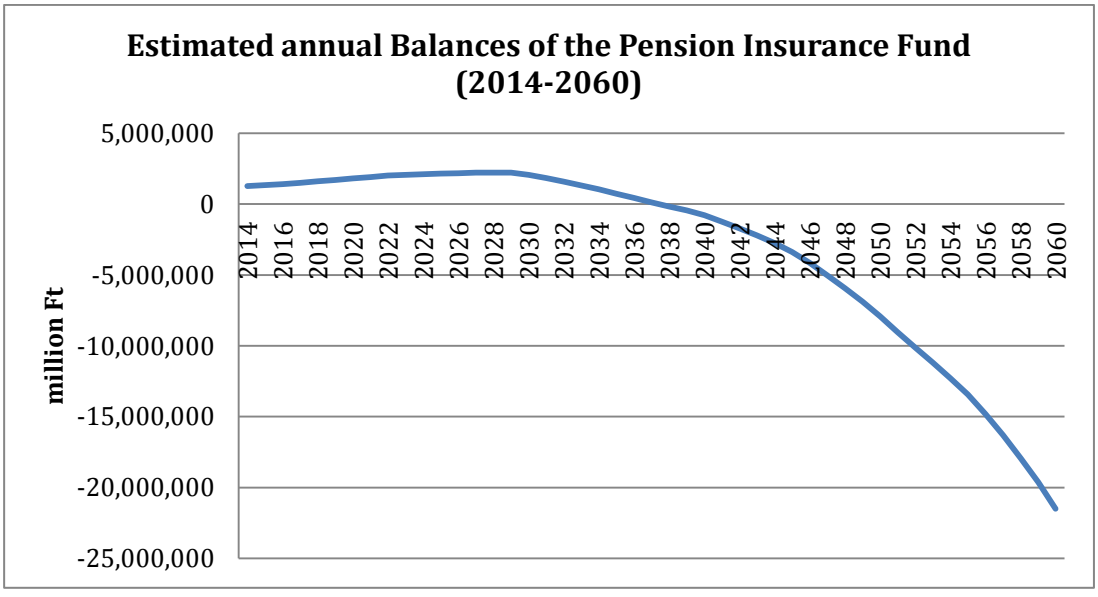

Figure 18 (own): Estimated annual Balances of the Pension Insurance Fund

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We can see it from the graph that before 2038 the system works very well, contributions cover expenditures fully. But after this time the system starts to have a huge deficit, as payments will not cover the benefits anymore. A one-pillar pay-as-you-go pension system is extremely sensitive to demographic changes. As the current trend is a continuous population aging in Hungary, the system can easily become unsustainable.

Differences in the calculation results from the MNB model (2006) can arise from the differing assumptions used by the models. During the calculations in the Hungarian National Bank, microeconomic assumptions about growth rates(GDP, real wage, pension increase, etc.) were used based on predictions by the European Commission, while I used average rates (gross wage, pension increase) calculated from past trends.

As I already mentioned, statisticians in MNB are currently working on a Freiburg-based IPD model, which will be able to measure perfectly the real effects of the pension reform taking place in 2011. The final results will show clearly whether the elimination of the funded pension pillar improved the sustainability of the pension system or it wasn't a solution for the problems.

5.1. Issues for further research

As I already emphasised, the calculations above are simplified as the model has several shortcomings. For example, the model doesn't have data on the number of unemployed and inactive contributors and also there is a lack of information on the income base on which they pay their contributions. To avoid inconsistency, these contributions are not included in the calculations.

The other problem is connected with the lack of public data on the retrospective contribution series of the currently active workers.

Another issue is the outcome of using lot of assumptions during the calculations. For example, the main assumption is that each member of the pension system pays the very same

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amount of contribution until the retirement age, and then nothing, which is not very realistic. The Pension Insurance Fund's income predictions are based on this hypothesis. The model also assumes that the annual growth rate of the future Old Age Security pension benefits are the same as the predicted annual growth rate of the gross average wage.

I used data from 2013 as a base of my calculations. The model assumes that the cohorts' activity ratios, the monthly pension contribution and social contribution rate and the ratio of the people being eligible for pension benefits in 2013 will be the same in the future.

The other issue is related to average gross wage in base year (2013). The figure available is the average of gross wages paid to employees in firms with over 5 employees, so it doesn't include the group of self-employed and people working in micro firms, who usually report a minimum wage to the tax authority. Because of this phenomenon the contribution base is lower than in than the number of people employed multiplied by the average wage.

The model doesn't have data on the past incomes, so the regressive treatment of these incomes in the pension formula (only smaller shares of past income in higher brackets are accounted for) cannot be expressed by the model.

In reality, years spent in higher education accounts for as service years for students graduating from higher education before 1998. As in the model the length of service is not increased by the number of years in higher education, it underestimates the amount of benefits in the first decades.

5.2. Policy recommendations

In the followings I present some policy recommendations, which can help accomplishing a better designed and managed public pension system. First, it is important to provide more clear information on the financial development and status of the system. Objectives and agreement on risk-sharing have to be totally transparent, and it became more important as ageing makes the system vulnerable to shocks such as unexpected longer lifespan or inflation.

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The so-called actuarial balance of PAYG pension systems gives a positive incentive to improve financial management by mitigating the mismatch between the planning horizons of electors and politicians, often only four years, and the system itself.

As Hungary already regularly provides official actuarial balance, it is important to continue this it with some improvements.

The frequency of the reports should be increased. A panel of independent, recognized experts is needed who decide on the economic, demographic and financial assumptions on which the actuarial balance is based. New methodologies should be used when making the actuarial balance. It should be ensured that the two basic focuses of the actuarial balance complement each other as far as possible. One focus is concerned with the future and covers the threats as negative demographic trends and lower productivity, while the other deals with the actuarial design problems of the system. It is also important to be in cooperation with international organizations such as the ISSA, the World Bank, and the OECD etc. which are interested or involved in the reform of pension systems. These organizations could be supportive in developing and enforcing international accounting and actuarial valuation standards for pay-as-you-go pension systems.

To eliminate the one-sided risk of the pure state pension system, residential self-care has to be promoted by incentives connected to the voluntary pension funds and other type of household savings. To mitigate the negative effects of population aging, retirement age should be increased and there should be effective incentives for increasing economic activity among the 15+ age group. As higher educated people have better chances for longer life and it indicates higher participation rates, higher education should be also supported significantly. (María del Carmen Boado-Penas, Carlos Vidal-Melia and Junichi Sakamoto, 2010)

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6. Conclusion

Many people criticized the Government decision, taken in 2011 to terminate the mandatory second pension pillar. According to them, the goal of this radical transformation was solely to eliminate the budget deficit problems, without taking into consideration the interests of the pension fund members.

According to the reviewed analyses, this statement is not completely true, as they clearly show the fact that the mixed, fully funded system has proved to be unsustainable.

As the consumption of retirees depends on the savings of the active population, in the case of decreasing population trend less and less number of active workers has to support the growing number of retired people. It slowly turned out that introducing the second pillar was not a solution for the problem of aging population as the system had significant structural problems. Pension paradigms developing over the past decades were only satisfied partially, in addition to the system's high transition costs. The fully funded system reduced the implicit public debt, but increased the explicit one, thus contributed to the deterioration of the country's investor, increased risk premium and vulnerability.

On the other hand, a positive trend was that the amount of investments and the number of contracts began to rise in voluntary pension funds over the past few years. More and more people started to recognize the importance of savings, so financial awareness started to grow. This process can be even intensified by the reform in 2011, as many people think that the future benefits coming only from the state will not be sufficient to maintain a normal standard of living. In addition to this, as the mandatory funds were eliminated, the voluntary ones got into the focus.

My calculations about the future balances of the Pension Insurance Fund show that the system works efficiently until 2040, mostly because of the growing amount of pension contributions going into the first pillar and not to the second one anymore. After that the system starts to

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work with huge deficit, contributions from the active workers do not cover the expenses anymore. Based on my results the currently existing pure state pension system is considered to be unsustainable and it is necessary to improve its performance and to make it more efficient by significant structural changes. We can conclude that even though the pension reform in 2011 was not an unfounded decision, the current state pension system also has many problems that need to be solved.

The Hungarian pension system is going through constant changes, even after the reform, and is in the centre of economic discussions. According to a working paper[6], still urgent changes are necessary regarding the future pension system. This document contains a number of proposals, such as rewriting rules on the pension taxation, speeding up the increase of retirement age and introducing the option of staggered retirement. It also writes about the pension base and the elimination of banks and insurance companies from the voluntary funds. This continuous change is not specific to Hungary. The problem of unsustainability, the negative impact of demographic trends observed worldwide. Political and economic leaders of countries are trying to find the best pension system for their society, let's hope this is the case in Hungary too.

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