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Policy Risk in Action: Pension Reforms and Social Security Wealth in Hungary, Czech Republic, and Slovakia *

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Abstract
We provide evidence on the policy risk of social security in Hungary, the Czech Republic, and Slovakia by computing the changes in social security wealth induced by the pension reforms undertaken since the 1990s. Analyzing the impact of reforms on workers of different genders, ages, and education levels allows us to document the aggregate, intergenerational, and intragenerational aspects of the policy risk. Pension reforms reduce social security wealth by amounts that sometimes exceed several years' worth of earnings and have large redistributive effects across and within generations. Our findings imply that uncertainties about the redistributive impacts, timing, and political dynamics of reforms contribute significantly to the policy risk in addition to the inevitable demographic and economic risks.

1. Introduction

The choice between the pay-as-you-go (PAYG) and fully funded pension system is sometimes put in terms of a trade-off between return and risk. The funded system should provide a higher expected return on workers' contributions at the cost of exposing workers to investment risk (Feldstein, 2005a,b), and (Lindbeck, Persson, 2003). Since contributions are invested in stocks and bonds, which yield uncertain returns, workers face uncertainty about the level of their pension when they retire.[1]

However, the PAYG systems are not risk-free either. The rules of the pension system may be changed any time as governments respond to demographic, economic, or political shocks. As a consequence of this so-called policy risk, the contributions actually paid and benefits actually received by a worker may differ substantially from what she was promised by the pension legislation at various moments in her lifetime.

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[1] Feldstein and Ranguelova (2001), Feldstein, Ranguelova and Samwick (2001), and Poterba et al. (2005) produced quantitative estimates of the distribution of benefits upon retirement in a risky funded scheme, and made expected utility comparisons between the funded and PAYG schemes.

Appropriate comparisons between the PAYG system and privately funded system should therefore involve a comparison of two risky systems.

We provide a detailed descriptive account of the policy risk of social security in three Central European countries: Hungary, the Czech Republic, and Slovakia. We compute the impact of all major changes in pension legislation adopted since the early 1990s on the social security wealth[2] (SSW) of workers of different ages, genders, and education levels. Altogether these countries undertook ten reforms during the span of 14 years covered. The reforms naturally differed in their breadth, from minor adjustments of several parameters to full-scale reforms introducing a mandatory funded pillar.

An emerging literature has already produced some quantifications of the magnitude of the policy risk. McHale (2001) computes the change in the present value of benefits induced by pension reforms that were implemented in the G7 countries during the 1990s for average workers at age 45 and at the standard retirement age. He finds that some of the reforms reduced the present value of benefits by as much as 29 % (the Italian 1992 reform) or 26 % (the German 1992 reform). McHale's contribution was valuable in demonstrating that cuts in benefits do happen and can be substantial. Shoven and Slavov (2006) compute the internal rates of return from the Social Security in the United States since 1939 for an average, 10th percentile, and 90th percentile worker in 1900–1985 birth cohorts. They find "a considerable variation in the internal rates of return through time for a given birth cohort". They also find substantial differences in IRRs across cohorts. Blake (2008) shows that even private pensions in the United Kingdom have not been completely immune to policy risk, but have been less sensitive than public pensions. Holst (2005) looks at a representative worker in the cohorts that have already retired in the United States and Germany and computes the discrepancy between the SSW that they were promised at age 55 and the SSW that they were promised when they actually retired. He also makes the first attempt to explain the deviation between realized and promised SSW by demographic variables.

Our approach is methodologically similar to McHale (2001) except that our definition of SSW deducts the present value (PV) of contributions from the PV of benefits. In our opinion it is appropriate to deduct the contributions, as they are an important component of the worker's lifetime wealth. For example, a reform that only raises the contributions clearly makes a worker worse off even though the PV of the benefits remains unchanged.

The main contribution of our paper is in providing a more comprehensive picture of the policy risk. The preceding literature generally computes the changes in SSW for a representative worker in selected cohorts. It thus captures only the aggregate component of the policy risk (the risk that a reform makes workers worse off on average) and partly the intergenerational component (the risk that a reform will affect one cohort differently than others). However, most pay-as-you-go systems also redistribute income within cohorts. This introduces an intragenerational component to the policy risk, i.e., the risk that a reform will affect one's income group or gender differently than others. We document both the intergenerational and intragenerational

[2] Social security wealth is the expected present value of the future stream of pension benefits minus the expected present value of future contributions.

impacts of the pension reforms, as we carry out our analysis separately for men and women with different levels of education and for all pre-retirement cohorts.

Although each of the reforms had unique impacts, our results do allow several generalizations. Most importantly, pension reforms produce large shifts in SSW and as such create substantial uncertainty. In seven of the ten reforms covered, there were some workers whose SSW declined by an amount exceeding the average annual earnings in their country, and in four reforms there were some workers whose SSW declined by more than twice the average annual earnings.

The reforms typically have had largely differential impact across cohorts, genders, and education levels. Seven reforms produced both winners as well as losers. As for the intergenerational redistribution, in four of the reforms older cohorts gained relative to younger ones (or at least lost less). In four other reforms older workers fared worse. While McHale (2001) observes that workers in the G7 countries aged slightly below the retirement age were essentially insulated from cuts in their SSW, this was not generally the case with the reforms studied here. Some reforms (Hungary 1997 and 1998) introduced different rules for different cohorts, and as a consequence the change in SSW between comparable workers in adjacent cohorts differed by as much as 1.6 average annual earnings. In only three reforms were the intergenerational patterns of the changes in SSW broadly consistent with optimal sharing of risk from negative demographic or economic shocks between generations.

The intragenerational component of the policy risk is also significant. As a whole, the reforms tended to be relatively beneficial to richer workers and detrimental to women. None of the reforms simultaneously benefited workers with lower education and hurt workers with higher education. Each country had at least one reform in which workers with university education benefited substantially relative to workers with low education (Hungary 1998, Czech Republic 1996, Slovakia 2004––2005). The Slovak 2004–2005 reform was extreme in this regard – for example, 50-year old men with elementary education lost 1.8 average annual earnings, while equally aged men with university education gained 4.7 average annual earnings. The desire to create a closer link between benefits and earnings is understandable. Nevertheless, the very fact that some older poor workers also experienced large cuts in SSW is troubling, as these workers generally have neither sufficient savings to cushion the cuts in benefits nor enough years of remaining working life to build them up.

Another observation concerns the political dynamics. Both radical reforms that introduced a funded pillar were quickly followed by another reform that mitigated some of its aspects. Should these two cases be generalized, such reversals make SSW more volatile, as one reform breeds yet another reform. On the other hand, they make SSW less volatile as long as the reversal reform brings SSW closer to the level it was at prior to the initial reform. Workers should somewhat discount the rules laid out by the first reform when making plans for the future.

Switching to a mixed system in Hungary and Slovakia did not increase the SSW of almost any workers. This surprising by-product of our analysis can be attributed to two factors. First, both countries also promised generous PAYG benefits to high--wage workers when they introduced the funded pillar. Second, the returns on savings in the pension funds appear to be low, due to a combination of overly conservative investment strategies and high fees charged by the funds. The policy lesson is

that the rules governing pension funds are indeed critical in order to provide workers with a high return on their savings and to keep the administrative costs low. Our calculations indicate that neither Hungary nor Slovakia have set the rules well enough to realize the potential of the funded system.

2. Methodology and Data

Social security wealth (SSW) is defined as the difference between the present value of expected future benefits and contributions promised to workers under the current pension legislation. We compute the impact of each reform on the SSW of all cohorts that either were working at the time of the reform or were born but not yet working, and within each cohort we carry out the computation separately for men and women and for representative workers with different levels of education: elementary, lower secondary (apprenticeship), upper secondary (high-school with a school--leaving exam), and college/university.

The SSW for each cohort (a) at the time of the reform (T) is calculated according to the following formula:

$$SSW(a,T) = -\sum_{t=T}^{R-1}\left[w_{a,t} \frac{C_e + C_r}{(1+r)^{t-T}} S(t|T) \right] +$$
$$+ \sum_{t=R}^{a+100}\left[\frac{B(a,R)}{(1+r)^{t-T}} \prod_{k=R+1}^{t} (1+i_k)\, S(t|T) \right] + \sum_{t=R}^{a+100}\left[\frac{A(a,R)}{(1+r)^{t-T}} \prod_{k=R+1}^{t} (1+j_k) S(t|T) \right]$$

where R is the year of retirement, t is the current year, C_e and C_r are the employee and employer contributions, respectively, to both the PAYG and funded pillars, B is the value of the initial benefit from the PAYG pillar, A is the value of the initial benefit from the funded pillar, r is the discount rate, w is the gross nominal wage, $S(t|T)$ is the probability of surviving until year t conditional on being alive at T, and i and j are the rates at which the benefits from the PAYG and funded pillars are indexed. Calculating SSW involves three basic steps. First, the discounted value of future contributions is calculated from a projected path of wages and the contribution rates specified by the current legislation. Second, the initial benefit is computed according to the formula prescribed in the legislation. Third, the discounted value of benefits is computed using the current indexation rule and a projected path of variables that affect the indexations.[3] To put the results in perspective we normalize the change in SSW by the average annual earnings in the economy in the year of the reform. A change in SSW by -1.0 units hence means that the worker lost SSW equivalent to the annual earnings of the average worker.[4]

Computing the social security wealth required a number of assumptions about the wage profiles of workers, the evolution of certain variables in the future, and the returns on savings in pension funds. These assumptions and the data used to construct

[3] The formula computes nominal SSW; we also discount all money flows by accumulated inflation to obtain real (as of the time of the reform) SSW.

[4] The level of SSW of a worker who is at the beginning of her working career also indicates the degree of redistribution built into the PAYG system. If it is positive, the system effectively provides a net transfer to the worker, while if it is negative, the system effectively taxes the worker.

them are described in detail in *Appendix B*. Our general principle is that we attempt to compute SSW under the legislation as it is written on the books and as actually implemented. For example, if a particular reform was passed with an understanding that some additional changes would be made in the future, we ignore those envisioned but unlegislated changes.[5] Similarly, the rates of return on savings in pension funds are to a large extent affected by the regulation of funds' portfolio choices and performance embedded in the pension legislation. Our assumptions about the future returns are based on the actual portfolio choices and performance of the funds instead of on arbitrary stock and bond market indices, which are indicators of potential, rather than actual, returns.

Our "representative" workers start working at age 20, work without interruption (men) or with an interruption devoted to child care (women) until the standard retirement age, and at each age they earn the wage that is predicted by the wage profile specific to their gender, education level, and calendar year. The wage profiles were estimated for each country from large individual-level datasets. The length of life is probabilistic, and the future taxes and benefits are discounted by the survival probability.

While the above assumptions are natural they inevitably have some limitations. Analyzing only representative workers does not fully characterize the impact of the reforms across the income distribution. Likewise, the assumption that the worker's wages follow a typical wage profile and that the worker is employed without interruption leaves out a part of the intragenerational component of the risk. Two workers with identical lifetime earnings may be affected differently by a particular reform if they differ in their individual wage profiles or working histories. By assuming that workers work until the standard retirement age we do not analyze the impact of changes in early retirement options that were part of some of the reforms and undoubtedly affected the workers who chose to exercise them. Analysis of such finer impacts of the reforms would be worthwhile but would require detailed data on individual working histories that were not available to us.

We assume that people had perfect foresight about the future evolution of the relevant variables at the time of the reform. That is, the actual wages, inflation, and returns on assets in pension funds until 2005 are used as the expected wages, inflation, and returns at the time of the reform. For 2006 onwards, we assume a 3% growth rate of real wages for all education categories and genders, and a 2% inflation rate.[6] To project the future returns on savings in Hungarian pension funds, we compute their average returns since the time they were established (1998). Slovakia introduced pension funds too recently to infer their historical returns. We therefore set the expected future returns equal to the average historical return on the portfolios that the funds currently hold. The fees charged by the funds are deducted from the gross returns.

3. Results

Below we describe the main outcomes of the reforms as they concern different aspects of the policy risk.[7] The key characteristics of all the reforms are sum-

[5] The Hungarian 1998 reform is the most significant case; see section 3.2.

[6] These are roughly the rates of wage growth and inflation currently experienced by all countries.

marized in *Appendix C. Tables H.1–10, C.1–2, and S.1–4* present the main result – the change in SSW – separately for men and women of different levels of education and birth cohorts, for all the reforms. We report results averaged over cohorts born during 5-year intervals, due to space limitations.[8] When the pension system has two pillars, separate tables are reported for workers in the PAYG pillar and the mixed pillar. The *figures* illustrate the impact of selected reforms on selected genders and education levels, and also separate the overall impact into a change in contributions and a change in benefits. (Tables and Figures see in *Appendix A*.)

3.1 Aggregate Risk

Pension reforms do produce large shifts in SSW and as such create substantial uncertainty. In seven of the ten reforms covered, there were some workers whose SSW declined by an amount equal to or greater than the average annual earnings in their country, and in four reforms there were some workers whose SSW declined by more than twice the average annual earnings. At the extreme, the Slovak 2004–2005 reform cut the SSW of women with elementary education born between 1955 and 1959 by 4.5 average annual earnings (*Table S.1*). Examples of other reforms with a large negative impact on SSW include the Hungarian 1993 reform (which postponed the eligibility age for women by 5 years and thus cut the SSW of all women (*Table H.1*), the Hungarian 2007 reform (which raised the employer contributions and altered the benefit formula, resulting in a decline in SSW for all workers, in particular by more than 2 average annual earnings for men and women with university education born after 1980 – *Tables H.9 and H.10*), and the Czech 1996 reform (which postponed the eligibility age for men by 2 years and women by 5 years and made the benefit formula more regressive, resulting in a cut in SSW by more than average annual earnings for most workers (*Table C.1*).

The three countries experienced declines in fertility and improvements in life expectancy during the 1990s. Since defined benefit systems do not have automatic adjustments to such shocks, measures such as higher contributions, postponed eligibility age, lower benefits or less generous indexations of benefits must be explicitly legislated – an inevitable source of aggregate policy risk. Governments should attempt to allocate the risk optimally across generations when they legislate the changes. Optimal risk sharing generally requires (Gordon, Varian, 1988), and (Ball, Mankiw, 2007) that the burden from a negative shock is distributed across all generations, although in absolute terms the younger generations should bear a proportionately greater burden.

Several reforms were adopted with the motive of improving financial sustainability, and their impact on SSW broadly emulates the optimal risk sharing pattern (with certain exceptions). Specifically, the Hungarian 1997 reform reduced the SSW of all men by 0.16–1.66 average annual earnings, and by less for most women (*Table H.2*). The Hungarian 2007 reform, adopted with a clear motivation to cut structural budget deficits, reduced the SSW of men with elementary education by 0.26–0.99 average annual earnings and the SSW of men with university education by

[7] Readers who wish to see the results discussed chronologically by each country and reform are referred to an earlier version of the paper (Dusek, Kopecsni, 2008).

[8] Detailed results for individual cohorts are available upon request.

0.61–2.45 average annual earnings. The cuts in SSW were gradually larger for younger cohorts and somewhat smaller in absolute terms for women (*Tables H.9––10*). Likewise, both Czech reforms (adopted in 1996 and 2002–2003) made approximately proportional cuts to the SSW of all workers with more than 10 years to go until retirement, and gradually smaller cuts to workers close to retirement, except that they hurt women more than men (see *Tables C.1* and *C.2* and *Figures C.1–C.3*).

Some features of certain reforms are clearly inconsistent with optimal responses to aggregate shocks. The current retirees are insulated from benefit cuts[9], contrary to the prescriptions of the literature on optimal risk sharing within a social security system (Bohn, 2001), and (Diamond, 1997). There were also reforms that *increased* SSW approximately proportionally for all workers at least within the PAYG pillar (the Hungarian 1999 and 2003 reforms, which cut contribution rates and provided additional benefits, respectively; see *Tables H.5–H.8*). Such reforms make economic sense if they respond to a positive shock. That clearly was not the case of Hungary in 1999 and 2003, as the two reforms were shortly preceded and followed by reforms which had a negative and much larger impact on workers' SSW. The political mechanism hence produces additional risk by promising more generous benefits even in the presence of a negative shock, necessitating an additional reform which cuts SSW by more than what would be necessary to improve the financial balance in a single reform.

Even if reforms always uniformly reduced SSW, people would still be exposed to additional risk about their timing. For example, shocks to fertility arrive gradually and take many years until they explicitly affect the financial balance of the PAYG system. Politicians may procrastinate before they implement the necessary reform. Worker are exposed to the risk of whether the reform is adopted before or after they retire, and how severe the cuts in SSW would be if it is adopted before they retire (postponing the reform longer implying more severe cuts).

3.2 Intergenerational Risk

The reforms have largely differential impacts across cohorts, genders, and education levels. In seven reforms there were both workers whose SSW increased and workers whose SSW fell. Such a pattern is generally inconsistent with efficient allocation of risk.

We observe a very diverse pattern of intergenerational redistribution. In four of the reforms the older cohorts gained relative to the younger ones (or at least lost less). In four other reforms it was the other way round.

Reforms may have a differential impact across cohorts by introducing different rules for different cohorts or by changing the general rules in a way that is relatively more beneficial to some cohorts than others. The Hungarian 1998 reform is an extreme example of the former. Among other adjustments it created different sets of rules for workers who were to retire before 2012 and after 2012. The benefit formula sets the initial benefit as a certain percentage of the worker's average net ear-

[9] The reform legislations never cut benefits to current retirees and the changes in the indexation rules were generally beneficial to them. The Hungarian 1998 reform was the only exception, as it provided for a gradual switch from net wage indexation to Swiss indexation (50 % CPI and 50 % net wage growth). As a consequence, those already retired saw the present value of their benefits cut by as much as 20 %.

nings until 2012 and as a fraction of average gross earnings from 2013. It was also planned that benefits would become taxable at the same time; however, the corresponding change in the income tax code has not been implemented. This rather ambiguous provision creates additional uncertainty over whether benefits will be taxable at all after 2013, and if so, what the income tax rates will be at that time.[10]

The impact of the Hungarian 1998 reform on different cohorts is clearly visible in *Figures H.2 and H.3.* Men with university education retiring before 2013 (the 1942–1950 cohorts) saw an increase in the present value of their benefits of approximately 49 % due to faster indexation of income brackets in the benefit formula. The same men born just after 1950 experienced an 80% increase (*Figure H.3*). In SSW terms, university-educated men and women born in the 1950s gained between 3.2 to 3.5 average annual earnings, while those just slightly older gained between 2.4 to 2.8 (*Table H.3*). The differential impact was less pronounced for workers with lower education, since the gap between gross and net earnings is smaller for them (*Figure H.2* shows that men with elementary education born before 1950 experienced a small cut in the PV of benefits, while those born in the early 1950s experienced a small increase).

Another example of a reform feature that reflects intergenerational risk is the Hungarian 1997 reform, which postponed the retirement age for men and women gradually to 62. However, it shifted the retirement age back by 1 year for women born between 1942 and 1944. The reform was clearly beneficial to these "privileged" women, whose SSW rose by as much as 2 average annual earnings (*Figure H.1*). In contrast, the SSW of women born between 1950 and 1954 fell by 0.45 (upper secondary education) and 0.96 (university education) average annual earnings (*Table H.2*).

Similarly, the Czech 1996 reform helped women just before retirement age (by raising their SSW by as much as 1.6 average annual earnings) while hurting all other women (*Table C.1*). This effect was due to a combination of a gradual increase in retirement age, which had only a minor impact on women who were close to retiring, and changes in the benefit formula that turned out to be relatively more beneficial to older women with historically lower earnings.

The Slovak 2004–2005 reform had a particularly strong intergenerational pattern. It gradually increased the retirement age from 55 to 62 years for women[11] and from 60 to 62 years for men. It cut contribution rates and allowed the opt-out of 9 % of the wage into the newly established private pillar. The new benefit formula made the benefit linear in the worker's average earnings over his entire working history since 1994, up to a cap beyond which workers with more than 3 times the average earnings do not receive higher benefits. The reform provided for a transitory period, initially legislated to last until 2006, during which the benefits were in fact regressive in the worker's lifetime earnings but becoming gradually less regressive over time. An additional provision that positively affected younger parents was a 0.5% deduction from contributions for every child aged below 26 as long as the child was studying.

[10] We do not subtract any income tax when we compute the benefits after 2012, since our goal is to evaluate the impact of the reforms as they were actually legislated.

[11] This is the case for women with two children. For women with no children the eligible age increased from 57 years, for those with 1 child from 56 years, for those with 3–4 children from 54 years and for those with 5 or more children from 53 years.

The mix of these adjustments was much more beneficial to younger workers relative to older workers (*Table S.1*). Men with elementary education born after 1975 gained (their SSW increased by 0.35–0.71 average annual earnings), while those born in the 1960s or earlier lost (their SSW fell by 0.8–2.38 average annual earnings, progressively more for older cohorts). Such differences are equally pronounced among women, especially poorer ones. Women with elementary education just before retirement age (the 1950–1954 cohorts) lost as much as 4.29 average annual earnings. Losses of a similar magnitude are observed for all women with elementary or lower secondary education born during 1950–1964, and are gradually smaller for younger cohorts.

The differential treatment of different cohorts is illustrated in *Figures S.1–S.4*. The retired cohorts were affected only by a change in indexations and the PV of their benefits rose by 11–14 %. Within each education level, the PV of benefits changed by an almost equal percentage for almost all working cohorts, while the percentage change in the PV of contributions differs by cohorts – those very close to retirement (1945–1948) saw a large increase (by 20–75 %), while those just at the beginning of their working careers experienced a 32% reduction.

The negative impact of the Slovak 2004–2005 reform on older workers demonstrates how substantial the policy risk is and how uncertain SSW can be even for workers with just a few years to go until retirement. If we think of this reform (unusually radical as it was in many respects) as a realization from a tail of a distribution of possible reforms, one could argue that the policy risk is in some sense greater than the investment risk in the funded pillar. It seems inconceivable that an amount worth four years of earnings would vanish from the accumulated savings in a pension fund during the last few years before retirement. Moreover, large cuts in the SSW of older workers, and especially poor ones, impose higher costs on such workers than cuts of equal magnitude suffered by younger and richer workers. The former usually have neither sufficient savings to cushion the cuts in benefits nor enough years of remaining working life to build them up.

A few other reforms also hurt workers aged slightly below the retirement age. Specifically, the Hungarian 1993 reform reduced the SSW of women of pre-retirement ages by between 0.4 and 1.3 average annual earnings; the 1998 reform was more severe, as it reduced the SSW of both men and women of pre-retirement ages by between 1.1 and 2.5 average annual earnings. The Czech 1996 and Slovak 2006 reforms also hurt workers of pre-retirement ages, although by less than the younger cohorts. McHale's (2001) observation that such workers were essentially insulated from cuts in their SSW does not appear to be a general phenomenon.

To summarize, the intergenerational impacts of many reforms are not consistent with optimal risk sharing and rather indicate that the political process generates additional intergenerational risk.

3.3 Intragenerational Risk

In the funded scheme, shocks to the stock market return raise or reduce the savings held by workers from a certain cohort by the same percentage irrespective of their wages or gender.[12] In contrast, the policy risk of the PAYG scheme contains an intragenerational component, as reforms may not have a uniform impact across

income levels and genders. Most reforms have a greater impact (positive or negative) on the SSW of workers with higher education, in part due to a higher absolute level of contributions and benefits. More interestingly, none of the reforms simultaneously benefited workers with lower education and hurt workers with higher education. Each of the countries had at least one reform in which workers with university education benefited substantially (in absolute or at least percentage terms) relative to workers with low education (Hungary 1998, Slovakia 2004–2005, and, to a lesser extent, Czech Republic 1996).

The Slovak 2004–2005 reform was extreme also in this regard, as it completely eliminated the redistribution from rich to poor workers that was explicit in the benefit formula with only a 3-year transition period. The stark difference between the impacts of the reform on workers with different education levels is illustrated in *Figures S.1 and S.2*. The PV of benefits fell by 36 % for almost all working men with elementary education, while it increased by between 61 and 71 % for almost all working men with university education.

Figures S.3 and S.4 depict the differential impact in SSW terms. SSW increased by at least 4 annual average earnings for all male cohorts with university education born in 1947 or later, and it increased by 7.6 annual average earnings for the 1982 cohort (i.e. those just entering the labor market). Young men with elementary education gained comparably little (0.7 average annual earnings).[13]

The peculiar provision of the Hungarian 1998 reform (setting benefits as a fraction of gross earnings instead of net earnings starting after 2012) had a strong redistributive impact as well, since the wedge between gross and net earnings is higher for high-wage workers. The SSW of the affected men with university education rose by 1.95–3.49 average annual earnings (depending on the cohort), while the SSW of men with elementary education changed only slightly, and similar differences are observed for women (*Table H.3*). The Czech 1996 reform made the formula somewhat less regressive and also increased the number of years counted in assessed earnings. SSW declined by approximately the same amount for all workers of the same gender (1 average annual earnings for men, 1.2 for women), implying that the declines were greater in percentage terms for workers with lower education (*Table C.1*).

Five of the reforms had a distinctly differential impact on women compared to men. In three of them, women fared worse than men (Hungary 1993, Czech Republic 1996, and Slovakia 2004–2005). In two of them they fared better (Hungary 2003 and Slovakia 2006), although overall the reforms tended to make women worse off.

The large negative impacts on women in the three reforms were caused by larger postponements in retirement age for women than for men. Specifically, the Hungarian 1993 reform gradually postponed the retirement age for women from 55 to 60 while leaving men unaffected. The Czech 1996 reform gradually postponed the retirement age from 55 to 60 for women but only from 60 to 62 for men, and the Slovak

[12] This statement is strictly true only if all members of the cohort always hold the same portfolio.

[13] On the other hand the pre-reform system taxed high-wage workers particularly heavily – an average man with university education who had just started working had SSW of minus 13.1 average annual earnings. The post-reform SSW of men with elementary education who have just started working is still higher than that of men with university education (-2 compared to -5 average annual earnings).

2004–2005 reform did likewise (from 55 to 62 for women and from 60 to 62 for men). Such changes reduced the implicit redistribution from men to women, as women had been retiring earlier than men before the reform and surviving longer at the same time.

The reforms as a whole tended to make the pension systems actuarially fairer and to reduce redistribution.[14] Such a trend logically followed from the highly egalitarian benefit formulas and very generous retirement ages for women that the three countries inherited from the communist era.[15] Actuarially fairer systems also reduce labor market distortions and tax evasion, a problem that had plagued the revenue side of the Slovak system before the reform. From the policy risk perspective, it is difficult to assess whether such intragenerational effects of the reforms could be anticipated or accommodated by workers. More importantly, the intragenerational effects of potential future reforms are much less predictable now than they could have been in the mid 1990s. Future reforms may be driven more by shifts in the government's preferences on the left-to-right scale than by a systematic desire to eliminate the most egalitarian features of the old system.

3.4 Early Reversals

Two of the reforms studied here were truly radical, as they introduced a fully funded pillar. In both the Hungarian 1998 reform and the Slovak 2004–2005 reform current workers were given the option of switching from pure PAYG to a mixed system, while new entrants to the labor market had to participate in the mixed system.[16] The reform legislations allowed switchers to contribute 8 % to the funded pillar in Hungary (out of the 31% total contribution by both the employee and employer) and 9 % in Slovakia (out of the 18 % total). Plus, the Slovak reform radically changed the benefit formula.

The new government in Hungary was opposed to private pensions and just one year later it cancelled the increase in employees' contribution to the private pillar that had been promised by the previous reform and increased the contribution rate to the PAYG pillar for workers in the mixed system. *Figures H.4 and H.5* show the differential impact on the stayers and switchers. While men in both systems experienced a 3% cut in contributions, workers in the PAYG had their benefits unaffected, while cohorts 1951 and younger in the mixed system saw the PV of their benefits decline

[14] We regressed the change in SSW on a measure of redistribution in favor of a particular worker type to formally assess whether the reforms systematically reduced redistribution. Our measure of redistribution was the ratio of the initial pension benefit to the last wage in the PAYG scheme before each reform. The unit of observation was the worker type characterized by gender, age, and education. We ran separate regressions for each country but pooled all reforms and worker types within countries, and as additional control variables we included the dummy variable for each reform, a gender dummy, and the number of years until retirement. The results show a statistically and economically significant negative relationship between the replacement ratio and the change in SSW. In the Hungarian case, workers whose replacement ratio was higher by 0.1 experienced a change in SSW that was 0.277 average annual earnings smaller (the corresponding magnitudes are 0.135 for the Czech Republic and 1.28 for Slovakia). The change in SSW for women was 0.18 average annual earnings smaller than that for men after controlling for other variables in Hungary (0.81 in the Czech Republic and 1.44 in Slovakia). The results are available upon request.

[15] (Müller, 2002)

[16] (Blake, 2008)

by 2.6–6.5 % (gradually more for younger cohorts, who, due to longer accumulation of savings, have a greater gap between the benefits from the funded and PAYG pillars).

Likewise in Slovakia, a reform adopted a mere one year later substantially postponed the final date by which benefits were to become strictly linear in earnings – from 2006 to 2014. This had a particularly negative impact on men with university education (*Table S.2*), whose SSW declined by between 0.25 and 0.85 average annual earnings depending on the cohort.

The policy risk from reversals of reforms should be particularly present if a radical reform is pushed through unilaterally by the current government coalition without a broader consensus with the opposition, as was clearly the Hungarian case. Early reversals make SSW more volatile, as one reform breeds yet another reform. On the other hand, they make it less volatile as long as the reversal reform brings SSW closer to the level it was at prior to the initial reform.

3.5 Funded Pillar Appears to Reduce Policy Risk

In the mixed system the two sources of future pensions are subject to different types of risk. Workers' pension wealth is invested in a more diversified "portfolio" than under a pure system, provided the policy shocks in the PAYG pillar are not positively correlated with shocks to returns in the funded pillar. Diversification hence provides a new argument in favor of a mixed system. Policy risk, however, is present also in the funded pillar[17] since politicians may adopt legislation that hurts workers in the mixed system relative to those in the pure PAYG system (the Hungarian 1999 reform being an example). Whether the mixed system is subject to more or less policy risk becomes an empirical question.

Our results indicate that the funded pillar does reduce the overall policy risk. Almost all workers in the mixed system experienced smaller absolute changes in SSW than their counterparts in PAYG systems from the reforms adopted in Hungary and Slovakia after mixed systems were introduced.[18] Most of the subsequent reforms, after all, concerned only the PAYG pillar; therefore, their impacts were less pronounced for workers in the mixed system, since the PAYG pillar constitutes only a fraction of their SSW.

3.6 Relative Attractiveness of the Pure PAYG and Mixed Systems

Both in Hungary and Slovakia, the outcomes of workers who switched to the mixed system at the time of the radical reform reveal a surprising result – most workers should either not gain by switching, or gain only marginally. In the Hungarian 1998 reform, consider the group that supposedly has most to gain from the private pillar, i.e., men with university education at the beginning of their career (1975–1979 cohorts). The change in SSW is essentially the same regardless of whether they switched or stayed in the PAYG (2.28 and 2.27 average annual earnings, respectively). Since older cohorts contribute to the PAYG for a shorter time, they do not accumulate enough savings to compensate for the 25% cut in the PAYG benefit, and so they are relatively even worse off by switching (*Tables H.3 and H.4*).

[17] (Blake, 2008)

[18] The reader can compare the respective pairs in *Tables H.5–H.10* and *S.3–S.4*.

In the Slovak 2004–2005 case, almost all workers who switched, including young men with university education, gained slightly less or lost more (typically by 0.1 to 0.4 average annual earnings) than their counterparts who stayed in PAYG (*Tables S.1 and S.2*).

There are two causes for this finding. First, high-wage workers have an incentive to switch from a redistributive PAYG system to avoid redistribution. However, both Hungary and Slovakia adjusted the PAYG benefit formulas at the same time in a way that was highly advantageous for high-wage workers, reducing or even eliminating the redistributive element.[19] Second, the actual net returns of the pension funds appear to be too low to make the funded pillar attractive; high fees and very conservative investment strategies are the main culprits.

The Slovak case is illustrative: The fees are regulated – a front-load charge of 1 % of the monthly contribution plus 0.07 % of the average monthly net value of assets. Such fees reduce the accumulated savings after 40 years of constant contributions by about 20 % compared to the idealized world with zero fees. Even though the so-called growth funds[20] are allowed to invest 80 % of their assets in stocks, they actually invest only 20 % because of additional regulation of the funds' performance. While our calculations assume a somewhat higher share (30 %), the resulting projected nominal return of 6.9 % is not sufficient to make switching to the mixed system attractive. The growth funds would have to invest 50 % in stocks in order to achieve the 8.1% return required to make young men with university education indifferent between staying and switching.

The relative unattractiveness of the funded pillar was hardly an intended outcome of the reforms. It rather appears to be a by-product of a desire to radically reduce redistribution within the PAYG pillar and poor implementation of the funded pillar.

The fact that more than 50 % of eligible workers in both Hungary and Slovakia switched appears at odds with our result. One possible explanation is that they may anticipate future improvements in the net returns of the pension funds. As the funds' costs do not rise proportionately with assets, the average administrative costs will fall as workers build up their savings. Competitive pressures would then reduce fees and improve returns. The second explanation is based on portfolio diversification, i.e., workers shift some of their contributions to the funded pillar precisely to diversify away from the policy risk in the PAYG. Last, workers may realize that the current PAYG is unsustainable and therefore anticipate that their PAYG benefits will be less generous than they are promised by the current legislation.

[19] If the PAYG benefits in Hungary do become taxable after 2013, the gains to switching to the mixed system relative to staying in the PAYG system will be more favorable than our computations suggest.

[20] Pension fund administrators have to offer three types of funds differentiated by their risk and expected return – growth, balanced, and conservative funds. Conservative funds may invest only in bonds and money market instruments and must be secured against currency risk. Balanced funds must invest at least 50 % of their assets in bonds and money market instruments and at most 50 % in stocks. Growth funds may invest at most 80 % of their assets in stocks and at most 80 % of their investments may be left unsecured against currency risk. The worker's choice of type of pension fund is regulated in order to prevent a significant loss as the worker approaches the retirement age – among other rules, workers with less than 7 years until retirement may invest in conservative funds only.

4. Conclusions

We documented the policy risk of social security by computing the changes in benefits, contributions, and social security wealth induced by pension reforms in three transition countries. Although the policy risk has various sources, it always materializes through pension reforms, when past promises are replaced by new ones. The reforms usually involve numerous adjustments to contribution and benefit formulas, which are complicated, not very transparent, and contain a large number of parameters. Such adjustments may affect people of different ages and earnings histories differently, often in ways that may not have been recognized or anticipated by the legislators.

Our findings confirm that the policy risk is real and can be substantial. We also show that the PAYG system exposes workers to aggregate as well as intergenerational and intragenerational risk. The policy risk of the PAYG system as documented here provides a new rationale for a pension system that combines the PAYG and funded pillars. A mixed system in effect follows the old investors' recommendation: "Don't put all your eggs in one basket." Finding the optimal balance between the two pillars requires an appropriate quantitative comparison of the risks, one that would characterize the policy risk in a similar way to how stock market risk has traditionally been characterized. Making such a comparison represents a challenge, as the data-generating process driving the changes in SSW induced by pension reforms is fundamentally different from the data-generating process driving stock market fluctuations. Our work may be regarded as the necessary first step towards making such a comparison.

APPENDIX A
TABLES AND FIGURES

TABLE **H.1** Reform 1993, pay-as-you-go, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1935–39	-0.01	-0.03	-0.19	-0.23				
1940–44	0.11	0.07	-0.03	-0.16	-0.40	-0.53	-0.90	-1.25
1945–49	0.27	0.25	0.15	0.09	-0.45	-0.46	-0.79	-2.06
1950–54	0.23	0.24	0.11	0.10	-0.45	-0.50	-0.83	-2.15
1955–59	0.19	0.19	0.06	0.06	-0.43	-0.52	-0.87	-2.07
1960–64	0.16	0.16	0.00	0.02	-0.41	-0.53	-0.88	-2.02
1965–69	0.13	0.12	-0.06	-0.01	-0.40	-0.54	-0.89	-1.95
1970–74	0.09	0.08	-0.08	0.03	-0.39	-0.53	-0.85	-1.80
1975–79	0.06	0.05	-0.09	0.04	-0.38	-0.52	-0.82	-1.67
1980–84	0.04	0.02	-0.11	0.02	-0.39	-0.52	-0.81	-1.57
1985–89	0.02	0.00	-0.12	0.01	-0.39	-0.51	-0.79	-1.50
1990–94	0.01	-0.01	-0.12	0.00	-0.38	-0.50	-0.76	-1.44

TABLE **H.2** Reform 1997, pay-as-you-go, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1935–39	0.04	0.02	-0.07	-0.34				
1940–44	-0.69	-0.84	-1.18	-1.66	0.63	0.74	0.99	1.00
1945–49	-0.49	-0.53	-0.70	-1.09	-0.09	-0.11	-0.17	-0.59
1950–54	-0.42	-0.45	-0.59	-0.92	-0.31	-0.34	-0.45	-0.96
1955–59	-0.35	-0.38	-0.50	-0.77	-0.27	-0.29	-0.39	-0.86
1960–64	-0.31	-0.34	-0.44	-0.67	-0.24	-0.26	-0.34	-0.77
1965–69	-0.27	-0.29	-0.38	-0.58	-0.20	-0.23	-0.30	-0.69
1970–74	-0.23	-0.25	-0.34	-0.51	-0.18	-0.20	-0.26	-0.63
1975–79	-0.20	-0.22	-0.30	-0.46	-0.15	-0.17	-0.23	-0.57
1980–84	-0.18	-0.20	-0.28	-0.43	-0.14	-0.16	-0.21	-0.54
1985–89	-0.17	-0.19	-0.26	-0.41	-0.13	-0.15	-0.20	-0.51
1990–94	-0.16	-0.18	-0.25	-0.38	-0.12	-0.14	-0.19	-0.48

TABLE **H.3** Reform 1998, pay-as-you-go, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1935–39	-1.13	-1.21	-1.36	-1.46				
1940–44	-0.38	-0.16	0.69	2.08	-1.74	-1.92	-2.49	-1.91
1945–49	-0.05	0.21	1.06	2.72	-0.57	-0.37	0.57	2.55
1950–54	0.07	0.37	1.36	3.49	-0.47	-0.25	0.78	3.46
1955–59	0.04	0.31	1.17	3.24	-0.44	-0.26	0.65	3.27
1960–64	-0.03	0.20	0.88	2.77	-0.42	-0.29	0.44	2.78
1965–69	-0.08	0.10	0.65	2.44	-0.39	-0.29	0.31	2.48
1970–74	-0.12	0.03	0.54	2.37	-0.16	-0.08	0.54	2.84
1975–79	-0.12	0.02	0.48	2.27	-0.13	-0.06	0.50	2.95
1980–84	-0.08	0.03	0.45	2.14	-0.08	-0.01	0.48	2.78
1985–89	-0.04	0.06	0.45	2.04	-0.01	0.05	0.50	2.66
1990–94	0.00	0.09	0.44	1.95	0.05	0.10	0.52	2.55

TABLE **H.4** Reform 1998, mixed system, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1951–54	-0.57	-0.32	0.51	2.41	-1.24	-1.09	-0.27	2.17
1955–59	-0.47	-0.26	0.46	2.29	-1.04	-0.93	-0.21	2.16
1960–64	-0.38	-0.19	0.42	2.21	-0.85	-0.75	-0.13	2.13
1965–69	-0.31	-0.14	0.39	2.17	-0.66	-0.57	-0.02	2.18
1970–74	-0.23	-0.08	0.42	2.27	-0.33	-0.25	0.34	2.68
1975–79	-0.14	0.00	0.46	2.28	-0.21	-0.13	0.41	2.89
1980–84	-0.07	0.05	0.47	2.17	-0.14	-0.06	0.42	2.76
1985–89	-0.03	0.08	0.47	2.06	-0.06	0.00	0.44	2.64
1990–94	0.00	0.10	0.46	1.97	0.00	0.05	0.46	2.53

TABLE **H.5** Reform 1999, pay-as-you-go, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1935–39	0.00	0.00	0.00	0.01				
1940–44	0.03	0.04	0.06	0.09	0.01	0.01	0.01	0.02
1945–49	0.07	0.08	0.11	0.17	0.06	0.07	0.09	0.15
1950-54	0.10	0.11	0.16	0.26	0.09	0.10	0.14	0.24
1955–59	0.13	0.15	0.20	0.34	0.12	0.13	0.18	0.31
1960–64	0.16	0.18	0.24	0.42	0.14	0.16	0.21	0.37
1965–69	0.19	0.21	0.28	0.50	0.17	0.18	0.25	0.42
1970–74	0.21	0.24	0.31	0.56	0.18	0.20	0.27	0.46
1975–79	0.23	0.27	0.34	0.59	0.20	0.22	0.29	0.48
1980–84	0.24	0.27	0.34	0.57	0.21	0.22	0.29	0.48
1985–89	0.22	0.25	0.32	0.54	0.20	0.21	0.28	0.46
1990–94	0.21	0.24	0.31	0.51	0.19	0.20	0.26	0.43

TABLE **H.6** Reform 1999, mixed system, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1951–54	0.00	0.00	0.00	0.01	-0.03	-0.04	-0.05	-0.09
1955–59	0.01	0.02	0.02	0.04	-0.03	-0.03	-0.05	-0.09
1960–64	0.03	0.03	0.04	0.07	-0.03	-0.03	-0.04	-0.08
1965–69	0.04	0.05	0.06	0.11	-0.03	-0.03	-0.04	-0.07
1970–74	0.05	0.06	0.08	0.14	-0.02	-0.02	-0.03	-0.06
1975–79	0.07	0.07	0.09	0.16	-0.01	-0.02	-0.02	-0.05
1980–84	0.07	0.08	0.09	0.16	0.00	-0.01	-0.01	-0.05
1985–89	0.07	0.07	0.09	0.15	0.00	0.00	-0.01	-0.04
1990–94	0.06	0.07	0.09	0.14	0.00	0.00	-0.01	-0.04

TABLE **H.7** Reform 2003, pay-as-you-go, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1935–39	0.24	0.26	0.33	0.40				
1940–44	0.37	0.41	0.53	0.69	0.31	0.36	0.47	0.57
1945–49	0.36	0.40	0.50	0.68	0.42	0.47	0.61	0.81
1950-54	0.29	0.33	0.43	0.62	0.35	0.39	0.52	0.76
1955–59	0.24	0.27	0.35	0.52	0.30	0.33	0.44	0.66
1960–64	0.20	0.22	0.28	0.41	0.27	0.29	0.38	0.56
1965–69	0.16	0.18	0.23	0.33	0.23	0.25	0.32	0.48
1970–74	0.13	0.15	0.19	0.29	0.20	0.22	0.29	0.44
1975–79	0.10	0.12	0.15	0.24	0.18	0.19	0.26	0.42
1980–84	0.08	0.10	0.12	0.20	0.16	0.17	0.23	0.38
1985–89	0.08	0.09	0.11	0.19	0.15	0.16	0.21	0.36
1990–94	0.07	0.08	0.11	0.18	0.14	0.15	0.20	0.34

TABLE **H.8** Reform 2003, mixed system, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1950-54	0.24	0.27	0.36	0.53	0.29	0.32	0.43	0.66
1955–59	0.21	0.23	0.31	0.46	0.26	0.29	0.39	0.60
1960–64	0.18	0.20	0.26	0.39	0.24	0.26	0.35	0.54
1965–69	0.15	0.17	0.22	0.34	0.23	0.24	0.32	0.50
1970–74	0.13	0.15	0.19	0.31	0.21	0.22	0.30	0.48
1975–79	0.12	0.13	0.17	0.28	0.19	0.21	0.28	0.46
1980–84	0.10	0.12	0.15	0.25	0.18	0.19	0.26	0.44
1985–89	0.09	0.11	0.14	0.24	0.17	0.18	0.24	0.41
1990–94	0.09	0.10	0.13	0.23	0.16	0.17	0.23	0.39

TABLE **H.9** Reform 2007, pay-as-you-go, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1935–39	0.00	0.00	0.00	0.00				
1940–44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1945–49	-0.26	-0.29	-0.37	-0.66	-0.21	-0.24	-0.30	-0.47
1950–54	-0.25	-0.28	-0.38	-0.61	-0.24	-0.26	-0.35	-0.63
1955–59	-0.33	-0.38	-0.53	-0.85	-0.31	-0.34	-0.47	-0.86
1960–64	-0.46	-0.53	-0.72	-1.22	-0.43	-0.47	-0.64	-1.16
1965–69	-0.58	-0.67	-0.90	-1.58	-0.54	-0.58	-0.80	-1.44
1970–74	-0.70	-0.81	-1.07	-1.91	-0.64	-0.69	-0.95	-1.69
1975–79	-0.81	-0.94	-1.22	-2.19	-0.74	-0.79	-1.08	-1.89
1980–84	-0.92	-1.04	-1.35	-2.40	-0.80	-0.85	-1.15	-2.00
1985–89	-0.99	-1.12	-1.45	-2.45	-0.86	-0.92	-1.23	-2.06
1990–94	-0.97	-1.09	-1.40	-2.33	-0.84	-0.90	-1.19	-1.96

TABLE **H.10** Reform 2007, mixed system, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1951–54	-0.21	-0.24	-0.34	-0.52	-0.20	-0.22	-0.30	-0.55
1955–59	-0.33	-0.38	-0.53	-0.85	-0.31	-0.34	-0.47	-0.86
1960–64	-0.46	-0.53	-0.72	-1.22	-0.43	-0.47	-0.64	-1.16
1965–69	-0.58	-0.67	-0.90	-1.58	-0.54	-0.58	-0.80	-1.44
1970–74	-0.70	-0.81	-1.07	-1.91	-0.64	-0.69	-0.95	-1.69
1975–79	-0.81	-0.94	-1.22	-2.19	-0.74	-0.79	-1.08	-1.89
1980–84	-0.92	-1.04	-1.35	-2.40	-0.80	-0.85	-1.15	-2.00
1985–89	-0.99	-1.12	-1.45	-2.45	-0.86	-0.92	-1.23	-2.06
1990–94	-0.97	-1.09	-1.40	-2.33	-0.84	-0.90	-1.19	-1.96

TABLE **C.1** Reform 1996, Change in SSW as a fraction of annual average earnings

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1936–39	-0.09	-0.14	-0.32	-0.33				
1940–44	-0.91	-0.90	-1.06	-0.98	1.60	1.40	1.01	0.75
1945–49	-1.16	-1.10	-1.27	-1.23	-0.73	-0.81	-0.76	-0.87
1950–54	-1.16	-1.12	-1.27	-1.25	-1.05	-1.22	-1.24	-1.38
1955–59	-1.16	-1.12	-1.24	-1.21	-1.11	-1.28	-1.28	-1.40
1960–64	-1.16	-1.14	-1.21	-1.15	-1.14	-1.30	-1.25	-1.37
1965–69	-1.15	-1.14	-1.19	-1.11	-1.18	-1.32	-1.23	-1.35
1970–74	-1.12	-1.11	-1.15	-1.07	-1.17	-1.30	-1.20	-1.32
1975–79	-1.08	-1.07	-1.11	-1.02	-1.14	-1.26	-1.16	-1.27
1980–84	-1.05	-1.03	-1.08	-1.00	-1.13	-1.24	-1.14	-1.25
1985–89	-1.01	-0.99	-1.04	-0.96	-1.09	-1.20	-1.10	-1.21
1990–94	-0.96	-0.95	-1.00	-0.91	-1.06	-1.16	-1.05	-1.16
1995–96	-0.93	-0.92	-0.96	-0.89	-1.05	-1.15	-1.05	-1.15

TABLE **C.2** Reform 2002–03, Change in SSW as a fraction of annual average earnings

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1941–44	0.01	0.01	0.01	0.01				
1945–49	-0.13	-0.14	-0.21	-0.31	-0.02	-0.02	-0.02	-0.05
1950–54	-0.48	-0.53	-0.65	-0.93	-0.61	-0.64	-0.78	-1.04
1955–59	-0.56	-0.63	-0.79	-1.11	-0.86	-0.92	-1.16	-1.51
1960–64	-0.60	-0.67	-0.86	-1.24	-0.87	-0.93	-1.19	-1.57
1965–69	-0.64	-0.71	-0.92	-1.36	-0.85	-0.92	-1.20	-1.60
1970–74	-0.68	-0.76	-0.99	-1.48	-0.86	-0.93	-1.23	-1.65
1975–79	-0.72	-0.80	-1.05	-1.59	-0.84	-0.90	-1.20	-1.60
1980–84	-0.75	-0.83	-1.09	-1.66	-0.82	-0.89	-1.19	-1.58
1985–89	-0.74	-0.82	-1.08	-1.60	-0.80	-0.87	-1.17	-1.52
1990–94	-0.71	-0.78	-1.03	-1.53	-0.77	-0.83	-1.11	-1.45
1995–99	-0.67	-0.74	-0.97	-1.44	-0.72	-0.78	-1.05	-1.37
2000–03	-0.65	-0.72	-0.94	-1.39	-0.70	-0.76	-1.01	-1.32

TABLE **S.1** Reform 2004–2005, pay-as-you-go, Change in SSW as a fraction of the annual average wage

Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1935–39	0.37	0.39	0.41	0.42				
1940–44	0.21	0.24	0.52	0.89				
1945–49	-2.38	-1.83	-0.41	3.97	0.45	0.48	0.58	0.97
1950–54	-1.83	-1.22	0.11	4.69	-4.29	-4.03	-2.81	-0.23
1955–59	-1.29	-0.66	0.62	5.27	-4.50	-4.26	-3.20	-0.87
1960–64	-0.80	-0.14	1.10	5.89	-4.08	-3.82	-2.82	-0.43
1965–69	-0.37	0.33	1.54	6.42	-3.61	-3.33	-2.32	0.16
1970-74	0.01	0.76	1.92	6.86	-3.23	-2.89	-1.91	0.60
1975–79	0.35	1.13	2.28	7.31	-2.89	-2.51	-1.55	0.98
1980–84	0.65	1.45	2.58	7.55	-2.54	-2.12	-1.16	1.33
1985–89	0.75	1.54	2.62	7.24	-2.32	-1.90	-0.95	1.33
1990–94	0.71	1.46	2.49	6.87	-2.20	-1.80	-0.90	1.26

TABLE **S.2** Reform 2004–2005, mixed system, Change in SSW as a fraction of the annual average wage

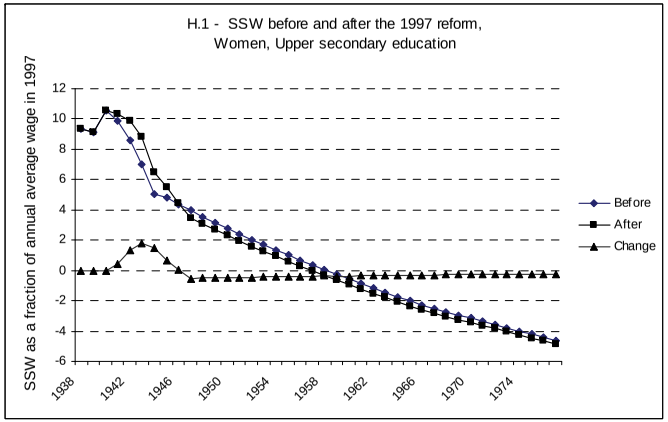
Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1953–54	-1.72	-1.16	0.14	4.59				
1955–59	-1.38	-0.80	0.45	4.94	-4.61	-4.41	-3.32	-1.19
1960–64	-0.91	-0.32	0.90	5.51	-4.25	-4.05	-3.02	-0.88
1965–69	-0.49	0.14	1.33	6.05	-3.80	-3.59	-2.56	-0.35
1970–74	-0.10	0.57	1.72	6.53	-3.41	-3.17	-2.15	0.08
1975–79	0.26	0.95	2.08	6.96	-3.07	-2.80	-1.83	0.35
1980–84	0.56	1.28	2.37	7.15	-2.71	-2.42	-1.45	0.61
1985–89	0.67	1.38	2.41	6.85	-2.50	-2.18	-1.24	0.63
1990–94	0.63	1.30	2.29	6.50	-2.37	-2.07	-1.18	0.59

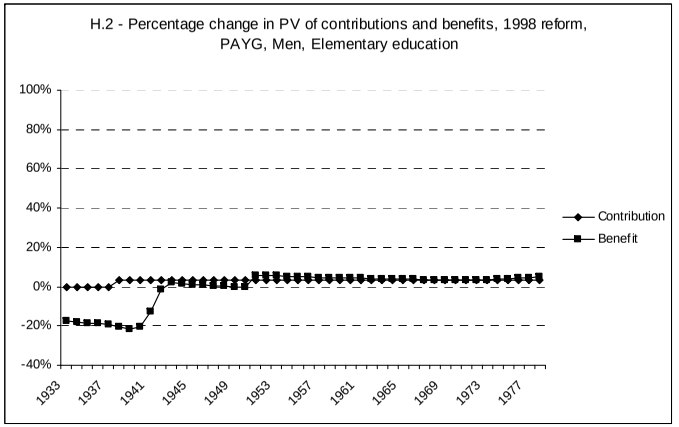
TABLE **S.3** Reform 2006, pay-as-you-go, Change in SSW as a fraction of the annual average wage

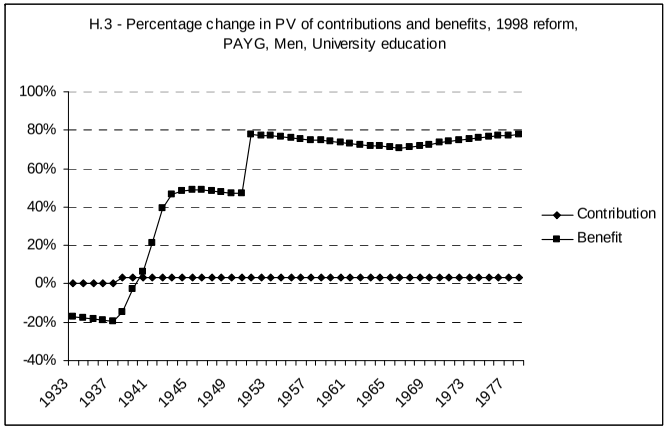
Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1935–39	0.00	0.00	0.00	0.00				
1940–44	0.00	0.00	0.00	0.00				
1945–49	0.30	0.19	0.02	-0.85	0.00	0.00	0.00	0.00
1950–54	0.08	0.09	-0.05	-0.26	0.44	0.40	-0.03	-0.16
1955–59	0.00	0.03	-0.10	-0.25	-0.03	0.00	-0.09	-0.04
1960–64	-0.07	-0.05	-0.19	-0.45	-0.07	-0.02	-0.08	-0.13
1965–69	-0.11	-0.11	-0.21	-0.41	-0.09	-0.02	-0.09	-0.13
1970–74	-0.12	-0.14	-0.19	-0.32	-0.03	-0.01	-0.03	-0.02
1975–79	-0.14	-0.16	-0.19	-0.36	0.00	0.00	0.00	0.00
1980–84	-0.13	-0.16	-0.19	-0.35	0.00	0.00	0.00	0.00
1985–89	-0.13	-0.15	-0.18	-0.34	0.00	0.00	0.00	0.00
1990–94	-0.12	-0.14	-0.17	-0.32	0.00	0.00	0.00	0.00

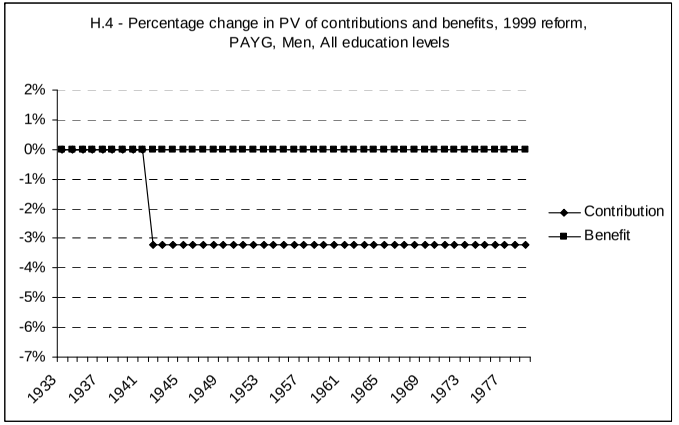
TABLE **S.4** Reform 2006, mixed system, Change in SSW as a fraction of the annual average wage

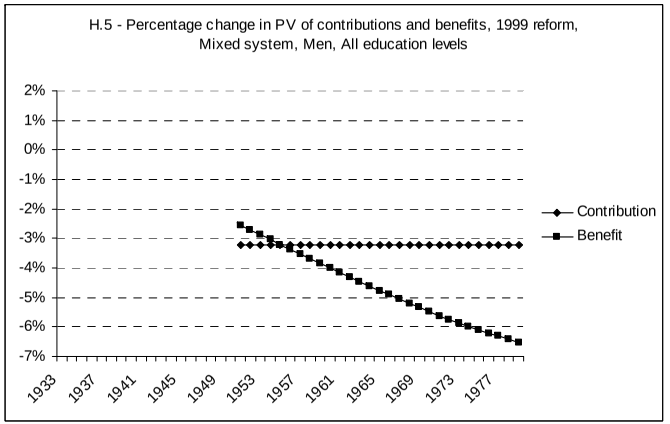
Cohort	Men				Women			
	Elementary	Lower	Upper	University	Elementary	Lower	Upper	University
1953–54	0.02	0.06	-0.06	-0.10				
1955–59	0.00	0.02	-0.08	-0.21	-0.02	0.00	-0.08	-0.03
1960–64	-0.06	-0.05	-0.15	-0.37	-0.05	-0.01	-0.07	-0.10
1965–69	-0.10	-0.10	-0.18	-0.35	-0.06	-0.02	-0.07	-0.09
1970–74	-0.12	-0.13	-0.18	-0.31	-0.02	-0.01	-0.02	-0.01
1975–79	-0.14	-0.16	-0.19	-0.36	0.00	0.00	0.00	0.00
1980–84	-0.13	-0.16	-0.19	-0.35	0.00	0.00	0.00	0.00
1985–89	-0.13	-0.15	-0.18	-0.34	0.00	0.00	0.00	0.00
1990–94	-0.12	-0.14	-0.17	-0.32	0.00	0.00	0.00	0.00

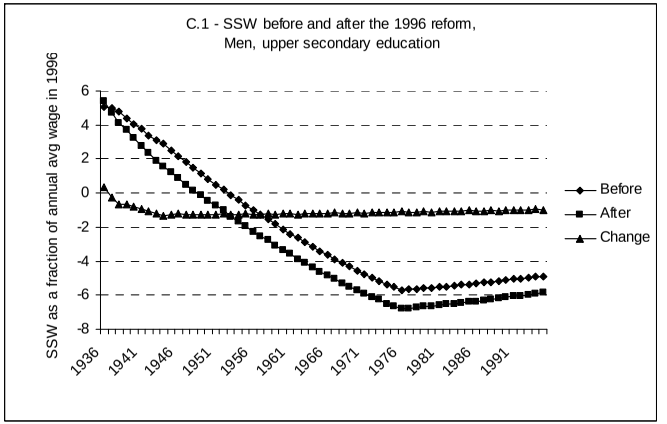

H.1 - SSW before and after the 1997 reform,
Women, Upper secondary education
SSW as a fraction of annual average wage in 1997
12
10
8
6
4
2
0
-2
-4
-6
1938
1942
1946
1950
1954
1958
1962
1966
1970
1974
Before
After
Change

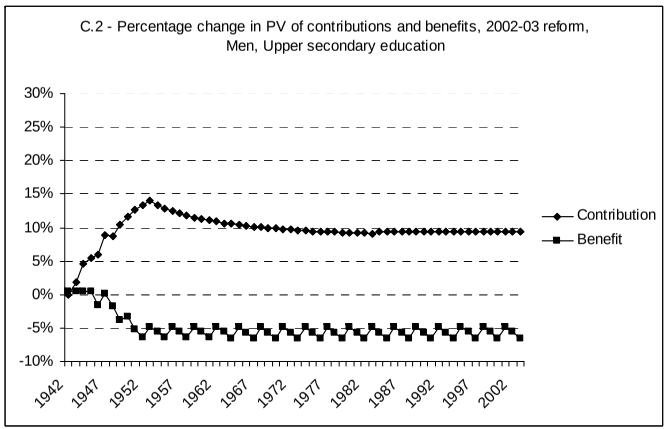

H.2 - Percentage change in PV of contributions and benefits, 1998 reform,
PAYG, Men, Elementary education
100%
80%
60%
40%
20%
0%
-20%
-40%
1933
1937
1941
1945
1949
1953
1957
1961
1965
1969
1973
1977
Contribution
Benefit

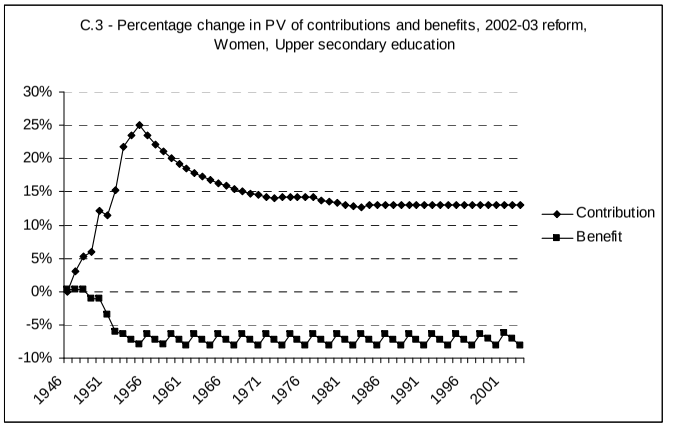

H.3 - Percentage change in PV of contributions and benefits, 1998 reform,
PAYG, Men, University education
100%
80%
60%
40%
20%
0%
-20%
-40%
1933
1937
1941
1945
1949
1953
1957
1961
1965
1969
1973
1977
Contribution
Benefit

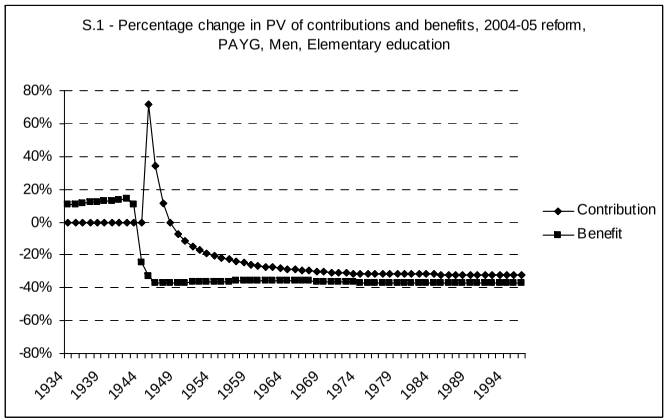

H.4 - Percentage change in PV of contributions and benefits, 1999 reform,
PAYG, Men, All education levels
2%
1%
0%
-1%
-2%
-3%
-4%
-5%
-6%
-7%
1933
1937
1941
1945
1949
1953
1957
1961
1965
1969
1973
1977
Contribution
Benefit

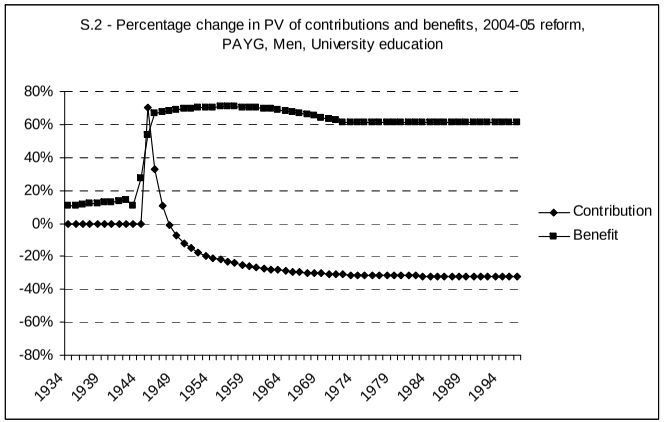

H.5 - Percentage change in PV of contributions and benefits, 1999 reform,
Mixed system, Men, All education levels
2%
1%
0%
-1%
-2%
-3%
-4%
-5%
-6%
-7%
1933
1937
1941
1945
1949
1953
1957
1961
1965
1969
1973
1977
Contribution
Benefit

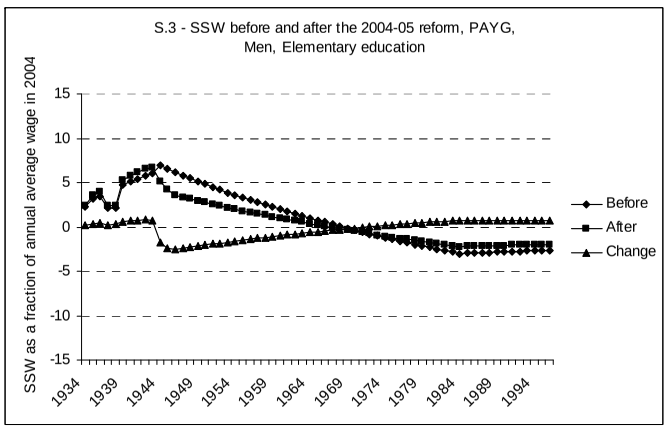

C.1 - SSW before and after the 1996 reform,
Men, upper secondary education
SSW as a fraction of annual avg wage in 1996
6
4
2
0
-2
-4
-6
-8
1936
1941
1946
1951
1956
1961
1966
1971
1976
1981
1986
1991
Before
After
Change

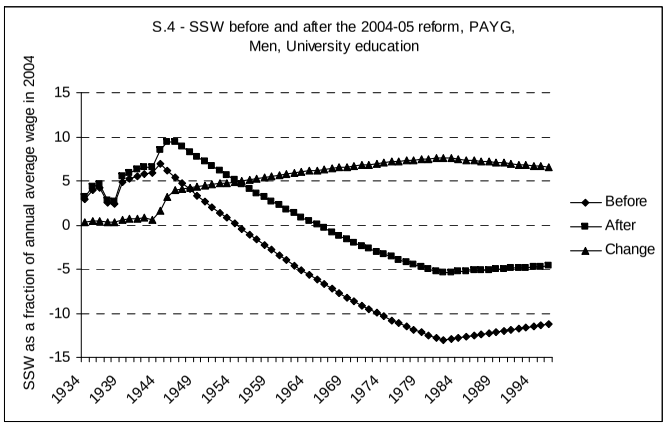

C.2 - Percentage change in PV of contributions and benefits, 2002-03 reform,
Men, Upper secondary education
30%
25%
20%
15%
10%
5%
0%
-5%
-10%
1942
1947
1952
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
Contribution
Benefit


C.3 - Percentage change in PV of contributions and benefits, 2002-03 reform,
Women, Upper secondary education
30%
25%
20%
15%
10%
5%
0%
-5%
-10%
1946
1951
1956
1961
1966
1971
1976
1981
1986
1991
1996
2001
Contribution
Benefit


S.1 - Percentage change in PV of contributions and benefits, 2004-05 reform, PAYG, Men, Elementary education
80%
60%
40%
20%
0%
-20%
-40%
-60%
-80%
1934
1939
1944
1949
1954
1959
1964
1969
1974
1979
1984
1989
1994
Contribution
Benefit


S.2 - Percentage change in PV of contributions and benefits, 2004-05 reform, PAYG, Men, University education
80%
60%
40%
20%
0%
-20%
-40%
-60%
-80%
1934
1939
1944
1949
1954
1959
1964
1969
1974
1979
1984
1989
1994
Contribution
Benefit


S.3 - SSW before and after the 2004-05 reform, PAYG, Men, Elementary education
SSW as a fraction of annual average wage in 2004
15
10
5
0
-5
-10
-15
1934
1939
1944
1949
1954
1959
1964
1969
1974
1979
1984
1989
1994
Before
After
Change


S.4 - SSW before and after the 2004-05 reform, PAYG, Men, University education
SSW as a fraction of annual average wage in 2004
15
10
5
0
-5
-10
-15
1934
1939
1944
1949
1954
1959
1964
1969
1974
1979
1984
1989
1994
Before
After
Change

APPENDIX B

DETAILED ASSUMPTIONS

Wage profiles

Our "average" workers start working at age 20, work full-time until the standard retirement age,[21] and earn the wage that is predicted by the wage profile specific to their gender, educational category, and calendar year. The wage profiles are estimated from individual level cross-sectional datasets described below and have the standard form

$$\log w_{ijt} = \alpha_{jt} + \beta_{1jt} a_{ijt} + \beta_{2jt} a_{ijt}^2 + u_{ijt}$$

where w is the monthly wage, subscript i denotes an individual, j denotes the worker's gender and educational category, t denotes the year, a is the worker's age, and α, β_1, and β_2 are the parameters that we estimate. The profiles were estimated on a sample of workers aged between 20 and the standard retirement age who worked at least 6 months in a given year. The regression estimates and the corresponding wage profiles are available upon request.

We constructed the wage profiles from individual-level datasets that were best suited to the task in each country. All of them contain basic information about each worker (gender, age, education level) and sufficient information about his/her employment status and labor income (either the monthly wage or the annual/quarterly wage and the number of weeks/months worked, from which the monthly wage can be imputed). For Hungary, we used the Harmonized Hungarian Wage Survey of the Public Employment Service. The survey was collected at the firm level in 1986 and 1989 and annually from 1992 to 2003 and contains data on 100,000–200,000 employees depending on the year. For the Czech Republic, we used the Czech Microcensus, a representative household survey conducted once every 4 or 6 years by the Czech Statistical Office. The surveys that we use were collected in 1992, 1996, and 2002[22] and cover approximately 44,000, 64,000, and 19,000 individuals in the respective years. For Slovakia, we used the TREXIMA dataset, a representative survey of firms. Collected in 2001, it contains quarterly data on 350,000 employees.

Since the samples allow us to estimate the wage profiles only for some years[23] while we need to have profiles for all years since 1988 (Hungary), 1986 (Czech Re-

[21] Workers with university education start working at age 22. Women have 2 children; the first one is born at the average age of the first childbirth in the respective country and year (information collected from the population statistics published by each country's statistical office), and the second one two years later. Women spend 5 years (Czech Republic, Slovakia) or 4 years (Hungary) in childcare without earning labor income.

[22] Unfortunately, the 1988 microcensus was not usable for our purpose, since all observations are recorded at the household level and not the individual level. Even though it does report the earnings of the head of household and his spouse, it does not allow us to identify the gender of workers who live in households other than traditional families of married couples.

[23] The Hungarian Wage Survey is not available for 1987–1988, 1990–1991, and 2004+. Moreover, the surveys from 1993, 1998–1999, and 2002 appeared to contain data problems, since the estimates of the wage profiles in these years produced estimates that were substantially different from the estimates for adjacent years and, more importantly, were economically implausible.

public) or 1984 (Slovakia), we impute the profiles for the remaining years. We assume that the coefficients on the age and age squared are the same as in the nearest adjacent year for which the profile was estimated.[24] Then we adjust the intercept α such that the average fitted wage in the sample is equal to the actual average wage in the year for which the wage profile is being imputed.[25]

The 2004–2005 Slovak reform allowed one of the parents to deduct 0.5 % for every child from their PAYG contributions. We assume that the deduction is claimed by men, since they earn more on average.

Future projections

Certain assumptions about the future were required to project future benefits and contributions. The length of life is probabilistic and future money flows are discounted by the survival probability. We had survival probability tables for all countries (unfortunately without a finer breakdown by education categories) until 2004. For 2005 onwards, we assume that the survival probabilities are the same as in 2004.[26]

We assume that as of the time of the reform people had perfect foresight about the evolution of all economic variables that affect future taxes and benefits (aggregate and individual wage growth, inflation, survival probabilities). That is, the future wages, inflation rates and survival probabilities that are expected at the time of the reform are equal to the wages and inflation rates that were actually realized up to 2005, and for 2006 onwards we assume a 3% growth rate of real wages for all education categories and genders and a 2% inflation rate.

The rate of return on savings in pension funds is the key parameter affecting the benefits from the funded pillar. It is to a large extent determined by the regulation of funds' investments and fees. Our choice of rate of return is an estimate of the net rate of return that the pension funds, as actually established and regulated by Hungarian and Slovak law, are expected to deliver to their clients. That is, we avoid using an average historical return on some "optimal" stock and bond portfolio as commonly done in simulations of benefits from the funded pillar (e.g. (Feldstein, Ranguelova, 2001), since that approach would give the level of benefits that the funded pillar could provide rather than did provide.

For Hungary, the expected real return on savings is calculated as the weighted average of the real net return[27] of all Hungarian pension funds during 1998–2005, which was 2.7 %[28] Pension funds in Slovakia were established too recently to project future returns from historical returns. Instead, we compute the expected future returns as the average historical returns on the portfolios that the growth funds currently hold. Specifically, we calculate the average historical return for each of the major bond and

[24] For example, the coefficients on age and age squared estimated from the Czech 2002 Microcensus were used to generate wage profiles for 2000–2004.

[25] The data sources for average wages by gender and education level are reported in detail in an earlier version of the paper (Dušek, Kopecsni, 2008, p. 25).

[26] This assumption probably underestimates the true survival probabilities, since life expectancies have been increasing in all three countries since the 1990s and are expected to increase in the future. However, we were not able to obtain specific projections of future survival probabilities.

[27] That is, after deducting fees.

[28] Source: (Czajlik, Szalay, 2006)

stock indices in which the funds currently invest, and then compute the average of these returns weighted by their share in the average growth fund's portfolio.[29] The resulting projected nominal rate of return after deducting fees is 6.9 percent.[30] As workers approach retirement age they may prefer a gradual switch to a completely risk-free portfolio (and in Slovakia they are in fact required to switch to more conservative funds). We therefore assume that the above-mentioned returns apply only from the beginning of employment until 15 years before retirement. Afterwards workers rebalance the portfolio each year such that the real return linearly decreases to zero by the age of retirement.

The pension funds offer unisex life annuities, which we computed as follows: First, the share of men and women upon retirement in the population is weighted by their wages. Next, the population structure in the future is projected by applying the mortality tables separately for the male and female parts of the population. The two projections are combined to obtain the evolution of the unisex population. The annuities are computed by applying the actuarial formulas to this unisex population. Finally, as the annuities are subject to Swiss indexation the technical interest rate was modified by the magnitude of this indexation.

Computing future indexations of benefits in the Czech Republic and Slovakia required additional assumptions. The legislation before the first reform did not prescribe any indexations, yet it is implausible to assume that the benefits or the system parameters would never be indexed. In fact, the benefits had been indexed in an ad--hoc manner with a clear goal to preserve their real value. Therefore, we assume that once granted, benefits would have been indexed for inflation, and the income brackets in the benefit formula would be indexed for wage growth. Under these assumptions, the replacement ratio remains at a similar level (48–50 % in the Czech Republic, 30–35 % in Slovakia) as it was during the years just preceding the reform.[31] After the 1996 reform, Czech law prescribed minimum indexations, but the government frequently provided more generous increases.[32] Therefore, until 2006 we assume perfect foresight and compute the benefits as they were actually indexed, and only after 2006 we index them conservatively by the minimum prescribed by the legislation.

[29] Specifically, the expected returns are computed from the returns on the following indices over the periods indicated: UX 1991–2007, PX 1995–2007, SLOVN SK 1999–2007, VIX 1990–2003, MXEU 1995––2007, FTSE 1990–2003, DAX 1990–2007, and SPX 1990–2007. The funds' stock portfolio is composed of stock indices in the Visegrad countries (20 %), the EU-15 countries (50 %), and the United States (30 %). Data on the portfolio compositions were taken from the funds' annual reports.

[30] The growth funds currently invest 80 % of their assets in bonds, which appears to be an overtly conservative strategy, particularly if the legislation restricts them to investing at most 80 % in stocks. Even though other regulations give funds incentives to invest in stocks below the maximum limit, several fund managers admit in official reports that they do plan to increase the share of stocks in the near future. In our computation we therefore assume that they will invest 30 % in stocks.

[31] In addition, prior to 1995, the new benefits were computed according to the old formula but were increased immediately (by 32 % in 1995) to make up for the inflation that had accumulated since 1990. We assume that such increases in newly granted benefits would continue into the future with the same purpose of compensating for the reduction in the real value of past wages that enter the benefit due to inflation. We increase the new benefits by 32 %, and further increase them by the ratio of the price index at the time of retirement to the average price index during the 5 years preceding retirement.

[32] (Dušek, 2007)

APPENDIX C

MAIN FEATURES OF THE REFORMS

	Hungary (1993)
Pension Scheme	PAYG system
Retirement Age	Men: 60, Women: 55 to 60 gradually
Contribution Rate	Employer: 24.5 %, Employee: 6 %
Assessed Earnings	Average net monthly earnings during 4 years with highest earnings in the 5 years before retirement ➔ average net monthly earnings from 1988 until the year of retirement
Benefit Formula	The benefit is set as a certain fraction (pension accrual) of average net earnings during the period considered. The benefits are regressive in average net earnings but less regressive after the reform.
Indexation Rule	Net wage indexation
	Hungary (1997)
Pension Scheme	PAYG system
Retirement Age	Men: 60 to 62 gradually, Women: 55 to 62 gradually except cohorts 1942–1944 whose retirement age was shifted back by 1 year
Contribution Rate	Employer: 24.5 % to 24.0 %, Employee: 6 %
Assessed Earnings	No change
Benefit Formula	Higher pension accrual was applied
Indexation Rule	No change
	Hungary (1998)
Pension Scheme	The reform split the mandatory PAYG scheme into a public PAYG and privately funded pillar. The workers already employed had the option to switch from the public to the mixed system and more than 50 % of eligible workers did switch. For new entrants to the labor market, participation in the mixed system was compulsory.
Retirement Age	No change
Contribution Rate	PAYG scheme – Employer: 24 % to 23 % (1999), to 22 % (2000), Employee: 6 % to 7 % (1998), to 8 % (1999), to 9 % (2000) Mixed scheme – Employer: 24 % to 23 % (1999), to 22 % (2000), Employee: (PAYG pillar): 1 % Employee (Funded pillar): 6 % (1998), 7 % (1999), 8 % (2000)
Assessed Earnings	No change
Benefit Formula	The benefit formula should switch from the net to the gross principle after 2013, meaning that the benefit will then be set as a fraction of average gross earnings instead of net earnings. It was also planned that the benefit would become taxable. The degression is gradually eliminated in the calculation. The switchers in the mixed system will have their benefit from the public pillar reduced by 25 % in such a way that their accruals are 75 % of stayers' accruals. In addition, they will receive unisex annuities from savings in the pension fund.
Indexation Rule	Net wage indexation ➔ Swiss indexation, gradually since 2001
	Hungary (1999)
Pension Scheme	Multi pillar system – public PAYG pillar with privately funded pillar
Retirement Age	No change
Contribution Rate	PAYG scheme – Employer: 23 % to 22 % (1999), 22 % to 21 % (2000), Employee: 8 % (1999), 9 % to 8 % (2000), Mixed scheme – Employer: 23 % to 22 % (1999), 22 % to 21 % (2000), Employee (PAYG pillar): 1 % to 2 %, Employee (Funded pillar): 7 % to 6 % (1999), 8 % to 6 % (2000)

Assessed Earnings	No change
Benefit Formula	No change
Indexation Rule	No change
	Hungary (2003)
Pension Scheme	Multi pillar system – public PAYG pillar with privately funded pillar
Retirement Age	No change
Contribution Rate	PAYG scheme – Employer: 18 %, Employee: 8 % to 8.5 %, Mixed scheme – Employer: 18 %, Employee (PAYG pillar): 2 % to 1.5 %, Employee (Funded pillar): 6 % to 7 %
Assessed Earnings	No change
Benefit Formula	Gradual introduction of an additional monthly benefit (13th monthly pension) within PAYG pillar. Pensioners would effectively receive their benefit 13 times a year from 2006 onwards.
Indexation Rule	No change
	Hungary (2007)
Pension Scheme	Multi pillar system – public PAYG pillar with privately funded pillar
Retirement Age	No change
Contribution Rate	PAYG scheme – Employer: 17 % to 21 % (2007), 16 % to 21 % (2009), Employee: 8.5 %, Mixed scheme – Employer: 17 % to 21 % (2007), 16 % to 21 % (2009), Employee (PAYG pillar): 0.5 %, Employee (Funded pillar): 8 %
Assessed Earnings	No change
Benefit Formula	For workers who would retire between 2008 and 2012 the employees' pension and health care contributions and the employees' contribution to the employment fund will be deducted from the net earnings entering the benefit formula in a way that will reduce the benefit. Earnings during the whole life will be indexed to the level of the individual's last working year, while before the reform earnings in the last three working years were not indexed at all.
Indexation Rule	No change
	Czech Republic (1996)
Pension Scheme	PAYG system
Retirement Age	Men: 60 to 62 gradually, Women: 55 to 59 gradually
Contribution Rate	Employer: 19.5 %, Employee: 6.5 %
Assessed Earnings	Earnings from 5 years with the highest earnings during the 10 years prior to retirement ➔ average monthly earnings from the 30 years of employment preceding retirement since 1986
Benefit Formula	The new benefit formula introduced a flat component of the benefit (same for all retirees) and at the same time made the variable component (which depends on the worker's average lifetime earnings) less regressive; the ceiling on the maximum benefit was abolished
Indexation Rule	Indexation ad hoc ➔ indexation to the consumer price index and at least once every two years also for at least 33 % of real wage growth, but the government has the discretion to provide more generous indexation.
	Czech Republic (2002–2003)
Pension Scheme	PAYG system
Retirement Age	Men: 60 to 63 gradually, Women: 55 to 61 gradually by 2013
Contribution Rate	Employer: 19.5 % to 21.5 %, Employee: 6.5 %
Assessed Earnings	No change
Benefit Formula	No change
Indexation Rule	Benefits have to be adjusted annually and the minimum increase has to include inflation plus at least 33 % of real wage growth

	Slovakia (2004–2005)
Pension Scheme	The reform split the mandatory PAYG scheme into a public PAYG and privately funded pillar. The mixed system is mandatory for new entrants to the labor market. Workers aged below 52 had a choice to switch from pure PAYG to a mixed system, and 60 % of workers had switched by 2006.
Retirement Age	Men: 60 to 62 gradually, Women: 55 to 62 gradually
Contribution Rate	PAYG scheme – Employer: 20.6 % to 16 % (2004), to 14 % (2005), Employee: 5.9 % to 4 %, one of the parents can deduct an additional 0.5 % in contributions for every child, Mixed scheme – Employer (PAYG pillar): 5 % (2005), Employer (Funded pillar): 9 % (2005), Employee: 4 %, one of the parents can deduct an additional 0.5 % in contributions for every child
Assessed Earnings	Earnings from 5 years with the highest earnings during the 10 years prior to retirement ➔ entire working period since 1994, which in turn should be at least 10 years
Benefit Formula	The new benefit formula made the benefit linear in the worker's average earnings over his entire working history since 1994, up to a cap beyond which workers with more than 3 times the average earnings do not receive higher benefits. The formula set the benefit as the worker's average earnings times the number of working years times the actual pension value. During a transitory period until 2006 the benefits were regressive in the worker's lifetime earnings but were gradually becoming less regressive over time. The PAYG benefits for switchers are cut proportionally to the number of years they have participated in the mixed system. In addition, they will receive unisex annuities from savings in the pension fund.
Indexation Rule	Indexation ad hoc ➔ Swiss indexation
	Slovakia (2006)
Pension Scheme	Multi pillar system – public PAYG pillar with privately funded pillar
Retirement Age	No change
Contribution Rate	Employee: the 0.5% deduction in contributions for every child was abolished
Assessed Earnings	Entire working period since 1994, which in turn should be at least 10 years ➔ entire working period since 1984, which in turn should be at least 20 years
Benefit Formula	Gradual adjustment in the benefit formula to create a stronger link between earnings and benefits. This was supposed to have been fully phased in by 2006, but was prolonged until 2014, after which the benefits should indeed be linear in earnings.
Indexation Rule	No change

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