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CHANGES IN THE IMPLICIT DEBT BURDEN OF THE HUNGARIAN SOCIAL SECURITY SYSTEM

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II. Summary

The paper studies the implicit debt burden of the Hungarian social security system, and especially its changes after certain real and hypothetical reform measures. It uses a computer simulation of a demographic model. The most important results are the following. The Hungarian implicit debt burden, prior to the 1998 reform, was quite substantial but not extraordinarily high in an international comparison. As the result of the implemented reforms, it has decreased from 100% of 1995 GDP to roughly 40% of it. This is equivalent to a permanent budget cut of approximately 1.5% of GDP per year. If we smooth the cyclicality of the late 90s less, then these measures are even better.
Considering further reform scenarios, the only promising direction (let alone the unrealistic 5% improvement in revenue collection) was the decrease of the size of the first (PAYG) pillar of pensions. Cutting contribution rates (which is a current policy proposal) seems absolutely infeasible from a long-run perspective.

III. I. Introduction[1]

Public debt has been a central and controversial issue for a broad spectrum of economic actors: academic researchers, investors, government agencies and political decision-makers. The debates are endless on the role of public debt and its effects on the economy. Investors closely follow the indebtedness of a country when evaluating the country's sovereign risk; and consequently, policymakers also pay heavy attention to deficits, measures of debt and constraints on these[2].

In addition to the aforementioned explicit public debt (which is in the form of loans and other financial instruments), all governments face additional pre-committed services. All these represent an income-expenditure flow, which can add up to a substantial (positive or negative) discounted value: this is the implicit debt burden of a government. Our goal is to give acceptable estimates of one major component of this number: social security deficits (or sometimes, surpluses).

The importance of the question is immediate: neglecting the implicit debt can lead both to serious inconsistencies of the budget, and to heavy under/overestimation of a country's financial situation, risk. So our results should be interesting both for investors and policymakers. This already indicates two main criteria any such estimate should meet: precision and (international) comparability. The ideal would be – as always – to satisfy both. If this is not feasible (as usually), then one can try to keep one criterion above some limit and improve as much as possible on the other side.

Our approach will be of this type as well: keeping most assumptions comparable to other (international) studies, and, in the same time, using specific details of the demographic, economic and legal (e.g. tax brackets and policy) situation of Hungary. We still cannot, however, expect numbers readily applicable for precise financial planning – only for international comparison, guidance in orders of magnitude and in directions of some effects. But this is not without practical use: the signs and magnitudes can help orienting the policymakers within their feasible region, where they can do the final fine tuning on a more trial-and-error basis.

Calculating the present discounted value of the income-expenditure flows is a useful measure of these burdens because it gives one single number. We can interpret this as the price the government would get or have to pay, were it to sell its social security system to a risk-neutral and infinitely lived entrepreneur (who would volunteer to run the system, based on the same legal constraints as the government), neglecting the costs of operation. Financing this transaction from debt (most social security systems represent a net liability, not a claim) would increase the public debt exactly by the value of the implicit debt. Independent Social Security Funds can also be interpreted as selling the sys-

[1] I would like to thank valuable comments and discussions by Mária Augusztinovics, István Hamecz, Gábor P. Kiss, István P. Székely, and seminar participants at NBH.
[2] Elmendorf-Mankiw [98] provides an excellent survey of these issues.

tem: in that case, the implicit debt measures the amount the Fund has to get at start if it is supposed to be self-financing from then on.

The implicit debt becomes explicit through time just by its nature – hence it is natural to consider it together with the explicit debt when assessing the long-run outlook of a country's financial position. Although it is easier to reduce the expenditure of the implicit debt than to default on government bonds: for example, with a pension or health-care reform; but changing the value of present and past contributions is also close to defaulting.

Of course, short-run dynamics of the implicit debt can substantially differ from the interest service of a sum equal to this debt – in this case, governments will always be less conservative on this side of budgetary planning than on the explicit government debt part. But someone will have to pay the cost of these good days: future governments must deal with the accelerated imbalances of the system.

Thus the implicit debt can be a strategic element in the game played by consecutive governments: one government can choose its measures such that the next one will inherit a situation where the implicit debt becomes explicit faster, and so this government will be more constrained in its decisions. Increasing the implicit debt can improve popularity of the regime while maintaining a seemingly good financial situation (this is the same misrepresentation of a country's indebtedness as what we mentioned earlier).

If there are international treaties limiting debt-GDP and other such ratios, it is in our view necessary to have such measures of the implicit debt as well. One could say that it would become explicit and thus part of the regulation anyway: but by that time the imbalance can be so serious that it is far more costly to stabilize. This is further emphasized by the nature of the implicit debt: it usually depends heavily on demographic factors, which change very slowly but steadily, and it is hard and costly to intervene into such processes, and as slow as their speed of change (if possible at all).

Besides its appealing features, the present value as a measure of the implicit debt burden has its disadvantages as well. Its largest blessing, namely that it is a single number, is also a curse: the result is extremely sensitive to the choice of the discount rate. This problem is present at the income-expenditure approach as well (when including the interest service of deficits, one has to choose a real interest rate, which is the same story), but to a lot smaller degree. And if one disregards the interest payments and considers the primary balance only, this ceases to be an issue.

This is not the only item on the list: the results are subject to mistakes from any forecasts used, economic, demographic, legal, political assumptions. This holds for basically any other measure as well (some of them may be eliminated, for example, if we use expenditure-GDP ratios, then the growth rate of the economy will matter less – but will still matter, because pensions reflect not only present, but also past wages). Moreover, calculating the discounted value can help decreasing these effects since it picks a particular measure of the standard present-future tradeoff (which measure is again ad hoc, one should not forget it).

The interpretation of the implicit debt is also somewhat hazy: whether we can or we should deal with it in the same way as we do with the explicit debt. On the one hand, we have already discussed that the time profile of its imbalances is quite different from that of the explicit burden. On the other hand, most of the constraints on the explicit debt are not valid, or at least not in their full strength, for the implicit debt. And as such, it has a maybe more similar nature to other future budgetary policy variables/expectations, and can be analyzed from the viewpoint of feasible long-run fiscal policies.

Besides this, the implicit debt is purely a financial indicator, and remains silent about any welfare effects of the transfers summarized in it (like aggregate measures usually). Moreover, in many cases, all the cut in the debt burden is matched one in one by the decreased value of pensions (the only situation where it is not true is when there are other sources of pensions and not only the pay-as-you-go). We will touch on some of these issues from time to time, but the main emphasis will remain strictly on the pure fiscal calculations.

The paper is organized as follows. The section following this introduction briefly summarizes the literature. Section three sketches the mechanics and assumptions of our model, and discusses their merits and shortcomings. The next section sets out the possible questions we wish to address and gives the results of the simulations and discusses them. The last chapter concludes and points to some further research topics.

IV. An overview of the literature

There are many articles in the literature which analyze similar questions. Usually they either discuss the topic of implicit debt and feasible fiscal policies in a wider perspective[3] (hence, also less detailed), or aim at short-run forecasts, analyses about deficits[4]. A further important distinction is that this paper attempts to evaluate a specific reform package (and its potential extensions), and not only the pre- or post-reform systems just in themselves.

Kane-Palacios [96] analyzes the flow cost rate (current expenditure and income ratio) and compares the ratio of the present value of wages and pensions with current contribution rates. The paper emphasizes the need for a standardized methodology of estimating implicit debt measures, for international comparability. It also reports some estimates for a few countries, including Hungary: its result is 213% of GDP (with a discount rate of 4%). We will compare this number to our results. The paper gives a further example: Feldstein-Seligman [81] shows that there is a negative correlation between the market value of a firm (measured by its stock market performance) and its implicit pension liability. The same should apply to a country's risk evaluation.

[3] Effects of aging (through tax bills and government expenditures, mostly healthcare, as well), e. g. Chand [96], Leibfritz et al [95]; studies of more than one countries but using less specifics of those, e. g. Kuné [93]. We will discuss one representative example of each in more details.
[4] See for example, Augusztinovics [95].

The 1995 IMF survey (World Economic Outlook) centers around the effects of aging on government budgets. Hence, there are two chief actors in the game: social security and healthcare. The paper defines the notion of sustainable contribution rates, and analyzes its changes as a result of reforms of different form and timing. For social security calculations, the results are between 5 and 115% (of GDP), but they do not take into account the balances after 2050. We will see that it heavily understates the total debt burden, since the current negative demographic trends keep worsening these imbalances.

Herd-van der Noord [94] analyses similar questions and also applies similar methods to our paper, but (like we mentioned earlier on) the authors consider more countries and courser details. Their basic assumptions are the following. They use country-specific and somewhat detailed information on social security systems and demography[5]. The population is chosen to be roughly constant. Real wage growth per year is 2%, activity rates are kept at the 1990 level. Finally, the real discount rate is initially 4%, then it gradually decreases to 3% (from 2010 to 2050). As results, they obtain total implicit debt numbers between -167 and -50 (with flat rate benefits), or 43 and 382 (with earnings-related benefits) percentage of GDP, depending on countries, choices of indexation and ways of calculating benefits. With higher discounting, these latter numbers decrease to values between -8 and 144%, while if the indexation of benefits become linked to wages and not to prices, then increase to 69 – 382%. The authors also analyze four reform scenarios (i.e., alternative ways of financing) : PAYG with increased contributions, fully funded system (with the need for extra financing of the transition), benefits less related to earnings, and finally, an increase of the retirement age. The approach is, however, rather from a generational account perspective: thus, for example, the simulations deviate from the current contribution rates, and assume instead a rate necessary for a balanced annual budget.

Roseveare et al [96] adopts a similar methodology again, with slightly modified assumptions, different set of countries and reform scenarios. The paper neglects economic fluctuations, estimates the size of the labor force, then hypothesizes a productivity growth of 1.5% and constant activity rates. When considering an increase in the retirement age, the activity rates of the cohorts involved are substituted with that of the population average. They use 3, 5, 7% as real discount rate; 1 and 2% as productivity growth is also considered. The present values of the implicit debt, with a discount factor of 3%, are between 28 and 416% (of GDP). With a choice of 5%, the results reduce to -18 and 235%. The numbers are not much sensitive to the choice of productivity growth. Lastly, this article also considers certain reforms, then runs several simulations for healthcare and fiscal policies in general. The results for reforms are as follows: an increase of the retirement age to 70 basically eliminates any debt. An increase of this size is out of question in Hungary, based on life expectancy measures. An expenditure cut starting from 2015 (meaning that social security expenditure growth is constrained by GDP growth) eases on the problems in most cases, but the numbers remain above 100% for many countries. Restricting eligibility also helps, but does not always solve the problems. Finally, a pure wage indexation of the pensions deteriorates the balances even further.

[5] Like population growth, but not using actual age-gender cells of the population; actual contribution rates but skipping detailed service years criteria, etc.

Augusztinovics [95] is the most similar paper to ours: it also evaluates the Hungarian social security system, in a medium horizon (50 years – as we will see, this is not always a time period long enough). Though it analyses a situation prior to the final setup of the pension reform, we will see that its conclusion are similar to ours: the short-run disguises the shortcomings and imbalances of the system, but these deteriorations have their full bite in the long-run.

V. Our model

III.1. The basics of the model

The model was developed during the preparations of the Hungarian pension reform, by Rita Bán, and was rewritten later by Pat Wiese. For our simulations, the program was in general appropriate. We had to broaden the operations it carries out, and some parameters, time series and cross-section data assumptions had to be modified. The nutshell version of the model is as follows.

As a first step, we update the number and pension stock of existing retirees, in age-sex categories: for population size, we use age-sex(-disability) specific death rates, while the pension stock is indexed according to previous year's age-sex-type categories.

Second, we determine the number, distribution and pension stock of new beneficiaries (excluding old age pensions). For disability accounts, the inflow is calculated according to age-sex specific entry rates. We assume a linear improvement in these rates, ending in 2030, at 50% of the current level (the reason for this is that current laws are way too soft for disability, mostly for camouflaging unemployment – but continuous tightening of the rules is underway). Benefits are tied to average wages. For survivor benefits of orphans, entry rates are obtained by assuming an average couple (age and age-difference) and using their death rates. The forecasts based on 1994 are matched with actual 1995 numbers, and their ratio is kept as a correction factor to be applied in all future years. Benefits are indexed to average wages. For survivor benefits of widowers in working age, we use average marriage rates, average couples, and death rates to determine the number of beneficiaries. The same correction method is used as in the case of orphans. Benefits are kept at a constant level relative to wages. Finally, for survivor benefits of widowers among retirees, the number of eligible persons are calculated using average marriage rates, age difference, measures of eligibility and death rates. We assume that half of them chooses this instead of her/his own benefit. The benefit itself is assumed to be equal to 55% of spouse's benefit (50% by law, but there is a selection bias in the actual numbers: people with high benefits will choose the survivor benefit relatively more. Data suggests this 55% as a working assumption). Current changes in law replaced this optional system by an automatic benefit of 20% — this is not yet incorporated into the model, but this should not really change the results.

As a next step, we need to index age-sex specific wage profiles: first of all, we need the shape of these distributions. Due to lack of data, we assume that these shapes are constant, which we choose to be the picture from 1994. In each year we multiply this by an appropriate number, to match the prescribed real wage growth in the economy. If the currently simulated scenario contains an increase in the retirement age, then the wages of the cohorts involved are equalized to the wages of the cohorts just prior to retirement. Then, we update the labor force, contributors and their contributions. We summarize the inactive segments of the population by age, sex and category: students, mothers on maternity leave, soldiers, disability beneficiaries and the unemployed. The sum of them plus the active segment cannot exceed 100%: if, due to certain (imprecise) trends or assumptions, this should happen, then we decrease the activity rate accordingly. Contributions by active persons are equal to their legal requirement. We assume that 60% of the inactive is a contributor, and their average contribution is 41.3% of the contribution of the active (based on actual data).

Next, we determine the number, composition and benefits of incoming old age beneficiaries: If a certain cohort has no eligible members (based on service years criteria – we assume the distribution of service years to be identical to the 1994 profile through time), then no entrants are considered. We distinguish the criteria for regular and early retirement. If a certain cohort gives new entrants, then we modify the distribution of service years (its mean must fall, since people with high value retiree relatively more).The base for early retirement consist of eligible non-active persons: eligibility is determined by service years, and their actual retiring behavior is estimated using 1994 data. We forbid this optional retirement decision for regular retirees: we assume that everyone retirees if eligible (neglecting work above the retirement age). Benefits are calculated according to actual rules, using the distribution of service years again.

Finally, we calculate annual balances, then start simulating the next year.

III.2. Extending the model to 2100

We will see in section IV that the model in its original form is not precise enough to calculate present values. Its time range is only up to 2050, and in spite of heavy discounting, the crudely estimated tails of the present value[6] are sometimes as large as, or even larger than the precisely simulated part (up to 2050). Hence, it was necessary to extend the model up to 2100. This involved the following modifications.

Any trends are assumed to fade away by 2050, after that, there are no other changes than in demography (i.e. a long-run equilibrium path is reached, and fluctuations are neglected). Death rate is kept at the 2050 level. Birth rates are modeled as approximately equal to the average between 2040 and 2050, i.e., in each year, there are 0.211587 births per person in the age group 20-25, 0.056431 between 26 and 30, 0.041285 between 31 and 35, and 0.02674 between 36 and 40. These numbers are obtained from estimating the original model's birth figures in the period 2040-50 (the demographic forecast of the original model ended there, and we could not access its continuation). We must notice that these numbers are substantially different form those presented in Tusnády [95], thus we get significantly faster population decline than they

[6] The part after 2050 is obtained by fitting a geometric series on the annual balances and calculating the discounted value of that series.

do. We cannot judge the validity of this or that model – but it would be worthwhile to run some simulations with this other demographic variant to check how much difference it makes.

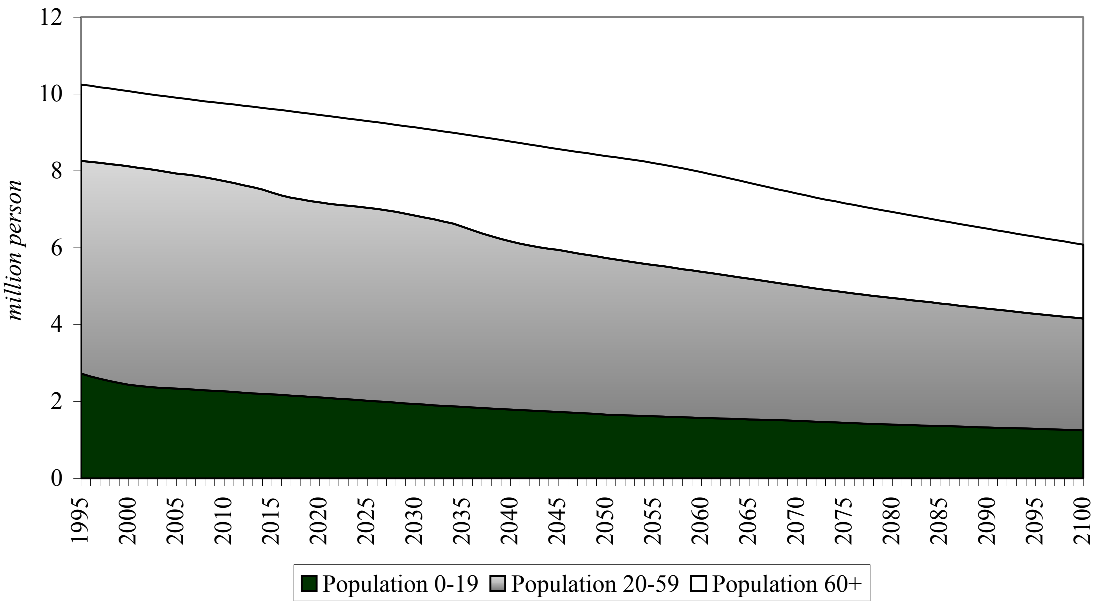
The population projection after 2050 shows a somewhat even more pessimistic picture than the first part (the population decline accelerates for a while after 2052), but not by much, so it is not likely to have a huge effect on our numbers, since deficits (or surpluses) of those years enter the present value sum with a heavy discounting.

III.3. Major assumptions of the model

All forecasts are based on 1995 numbers (the time when the model was originally developed). Data that became available since then shows that those projections were a bit pessimistic with respect to economic growth, and too optimistic for inflation. In spite of all these, most of our figures and calculations are based on the original assumptions, thus showing the situation facing the policymakers involved in the preparation of the pension reforms. Of course, we will also make simulations with the updated data, partly to see how much difference these things make, partly to obtain more reliable results.

The next couple of figures will display the major economic and demographic assumptions of the model. Figure 1 shows the size of population and its composition by age: Notice the worsening after 2050, which may turn out to be a far too pessimistic assumption. It would be useful and interesting to run a more optimistic version, where birth rates would start improving, leading to a zero population growth in the long-run (it is even more optimistic than the demographic model of Tusnády [95]).

Figure 1. Population and its age composition



The next two figures show the growth rates of the population, retirees and the labor force. We can also see the effect of a pension age reform on the latter two variables.

Figure 2.1. Demograpy I.

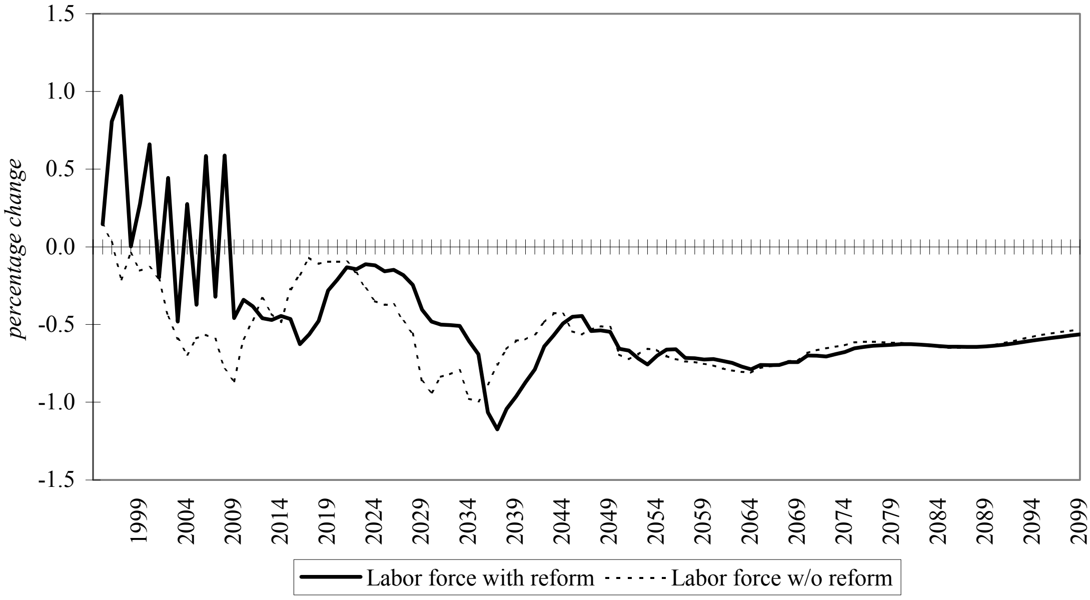
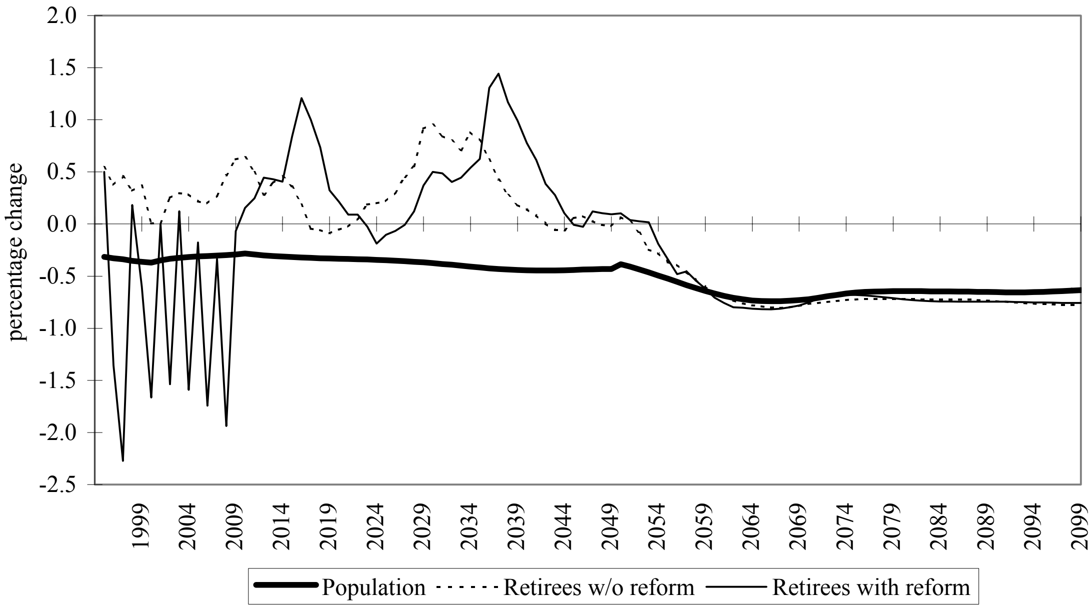


Figure 2.2. Demography II.



Figures 3 and 4 display the gender-specific age-earnings profiles. Many concerns and questions can be raised. First of all, why should these cross-section profiles be stationary? This seems to be particularly doubtful in a transition economy, but one can observe important changes in the earnings profiles even in well-developed (and well-settled) countries. The distinction of different segments of the labor market is likely to be even more important – one could maybe use some rough data or guesses on this. Unfortunately, neither the current version of the model, nor (and it is the main constraint) the available data allows this. The data is not simply inaccessible – in many respect, it is not appropriately collected, not processed or even lost. As a consequence, we will stick to the stationarity assumption. A compromising (but also speculative) working method could be to distinguish some segments of the labor market, using Hungarian or OECD data, then weighting these profiles by the sizes of these segments. The sizes could follow a trend from current Hungarian data towards OECD averages. Such a solution may be undertaken in the future, but, unfortunately, not within this paper.

Another concern raises the issue of work after retirement age, and also, the anomaly of the picture that net wages are above gross wages and constant, for ages above 60. This latter is most likely to come from some data error or irregularity, and does not make a real difference for our results: we are not considering work after retirement age. The reliability of the data is still in question, however – unfortunately, it is quite hard to check its validity. On the other hand, for some fractions of the labor force, this extra work is important, and may interfere with pension contributions and benefits[7]. Some further anomalies can obscure the picture even more, thinking especially of the illegal, semi-legal sector (people working officially for the minimum wage, and obtaining compensation of other forms – which is an emerging way of tax evasion in Hungary, or other methods).

[7] The main problem is, however, that it is hard to interpret and to estimate the notion of net wages in a complex income tax system. This also questions the choice of net wages as the means of indexation for pensions.

Figure 3. Male earnings

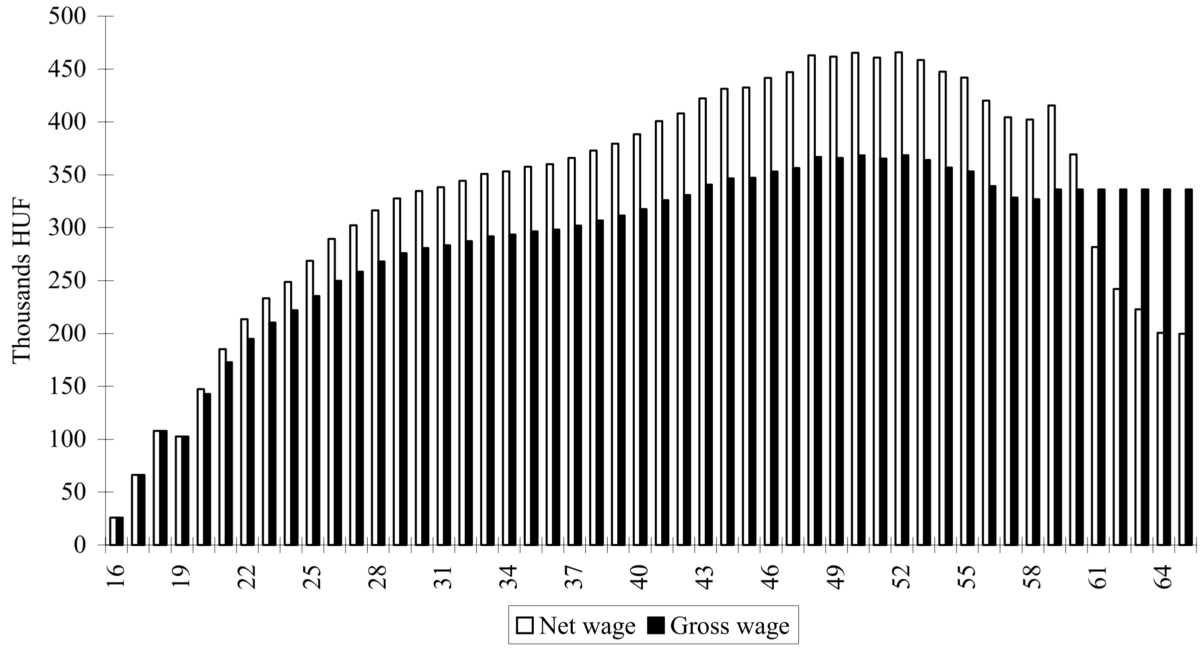


Figure 4. Female earnings

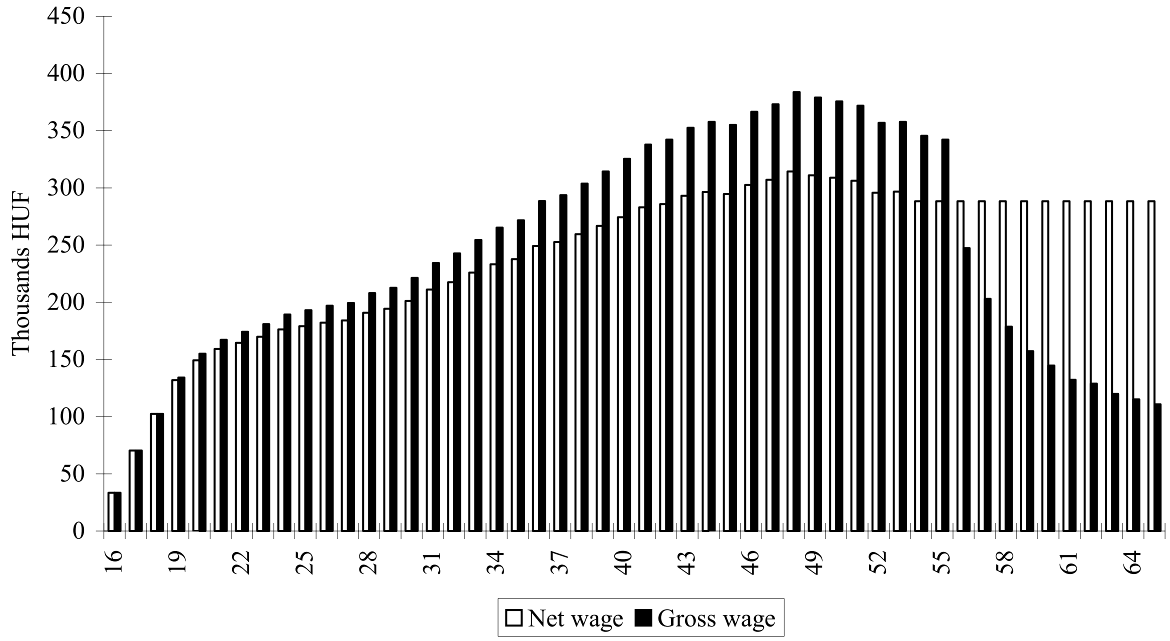
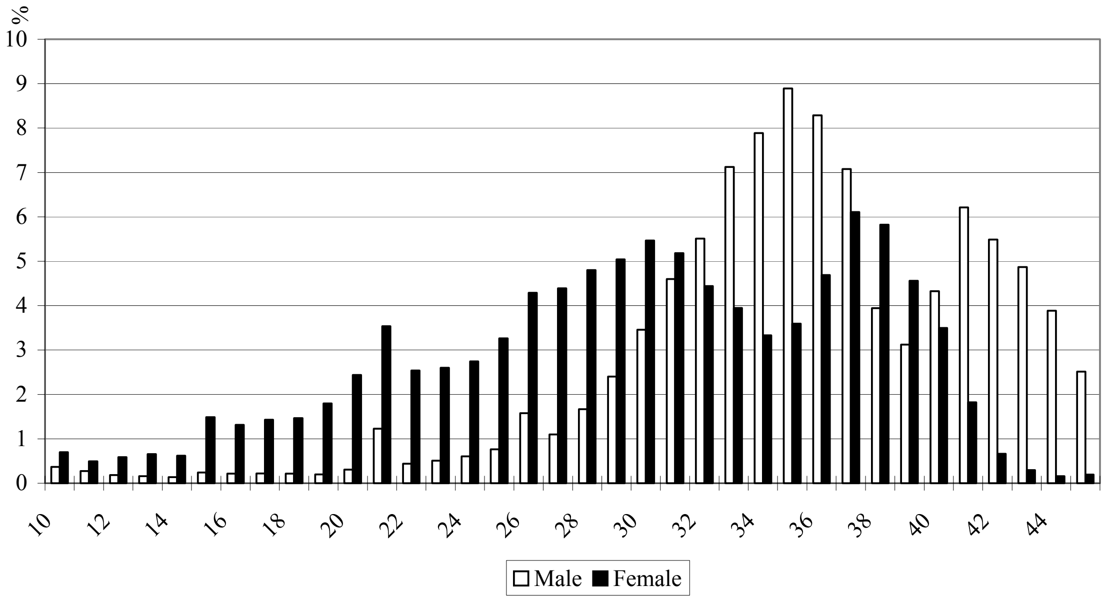


Figure 5. displays the cross-section of the service years of retirees. Stationarity of the picture is again controversial, and nothing guarantees that no major changes would occur in the close or distant future. Data is in lack for this issue, just like in the previous case. A problem of similar magnitude is that huge masses became unemployed around the 90s and lost quite substantial service years. Again, hardly any data is available.

Figure 5. Distribution of service years



The next two figures show the initial assumptions and forecasts on the economic performance: CPI, net and gross wages, GDP – are we too optimistic or too pessimistic about convergence and catch-up? The period between 95 and 98 has proven to be better in growth terms, but worse for inflation. Changes in both the short (more dynamic catch-up to the EU) and the long run (slower growing long-run economy) may have substantial effects on our results. Some reforms (e.g. the fully funded system) may have positive economic effects on productivity or aggregate savings. These effects are not incorporated into our simulation. The main reason is that it would be hard to quantify them in a demographic model. Our results still carry meaning for these issues as well. If our numbers measure the changes without these positive side effects (e.g. if the debt increases with the introduction of a fully funded second pillar), then the increase in savings, work effort etc. can balance that – but for this it needs to bring at least as much improvement as the worsening indicated by our results.

Figure 6.1 Economic forecasts I.

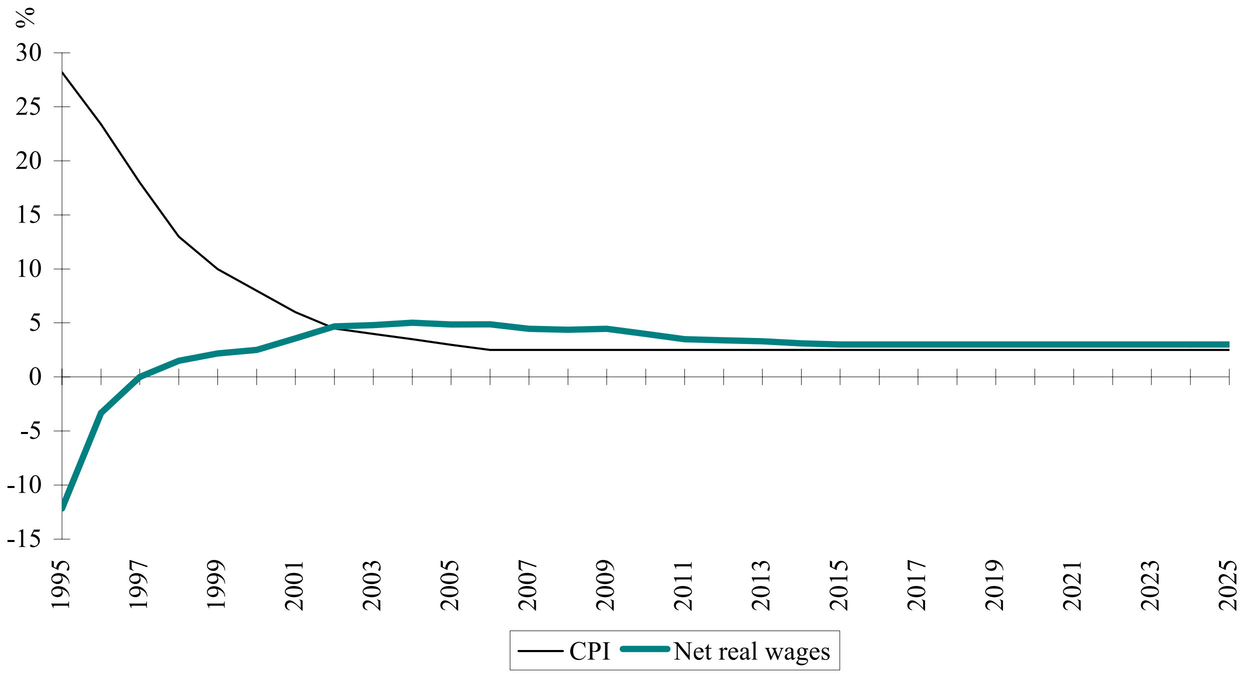
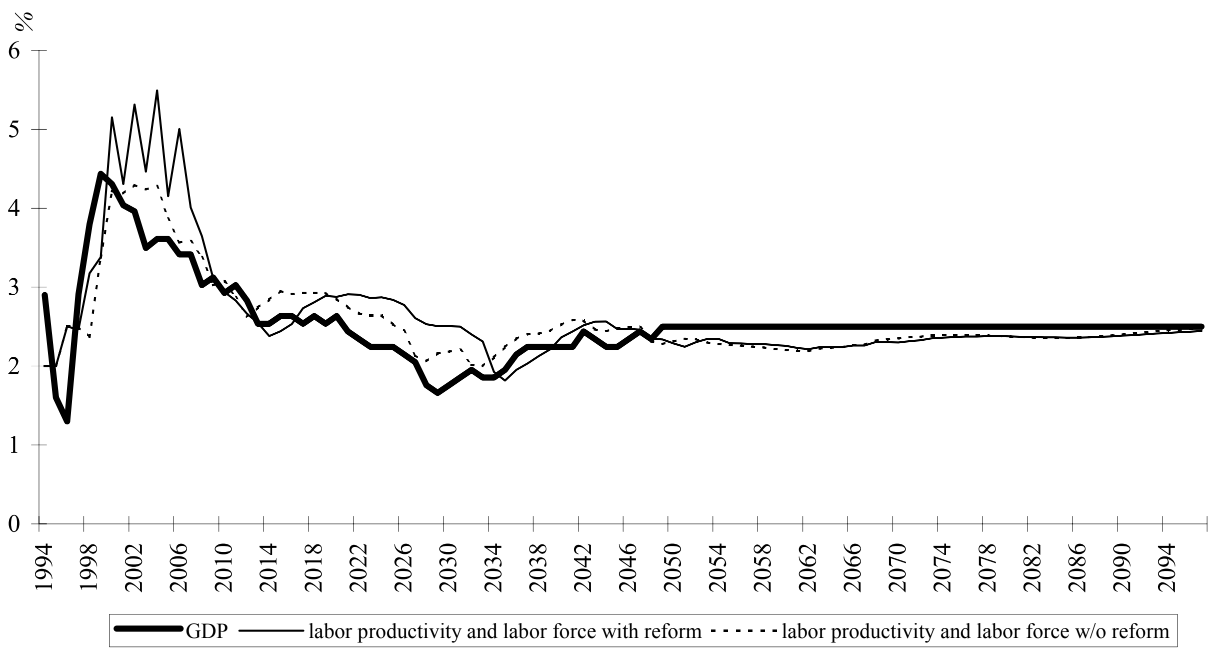


Figure 6.2. Economic forecasts II.



The reform variables and other trends considered are the following. For the second pillar of the social security system (which is a fully funded system, with statutory minimum contribution rates), the scenarios are: none, voluntary or compulsory (for men, up to year 40, for women, up to 35) switch from 1998. Indexation of pensions is based on either last year's real wages or on the Swiss system (half real wages, half inflation) from 2009. In case of an increase of the retirement age, it becomes 62 for both men and women. During its transition, the service year criteria are gradually changing as well. The contribution to the 1st pillar of pensions (a "traditional" PAYG system) is 66.66%, which is slightly higher now, but will be reduced to a similar value soon. We assume a linear decrease of the entry rate to disability insurance: halving the entry rate from 1998 to 2010, then keeping it constant. Its rationale is that current legislation is very soft on eligibility (to camouflage unemployment) but the rules will become more restrictive gradually. Thus, this is a reasonable catch-up assumption to Austrian-German averages. For changes in the age-specific activity rates, we use a similar linear adjustment to current German-Austrian standards, assuming catch-up by 2015. Unemployment rates are assumed to decrease linearly from 1995 to the natural rate by 2015, then stay constant. We also consider an 8% increase in the base of social security contributions from 1997.

VI. Results

First of all, we need to summarize the most important issues we want to address. The most basic question is that how large the implicit pension debt is (would be) if we were not to introduce the reforms (but only the consolidation of the contribution rates). Then, how much is the decrease when the contribution base is broadened, retirement age is increased, and indexation and second pillar is introduced?

What would be the effects of further reforms? For example, a cut or increase in contribution rates; an improvement of the efficiency of revenue collection[8]; a change in the relative size of the first and the second pillar. What are the (relative) dynamics of the explicit and implicit part of the pension debt? How does it relate to a potential interest service of the total implicit debt? A further issue could be its interaction with the maturity structure of public debt (does it exaggerate or mollify the spikes)? With the exception of this very last one, we will get some results for all the other questions.

The forthcoming tables contain the results of our computer simulations, under various reforms, parameter and forecast constellations. Numbers describing parts or the whole of the implicit debt are expressed as percentage of the 1995 GDP. For absolute levels, this value is 3698 T HUF (approx. 17 T USD since 1 USD is around 210 HUF), and the explicit public debt was 3698 T HUF (66% average between 1990 and 95)[9]. There are some entries marked with an 'X' – they refer to an infinite (in all cases: positive) value of the discounted sum (or more precisely: its tail after 2100 grows faster than the discount rate). Negative numbers indicate a net deficit, while positive numbers correspond to net surpluses.

To guide us in orders of magnitude, it is useful to remember the following result. Should one cut the government budget by 1% of GDP each year from now on (from 1995 on), that would reduce the present value of future expenses by 43-75% of current

[8] Amounts that are taken into account when calculating pensions, but not collected because of bankruptcy etc., or student years without contributions, but still counted as service years.

[9] A question may be raised: should one compare the present value of implicit debt to the actual stock of the explicit debt, or rather, to the present value of its interest services? It can be checked easily that these two measures are identical.

GDP[10]. Hence, if the implicit debt is reduced by 100% of GDP, that is equivalent to a permanent budget cut of 1.5–2.5% per year.

IV.1. Basic Results

The headlines of the tables contain the abbreviations of certain sub-steps of the reform introduced. They stand for the following: no reform – only the contribution rates are changed, base br. – an increase of 8% in the contribution base, starting from 1997, ret. age – an increase of the retirement age (62 for both female and male), index – introducing a fifty-fifty percent Swiss indexation from 2009, vol. 2.p. – introduction of the second pillar with voluntary choice of joining it or not, comp. 2.p. – second pillar with compulsory choice (below 40 for men, below 35 for women).

The first table shows the results of the original model: which had simulations up to 2050. As the flow of contributions and pension payments does not stop in 2050, the rest of the present value can be estimated. In our case, a geometric series was fitted on the imbalances of the last decade, and the tail of that series have replaced the "true" infinite simulation run.

scenario	no reform	base br.	base br. ret. age	base br. ret. age index.	base br. ret. age vol.2.p.	base br. ret. age index, comp.2p	base br. ret. age index, vol.2.p.
PDV up to 2050 (%)	**-75.3**	**-67.0**	**-24.8**	**0.3**	**-51.4**	**-33.8**	**-28.4**
last PDV increment (%)	-1.29	-1.34	-0.96	-0.38	-0.87	-0.25	-0.38
fitted growth rate of annual balance	1.055	1.062	1.068	1.073	1.05	1.034	1.038
Discount rate	1.075	1.075	1.075	1.075	1.075	1.075	1.075
estimated tail after 2050 (as a geom. series, %)	**-66.8**	**-111.7**	**-149.0**	**-259.2**	**-37.0**	**-6.6**	**-10.9**
total (%)	**-142.1**	**-178.7**	**-173.8**	**-258.9**	**-88.4**	**-40.4**	**-39.3**

Notice that the results are driven in many cases by the fitted geometric series tail – this makes it necessary to extend the model until 2100. The results with this modified version are the following:

[10] Depending on ways of discounting – if the discount factor 1 + i is obtained by i = 5% + CPI, then 43%, while if i = 5 % + 100 year forward average of inflation, then 75%.

scenario	no reform	base br.	base br. ret. age	base br. ret. age index.	base br. ret. age vol.2.p.	base br. ret. age index, comp.2p	base br. ret. age index, vol.2.p.
PDV up to 2100 (%)	**-114.7**	**-108.5**	**-55.1**	**-12.5**	**-74.4**	**-41.7**	**-37.5**
last PDV increment (%)	-0.39	-0.41	-0.30	-0.12	-0.21	-0.07	-0.07
fitted growth rate of annual balance	1.046	1.046	1.045	1.041	1.045	1.040	1.040
discount rate	1.075	1.075	1.075	1.075	1.075	1.075	1.075
estimated tail after 2100 (as a geom. series, %)	**-14.0**	**-14.7**	**-10.4**	**-3.6**	**-7.3**	**-2.1**	**-2.1**
total (%)	**-128.7**	**-123.2**	**-65.5**	**-16.2**	**-81.7**	**-43.8**	**-39.6**

It is clear that our previous results for the tails after 2050 were indeed quite imprecise. Moreover, the tails we obtained now are really small relative to the simulated part, which makes it likely that our results are good enough, both in an absolute and a relative way. The estimated tails are still not completely insignificant, which might call for further extensions. Also, this simulation is even more accurate than the original one (simulation until 2050 only), as all the variables of the model are obtaining their long-run (forecasted) equilibrium values. However, extending the model further on would imply a large cost in computing time, and only a small gain in accuracy. So we will use the 2100 extension of the model from now on.

The results are impressing already just in themselves. The pre-reform debt value is 128% of GDP, which is roughly double the size of the explicit debt. The largest reduction is due to the increased retirement age and the Swiss indexation. Together with base broadening, the debt reduces to 16% of GDP. In fact, all this decrease is one in one taken away from the value of pensions: the only source of pensions is the pay-as-you-go system, so all liabilities of the government are also claims for citizens, and vice versa.

So, from a purely financial point, it would have been enough to introduce these three measures only – but that would have implied a large cut in the value of pensions. Introducing the second pillar can get through this problem: here we can decrease the value of the pension debt and still keep the level of pensions relatively high, since the PAYG system ceases to be the only source of benefits.

We can see that introducing the second pillar but not the Swiss indexation increases the debt value quite much: from 3614 T (65.48%) to 4507 T (81.66%). This is due to the financing need of the transitory period: benefits remain at the same level while contributions are cut back. We see that this effect grows with the number of people joining the second pillar: the result is 2416 T (43.78%) with compulsory, 2170 T (39.57%) with voluntary switching (but with Swiss indexation introduced again, in both cases).

Taking a closer look at these scenarios, we find that this difference is due to the relatively early years of the time frame. The detailed expenditure-revenue numbers indicate the following. The present value of benefits from 2004 to 2019 minus the value of contributions from 1998 to 2013 is bigger for the compulsory scenario. This shows that for the main contributors of this period, i.e. the age group above 45, it is more beneficial to follow the compulsory switching (zero for them) than the Argentine (around 50%). The same applies for benefits between 2020-31 and contributions in 2014-25, which shows that the cohorts below 35 will also be closer to 100% than in Argentina (70-80%). Actual experience seems to support these conclusions – but we also state that this was predictable from these calculations, and would have been predictable even back in 1995. To put it in a different way, we can say that people in general were not at all averse to the new system (as many policy makers were suspecting), and, after evaluating the situation carefully, has made a fairly rational decision.

Comparing these results to the preexisting number in the literature, we find that Hungary was in the middle range before the reforms, and moved to the low-range after them. Which means that the pre-reform numbers were large but not outrageous, and became nicely low since then. Note that, however, most countries with higher implicit debt indicators still run a pay-as-you-go system, so any Hungarian post-reform number should not be used as a measure for comparing the effects of demography to social security systems. But as financial indicators, our results have full strength.

IV. 2. Sensitivity analysis: How much do our results change when we modify some of the assumptions, parameter choices?

It is interesting and particularly important to investigate how sensitive our results are to certain forecasts we have employed in our simulations, or to some other parameters (discount rate etc.). As this might lead to an explosion of computing time, it is necessary to restrict the set of modifications.

The following comparisons seem to be the most important: pre-reform values (rel. to GDP), effects with all the reforms but the second pillar, effects with all the reforms but the Swiss indexation, and finally, the relative behavior of voluntary and compulsory switching. We will calculate the results for these scenarios (meaning that the two scenarios with base broadening only, and base broadening and age increase only, will be omitted),. with the following parameters changed: 2 and 1.5% productivity growth instead of 3%; a long-run inflation of 2 and 3%, instead of 2.5%; finally, an improvement of 25% in the disability entry rate, instead of 50%. The choice of the discount factor will be analyzed in a separate section.

Besides these macroeconomic features of the model, it would be interesting to introduce new data (or data substituting methods) for age-earnings profiles, and also for the distribution of service years. An alternative demographic scenario, based on Tusnády [95] would also worth considering. Unfortunately, due to the huge amount of necessary data and other calculations, these issues remain for future work.

Now let us see the results of the simulations.

%

Reform	Part of PDV	Para-meters in basic setup	2% growth	1.5% growth	2% inflation	3% inflation	25% impr. in disab. rate
	Until 2100	*-114.67*	*-93.58*	*-86.39*	*-115.26*	*-114.01*	*-124.03*
Original	After 2100	-14.02	-4.61	-2.77	-13.87	-14.16	-12.778
	Total	***-128.68***	***-98.19***	***-89.16***	***-129.13***	***-128.17***	***-136.81***
Base broaden-ing,	*Until 2100*	*-12.53*	*-15.93*	*-16.56*	*-13.85*	*-11.13*	*-25.13*
Age increase,	After 2100	-3.64	-1.99	-1.43	-3.77	-3.49	-4.36
Indexation	***Total***	***-16.17***	***-17.92***	***-17.99***	***-17.63***	***-14.62***	***-29.68***
Base broaden-ing,	*Until 2100*	*-74.4*	*-62.11*	*-57.81*	*-75.03*	*-73.67*	*-89.49*
Age increase,	After 2100	-7.26	-2.45	-1.49	-7.26	-7.27	-8.11
Vol. 2. Pillar	***Total***	***-81.66***	***-64.56***	***-59.29***	***-82.34***	***-80.94***	***-97.6***
Base broadening,	*Until 2100*	*-41.68*	*-44.55*	*-45.08*	*-42.62*	*-40.69*	*-53.09*
Indexation,	After 2100	-2.1	-1.3	-0.96	-2.22	-1.98	-3.15
Comp. 2. Pillar	***Total***	***-43.78***	***-45.86***	***-46.04***	***-44.84***	***-42.67***	***-56.24***
Base broadening, age increase,	*Until 2100*	*-37.47*	*-39.85*	*-40.19*	*-38.42*	*-36.47*	*-48.98*
Indexation,	After 2100	-2.1	-1.3	-0.96	-2.22	-1.98	-3.15
Vol. 2. Pillar	***Total***	***-39.57***	***-41.15***	***-41.15***	***-40.64***	***-38.45***	***-52.13***

With a 2% of growth rate, the pre-reform value is 98%, which reduces to 18% as a result of the first subset of reforms (no second pillar, but all the other). With second pillar but no indexation, it stays at 64%. Reintroducing the indexation reduces the debt burden to 45.86% and 41.15%. The difference between the two switching scenarios remains similar to the previous, and their dynamics also (which is no surprise, since the decreased growth assumption is in effect only from around 2010). In general, we can say that the slower growth did not change the post-reform results by much, but just the opposite with pre-reform values. The other observation is that the values of scenarios without indexation have decreased, while those with indexation have increased. This is due to the nature of indexation: Since slower growth reduces the wage bill one in one, the pension bill without indexation also one in one, while with indexation, the reduction is less than one in one, so the pension bill decreases less than the wage bill.

The effects of an even smaller growth rate are almost the same as previously, but here the decrease of the pre-reform values is also relatively smaller. It is true in general that the debt became less sensitive to the growth rate as a result of the reforms, and also that a smaller growth rate tends to increase the implicit debt. One may say, however, that these effects are not significant, relative to the general errors of the simulation.

The effect of a different long-run inflation is really small, and goes to the direction we expected: with higher inflation, due mostly to discounting, we gain some, and the opposite with smaller inflation. The overall effect is, however, almost unnoticeable in the numbers.

A less bright trend in disability entry rates has a far bigger, but still not surprising effect: the post-reform numbers are about 25% larger than previously. Thinking about the increased number of beneficiaries and the smaller number of contributors, the increase comes at no big surprise.

Summarizing the results of the exercises, we see that our estimates of the implicit debt are not significantly sensitive to most of the parameters involved. This is quite promising for the reliability of the numbers – we will see, however, that the choice of the discounting will matter far more.

IV. 3. The choice of discounting

As we will see quite soon, the choice of the discount factor will matter much for the size of the implicit debt. This is expected, on the one hand – but makes it hard to compare the explicit and implicit debt measures, on the other hand. At a later point, after seeing the results, we will argue again for the initial choice of 5%.

A second issue is about nominal discounting: to which measure of inflation should we add the real discount factor? One approach is the one we used so far: adding it to the CPI of the current year. If the government finances the deficit with short-run, mostly one-year debt, then this choice seems to be valid. But this gives a major role for economic fluctuations: with a higher inflation, the medium-future is already discounted away, and our measure of the implicit debt is mainly driven by current and close future events.

As an alternative, one could consider the required return on long, say, 5, 20 or 100 years-long treasury papers (we will choose the last one). For us, it means that we need to take the (geometric) average of the inflation forecast of 100 years starting from the current year.

Here come the results: for CPI plus 7 and 3% of real discount rate, then using the values of the 100 years coupon (with 5% again).

%

Reform	Part of PDV	5% discount rate	7% discount rate	3% discount rate	100 years coupon
	Until 2100	*-114. 7*	*-56.8*	*-298.6*	*-170.1*
Original	After 2100	-14.02	-1.21	-321.4	-4.19
	Total	***-128.7***	***-58.04***	***-620.0***	***-174,3***
Base broadening,	*Until 2100*	*-12.53*	*-2.26*	*-57.2*	*12.61*
Age increase,	After 2100	-3.64	-0.33	-63.52	-1.02
Indexation	***Total***	***-16.17***	***-2.59***	***-120.7***	***11.59***
Base broadening,	*Until 2100*	*-74.4*	*-38.09*	*-185.2*	*-110,9*
Age increase,	After 2100	-7.26	-0.64	-157.7	-2.18
Vol. 2. Pillar	***Total***	***-81.66***	***-38.72***	***-343.1***	***-113.9***
Base broadening, age increase,	*Until 2100*	*-41.68*	*-25.47*	*-85.39*	*-46.65*
Indexation,	After 2100	-2.1	-0.19	-35.03	-0.67
Comp. 2. Pillar	***Total***	***-43.78***	***-25.66***	***-120.4***	***-47.33***
Base broadening, age increase,	*Until 2100*	*-37.47*	*-22.05*	*-82.15*	*-37.81*
Indexation,	After 2100	-2.1	-0.19	-35.03	-0.68
Vol. 2. Pillar	***Total***	***-39.57***	***-22.25***	***-117.2***	***-38.49***

With 7%, present and close future gets relatively more weight than distant future, and present values decrease in general, since future becomes cheaper both in relative and absolute terms. As a consequence, pre-reform and no-2nd-pillar results reduce to 58% and 2.6% respectively. 2nd pillar without indexation gives 38%, while the full scenario with the two different switching variants take 25.6 and 22.2%. The difference reduces between these two, but the sign remains the same.

With 3% as the real discount rate, both the direction and the magnitude of the changes is the opposite of those with 7%. This is not surprising, since as we approach the growth rate with the discount factor, the discounted sum (like a geometric series) starts to increase in a nonlinear (and quite fast) way. The tail values of the results exceeding 200% should not be taken too seriously, since the fitted values are quite likely to be really imprecise, but even the subparts up to 2100 are gigantic. The total debt value is 620% without any reforms, which reduces to 120% with partial reforms (no second pillar). The result is 343% if we exclude indexation but include the second pillar. The debt values of the full reforms are 120 and 117%, respectively. This is the only scenario where these numbers are smaller than the no second pillar values. This is reasonable: the second pillar involves bad present and close future, and promises a brighter distant future (transitory imbalances at the beginning, then the deteriorating demographic structure hits only a 66% level of PAYG pensions). So if we discount the future relatively less, then the evaluation of the second pillar improves.

Using the 100 years coupon, the pre-reform numbers are significantly higher, as future (which is not so bright) gets a higher relative weight. The reform scenario involving everything but the second pillar gets a better grade – this must be due to the positive effects of the close future. The scenario of everything but indexation shows a poor picture, but once indexation is reintroduced, the choice of the nominal part of discounting ceases to matter much.

It will be interesting to compare the literature's result of 213% not only with these numbers, but also with those obtained by using more current data. What we see right here is that pre-reform values are a lot higher with 3%, smaller with 5 and 7%, post-reform values are smaller even with 3%, and similar can be said about the 100 years coupon choice.

To summarize our analysis of the discount rate, we can further emphasize the foreseen and completely reasonable fact that the implicit debt is very sensitive to this choice. Based on our numbers, and also on the literature, the choice of 5% seems to be the most reasonable (even as a future conventional choice).

Comparing different scenarios may provide us with a crude way to estimate an aggregate discount rate of the population (assuming complete intergenerational altruism). The idea is the following. Any pension payments other than the government support are just redistribution among people, so the population will maximize the size of this support by its switching decision. Of course, these supports are financed by taxes paid by the very same people – this is often forgotten by many, thus we will also do that in our approach… So if we are perturbing the switching numbers of any age-gender cell, the present value should not increase. Writing the present value as a function of these switching rates and the population discount factor, then r satisfies

$$\nabla_{\text{switching rate}} f(\text{switching rate}, r) = 0.$$

Approximating the gradient numerically by simulations, we can obtain an estimate of r. Notice that we do not need our entire machinery for this numerical gradient: only the future contributions and benefits of each age-gender cell are required. An econometric analysis of this switching behavior could give us valuable information on how people are evaluating their future earnings.

Regardless of what discount rate we would be getting, this value does not necessarily contradict our favorite choice of 5%. When we consider the implicit debt as a potential debt burden, the appropriate number is the real interest rate the government must offer on its bonds, which may differ from the discount rate of the consumers. The question then becomes that there can be many real interest rates, first of all, the riskless and the risky (stock performance) rate. The former is around 1% in the US, while the latter is 6%, not very far from our 5% value. The choice of 1% would not make much sense, since growth rates are in general above this value, so the sums would become infinite. This supports the risky rate. The counter-argument is that the government will have to pay the riskless rate on its debt, and if the implicit debt were made explicit, the extra interest service would be based on this market's prices. If, however, we want to consider selling the system, then the buyer will use the risky rate as her opportunity cost, and also, if there were independent funds running the system, they would invest their current extra resources (which they need for future expenditures) on the stock market in general. This can be interpreted that the government obtains loans at 1% real interest rate, then transfers it to the social security funds, which invests it in the risky stock market. These funds have a long enough horizon and big enough amount to invest, so the risky rate can be realized in the long-run average. And these funds, based on their declared long horizon, may be more appropriate to do this investment on the stock market than the government. This way, one may find the negative debt of the government in the stock market, which the literature calculates to be optimal, but is missing empirically.

IV. 4. "Reality check"

Inserting data from 95-98 (not yet available when the model was developed): real wage growth, inflation, the earlier introduction of Swiss indexation in 2001, actual distribution of people joining the second pillar (under the parameter choice of the main scenario). We still do not have all the necessary numbers (data on people joining the second pillar is only in very crude guesses), but no matter what, the results will be more or less similar to what we will soon see. There are quite substantial differences relative to the original numbers. This can mostly accounted to the faster economic growth and the slower deceleration of the inflation. We will also analyze a version when double digit inflation is present until 2010.

%

Reform	Part of PDV	Original data, annual inflation	Updated data, annual inflation	Original data, 100 yr. coupon	Updated data, 100 yr. coupon
	Until 2100	*-114.67*	*-103.64*	*-170.12*	*-187.03*
Original	After 2100	-14.02	-14.56	-4.19	-5.27
	Total	***-128.68***	***-118.2***	***-174.31***	***-192.30***
Base broadening,	*Until 2100*	*-12.53*	*19.53*	*12.61*	*29.14*
Age increase,	After 2100	-3.64	-3	-1.02	-1.34
Indexation	***Total***	***-16.17***	***16.52***	***11.59***	***27.80***
Base broadening,	*Until 2100*	*-74.4*	*-61.97*	*-110.89*	*-115.70*
Age increase,	After 2100	-7.26	-7.18	-2.18	-2.74
Vol. 2. pillar	***Total***	***-81.66***	***-69.15***	***-113.07***	***-118.43***
Base broadening, age increase	*Until 2100*	*-41.68*	*-16.56*	*-46.65*	*-44.13*
Indexation,	After 2100	-2.1	-1.55	-0.67	-0.85
Comp. 2. pillar	***Total***	***-43.78***	***-18.11***	***-47.33***	***-44.99***
Base broadening, age increase,	*Until 2100*	*-37.47*	*-13.67*	*-37.81*	*-33.00*
Indexation,	After 2100	-2.1	-1.55	-0.68	-0.86
Vol. 2. pillar	***Total***	***-39.57***	***-15.21***	***-38.49***	***-33.86***

Comparing once more to the 213% result from the literature: numbers after the reforms are by far smaller, pre-reform results with a 5% discount rate are also. Pre-reform results with 4% as discount rate are 164%, which is not that far form 213%, but still substantially smaller than that. With the 100 years coupon, the numbers are quite close, though (even with 5%).

When relating to the “as of 1995” results, we find that all numbers have decreased, and the values for scenarios containing the second pillar have particularly improved. Though most of it is due to higher inflation (and hence, heavier discounting), the effect of faster economic growth is not negligible either: pensions are growing slower than wage-based contributions.

The situation for the 100 years coupon numbers is somewhat different: the no-indexation scenarios fare worse, while the others improve again, but much less than previously. The results still give a very positive evaluation for the reforms, and we also see that the 100 years coupon numbers are less sensitive to economic fluctuations.

IV.5. Further reforms

Here we will consider some potential deviations and further reform possibilities, relative to the fully implemented reform (including the earlier introduction of the Swiss indexation: 2001 instead of 2009 – hence the cells "pre-reform" may as well differ from our previous results).

The first case is an increase in the contribution rates. As an example, we consider a 1% increase starting at 2010. As second, alternative demographic scenarios could be examined. The demographic model of Tusnády [95] uses similar death rates but quite different birth rates. It would be good to introduce those numbers into the framework of our model and redo some of the calculations. The measure of the implicit debt is likely to decrease, but the size of this decline is hard to guess, though it would be quite important. Moreover, one could assume a gradual improvement in the birth rates (up to levels high enough for a non-decreasing population). Both of these modifications should decrease the value of the implicit debt, but the magnitude is far from being clear. And it has quite an importance: it would give a lower bound on the benefits of such an improvement in birth rates, hence a government program can count on at least as many savings when considering such measures. As we have already mentioned, this analysis remains for future work.

A next possibility is an improvement in the efficiency of contribution collection (this increases revenues but not benefits – hence differs from a pure base broadening). In the first example, we consider a 5% increase from 2010, in the second, it is only 1%. Changing the percentage of first-second pillar contributions (e.g. 50, 33%) is also an appealing reform to check, and, as we will see, it would really help a lot. Last, which is not even a reform literally, a slower deceleration of inflation – for example, 10% until 2010, then a gradual decrease to 2.5% (identical to the previous inflationary dynamics).

%

Scenario/parameters				No Reform	1. pillar 33.33%	1. pillar 50.00%	Collection 5.00%	Collection 1.00%	Contrib. Increase	Higher Inflation
	Disc.	Growth	Infl.							
	5.0	**3.0**	**2.5**	**-27.6**	**7.8**	**-10.0**	**16.3**	**-26.0**	**-20.7**	**-20.2**
PDV	3.0	3.0	2.5	-68.3	43.7	-12.4	64.9	-64.2	-50.8	-54.3
Until	7.0	3.0	2.5	-14.9	-1.1	-8.0	3.1	-14.1	-11.5	-10.0
2100	5.0	2.0	2.5	-30.1	-3.2	-16.7	3.6	-28.7	-24.6	-23.4
	5.0	1.50	2.5	-30.5	-6.5	-18.5	-0.3	-29.2	-25.4	-24.0
	5.0	3.0	2.0	-28.9	6.3	-11.3	14.7	-27.3	-20.4	-18.9
	5.0	3.0	3.0	-26.3	9.3	-8.5	17.9	-24.7	-17.7	-22.1
(real)	**5.0**	**3.0**	**2.5**	**-13.7**	**28.8**	**7.6**	**-3.8**	**-11.7**	**-5.5**	**-7.9**
	5.0	**3.0**	**2.5**	**-2.1**	**5.7**	**X**	**6.7**	**-1.7**	**-1.3**	**-1.7**
PDV	3.0	3.0	2.5	-35.0	489.5	X	427.7	-11.8	-19.6	-12.2
After	7.0	3.0	2.5	-0.2	0.4	0.2	0.5	-0.2	-0.1	-0.3
2100	5.0	2.0	2.5	-1.3	1.3	-0.1	1.6	-1.1	-0.9	-0,6
	5.0	1.5	2.5	-1.0	0.6	-0.2	0.8	-0.8	-0.7	-0,5
	5.0	3.0	2.0	-2.2	3.7	X	6.3	-1.6	-0.9	-0,5
	5.0	3.0	3.0	-2.0	6.0	17.3	7.0	-1.8	-0.6	-1,1
(real)	**5.0**	**3.0**	**2.5**	**-1.5**	**7.4**	**4.7**	**-0.6**	**-1.3**	**-0.7**	**-1.6**
	5.0	**3.0**	**2.5**	**-29.7**	**13.5**	**X**	**23.0**	**-27.7**	**-22.0**	**-21.9**
Total	3.0	3.0	2.5	-103.3	533.2	X	492.6	-75.9	-70.4	-66.5
PDV	7.0	3.0	2.5	-15.0	-0.7	-7.8	3.6	-14.3	-11.6	-10.2
	5.0	2.0	2.5	-31.4	-1.9	-16.8	5.2	-29.8	-25.5	-24.00
	5.0	1.5	2.5	-31.4	-6.0	-18.8	0.5	-30.1	-26.1	-24.5
	5.0	3.0	2.0	-31.1	10.0	X	21.0	-28.9	-21.3	-23.2
	5.0	3.0	3.0	-28.3	15.4	8.8	25.0	-26.5	-18.3	-19.4
(real)	**5.0**	**3.0**	**2.5**	**-15.2**	**36.2**	**12.3**	**-4.4**	**-13.1**	**-6.3**	**-9.5**

The results are quite telling: the increase of the contribution rate is not enough to balance the budget, in many cases, it does not even bring substantial improvements; higher inflation helps, due to the incomplete valorization. The 5% efficiency gain in contribution collection roughly balances the system, but the more realistic 1% gain does not bring that much. Finally, the most interesting results: the decrease in the relative importance of the first (PAYG) pillar of the system is really beneficial. This must be attributed to the long-run improvement and the working force peak in the medium future, which more than offsets the short-run loss.

It would be worthwhile to check how the reforms change the dynamics of annual balances and the speed with which the implicit debt becomes explicit. However, the numbers themselves are not precise enough to enable any kind of short-run planning or forecast; and the scenarios are not different enough to get any valuable comparisons. So, instead of giving the actual results themselves, we are just describing them verbally.

Initially, the deficits are initially lower than the virtual interest payments, so the short-run situation is far more comfortable than the full picture. The early deficits turn into a heavy surplus — mostly due to the increased retirement age —, but later on (after 2020 or slightly earlier), they deteriorate quite significantly, leading to the negative total value.

The comparison of the explicit and implicit parts would show this trend even stronger: by 2020, the implicit debt decreases only very slightly, so most of it remains for the years after 2020... Of course, new measures, reforms will be implemented by then to balance the system – but this is still not enough to validate any optimism about the present situation. On the other hand, it is quite obvious that our model is not fine enough to give precise short-run estimates of balances. Factors that are of secondary effects for the implicit debt value, can move annual balances in any direction. But it is clear, even from our numbers, that the reforms have done quite much to ease on the budgetary pressure, but we have still not fully escaped from it.

VII. Conclusions and further research topics

Our paper studied the implicit debt burden of the Hungarian social security system, and its changes after certain real and hypothetical reform measures. The most important results are that the Hungarian implicit debt burden prior to the 1998 reform was quite substantial but was not extraordinarily high in an international comparison. As the result of the implemented reforms, it has gone down from 100% of 1995 GDP to roughly 40% of it. This is equivalent to a permanent budget cut of approximately 1.5% of GDP per year. If we smooth the cyclicality of the late 90s less, then these measures are even better.

Considering further reform scenarios, the only promising direction (let alone the unrealistic 5% improvement in revenue collection) was the decrease of the size of the first (PAYG) pillar of pensions. Cutting contribution rates (which is a current policy proposal) seems absolutely infeasible from a long-run perspective (though we have neglected both the incentive effects of this cut and the savings and work effort effect of the fully funded system).

Note that even if the present value is around zero, it still does not mean that there are no financial difficulties in the system. This total balance may disguise high temporary deficits and surpluses, so it becomes necessary to borrow for the deficit period and pay it back later, or the opposite, invest the surplus to save for future deficits. Both of these may be problematic.

Would a government sell the social security system (or, at least, make it independent)? Here we face the familiar short vs. long-run picture: if the system gives low deficits today but far bigger ones in the future, than the current government has no incentive to privatize the system[11]. Reversing the stream of thought, destroying preexisting inde-

[11] Moreover, if imbalances are growing just slightly slower than the discount factor, it is possible that this situation holds *at any point in time*.

pendent social security funds can be interpreted as not selling them ("buying them back"), which is reminiscent of the current Hungarian situation.

From the viewpoint of methodology, the most important message was the problem of discounting. We saw that the results are extremely sensitive to the choice of the real discount factor, and we cannot come up with "scientific" arguments for any choice, other than citing the riskless and the risky rates of return. The government may use the margin between the two for improving its financial position (or diversifying risk), by obtaining low interest loans and investing those sums in the stock market via social security funds. But it is not only the real part of the discounting that is unclear: should one use annual measures of inflation, or a 5-20-100-years moving average of it?

There are many open research agendas left around this question, for some of which we hope to get results in the future. One important direction points towards more detailed and reliable data assumptions: data on the labor force like longitudinal data on wages, activity rates, service years. Incorporating the positive economic effects (increased savings etc.) of certain reforms would be also instructive (in an OLG-type framework, for example). One could develop or use different models or obtain data for retirement behavior and combine that with the previous assumptions to refine the results. As an independent project, both a theoretical and an econometric analysis of the switching behavior would give us important insights.

It would be extremely interesting to run similar simulations for other big parts of the implicit debt: healthcare, deposit insurance, certain subventions etc. As for a bit more general topic, one could analyze whether the effects of the implicit and explicit debt are different to the economy as a whole. If yes, then can their mix be considered as a policy choice variable? As a last proposal, can we observe discrete jumps in a country's risk evaluation after implementing a reform decreasing the implicit debt with such a magnitude? Should there be such an effect? Hopefully, future research will shed more light on these issues.

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