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CEE Transition from PAYG to Private Pensions: Income Gaps and Asset Allocation

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Abstract
Rapid population aging driven by low fertility and increasing longevity requires further adjustments of the traditional pension frameworks in Central and Eastern Europe (CEE). In this article we analyze the pension systems of the Czech Republic, Hungary, Poland, Slovakia, and Slovenia and show firstly *that fiscal limitations are expected to significantly reduce PAYG pensions in CEE countries given the current and projected demographic dynamics.* Secondly*, we show that existing private pension plans will not be able to fill the gap to the desirable replacement rate. Without implementation of additional pension saving plans during the active period, there is a threat that many individuals will fall below the poverty line after retirement.* Thirdly*, we argue that the success of such pension plans will crucially depend on asset allocation decisions. Hence, governments should implement financial literacy programs in order to promote less conservative, more profitable asset allocation decisions by individuals over the longer run.*

1. Introduction

Population aging requires the traditional pay-as-you-go (PAYG) systems to be downscaled. Projections of age—related expenditures from the European Commission (2012) point toward a significant risk to the sustainability of PAYG systems as a consequence of increasing demographic shifts. Muenz (2007) argues that by 2050 demographic dynamics are projected to result in a 10-year increase in the median age of the EU population, from 38 to 48 years old. Substantial funded pension systems should be built to complement the traditional PAYG (Du et al., 2011) as a significant pension gap is expected to emerge that will push many people into poverty. Moreover, private pension systems based on long-term savings may provide additional protection for the retired compared to the prevailing PAYG systems, which are fully exposed to the unfavorable demographic dynamics. These dynamics make PAYG inferior in terms of the efficiency of the mechanism for providing means for deferred consumption, i.e., under realistic assumptions, private pensions can deliver higher pension benefits with the same level of contributions or the same level of pension benefits with a lower level of contributions (Garrett and Rhine, 2005; Berk and Jasovic, 2007).

Trends in redesigning pension systems during the past decade have favored the diversification of risks across all sources of old-age income, as the coexistence of the three pillars positively effects benefits and consumption under various shocks, e.g., population aging, inflationary shocks, and stock market crashes (World Bank Pension Conceptual Framework, 2008; Holzmann and Hinz, 2005; Lindbeck and

Persson, 2003; Du et al., 2011). This long-term shift toward funded private pensions should be based on sound second- or third-pillar frameworks, or both (Boersch Supan et al., 2008). They should be safe on the one hand, but also designed in a way to benefit from the nature of financial markets. In the CEE region not only the design, but also the transition costs of the shift from PAYG toward funded pillars were sub-optimal. The latter is the main reason why some countries have reversed their reforms during the last couple of years—see chapter 2 of the European Commission (2012c) report for Hungary, Poland, and Slovakia.

However, the above-mentioned characteristics of private pension systems are insufficient by themselves to provide for society's well-being if people do not have sufficient financial knowledge, i.e., if they are only modestly financially literate. Financial illiteracy is a very important issue, and it has been reported even for the most advanced countries (on the United States, see Lusardi and Mitchell, 2007; on the United Kingdom, see Disney and Gathergood, 2011; on Japan, see Sekita, 2011). Studies have found that many households are unfamiliar with even the most basic economic concepts in order to make saving and investment decisions. Financial illiteracy is lowest among women, young people, and individuals with lower incomes and lower education levels. With respect to pension savings, financial literacy increases individuals' likelihood of having a savings plan for retirement, which has a very strong impact on their wealth levels at retirement (Lusardi and Mitchell, 2007a). a very important aspect of financial literacy is knowledge about the characteristics of various asset classes for investments. Rooij et al. (2007) found that financially illiterate individuals are significantly less likely to invest in stocks.

In this paper we focus on the need of the individuals and societies of CEE countries that entered the EU at the same time back in 2004 (i.e., the Czech Republic, Hungary, Poland, Slovakia, and Slovenia) to be familiar with the basic characteristic of financial asset classes and the consequences of pension allocation decisions. Many researchers illustrate the importance of strategic asset allocation and how it determines up to 90% of portfolio performance (see Brinson et al., 1986; Ibbotson and Kaplan, 2000; Statman, 2000; Andreu et al., 2010). We argue that it is of crucial importance for government and professional-supported financial literacy campaigns to address both topics: individuals' need to start saving for their pension (e.g., in a pension savings account) and at the same time their need to allocate savings into appropriate asset classes. Along with a return analysis, we address risk and simulate the results of a conservative investment strategy. Our contribution on this front is in showing the opportunity loss to a financially illiterate individual.

This article is structured as follows. In the next section, we briefly describe the existing pension systems in CEE countries. We also report the performance of CEE country pension vehicles since the start of the recent global financial and economic crisis. In the third section, demographic projections up to the year 2060 are presented along with future public pension expenditures, which—without changes—are expected to cause huge deficits in the pension budget. As these imbalances are unsustainable and cannot be financed through subsidies from the central government budget, we impose fiscal caps at various percentages of gross domestic product (GDP) that can be allocated to finance pensions. These, in turn, put further caps on the future levels of expected public pensions. The fourth section provides an

Table 1 Overview of the Need of Private Pensions in Five Selected Counties and Its Current Relative Size (2011)

	Gross replacement rates from public systems	Private pension assets (in bln EUR)	Private pension assets as a % of GDP	Private pension assets per capita (in EUR)
Czech Republic	28.55*	10.8	6.5	1,064.6
Hungary	38.40*	4.1	3.8	410.3
Poland	49.13*	59.8	15.0	1,557.8
Slovakia	50.67*	6.2	8.4	1,136.7
Slovenia	44.20* **	1.3	2.9	644.8
OECD average	42.20		33.8	12,388.3
Selected benchmark countries				
Australia	11.80	1,035.6	92.8	47,039.3
Netherlands	29.20	894.5	138.2	53,462.1
UK	31.90	1,645.8	88.2	26,104.7
US	39.40	8,180.1	70.5	26,063.9

Notes: * The data are for 2010 (European Commission, 2012).

** For Slovenia gross replacement rates were not published. We use estimates of net replacement rates from microsimulation pension model (Majcen et al., 2011) and applying the ratio between net and gross replacement rate for Slovenia from OECD (2011).

Sources: OECD Global Pension Statistics; European Commission (2012) (replacement rates for CEE countries) and CIA Fact Book (population).

overview of three basic asset classes available for the allocation of private pension savings. Using historical data, we calculate the real long-term yield and further assume that those returns are a reasonable approximation of future long-term yields. We thus use historical returns as the expected returns in our model, which we present in detail in the fifth section. The last section concludes.

2. Overview of Pension Systems

All five selected countries have undergone radical pension reforms during their transition toward a market-oriented economy. They have all kept a mandatory PAYG-based first-pillar pension system. Slovakia, Hungary, and Poland initially introduced a mandatory fund-based second pillar. This has recently been effectively abandoned in Hungary, while in Slovakia it has not been compulsory since February 2013. On the other hand, Slovenia and the Czech Republic initially did not introduce a mandatory second pillar. This remains the case in Slovenia, while the Czech Republic is now opening the option for employees to divert part of their contributions from the first to the second pillar.

The gross replacement rate[1] from the mandatory pension system varies across the selected countries (see *Table 1*). Currently, it is lowest in the Czech Republic (28.55%) and highest in Slovakia (50.67%).

If we compare the selected countries with the most developed countries (see the data for selected benchmark countries in *Table 1*), we can see that the selected CEE countries lag behind in terms of the importance of their private pension system in relation to GDP and even more so in terms of private pension assets per capita.

Table 2 Pension Fund Performance for Five Selected Countries and Their Benchmark Countries from 2008 to 2011

	2008*	2009	2010	2011	2008–2011 average	2009–2011 average	Since inception (year)**
Czech Republic	-5.6	-0.7	-0.4	0.5	-1.5	-0.2	n.a.
Hungary	-22.3	14.3	4.0	-0.5	-1.1	5.9	n.a.
Poland	-17.7	8.9	7.7	-9.1	-2.6	2.5	n.a.
Slovakia	-5.7	-0.1	0.4	-3.8	-2.3	-1.2	n.a.
Slovenia	-5.3	5.2	2.9	-1.8	0.3	2.1	n.a.
OECD average	-14.02	5.4	4.3	-1.7	-1.52	2.6	n.a.
Selected benchmark countries							
Australia	-23.9	-10.5	6.2	4.1	-6.0	-0.1	8.9 (1990)
Netherlands	-17.8	11.1	18.6	8.2	5.0	12.64	6.1 (1993)
UK	-17.0	-0.3	7.8	-2.5	-3.0	1.68	8.7 (1982)
US	-26.7	4.5	1.0	-2.7	-6.0	0.94	6.6 (1988)

Notes: Performance is measured in real terms; * = 2008 real performance is calculated from nominal returns; ** = geometrical real performance.

Sources: OECD Global Pension Statistics (OECD), UK pension funds achieve returns of… (2011) (UK for 2010); Eurostat HICP database (inflation rate); OECD.StatExtracts (inflation rate for Australia, Netherlands, UK & US); Antolin (2008) (performance since inception).

There are also differences in pension fund performance (see *Table 2*). Even though performance in the selected countries over the last couple of years has been rather similar to that in the developed peer countries, the latter set of countries has exhibited much higher performance since the inception of their private pension systems than is achievable in the selected CEE countries. The reason is investment policy (i.e., asset allocation), which is unreasonably conservative in the set of selected CEE countries. Besides this fact, we also observe some kind of snakebite effect within the region. Whereas developed countries have reduced their stock exposure by only roughly 6% (from a much higher level), the selected countries (except Poland) have almost eliminated stock exposures from their portfolios. What is even more interesting and flies directly in the face of the evolution of a more sustainable pension landscape, is the emergence of political risk obviously inherent in the emerging countries' private pension frameworks. To be specific, politicians have myopically diverted assets into the PAYG systems during the crisis in order to temporarily improve the fiscal position regardless of the long-term consequences.

2.1 The Czech Republic

Together with Slovenia, the Czech Republic is the only country in the region without a mandatory second pension pillar.[2] Its pension system consists of a mandatory PAYG first pillar, a voluntary private funds-based second pillar (since 2013,

[1] The gross average replacement rate is calculated as the average first pension divided by the economy-wide average wage at retirement that was reported by the EU Member States in the pension questionnaire reported to the Ageing Working Group. The European Commission represents the main data source for EU Member States and it also provides projections of replacement rates in the future, which we need in our calculations. There can be substantial differences between these gross replacement rates and those reported by the OECD.

[2] However, Hungary effectively abandoned the second pillar in 2011, while Slovakia made it voluntary in February 2013.

see our discussion above),[3] and a third pillar comprising voluntary supplementary pension saving plans.

Mandatory pension contributions are set a rate of 28.0% (6.5% employee and 21.5% employer). In 2013 employees were given the option of diverting 3% of their earnings from this contribution to new second-pillar pension funds, but must add 2% from their own pockets. The public pension system consists of two components: a flat-rate basic pension, which is available to all entitled citizens, and an earnings-related component, which has a strong redistributive character.

The third pension pillar is run by pension companies (joint-stock companies). Contributions paid by employees are supplemented by the government up to a certain threshold, while the size of the supplements depends on the level of contributions. Employers can deduct their contributions from their tax base up to 3% of the employee's assessment base. Employer contributions of up to 5% of wages or CZK 30,000 (EUR 1,170) per year are exempt from income tax for the employee (European Commission, 2012a).[4]

Under the 2013 pension reform, existing supplementary pension funds are to be closed to new entrants. The providers can set up new funds in the new second pillar and a new third pillar for new products after supplementary pension insurance, i.e., for supplementary pension savings.

The current retirement age of 62.5 years (men) and between 56 and 61 years (women, based on the number of children) will gradually increase to 67 years by 2044 and then increase by two months per year, with no final retirement age set in law (Swiss Life Network, 2012; Pensionfundsonline, 2013).

2.2 Hungary

Following the 1997 reform, the Hungarian pension system consisted of a mandatory PAYG first pillar, a mandatory private funds-based second pillar, and two voluntary pillars: voluntary pension funds and voluntary individual pension saving accounts. However, due to the economic crisis, the second pillar was renationalized and to a large extent defunded in 2011. The Pension Reform and Debt Reduction Fund were established to absorb the savings transferred to this public fund, amounting to 10.2% of GDP. Around 4.8% of GDP which was held in government bonds was revoked, directly reducing the public debt. The real returns of the funds (around 0.9% of GDP) were paid out to former fund members. An amount (1.8% of GDP) was liquidated in order to finance the deficit of the National Pension Insurance Fund (the basic PAYG system), while the rest of the assets will cover further debt reductions or specific budgetary purposes

The mandatory contribution rate for the pension system remains unchanged at 34% (24% employer, 10% employee), while a tax credit equal to 20% of payments to voluntary funds or pension savings accounts is provided, up to HUF 100,000 (EUR 320) per year (EU Commission, 2012a, 2012b). The standard retirement age, which has been 62 years for both genders since 2009, is going to increase to 65 years for both genders by 2022.

[3] Similar to the experience in other countries, the Czech authorities realize that the introduction of voluntary second-pillar plans has had only limited success (Penzijni reforma..., 2013).

[4] This is a joint limit for pension and life insurance.

2.3 Poland

Poland's pension system has mandatory first and second pillars that are complemented by a third pillar—voluntary occupational pension plans, while a zero pillar covers disability and survivor benefits. In addition to voluntary occupational pension plans, there are personal voluntary plans (a fourth pillar). The first mandatory PAYG pillar is based on NDC accounts. The total mandatory contribution rate is 20.7% (9.75% employer and 10.95% employee). The employer's part (9.75%) goes entirely to the NDC plan, while employee's part is split: 7.45% goes to the NDC plan, and 2.3%[5] goes to the individual account in the mandatory second pillar. The retirement age is currently 65 for men and 60 for women, but is being increased to 67 years by 2020 for men and by 2030 for women.

The mandatory second pillar consists of open pension funds of the DC type. Due to low investment efficiency, a high share of investments in state securities, high managing costs, and fiscal pressures (similar to Hungary), the government reduced the contribution rate from 7.3% to 2.3% in December 2010 (European Commission, 2012c). For those individuals whose total pension—from the first and second pillars—does not reach the minimum pension, the government pays a guaranteed minimum pension (provided that they have participated in the pension system for a minimum number of years). In addition, there are several programs for farmers and selected civil servants. The state subsidizes farmers' pension program by more than 90%. Both contributions and benefits are flat-rate and amount to roughly half the average of the public pension benefits (Pensionfundsonline, 2013).

The third pillar—voluntary occupational pension plans—is supported by tax incentives. Contributions to voluntary occupational pension plans which are paid by the employer are entitled to capital gains tax exemption and to exemption from social security contributions up to 7% of employees' gross salary. Employees can make additional contributions that supplement those of the employer. These cannot exceed 450% of the average monthly salary. All of the contributions are subject to income tax (Pensionfundsonline, 2013; EU Commission, 2012b).

2.4 Slovakia

The Slovak pension system consists of a mandatory PAYG first pillar, a mandatory private funds-based second pillar, and a third pillar comprising voluntary supplementary pension saving plans. Mandatory pension contributions are set a rate of 18.0% (4.0% employee and 14.0% employer). In 2007 the contribution rate was divided between the public pension program and the private second pillar (9%), which was made mandatory. Employees who first joined the labor market in 2007 were automatically included in the new system, while older employees could decide to join the new mandatory pillar or to stay in the old system. In February 2013 inclusion in the second pillar became voluntary.

In September 2012, the pension contributions to the second pillar were reduced from 9% to 4%. This is a temporary measure which expires at the end of 2016, and from 2017 the 4% contribution to the second pillar will gradually increase to 6% in 2024 (Slovakia turns away…, 2012; Eironline, 2012).

[5] The percentage will be gradually increased to 3.5% in 2017.

The second-pillar pension funds are managed by pension asset management companies (PAMCs), which are joint-stock companies established exclusively to administer pension funds.

The public PAYG system is gradually increasing the retirement age to 62 years for both genders (by 2007 for men and by 2024 for women). In 2011, women retired at age 56.75 to 60.75 years depending on the number of children (European Commission, 2012).

The third pillar—voluntary supplementary pension saving plans—is governed by private supplementary pension companies and is supported by tax incentives. The original tax allowance for contributions up to EUR 398 per year was abolished in January 2011, while employers' contributions paid on behalf of employees up to 6% of their gross wages have been preserved (European Commission, 2012).

2.5 Slovenia

The Slovenian pension system consists of a mandatory PAYG first pillar and a funds-based second pillar which is voluntary (with the exception of some selected professions). Mandatory pension contributions for the first pillar are set at a rate of 24.35% (15.5% employee and 8.85% employer, while the self-employed pay an overall rate of 24.35%). The retirement age (for full old-age pension) is gradually increasing from 61 years (women) and 63 years (men) to 65 years for both genders (by 2016 for men and by 2020 for women).

The second pillar is organized in two programs:

- A mandatory program intended only for selected "health risky" professions (such as miners and policemen). Overall, around 5% of all employees are included in this program. For employees from those professions, their employers pay an additional mandatory contribution at a rate of 10.55% or 12.6%, depending on the type of profession. Those contributions are paid into a special pension fund operated by the government-owned Kapitalska družba (Kapitalska družba, 2013).
- A voluntary private program, supported with tax incentives, organized by pension or insurance companies. Contributions to second-pillar pension funds can be paid by the employer, the employee or by both. If they are paid by the employee, they are deductible from the personal income tax base up to a level equal to 5.844% of the employee's annual gross wage or up to an absolute amount which is set annually (EUR 2,819.09 in 2013). Where the employer pays the contributions, they are deducted from the corporate income tax base in the same amount as in the case of the employee.

3. The Impact of Demographic Changes on Benefits from the PAYG Pillar

The twentieth century experienced explosive population growth, but the twenty-first century is likely to see the end of population growth and face rapid population aging instead (Lutz et al., 2004). According to projections, in the future there will be strong demographic pressure on public expenditures for pensions, health care, and long-term care (European Commission, 2012). Scholars began warning of this danger decades ago, but we have not seen much change in public policy, mainly because politicians have only the next elections as their horizon and are not very interested in projections for the distant future. However, the situation has become so aggravated

that action cannot be put off any longer. Many countries have already taken various measures. International organizations are pressuring countries to act in a timely manner to facilitate and accelerate change.

PAYG systems are vulnerable to population aging. In our analysis, we apply Eurostat EUROPOP2010 population projections for 2010–2060. They were prepared by Eurostat for the European Union countries (EU27) and the European Free Trade Association (EFTA) countries, i.e., Iceland, Lichtenstein, Norway, and Switzerland. The projections assume gradual convergence of countries' mortality and fertility, with the year 2150 set as the convergence year. However, the projections extend only until 2060, when only partial convergence will have been reached.

In all of the five countries analyzed, life expectancy at birth is increasing rapidly. The past decade alone (from 2001 to 2011) saw an increase ranging from 2.5 years in Slovakia to 3.7 years in Slovenia[6] (Eurostat, 2013). Some developed countries already have a considerably higher and still increasing life expectancy, which indicates that there is room for a further increase in the countries analyzed.[7]

In all the countries analyzed, the large baby-boom generation born after World War II is approaching retirement. On the other hand, people born in the 1980s are starting to enter the labor market. During the 1980s and 1990s fertility declined, and during the 2000s it reached lows of about 1.3 children per woman or even less, which is far below the replacement level of 2.1. The number of children born in the 2000s was only about one half of their parents' generation. In the coming two to three decades this reduced generation will represent the working population and will have a negative impact on the number of births because there will be fewer women of reproductive age. Even a sudden and strong increase in fertility would not have positive economic effects in the next two decades, as it takes time for new-borns to grow up and enter the labor market. In the meantime, the economic effect is in fact negative because of costly investment in human capital.

Immigration slows down population aging, since immigrants are usually young (Eurostat, 2011). However, the positive effect is limited and transitory, since over time immigrants age and enter retirement as well.

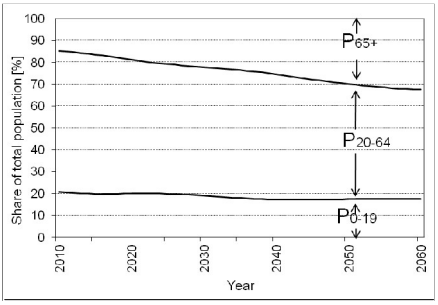
Figure 1 summarizes the population projections for our five analyzed countries in three broad age groups related to economic activity:[8] 0–19, 20–64, and 65+. In the future we will witness radical changes in the population age structure. The trend is expected to be similar in all five countries analyzed. The percentage of people aged 65 years or older is expected to more than double in the 2010–2060 period, ranging between 12.3% (Slovakia) and 16.7% (Hungary) in 2010 and between 30.6% (Czech Republic) and 34.6% (Poland) in the projections for 2060. On the other hand, the share of the working-age population aged 20–64 is expected to

[6] In Czech Republic and Hungary the increase was 2.6 years, whereas in Poland it was 2.7 years.

[7] In 2010 life expectancy at birth was 80.3 years for males in Switzerland and 86.4 years for females in Japan (OECD, 2011). In the countries analyzed, life expectancy for males ranged between 71.2 years in Hungary and 76.8 years in Slovenia, while for females it ranged between 78.7 years in Hungary and 83.3 years in Slovenia.

[8] In demography the traditionally defined dependency ratio compares the population aged 65+ with the population aged 15–64. In developed countries, however, using 20–64 years in the denominator is seen as more appropriate from the economic point of view, since not many individuals enter the labor market before age 20.

Figure 1



Note: The figure containd average of the studied counties.

shrink strongly—from almost two thirds of the total population in 2010 to about one half in 2060. The share of people aged 0–19 is projected to decrease slightly from just above 20% in 2010 to just below 20% in 2060.

The sensitivity analysis reveals that strong population aging in the future is a robust result. The population aging turns out to be mainly driven by increasing longevity and by the current population structure—which is given.[9] This strong population aging will exert strong pressure on the long-term sustainability of public finance systems if those systems are not adjusted accordingly.

From the economic point of view both the increase in the share of the elderly and the decline in the active population are having negative impacts on public finance systems. The indicator connecting those two age groups is the old-age dependency ratio, which is calculated as the ratio of the elderly (aged 65+) to the working-age population (aged 20–64). According to the EUROPOP2010 population projections for all five countries analyzed, the old-age dependency ratio is projected to sharply increase, which induces an increasing demographic burden on the productive part of the population in order to maintain the benefits of economically dependent elderly people. While in 2010 the old-age dependency ratio ranged between 18.7 in Slovakia and 26.6 in Hungary, for 2060 it is projected to range between 60.2 in the Czech Republic and 70.7 in Poland (see *Table 3*). Thus, the un-

Table 3 Old-age Dependency Ratio in 5 Analysed Countries: Actual Data for 2010 and EUROPOP2010 Projections for Selected Years to 2060

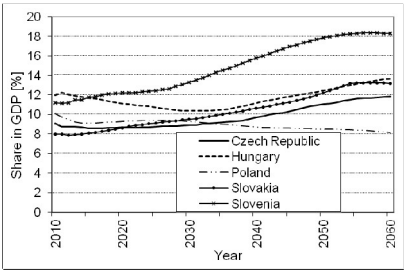
	2010	2020	2030	2040	2050	2060
Czech Republic	23.8	33.1	37.8	44.2	54.9	60.2
Hungary	26.6	32.9	36.5	43.5	54.7	63.1
Poland	20.9	29.6	38.8	43.6	58.0	70.7
Slovakia	18.7	25.9	34.5	41.7	56.2	67.6
Slovenia	25.7	32.6	42.5	50.1	59.8	63.4
Average-5*	23.1	30.8	38.0	44.6	56.7	65.0
EU27	28.4	34.1	41.9	49.7	54.8	57.7

*Note:** Unweighted average for analysed five countries (Czech Republic, Hungry, Poland, Slovenia and Slovakia)

Source: Eurostat, 2011 (EUROPOP2010).

[9] For a sensitivity analysis of the Slovenian case, see Sambt (2009).

Figure 2



weighted average shows that for those five countries the old-age dependency ratio is expected to nearly triple in this period—from 23.1 in 2010 to 65.0 in 2060. We also add the results for the EU27, which show that the old-age dependency ratio is expected to double from 28.4 in 2010 to 57.7 in 2060. This rapid population aging will be a challenge to the whole EU, but in our five countries the challenge will be distinctly greater.

3.1 Projecting Future Public Pension Expenditures

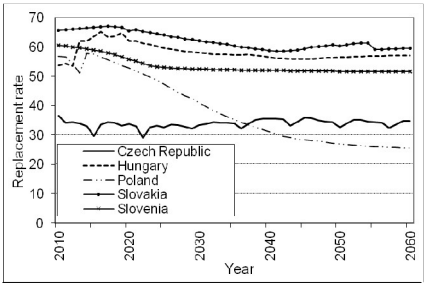
Strong population aging translates into pressure on the public pension system. We will build on the projections presented in The 2012 Ageing Report (European Commission, 2012). Each country uses its own model for projecting future pension expenditures, based on the converging macroeconomic assumptions provided by the European Commission and Eurostat's EUROPOP2010 population projections.

In *Figure 2* we present projected net public pension expenditures as a percentage of GDP. Slovenia and Slovakia are expected to face strong growth in public pension expenditures under the current pension system. Between 2010 and 2060 the share of net public pension expenditures in GDP is projected to increase from 11.2% to 18.3% in Slovenia and from 8.0% to 13.2% in Slovakia. a constant increase is also projected in the Czech Republic, but only by 2.7 percentage points—from 9.1% to 11.8%. In Hungary the share of net public pension expenditures in GDP is expected to decline by 1.6 percentage points in the next two decades, but then an increase of 3.3% is expected by 2060. In total, an increase of 1.7 percentage points is projected—from 11.9% in 2010 to 13.6% in 2060. In contrast, in Poland a substantial decline of net public pension expenditures in GDP of 1.9 percentage points is projected—from 10.0% in 2010 to 8.2% in 2060.

The pressure on pension expenditures can be eased through three different measures. The first and most straightforward response to increasing longevity is to increase the retirement age. The second option is to increase taxes (i.e., mandatory pension contributions). However, high taxes hinder international competitiveness and in Europe taxes are already relatively high. Taxes on labor also dampen incentives to work and therefore employment. The third solution is to reduce pension benefits.

Our analysis is based on the third of the options listed above—assuming reductions of pension benefits in the future. Specifically, we focus on the significance of private savings without simulating an increase in the retirement age, even though such an increase is unavoidable in the long run.[10] We assume that at some point governments will have to prevent further increases in public pension

Figure 3



expenditure above a certain percentage of GDP (i.e., cap expenditures) in such a way that public pensions will be cut proportionally, regardless of the type and level of pension. In particular, we set the maximum tolerated public pension expenditure at 10%, 11%, 12%, 13%, 14%, and 15% of GDP.

3.2 Expected Level of Pensions from the Mandatory Pension Pillars

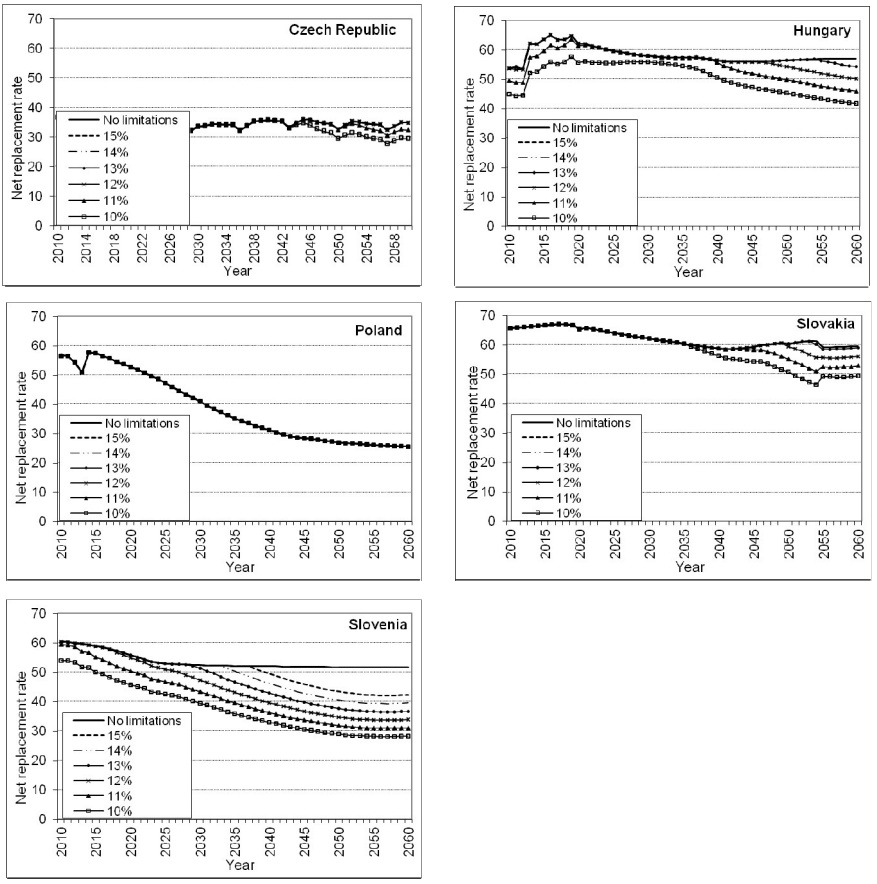
Figure 3 shows the projections of net replacement rates by countries. In The 2012 Ageing Report (European Commission, 2012) only projections of gross replacement rates are available. We estimated the net replacement rates from the gross replacement rates by using the ratio of the net replacement rate to the gross replacement rate for each country in 2008 (OECD, 2011). No such results were calculated or published for Slovenia in The 2012 Ageing Report. We used a recently developed microsimulation pension model (Majcen et al., 2011) to estimate the level of the first pension relative to the pension base. Although not perfect, these are the closest estimates of the net replacement rate we were able to obtain at the moment.

Depending on the level at which pension expenditures are assumed to be limited we additionally reduce the net replacement rates proportionally for all individuals. Again, the net replacement rates include both public pensions and mandatory private pensions. In countries which also have private pensions the net replacement rates are reduced only for the public part. In the Slovenian case the capping starts early—in the 10% and 11% scenarios it starts already in 2010—and it reduces the declining net replacement rate substantially further (see *Figure 4*). On the other hand, in the Polish case the ratio of public pension expenditures to GDP never even exceeds the 10% level, therefore the original projections of the net replacement rate are not further reduced.

As a consequence of limited pension expenditures in relation to GDP, the presented net replacement rates fall to very low levels, and individuals without other means will at best not be able to sustain their standard of living (see *Figure 5*). Achieving the 70% net replacement rate suggested by the OECD will be possible only with regular private pension savings to make up the shortfall from the mandatory pension pillars. Before we present our analysis of the saving required during the working period, we first present the characteristics of traditional asset classes, as they have an impact on the amounts of savings needed.

[10] It is worth noting here that an increase in the retirement age could not compensate for the need to include private savings.

Figure 4



4. Characteristics of Traditional Asset Classes over the Long Run

In this section we analyze three traditional asset classes (i.e., stocks, treasury bonds, and treasury bills). The purpose is not to provide detailed simulated optimal asset allocations over the long run, but to show the impact of the asset allocation decision stemming from the characteristics of the above-mentioned asset classes.

We base our approach on the historical yields (arithmetic and geometric) and volatilities reported in the literature. We use various global historical datasets:[11] US data for the period 1802–2001 and the period 1946–2011 (Siegel, 2002), US large-cap and world data for the period 1926–2005 (Bodie et al., 2009), US and world data for the period 1900–2000 (Dimson et al., 2002), US large-cap data for the period 1926–2005 (Malkiel, 2007), and MSCI stock indices for the period 1969–2010. Of course, the authors of these sources report yields for different periods. Although this might seem to be a limiting factor, we view it as an advantage, as the different

[11] Pension funds' investment policies should to a large extent be global. Therefore, global historical data are the most reasonable data input in our analysis.

Table 4 Performance of Stock Indices MSCI WORLD Standard Core, MSCI US Standard Core, and MSCI Europe Standard Core in the Period 1969–2010

	THE MSCI INDEX WORLD		MSCI EUROPE		US	
	Standard Core		Standard Core		Standard Core	
	Price Index	Total Return	Price Index	Total Return	Price Index	Total Return
Start date	31.12.1969	31.12.1969	31.12.1969	31.12.1969	31.12.1969	31.12.1969
End date	29.1.2010	29.1.2010	29.1.2010	29.1.2010	29.1.2010	29.1.2010
No. of years	40.11	40.11	40.11	40.11	40.11	40.11
Start index value	100	100	100	100	100	100
End index value	1,119.54	3,661.75	1,356.25	5,755.28	1,052.00	3,797.00
Cumulative yield (%)	1,019.54	3,561.75	1,256.25	5,655.28	952.03	3,697.38
Average annual geometric yield (%)	6.21	**9.39**	6.72	**10.63**	**6.04**	**9.49**
% of capital yield in total yield		66.09		63.17		63.67
% of dividend yield in total yield		33.91		36.83		36.33
Dividend yield (%)		**3.18**		**3.92**		**3.45**

Sources: MSCI Indices; authors' calculations.

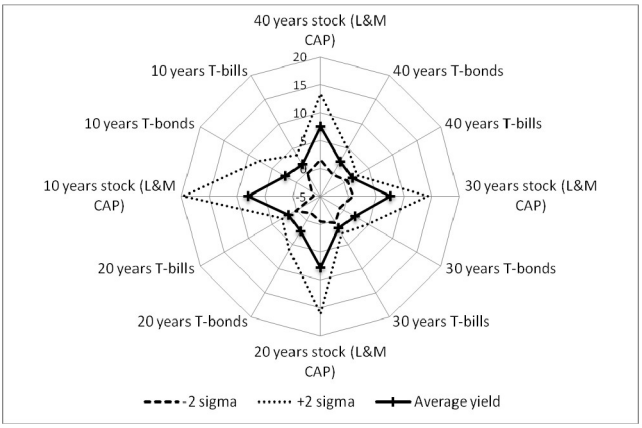
periods represent various events, which means that the histories are diversified. We calculated the 2- to 40-year yields and standard deviations using every data source and then averaged the yields and standard deviations. The yields are calculated according to the fact that they should fall over time, as the geometric average becomes more realistic than the arithmetic average over time. We borrow the formula from Bodie et al. (2009). We calculate the standard deviation according to the random-walk assumption (i.e., as the square root of the forecasting period multiplied by the one-year standard deviation of the indices used, as the distribution of the returns is assumed to be *i.i.d.*—identically independently distributed).

In the short run stocks are more volatile than the other two asset classes, which calls for a higher required yield: historically, the yield plus dividends (representing one-third of the total nominal return) has been around 10% (see *Table 4* for MSCI global, European, and US index returns). Over shorter horizons (even 10 years), investment performance can be quite different (i.e., negative in nominal terms, but reaching as high as 19%).

Moreover, the standard deviation is not persistent if we consider longer investment horizons. Specifically, in 15 years, the yield distribution is approximately one quarter of the one-year standard deviations. Thus, in the longer run, the changed relationship between the yield and risk of stocks relative to bonds or bills favors stocks.[12]

[12] There are still multiple differences in yields, but the differences in the standard deviations become much smaller. Siegel (2002) argues that the empirically verified long-term standard deviations are much lower than the standard deviation assumed by the random-walk model, and that after around 18 years, the standard deviation of stocks even falls below the standard deviation of bonds.

Figure 5



We deliberately chose the conservative *i.i.d.* assumption and used a 6.53% expected average real yield for 20-year investment in stocks, 1.25% for 20-year investment in T-bonds, and 1.11% for 20-year investment in T-bills. Over the 40-year investment horizon, the yields used were 6.17%, 1.17%, and 1.07%, respectively. All the yields are expressed net of management fees, which we assumed to be 1.3% for stocks, 1.0% for T-bonds, and 0.5% for T-bills. After calculating the average yields, we calculated the standard deviation and then the minus-one and minus-two standard deviation yields (–1 sigma and –2 sigma yields) for each asset class for various investment horizons (see *Figure 5*).

5. The Model

Taking into account the unsustainability of the current pension systems (deriving from the PAYG pillar) in the sample countries, we assume that an average future pension recipient is expected to receive pensions from the mandatory pension pillars in amounts that are lower than the 70% net replacement rate recommended by the OECD. Therefore, we estimate the monthly pension gap, *PGAPt* (i.e., the difference between the 70% net replacement rate and the forecasted PAYG replacement rate) for a typical male pension beneficiary and assume that he is motivated to increase his periodic pension savings over the entire working period to a level sufficient to cover the future pension gap:[13]

$$PGAP_t = \left(Pension_t^{70\%} - Pension_t^{MANDATORY} \right)$$

Apart from the gender and the retirement age, which affect the pension gap ($PGAP_t$), we also take into account three different public finance scenarios that affect the individual PAYG monthly pensions in each sample country. Because of the fiscal unsustainability issues addressed in section 3, we decided to work with three hypothetical public finance scenarios, which were developed for each sample country separately:

[13] The calculations do not differ conceptually for female individuals, but we excluded those results from this paper for the sake of keeping the results as concise as possible.

– The no-limit scenario assumes no limits on PAYG pension expenditures as a percentage of GDP for the future.
– The 13% of GDP scenario assumes PAYG pension expenditures to be capped at 13% of GDP.
– The 10% of GDP scenario assumes PAYG pension spending to be capped at 10% of GDP.

Of course, by increasing the restrictions on the pension-to-GDP ratio, the actual forecasted net replacement rate deteriorates gradually and the monthly pension gap increases accordingly. Consequently, the additional pension savings that have to be accumulated through the private pension system must increase by increasing the level of public finance restrictions, assuming that individuals target their individual total pensions at the 70% net replacement rate.

In the next step the monthly pension gap values ($PGAP_t$) for individual pension recipients are discounted using a 0.5% technical discount rate[14] to the total amount of savings needed at the year of retirement (*ACCUSAVINGS*), which represents the target value an individual must accumulate over his working period through his monthly savings in the private pension pillar. In discounting, we use male life expectancy at the age of retirement in each country in the sample according to the Deutsche Aktuarvereinigung (DAV) tables. Further, we assume the retirement ages according to the current legislated systems in each country (see section 2). Again, we take into account the effect of the length of the savings period for typical individuals, and we simulate investment strategies that are consistent with three different asset allocation strategies. The simulated investment strategies rely on three asset classes, characterized by their distinct risk-return profiles: (1) stock strategy, (2) bond strategy, and (3) bill strategy. For simplicity, investors are assumed to stick to the selected asset class (i.e., risk-return profile) throughout the entire investment horizon, and they are assumed not to mix the three asset classes.

In our results we present the amounts that must be saved by a male individual in the private pension system for a 20-year and a 40-year working period. We assume the starting annuity ($A_{t=1}$) to grow monthly by the expected average growth rate of salaries (g), which should be in line with the productivity growth rate (we assume the average salary grows by 2.3% per year), and we assume those annuities to be invested at the constant investment rate r, which depends on the preselected asset class and related risk-return profile (see the previous section):

$$A_{t=1} = \frac{ACCUSAVINGS * (r-g)}{(1+r)^n - (1+g)^n}$$

Table 5 displays a summary of the results. The results are presented for male individuals in all five sample countries for selected years in the period from 2010––2050. Evidently, the pension gap ($PGAP_t$) is inflated throughout the forecasted period in all five sample countries, as the net replacement rate from the mandatory pension pillars is projected to deteriorate. In nominal terms the gaps differ across countries, as the projected net replacement ratios reflect differences in the sustainability of their PAYG pension systems.

[14] We use 0.5% discount rate as it reflects the need to minimize risk exposure once the individual is retired and it is consistent with annuity industry practice.

Table 5 PAYG Pensions Calculated by the Official Net Replacement Rate in Selected Years and Gaps (in EUR) to the 2010 Pension, 70% Net Replacement Rate Pension, and Gap to the Forecasted Salary in Selected Years to 2050

		2010	2020	2030	2050
Czech R.	Mandatory pension (M)	232	269	335	465
	Net replacement rate	36.6%	33.8%	33.5%	29.5%
	Gap to the 70% net replacement rate	212	288	365	638
	Gap to the salary	402	527	665	1,111
	Salary	634	796	1,000	1,576
Hungary	Mandatory pension (M)	219	342	431	549
	Net replacement rate	45.0%	55.8%	56.0%	45.3%
	Gap to the 70% net replacement rate	122	87	108	299
	Gap to the salary	269	271	339	663
	Salary	488	613	769	1,212
Poland	Mandatory pension (M)	244	287	279	289
	Net replacement rate	56.5%	52.8%	41.0%	26.9%
	Gap to the 70% net replacement rate	58	93	198	463
	Gap to the salary	188	256	402	785
	Salary	432	543	681	1,074
Slovakia	Mandatory pension (M)	322	403	481	603
	Net replacement rate	65.7%	65.4%	62.2%	49.5%
	Gap to the 70% net replacement rate	21	28	60	250
	Gap to the salary	168	213	292	615
	Salary	490	616	773	1,218
Slovenia	Mandatory pension (M)	442	470	509	588
	Net replacement rate	54.0%	45.8%	39.5%	29.0%
	Gap to the 70% net replacement rate	131	249	394	834
	Gap to the salary	376	557	780	1,444
	Salary	818	1,027	1,289	2,032

Source: Authors' calculations.

As previously explained, the discounted pension gaps represent the accumulated savings that each pension recipient is expected to accumulate during his working period until the end of his retirement year. Consequently, the volume of the required accumulated savings determines the monthly savings contributions each male individual is expected to save until the retirement year. *Table 6a* presents the first annuity (i.e., at retirement) a male individual is expected to start saving in each of the sample countries under varying assumptions. *First*, we assume that individuals from different countries have to accumulate different savings volumes to supplement the regularly expected pension from mandatory pension systems. *Second*, we assume that future public finance scenarios affect the monthly savings contributions. And *third*, the length of the expected savings period also affects the volume of accumulated funds at the end of the working period. For simplicity, we present calculations for 20 years and 40 years only.

Table 6a Required Contributions under Three Different Fiscal Scenarios Consistent with Average Real Yield under Three Different Asset Class Allocations

			–2 sigma yields				
			CZ	HU	PL	SK	SL
40 years	SC1-stocks	1st contrib. under 10% GDP	60	28	44	23	78
		1st contrib. under 13% GDP	55	15	44	11	62
		1st contrib. under "no limit"	55	15	44	11	35
	SC2-bonds	1st contrib. under 10% GDP	177	83	129	69	232
		1st contrib. under 13% GDP	164	46	129	32	183
		1st contrib. under "no limit"	164	46	129	32	103
	SC3-bills	1st contrib. under 10% GDP	181	85	131	71	236
		1st contrib. under 13% GDP	167	47	131	33	186
		1st contrib. under "no limit"	167	47	131	33	105
20 years	SC4-stocks	1st contrib. under 10% GDP	165	50	84	28	178
		1st contrib. under 13% GDP	165	43	84	28	109
		1st contrib. under "no limit"	165	43	84	28	102
	SC5-bonds	1st contrib. under 10% GDP	287	87	145	49	309
		1st contrib. under 13% GDP	287	74	145	49	189
		1st contrib. under "no limit"	287	74	145	49	178
	SC6-bills	1st contrib. under 10% GDP	291	89	147	49	313
		1st contrib. under 13% GDP	291	76	147	49	192
		1st contrib. under "no limit"	291	76	147	49	180

Note: 1st contrib. under… = amount an individual should save in the beginning of the 40/20 year period.
Source: Authors' calculations.

As is evident from *Table 6a*, the individual's decision for a particular type of investment (i.e., asset class) and the length of the savings period have a substantial impact on the size of the annuity that the individual saver is expected to start saving. So, a male individual in Slovenia who decides to invest in a portfolio of large- and mid-cap stocks (see section 4) is expected to start saving EUR 78 per month if he has a 40-year investment period and EUR 178 per month if he has a 20-year investment period under the assumption of the PAYG limitation at 10% of GDP. If the same male individual were to decide to invest in a portfolio consisting exclusively of T-bills under the same PAYG scenario, he would need to start saving EUR 236 with an intended investment period of 40 years and EUR 313 per month with an intended investment period of 20 years. The differences in required monthly savings contributions are significant, and one can clearly observe how important it is to decide on a proper investment strategy in terms of both portfolio structure and length of the savings period (i.e., individuals should start saving as soon as possible). All other accompanying aspects that also affect the final savings outcome (e.g., different public finance scenarios that directly affect the PAYG pensions) make the differences only more pronounced. Our results also show that the relative importance of allocation decisions is very similar across the selected CEE countries, as the percentage differences in the required monthly savings amounts (stocks vs. T-bonds as

Table 6b Required Contributions under Three Different Fiscal Scenarios Consistent with –2 sigma Real Yield under Three Different Asset Class Allocations

			–2 sigma yields				
			CZ	HU	PL	SK	SL
40 years	SC1-stocks	1st contrib. under 10% GDP	207	97	150	81	270
		1st contrib. under 13% GDP	191	53	150	38	213
		1st contrib. under "no limit"	191	53	150	38	120
	SC2-bonds	1st contrib. under 10% GDP	280	131	203	109	365
		1st contrib. under 13% GDP	258	72	203	51	288
		1st contrib. under "no limit"	258	72	203	51	163
	SC3-bills	1st contrib. under 10% GDP	215	101	156	84	280
		1st contrib. under 13% GDP	198	55	156	39	221
		1st contrib. under "no limit"	198	55	156	39	125
20 years	SC4-stocks	1st contrib. under 10% GDP	348	106	176	59	375
		1st contrib. under 13% GDP	348	90	176	59	230
		1st contrib. under "no limit"	348	90	176	59	216
	SC5-bonds	1st contrib. under 10% GDP	405	123	205	69	436
		1st contrib. under 13% GDP	405	105	205	69	267
		1st contrib. under "no limit"	405	105	205	69	251
	SC6-bills	1st contrib. under 10% GDP	330	101	167	56	356
		1st contrib. under 13% GDP	330	86	167	56	218
		1st contrib. under "no limit"	330	86	167	56	205

Note: 1st contrib. under… = amount an individual should save in the beginning of the 40/20 year period.

Source: Authors' calculations.

well as stocks vs. T-bills) do not vary much across countries despite the differences in the current and projected replacement rates.

The second set of results is based on simulations in which the investment yields were adjusted to reflect the volatility of the average historical returns of the preselected asset classes. Therefore, the results in *Table 6b* present the required monthly savings contributions for a risk-aware male individual who wants to avoid the case where the investment yield deviates downwards by two standard deviations (–2 sigma) from the average historical returns of the individual asset classes. In this scenario all the required monthly savings contributions are significantly higher, which reflects the sensitivity of the saving strategy to financial market volatility.

Finally, we compare accumulated savings (i.e., pension wealth) assuming that an individual starts saving monthly contributions commensurate with the expected extreme market performance (i.e., –2 sigma) and at the same time it turns out *ex post* that he can realize the expected average market yields (mean yields). The results are striking. *First*, individuals who choose stocks over a 40-year period are (according to the expected average yield) required to save about one-third the amount of individuals who choose T-bond or T-bills. According to expectations of extreme financial market performance, stock investors can still save about one-quarter less. *Second*, when risk-aware investors decide to save according to expectations that they

close the gap despite extreme financial market performance, but those results turn out (most likely) to be average, a stock strategy would beat a T-bond and/or T-bill strategy by a substantial margin. This margin is already very material at a 20-year investment horizon. Investors with a stock strategy accumulate roughly 50% more pension wealth than those with a T-bond strategy and approximately 85% more than those with a T-bill strategy. Over the 40-year investment horizon, the respective differences are substantial: 119% relative to a T-bond strategy and 190% relative to a T-bill strategy.

We argue that governments in all five selected countries face similar issues and should be interested in improving the financial literacy of the public in both aspects, i.e., improving awareness about the need to save and also knowledge about the basic characteristics of financial asset classes. Doing so would prevent opportunity losses in terms of lower available pension wealth and old-age disposable income despite people being aware about the need to save for their pensions.

6. Conclusion and Discussion

Given EU demographic dynamics, many countries are expected to face a situation where the PAYG system will not be able to finance the levels of pensions set out in current rules. In this article, we show that this is the case for all the selected CEE countries, i.e., the Czech Republic, Hungary, Poland, Slovakia, and Slovenia. Taking into account the current pension system and assuming no further increase in the retirement age and an aging population, PAYG pension benefits as a share of GDP would increase to about 11.8% in the Czech Republic, 13.6% in Hungary, 8.2% in Poland, 13.2% in Slovakia, and 18.3% in Slovenia by 2060. We believe this is fiscally unsustainable, except in Poland. Cuts to PAYG benefits are thus unavoidable. It is therefore the role of private pensions to fill the gap between the projected first-pillar pension and the overall pension level at the 70% net replacement rate suggested by the OECD.

Currently (after a crisis-initiated adjustment), only Poland has a mandatory private pension system, while the private systems in Slovakia, the Czech Republic, Hungary, and Slovenia are voluntary and have relatively low assets. This means that the level of savings from the second pillar will not be enough to finance the emerging gap. We have shown how much people should save and what kind of asset allocation they should choose in order to reach the suggested target of a 70% replacement rate at retirement. Governments should try to address the issue of financial illiteracy and encourage people to save. Current literature in the field suggests that educational programs should be targeted specifically at particular subgroups in order to address substantial differences in preferences and saving needs (Lusardi and Mitchell, 2011; Hathaway and Khatiwada, 2008) and that the effectiveness of such programs is enhanced when they are conducted in time just before the specific financial event, i.e., in the case of pension savings when young workers enter the labor force, and when program evaluation is made as an essential element of the program.

In addition, the government should conceptualize reasonable legislation on the available financial vehicles offered in the private pension system and work on ways to properly communicate the asset allocation decision. Specifically, we have shown that if an individual saves over a period of 40 years and allocates savings into

a well-diversified stock portfolio, he can save far more than an individual who allocates savings into a well-diversified T-bond or T-bill portfolio for the same expected horizon. The differences are also large over a 20-year period.

We have also checked the episodes of the worst historic financial market performance over the above-mentioned investment horizons and concluded that individuals with a stock strategy that are aware of the potential (but highly improbable) low performance would beat individuals with a bond and/or bill strategy by a substantial margin. We thus conclude that people who are saving for their pension and have a long-enough horizon should predominantly allocate investments into stocks. This is exactly the opposite recommendation regarding the allocation of savings into asset classes from what is currently the state of affairs in the selected countries.

Furthermore, our results show that the relative importance of asset allocation decisions is very similar across the selected CEE countries, as the percentage differences in the required monthly savings amounts (stocks vs. T-bonds as well as stocks vs. T-bills) do not vary much across countries. In this setting, where individuals choose asset allocation for a long (i.e., 40-year) investment horizon, the amount that people should save every month is determined by the asset allocation choice, not by the income level, which is commonly assumed to determine an individual's risk aversion. Governments should bring that finding into the legislation, and one way of doing so would be to adopt the life-cycle investment policy approach.

Recent reform reversals in some countries in the region will exacerbate the long-term pension problem and trade it off with short-term fiscal pressures that countries within the region faced during the latest crisis. With such decisions countries have been able to reduce increases in explicit public debt, but this will inevitably increase the cost of transition to more sustainable pension systems in the region. Such costs were already underestimated in the initial reform (see, for example, Simonovits, 2011, and Fultz, 2004). Despite the recent backward steps, the societies of CEE are likely to rely substantially on financial markets to fund their pensions in the coming decades. Without such developments, pension incomes will not enable many retirees to make it through the month.

The recent anti-reform in Hungary highlights the need to pay great attention to the design and implementation capacity issues addressed by Barr and Diamond (2008). Besides, stronger private pillars are also expected to stabilize pension income, as the risks inherent in the PAYG and private pillars have different drivers (labor market vs. capital markets) and substantial benefits can be expected from diversifying pension income among conceptually different pension pillars (Berk, 2013). The resulting additional pension savings are expected not only to provide a more sustainable and efficient environment for managing inter-temporal consumption, but also to support the underdeveloped financial markets of the region. Davis (2008) and Davis and Hu (2008) show that pension fund growth in the European Union is likely to lead to beneficial financial development with a broader range of instruments, a lower cost of capital, and better access to sources of finance, thus leading to higher welfare. He further argues that pension fund growth has a significant effect on Eurozone financial markets, by moving them partly toward the Anglo-American system, as well as promoting integration. Therefore, pension savings plans in the CEE countries are not only solving the problem of future sustainable pensions, but also bringing benefits of higher achievable living standards.

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